
PARTIE OCCIDENTALE
de la
NOUVELLE FRANCE
ou du
CANADA
Par Mr Bellin Ingenieur du Roy et de la Marine
Pour servir à l'Intelligence des Affaires et de l'Etat
present en Amerique, communiquée au Public par
les Heritiers de Homan, en l'an 1758.
Echelles
Lieues Communes de France de 25. au Degre
Lieues Marines de France et d'Angleterre de 20. au Degré
On ne connoit point le Cours de toutes ces Rivieres.
Toute cette coste n'est pas connue
Toute cette coste n'est presque pas connue
LAC SUPERIEUR
LAC HURON
LAC MICHIGAN
LAC ERIE
LAC ONTARIO
PAYS DES NIPISSINGS
PAYS DES TEMISCAMINGS
PAYS DES ANCIENS OUTAOUAIS
PAYS DU NORD
ANCIEN PAYS DES HURONS
LES IROQUOIS
PAYS DES RENARDS
PAYS DES MASCOUTENS
PAYS DES ILINOIS
PAYS DES MIAMIS
PAYS DES ERIE'S
Qui ont été détruit par des Iroquois
PAYS DES IROQUOIS
PENSILVANIE
NOUVEAU JERSAY
Le Missouri R.
Kaskasquias et Tamaroas
Ohio ou la Belle Riviere
Michillimakinac
Le Detroit
Mine de Plomb
Mines de Cuivre
Lac des vieux deserts
Lac des Abitibis
Lac Nipissing
Matouan
Lac Caouinaganic
Baye de Niagara
Baye de Laware
Philadelphie

In Volume One of this history the origins and growth of surveying and mapping in Canada were traced in the context of Old World developments in these allied fields of activity.

From the adoption in 1867 of the concept of a distinctive Canadian nationality the country began to take on a new form and its citizens to display new vision and vitality. The eyes of the world turned, at the start of a new century, toward the western interior of North America as a glittering land of promise and opportunity. The centre of gravity of Canada's population began to shift westward as more than a million people swarmed into Western Canada during the first ten years of the twentieth century, settling on more than 80,000 homesteads.

To prepare for and to accommodate this immense influx a campaign of speedy, economical and accurate land surveys in the West had to be undertaken on a scale so large as to be without precedent. The opening chapters of Volume Two of MEN AND MERIDIANS tell how these extensive operations were performed under surveyors-general Dennis, Russell and Deville. In the wake of these ambitious, foundation-laying efforts great cities began to take shape and hundreds of towns sprang into existence.

In the post-Confederation period railway surveyors also worked under intense pressures to help provide, in quick order, transportation links essential to national unity and to the provision of entry into international markets. Giants of the earliest rail surveys in this country, men such as Sanford Fleming, T. C. Keefer and S. Gzowski, are pictured in dramatic action. Here also is the stirring story of how surveyors Dennis, Pearce and others of the profession helped to make possible the successful introduction of irrigation to southern Alberta as well as a memorable description of the feats of Bridgman, Wheeler and McArthur in pioneering the use of the survey camera in mountainous areas in the 1880s.

An adventure-filled account is given of the meticulous measurements involved in the establishment of thousands of miles of boundary lines between Canada and the United States. Featured in these episodes are the dedicated services of Canadian surveyors as they pursued their important tasks along the 49th parallel, the Alaska Panhandle and the 141st meridian.

The story of fifty years of post-Confederation mapping and map making, under federal and provincial auspices, is told against the background of such individual accomplishments as those of Logan, White, Chaiifour and Senécal; of Dawson, Low, Chipman, Campbell and Swannell. The book is generously illustrated by maps, diagrams and photographs of historical value and interest.

Glimpses of the unhampered spirit and freedom of action of native peoples roaming the wide open spaces before the advent of intensive settlement are provided in the story of earliest surveys of Indian Reserves. The enduring contribution made by William Ogilvie to the transformation of Yukon gold rush chaos into peace and order in the Territory is recounted with special emphasis upon Ogilvie's surveys of mining properties in the Klondike district.

The founding of Canada's advancement in the astronomical sciences is illuminated by references to the exceptional foresight and ability of King, Klotz, Stewart and Plaskett in this highly specialized field of surveying and mapping the heavens. Achievements in the surmounting of problems peculiar to Canada's early development are revealed in the beginnings of geodetic, hydrographic and geological surveys under Canadian direction.

In concluding this panoramic review of the first fifty years of Canadian nationhood, in terms of surveying and mapping, the author draws attention to the historic significance of the ventures into north polar seas by Stefansson, Bernier and other explorer-surveyors and the assertion by them of Canada's sovereignty over the then remote islands of the Arctic Archipelago.

Monument of Champlain by Hamilton MacCarthy at Nepean Point near Parliament Hill, Ottawa.

MEN
AND
MERIDIANS

CREDITS

Figures

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6, 44, 45, 46.	Geol. Surv. Can. 81496, 73331, 81367, 68775.
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16, 18, 35.	Public Arch. Can. A965, C1531, C10868.
20.	Quebec Hist. Soc.
21.	Nat. Mus. Can. J2533.
22.	Nat. Gallery Can. 8000.
23.	Vancouver Sch. Bd., K618.
24, 26, 27, 28.	Ont. Dept. Public Rec. & Arch., Toronto.
25.	Ont. Dept. Lands & Forests, Toronto.
29.	Ont. Dept. Travel & Publicity.
31.	Ont. Dept. Public Rec. & Arch. (Ont. Hist. Soc.).
32.	C. F. J. Whebell, Univ. Western Ontario.
33.	Int. Boundary Comm. Rept. 1934.
36.	Can. Geog. J., July, 1964.
39, 40, 41, 42.	Prov. Arch., Victoria, B.C.

MEN AND MERIDIANS

The History of Surveying and Mapping in Canada

Volume I
Prior to 1867

Don W. Thomson

Available by mail from the Queen's Printer, Ottawa.

Price $8.00 Catalogue No. M52-2065

ROGER DUHAMEL, F.R.S.C.
Queen's Printer and Controller of Stationery
Ottawa, Canada
1966

Department of Mines and Technical Surveys Req. no.: 232-5328

Book design by D. A. Shenstone, Ottawa

Preface

In a country as dependent as Canada upon the arts of surveying and mapping it is surprising to find both fields so neglected in history books. True, several excellent historical atlases have been published in fairly recent years but the main story of Canadian surveying has never been published in any major, comprehensive or coherent form. This large gap in the written record of Canada's growth and achievements is all the more surprising when it is realized that surveying and mapping have played roles of primary importance in contributing to the orderly settlement of the land, in promoting the greater safety and efficiency of navigation in our waters and in the location and development of the renewable and non-renewable natural resources of this country. These resources include in addition to land, the fisheries, water, forests, wildlife, waterpower, minerals, and recreational facilities of Canada. In the related fields of town planning and highway construction, and in multiple-resource regions these roles have been and continue to be highly significant in the task of nation-building.

Surveying and mapping contribute in a continuing way to national growth and well-being. To these activities Canadians owe the fundamental order and symmetry of their urban communities. Through a system of precise definitions these arts have bestowed beauty and visual distinction upon the distribution of land holdings. The development of the spirit of possession in the private individual made inevitable the work of the surveyor and the mapper. No subject, other than politics or religion, is more difficult to discuss without arousing deep passions than that of disputed national boundaries. And none, more than surveyors and mappers, have done so much to prevent nations from resorting to war, or for that matter, individuals from going to law.

In recent times the word "survey" has taken on a wide variety of meanings, some of them only remotely related to the word's original definition. The term has now come to signify, in addition to surveys of land, sky or water, surveys of public opinion, of slum conditions, of radio or television programs, of election results, hospital facilities, industrial trends and even of human habits. This history does not pretend to extend to these more or less exotic activities. In this story there will be an attempt, rather, to portray the origin and growth of the very considerable range of Canadian surveys of land and mineral resources; the hydrographic or nautical surveys of our three coasts and inland waters; of international and provincial boundaries and of surveys cadastral, geodetic, magnetic, topographical and astronomical.

All of these diverse pursuits have evoked in men and women the very best qualities of physical and mental endurance and resourcefulness; of determination in the face of formidable odds, of unselfishness, good humor in the teeth of real hazards and, above all, a spirit of profound dedication. In so many instances in the story of Canada have these qualities of heart been so allied to gifts of mind and to the product of intensive training, that they provide a truly memorable epic of constructive achievement.

What is the surveyor's task? It is to measure the natural features of the earth and its waters, to scan the heavens, to locate and fix the boundaries of areas into which man has decided to divide this planet and to determine precise dimensions, directions and relative positions. The mapper, for his part, meets the urgent need of man to see his locality, his nation and his world as a whole and in relation the one to the other; to orient himself and his interests within his earthly and heavenly environment.

But when a surveyor has completed his measuring and the mapper his accumulation of facts, there remains the task of putting results in a form readily understood by others. In like manner through this history there runs the endeavor to trace and to interpret the deeds and accomplishments of the explorers, mappers and surveyors of Canada from the days of compasses and chains to the use of transits, tellurometers and helicopters.

The opportunity to relate, in a comprehensive and coherent manner, the story of surveying and mapping in Canada has been provided by a relatively small company of men of imagination and vision. To Carl W. Lester of Edmonton, who retired in 1964 as Director of Surveys for Alberta, belongs credit for the initial concept. In February, 1962, Mr. Lester, at the time immediate past president of the Canadian Institute of Surveying, by letter conveyed the idea of this history-writing project to the then federal Minister of Mines and Technical Surveys. With the approval, first of Hon. Mr. Martineau, and then of Hon. Mr. Benidickson, it was possible for the deputy ministers of that department, Dr. Marc Boyer and his successor, Dr. W. E. van Steenburgh, to take preliminary steps to launch this formidable undertaking. To an important extent progress on this project was made possible by the enthusiastic understanding and continuing support of federal and provincial officials at policy-making levels and by the special facilities provided the author by the Department of Mines and Technical Surveys and, in particular, by the Surveys and Mapping Branch. By no means the least significant factor in the transformation of the concept into reality has been the active cooperation of officers and members of the Canadian Institute of Surveying in freely placing their services and records at the author's disposal.

* * *

In this first of three volumes of *Men and Meridians* the story of Canadian surveying and mapping has been set in the context of pre-Champlain world progress in these fields. The narrative of Canadian advances in the 17th, 18th and 19th centuries is carried up to the time of Confederation. The second volume will open with the beginning of large scale surveys of Canada's western interior.

Issued by the
DEPARTMENT OF
MINES AND TECHNICAL SURVEYS

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"We fortify in papers and in figures,
Using the names of men instead of men:"

King Henry IV (2) Act 1. Scene 3.

Introduction

The Action at Louisbourg and its Significance

By 1750 French hydrographers and French land surveyors had been more or less busily occupied for a century and a half in their respective tasks in the St. Lawrence River basin. Nowhere else in the world, outside European waters, was there such marine surveying activity in the seventeenth century as in the Gulf of St. Lawrence. In the realm of the cadastral it is astonishing to find today evidences of an imposing number of property-line surveys completed by 1650 on both banks of the St. Lawrence near Quebec City and on the Isle of Orleans.

The annals of French Canada abound with names of brilliant surveyors and mappers of those early times: Champlain, Franquelin, Bourdon, Jolliet, de la Rivière, Boutet, de Catalogne, de Villeneuve, de Verville, Guyon, Boutin, Father Lauzon and Father Bonnécamps. These and other pioneers wrote a unique, imperishable chapter in the history of man's measurings on the North American continent. But in the mid-eighteenth century events began to march remorselessly against the strongholds of French power in the New World. Pitt the Elder was once again in control of policy at Westminster and the British people were in the grip of war fever and in a mood for military victories. The reduction of the fortress of Louisbourg was a first objective of the campaign in America. For Louisbourg guarded the entrances to the Gulf of St. Lawrence and therefore of the river itself and the centres of power in New France.

When the fortress of Louisbourg, located on the rocky southeast shore of Cape Breton Island (Île Royale) was sighted on June 2, 1758, by Admiral Boscawen's 108 ships, carrying 14,000 men, the fate of the mother country France as a direct political power in Canada was sealed. For the final fall of Louisbourg would mean the exposure of vital communication lines between France and her St. Lawrence possessions. From the moment of troop landings on June 8th under Wolfe it was but a matter of time before capitulation of Louisbourg took place, despite the gallant showing of the relatively small French garrison. On July 27th, after more than 40 days of siege, during which the fort and town suffered severely from cannonading, Louisbourg fell for the second time within thirteen years. Yet another year was to pass before Quebec itself was captured. But the handwriting of destiny could be readily discerned on the battered walls of the fallen Cape Breton stronghold.

The final fall of Louisbourg marked in effect the end of the French regime in America, not only in the political sense but also in relation to surveying and mapping in the New World under the direction of authorities in Paris. The event marked as well the beginning of the British period leading up to Confederation in 1867. The illustrious day of Champlain, Franquelin, Jolliet, Deshayes and their successors was now on the wane. The day of Samuel Holland, James Cook, J. W. DesBarres and of John Collins was dawning. Over the horizon of the future, events and forces were already shaping developments that would lead in time to the advent of surveying and mapping of a purely Canadian character on the northern half of the continent.

As waves of the North Atlantic pounded moodily against the rocks near Flat Point and the surf rose in lazy rhythms, three men came to Louisbourg; men who by force of character, long training and scientific ability were destined to dominate the post-war era of surveying and mapping in British North America, both on land and water. In one of those odd pranks played by the spirit of historical coincidence James Cook, a master (navigator) was on H.M.S. *Pembroke*, one of Boscawen's blockading ships. After the

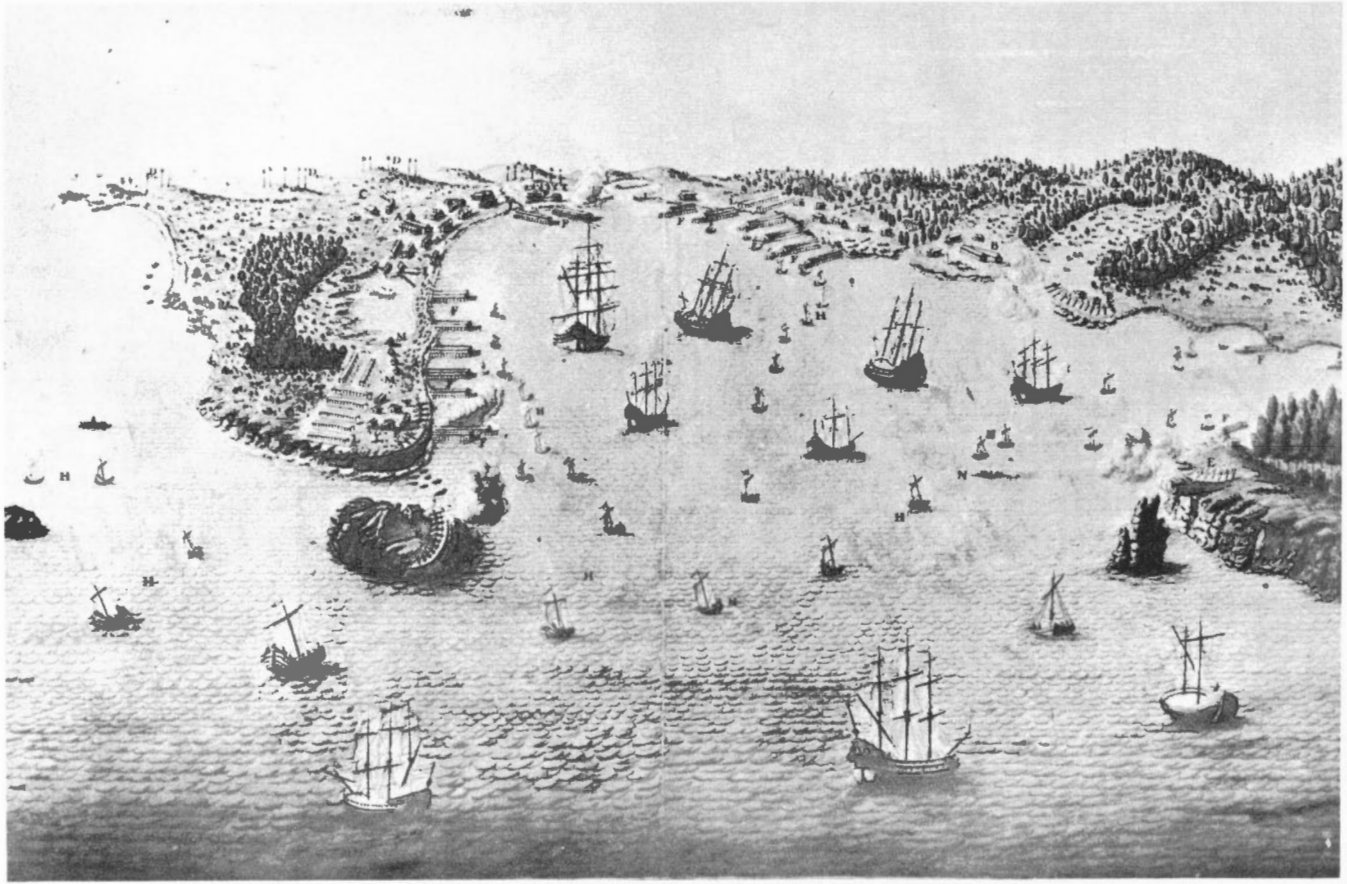


FIGURE 1. Plan of Louisbourg Fortress c. 1717, showing *jalons*, the pickets or poles used by French military surveyors in the alignment of bastions. From Cartes Marines, Paris. (Reference letters apply to points of military significance except D—left centre horizon—denoting *jalons*.)

fall of Louisburg a chance meeting brought Cook into contact with Samuel Holland. Cook proceeded to give Capt. Lieut. Holland of the Royal American Regiment of Foot assistance in drawing up a plan of Louisbourg and its fortifications. This task was, in fact, performed so admirably that both men were later engaged to prepare charts of the River and Gulf of St. Lawrence in anticipation of the following year's onslaught against Quebec. There is every indication as well that Cook also met J. W. DesBarres at Louisbourg, a man from whom the British discoverer of the future learned much of mathematics and draftsmanship.

How did these three notable men arrive in the same locality in Canada at just about the same moment in world history? James Cook came as ship's master on the *Pembroke* commanded by Capt. J. Simcoe. The vessel had sailed from England as a ship of the line to take part in the siege of Louisbourg. But in a tragic, stormy crossing of the Atlantic she lost 29 men. As a result the *Pembroke* was delayed in Halifax harbor until June 8, 1758, the very day the first successful landing of troops took place under Wolfe's direction. However, on arrival at the scene of action, the *Pembroke* did form part of Sir Charles Hardy's blockading squadron.

In the same pattern of coincidence the *Pembroke* carried another significant human link with the destiny of Canada. Capt. Simcoe was the father of John Graves Simcoe who, 34 years later, was to become the first Lieutenant Governor of Upper Canada. In that post he was to develop very close relations with Samuel Holland who, six years after the siege of Louisbourg, became Surveyor General of Quebec and the Northern District of North America.

Both Samuel Holland and Joseph F. W. DesBarres had gone to Louisbourg as officers with the Royal American Regiment of Foot, the 60th. Both served as engineers engaged in making surveys, preparing plans and taking soundings during the siege. At Gabarus Bay DesBarres, soon to become one of the world's outstanding oceanographers, was among the first to land and to capture a French entrenchment.

The day following the capitulation of Louisbourg, Holland was busily engaged in making a survey of the local fortifications and of the town and its environs. It was while he was thus occupied near Kennington Cove that he was approached by James Cook. The newcomer introduced himself and became intensely interested in the plane table employed by Capt. Lieut. Holland. Cook made known his keen desire for instruction in the use of this instrument. Upon the invitation of Capt. Simcoe, Holland a day later brought the instrument to H.M.S. *Pembroke* and remained on the vessel overnight. Next day Cook acted as one of Holland's assistants on the continuing survey at White Point. These surveying activities continued in the vicinity of Louisbourg until the end of the 1758 season.

In Halifax during the winter months Cook was introduced to some of the mysteries of higher mathematics, to Euclid and to the wonders of astronomy by his new-found friends, Samuel Holland and Joseph DesBarres.

In Fort Needham Park at Halifax there stands today a memorial plaque bearing this inscription:

"JAMES COOK, AS MASTER OF H.M.S. PEMBROKE AND H.M.S. NORTHUMBERLAND SPENT THE WINTER MONTHS OF 1758-1762 IN HALIFAX, COMPILING CHARTS OF THE ST. LAWRENCE AND DESCRIPTIONS OF THE COAST OF NOVA SCOTIA FROM PREVIOUS CHARTS AND HIS OWN OBSERVATIONS, AND IMPROVING THAT KNOWLEDGE OF MATHEMATICS AND SURVEYING WHICH HE PUT TO SUCH GOOD USE LATER IN NEWFOUNDLAND AND THE SOUTH PACIFIC".

And it might be added, on the coast of British Columbia.

1

EARLY MAN DRAWS HIS PATHS AND BOUNDARIES

Cartography has no definite point of beginning in history; its roots are deep in a wide range of human activities. One could as easily trace the art of mapping to its origin as discover and identify the first wheel made by man. These are happenings lost forever in the mists of antiquity. But some of the basic elements of map-drawing, such as graphic representations of paths leading to game haunts, to oases or to salt-licks, were present in the earliest sketchings of primitive peoples. These crude portrayals first appeared on the walls of caves, on dried animal skins, on desert sands and on Arctic snows. Mapping and man's mobility have progressed together. Indeed, a map that serves its purpose speaks a universal language, is timeless and transcends all human barriers.

There is an ancient clay tablet in existence today that bears a map of part of what is now known as northern Mesopotamia. The tablet was fashioned about 3800 B.C.[1] In Turin, Italy, there is a representation of Wadi Alaika in Africa, an area in which Nubian gold mines were then in operation. This map, according to experts, dates back to 1370 B.C. As a sample of early cartography it is of special significance because it demonstrates that even at this early stage in man's story, mapping was closely linked with the development of natural resources.

On their Pacific islands native Tahitians constructed relief maps out of wood. Aborigines of the Marshall Islands sought to make crude charts out of bamboo material. Primitive peoples generally seem to have possessed the instinctive ability to produce quite accurate, if somewhat rough, sketches on sand or bits of skin in order to guide themselves on their ambitious journeys.[2]

The first reference to a map in the writings of the Hellenic world is to be found in Herodotus.[3] Anaximander is credited with the production of the first Greek map. It made its appearance early in the sixth century before the birth of Christ. But for the most part we of the twentieth century must only imagine what early maps looked like. It is certain that such productions suffered from a very high rate of destruction. Sand

and snow do not lend themselves to the perpetuation of lines drawn across their shifting surfaces. On vessels at sea, when navigation was young, maps were highly expendable items. Fires and floods, as well as shipwrecks, contributed greatly to the mortality of maps. Metal globes fared little better. A hollow metal globe cut more or less neatly in half would produce serviceable camp pots for bandits or for invading soldiers. In addition, large maps were very awkward to store and folding them only hastened deterioration.

But it was in Egypt, under the Pharaohs, that ancient mapping entered a period of marked development. Up until that time the practice of cartography had grown very gradually. Now a fairly exact science was to blossom out of what had been a rather crude form of art. Some early Egyptian maps were murals only but maps and plans have been discovered on papyrus rolls. The concept of maps as instructions helpful to travellers had an early portrayal in the maps of the nether regions inserted in coffins.

In the quarter century preceding the birth of Christ, Egypt and the teeming city of Alexandria near the great Nile's mouth, provided an environment favoring the exercise of the human intellect. The climate was salubrious and the spirit of the place stimulating. Alexandria not only spurred the ambitious to excel in scholarship and research, it encouraged creativity of scientific thought.

Egyptians enjoyed, in these fields, a rich heritage from the distant past. An amazingly extensive and relatively accurate catalogue of star movements over a period of centuries had been compiled and preserved by Babylonian priests. All modern surveyors and cartographers owe much to that unknown person who first uncovered the mighty, though paradoxical fact of nature that in order to best find one's location on this earth, one must first scan the starry heavens. From Babylonia, it is now thought, came the idea of devising the separation of the eclyptic into twelve signs and later into 360 degrees with the further refinements of 60 minutes and 60 seconds of subdivision, as well as the division of the day into 24 hours. When the Greeks and Egyptians adopted these concepts, mapping entered the category of a science.

As man, in those far-off times, pondered the night skies, it came to be realized, at least by the elite, that the stars as well as the sun re-appeared in the east after apparently setting in the west. Up until this revelation the idea had been prevalent that the earth was a disk suspended between heaven and hell. The Greeks liked to believe that Atlas braced the pillars supporting the heavens. But gradually it dawned upon the more discerning that the world was, in fact, isolated in space. Yet it was not until Aristotle, the founder of theoretical geography, that the concept of a spherical world was proposed with some confidence. There were the persuasive arguments, impressive enough to the ancient Greeks and familiar to moderns, of ships that slowly slipped beneath far horizons, their masts being the last of the vessels' parts to disappear from sight; of the circular shadow of the earth on the moon in eclipse as well as the differing appearance of heavenly bodies as witnessed by anyone travelling from point to point on the earth's surface.

Among the Greeks attracted to Alexandria about 25 B.C. was a young man named Strabo (born 63 B.C.) who was destined to exercise a profound influence on the science of cartography and to occupy a high place among the eminent geographers of all time. He was well educated, partly in Rome, before coming to Egypt. He had travelled over much of the ancient world of Europe and Africa. Although it is uncertain whether Strabo ever compiled a map of his own, he did write a *Geography* which was the first manuscript of its kind to survive to our times. It is therefore the key to the foundation of modern cartography.

Just as Champlain, in his surveys and mapping expeditions in Canada, was materially aided by the heritage of knowledge and experience bequeathed by the searching minds of earlier centuries, so did Strabo benefit from the pioneers in astronomy and navigation who had preceded him.

Even before the time of Strabo the Phoenicians of the eastern Mediterranean had become accustomed to sailing their ships on occasion out of sight of land and at night. Without compasses, how did they accomplish this? The answer seems to be in their natural skill and some training in the uses of astronomy and arithmetic. The Phoenicians knew their stars and how to steer by them. Quite likely they possessed crudely drawn charts and written sailing directions of a sort. They developed a type of wind-rose on their charts. This was a circular design containing points in various directions bearing names of the winds and the quarters from which they blew. But it was not until the eighth century A.D. that the idea was accepted of limiting the number of points to 32 on the wind-rose card, based on the north, south, east and west winds, supplemented by quarter- and half-winds.

The oldest existing example of sailing directions for navigational purposes is Stadiasmus, a kind of Cook's Tour guidebook of ports of the Mediterranean and Black Seas, written by one Scylax of Caryanda several centuries prior to Christ's birth. The text is no masterpiece of literary art but it was remarkably comprehensive in its scope, indicating among other things the sailing times between ports. If this text was written to accompany a chart then no such chart has yet been discovered. Sailing directions may be said to be the lineal predecessors of marine charts. Stadiasmus, if compiled in the 4th or 5th centuries B.C., forms the final Greek contribution of this nature to the art of navigation.[4]

In his *Geography* Strabo endeavored to put the known world of his day in its setting within the entire universe, including the movements of stars and planets as well as the nature of the earth itself. He stressed the importance to geography of astronomy and geometry. Once again we find this awareness of the fact that in order to locate himself in his world, man should first study the heavens and master their awesome secrets. Astronomy was indeed to become the handmaiden of surveying and cartography and Strabo was one of the first to realize this fundamental relationship. He realized as well the value of the priestly records of Babylonian star-lore related to the task of mapping the earth.

What were some of the questions challenging the curiosity of scientists in Strabo's day? Greek and Egyptian scholars pondered over a number of insistent queries. What is the true shape of the world? How big is the world? Does it move or is it stationary? Homer's idea was that the world was composed of a flat disk entirely surrounded by water, "washed by the oceans" for no matter in what direction man travelled in the ancient world he finally ecountered the apparently endless seas. And for those early Greek philosophers the skies were held in place by a series of invisible pillars, braced by the muscular god Atlas.

About 500 B.C. Pythagoras the Greek suggested that the earth might not be flat after all, but spherical. Aristotle was convinced of the validity of this hypothesis. He had a firm supporter in another distinguished Greek thinker. He was one who, to an important extent, paved the way for Strabo, his fellow-countryman. The name of this pioneer was Eratosthenes of Cyrene (276 B.C.-196 B.C.) who became head of the Alexandrian Library. He, too, was convinced that the earth was spherical and he became the first person to work out a sound method of measuring the earth's size. In this respect Eratosthenes made a basically significant contribution to the sciences of carto-

graphy and surveying because once the fact of spherical form was accepted, astronomers were able to establish lines of latitude on the earth's surface.

How then did the learned and ingenious Greek scientist go about the solving of this problem, so formidable in his day, of measuring the size of the earth? To begin with he was aware of certain basic facts. He believed that the distance between Alexandria and Syene, Egyptian cities located on a north-south line, was 500 miles. Actually that distance was 453 miles. He had heard from citizens of both cities that the sun reached its meridian, highest point in the sky, at the same time of day in both places. He knew that at Syene when the sun came as far north in summer as it would come, it was directly overhead at mid-day and sundials at Syene on that particular day did not cast shadows.

But Eratosthenes also knew that in Alexandria the situation was not just the same as in Syene. Instead of being directly overhead at the peak of the summer solstice the sun, shining over a pole stuck in the ground, cast a shadow equal to one-fiftieth part of a circle.

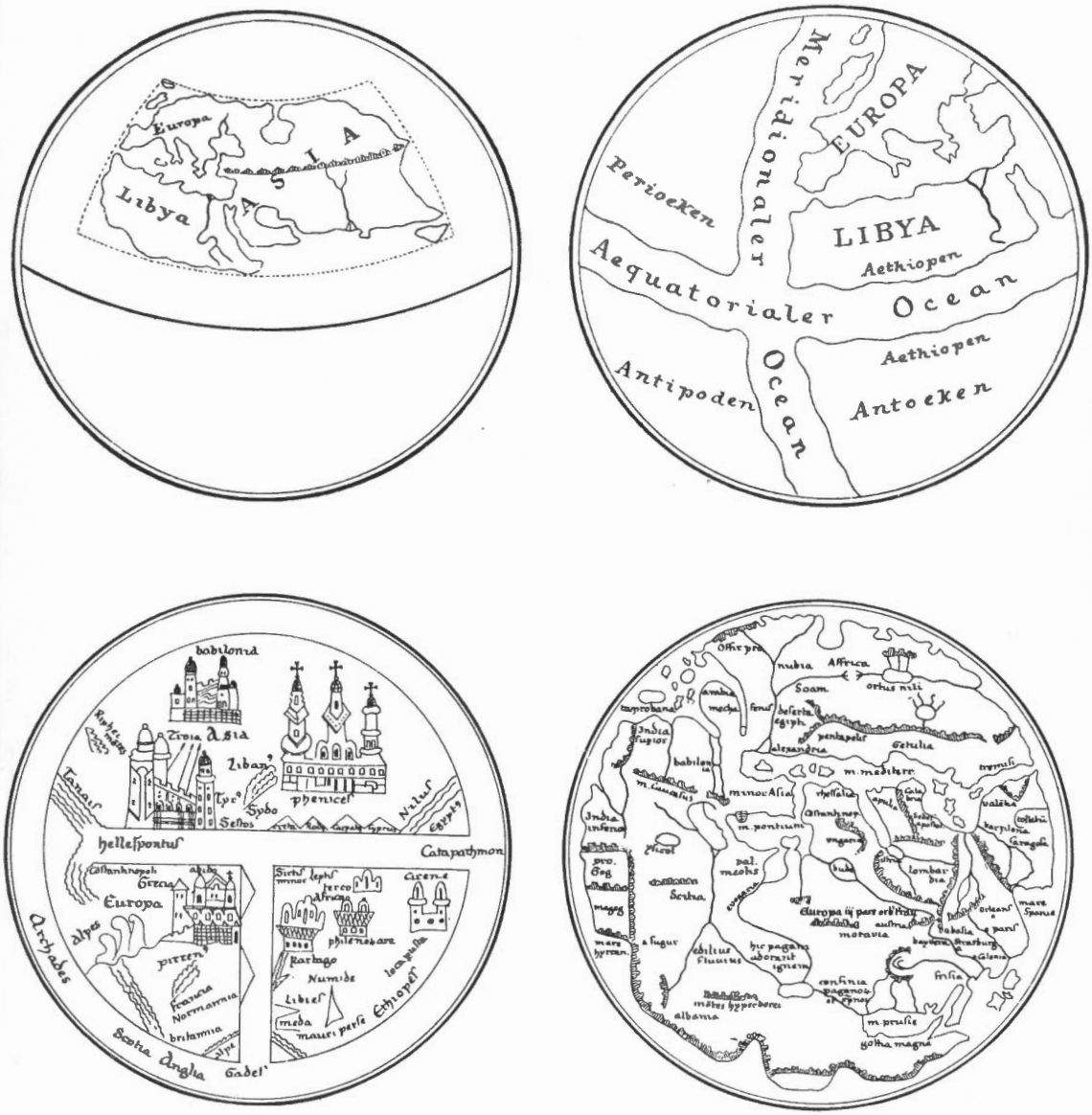
Those were the fundamental facts, then, on which Eratosthenes theorized that the distance (as he thought) between Alexandria and Syene being 500 miles, this distance was equal to one-fiftieth of the circumference of the spherical earth. Thus the linear distance of the earth's circumference would be 25,000 miles or in terms of the units of length which he used, 225,000 stadia or 24,662 miles. The actual figure is 24,899 miles.

Obviously Eratosthenes did not realize at the time of his historic measurement that the earth was not a perfect sphere. From his calculations, and on the basis of the earth being divided evenly into 360 degrees, each degree would then be equivalent to 68.5 miles. As matters turned out this quite accurate figure was not respected in subsequent times. This failure to accept the finding of Eratosthenes had the effect of slowing up the growth of cartography generally. But his was the first attempt to ascertain the earth's true size by measuring the arc of a meridian. In nearly every respect this method was the one later to be used for this purpose even into modern times. The measurement of Eratosthenes, having regard to the unavailability then of telescope or of any precision instrument, is truly remarkable. It was a phenomenal achievement in the advancement of both surveying and mapping.

Strabo, for his part, did the science of cartography a signal disservice when he did not accept Eratosthenes' theory but used another calculation of 18,000 miles[5] as the distance around the earth at the equator and 50 miles as the distance of one degree of arc. These two conclusions were to bedevil geographers for a long time to come.

The use of a stake inserted in the ground led to the fixing of the first three parallels of latitude on a map. It was the ratio of shadow to the height of the stake which determined these basic decisions. On the day when no shadow was cast by the stake situated on the equinoctial line because the sun was directly overhead, that line became the equator as well. This served to divide (theoretically) the earth into northern and southern hemispheres. This was a kind of astronomical base line, the first to be established. The second and third parallels of latitude were, of course, based upon the line of the equator. To the ancients these were the summer and winter Tropics, marking the extremes in the sun's upward (to them) course and its downward limit. The summer Tropic in time became the Tropic of Cancer, or crab, and the southern or winter Tropic that of the he-goat or Capricorn. Cartographers were thus provided with the first east-west parallel lines that could be set down on a map.

Eratosthenes defined "meridian" as a circle passing through the poles of a spherical earth and at right angles to the horizon. The equatorial line was one midway between



MAP 1. Circular maps from earliest pre-Ptolemaic times to the late Renaissance period.

the two poles of the earth's axis and in a plane at right angles to it, the line where day and night were of equal lengths.

The learned Greek laid down a map of the inhabited world and claimed that its length from ocean to ocean was 7,800 miles. The remainder was sea. His north-south lines were not laid down in any methodical or orderly fashion. He placed them where convenient or where the spirit moved him to put them, nine of them in all. Apart from the irregularity of the Eratosthenes map grid, his network of parallels and meridians, his production was, in the main, approved by Strabo. He explained to critics of the map that it was drawn without the aid of such instruments as stakes or sundials. But like most early maps the result was a curious combination of folklore, philosophy and fact.

One of the critics of Eratosthenes was Hipparchus who made one influential suggestion concerning the construction of a series of lines at right angles to the parallels, to be determined astronomically, with great circles passing through the poles (lines of longitude) equally spaced and thus forming an orderly, geometrical pattern of the surface of the whole world. This dream of Hipparchus about establishing lines of longitude was destined to remain a vision until the invention of an instrument that would accurately mark the passage of time, even on a storm-tossed sea. Hipparchus and, some 300 years later, Claudius Ptolemy, laid down the basis for trigonometry, compiling mathematical tables of considerable durability.

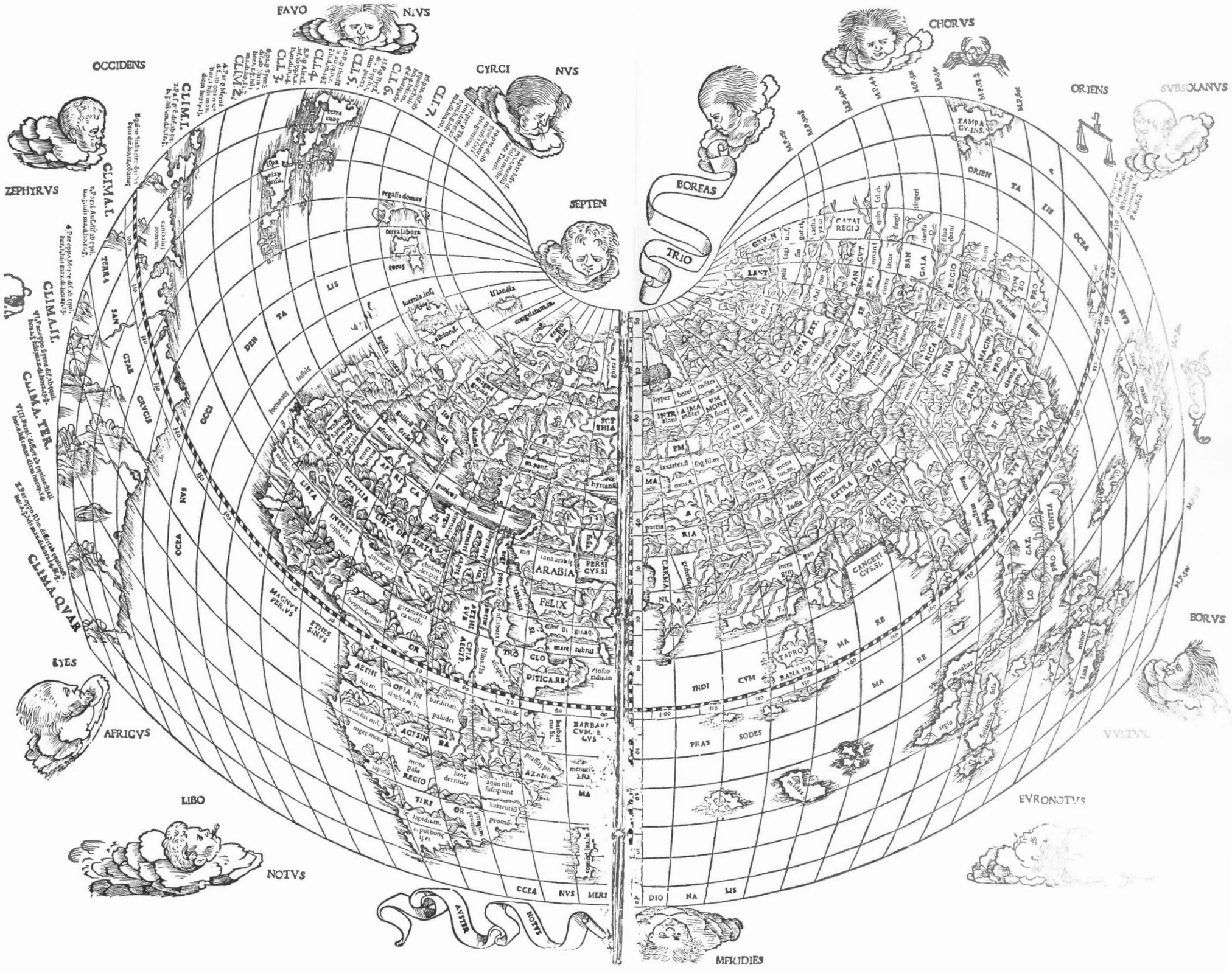
Strabo foresaw the problem of map transposition, from globe to flat surface, a problem met for most practical purposes by Mercator and his projection plan, a development to come more than 1,500 years later. As Lloyd A. Brown points out in his book "The Story of Maps" the publication of Strabo's *Geography* took place within the first 20 years of the Christian era and brought to a climax the initial period in the history of cartography prosecuted on a scientific basis.

The age of Strabo was followed by the age of Ptolemy. Claudius Ptolemy is, in many ways, a mysterious figure in cartographic history. Little is known about him as a man, about his origins or the details of his highly useful career. Probably Ptolemy's greatest works were his *Geographia* and his *Almagest*. The latter contained his theories on map-making. Ptolemy's principle was to repeat observations many times in order to reduce chances of human error, a principle faithfully followed by scientists today. He conceived the primary function of geography to be map making and indicated that the task of the cartographer was to survey the entire world to scale. He believed that mathematics and celestial observations were the principal tools of the map maker.

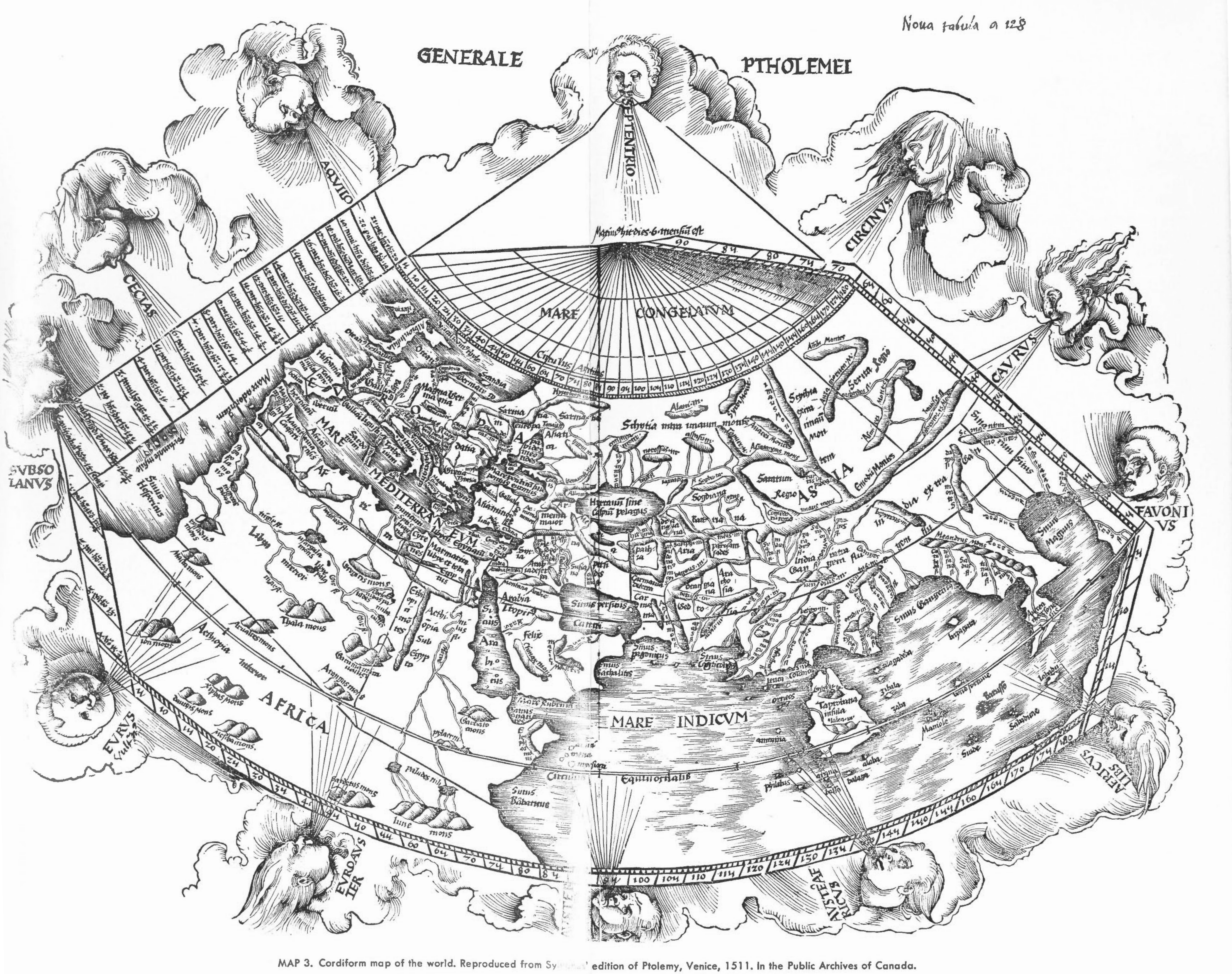
In Book 8 of his *Geographia* or Atlas of the World, Ptolemy states: "It remains for us to show how we set down all places, so that when we divide one map into several maps we may be able accurately to locate all of the well-known places through the employment of easily understood and exact measurements."

Ptolemy was concerned about the importance of drawing maps to scale, to maintain proper proportions. In his 27 maps accompanying the text of the *Geographia,* Ptolemy made 10 of Europe, 4 of Africa, 12 of Asia and one general map of the world. He included tables of distances with his maps. Nobody can be absolutely certain whether Ptolemy drew these maps himself or whether someone else actually performed the work. Whoever is responsible for the handiwork was the first to employ hachuring and various colors.

Ptolemy chose to follow the erroneous conclusions of Strabo rather than the more correct deductions of Eratosthenes on the estimated linear length of the earth's circumference and, correspondingly, the value of each degree. His value of a degree was only 56½ miles. One result of following this false lead is that Ptolemy's equator is 400



MAP 2. Ptolemaic map of the world. Reproduced from the 1513 Strasburg edition of Ptolemy's *Geographia*. In the Public Archives of Canada.



MAP 3. Cordiform map of the world. Reproduced from Sylvanus' edition of Ptolemy, Venice, 1511. In the Public Archives of Canada.

miles too far north of the actual. He laid down his principal or prime meridian through the Fortunate Isles (the Canaries or the Madeira group). His factual meridians were calculated and fixed westward from Alexandria. His Mediterranean was many degrees too long and its width was also too great. His Indian Ocean was portrayed as a land-locked sea.

With all its faults, the outcome of a none-too-surprising lack of authentic information, Ptolemy's towering work proved to be cartography's most helpful and most spectacular beacon of knowledge and guidance for more than 14 centuries. Without this prodigious intellectual achievement the progress of western civilization would have been profoundly slower. It was on Ptolemy's achievements that Christopher Columbus based his ambitions and, for better or for worse, revealed not quite in accordance with his expectations, a New World to mankind.

Thus, even in the years immediately following the birth of Christ, scholars and scientists of the ancient world were altering man's concepts of the earth and the universe as well as suggesting more precise methods of fixing positions on the earth's surface. A fairly accurate estimate had been made of the length of the earth's circumference and therefore of the value of each of the 360 degrees of that circumference. The Greeks had made an initial attack on the projection problem involved in transposing the surface of a sphere to the surface of a flat paper. There had been a bold attempt to set up a more or less rigid framework of latitudes and longitudes for a world map. A table of latitudes had been compiled by the Greek astronomer, Hipparchus. The difficulty over fixing meridians, the north-south lines of a map in proper and uniform spacing, was to remain unsolved for centuries to come. Without the aid of the magnetic compass it was impossible to determine the bearing of one place in relation to another.

Whether Ptolemy himself did or did not draw the famous maps bearing his name, a wealth of topographic detail was transmitted to the leaders of Renaissance activity in map making and profoundly influenced their cartographic ideas and practices.

2

THE ROMANS AND RECTANGULAR LAND SURVEYS

As early as three thousand years ago a rectangular system of dividing land was in use in China. In the course of several more centuries a similar system appeared in Italy under the Romans. For purposes of colonization the land was divided into squares, each called a *centuria.* Land so divided was described as *agro centuriato,* land divided into hundreds. The traces left today in Northern Italy represent the oldest surviving form of land survey in the Western World.

Clues to the existence of a rectangular system of survey under the Romans are to be found in the road and canal patterns seen between the Po Valley and Rome, as well as in the shape of farm holdings in that region. But it was not until fairly recent times that these arrangements were recognized as the product of surveys of the classical period.

Although existing traces of the system in Italy are the oldest to survive in the Western World, it is generally accepted by historians in this field that the first definite identification of a rectangular survey of Roman origin was at Carthage in North Africa. After the fall of that city in 140 B.C. the Romans introduced a land survey *divisio et assignato;* boundary markers used in it have been uncovered in recent times. In fact the *lex Livia,* the law pertaining to the disposition of Carthaginian territory, provided that it should be surveyed and divided according to the *centuria,* a unit containing 100 heridia. It was 2,400 feet square or 132 acres. This Roman survey unit may be compared to the present Canadian and U.S. unit of the township consisting of 23,000 acres.

The first step in a Roman survey was the selection of a central point, a point of beginning, called *umbilicus.* This was to be the intersection of the principal coordinates. In addition to the point of origin, other features of the Roman system of special interest consisted of a principal meridian or *cardo maximus* and a base line or *decumanus maximus.*[1] As in the realm of mapping, it is quite impossible to trace the invention of the rectangular survey system to any individual of ancient times.

The first lines laid out by Roman surveyors, therefore, were the *decumanus* and

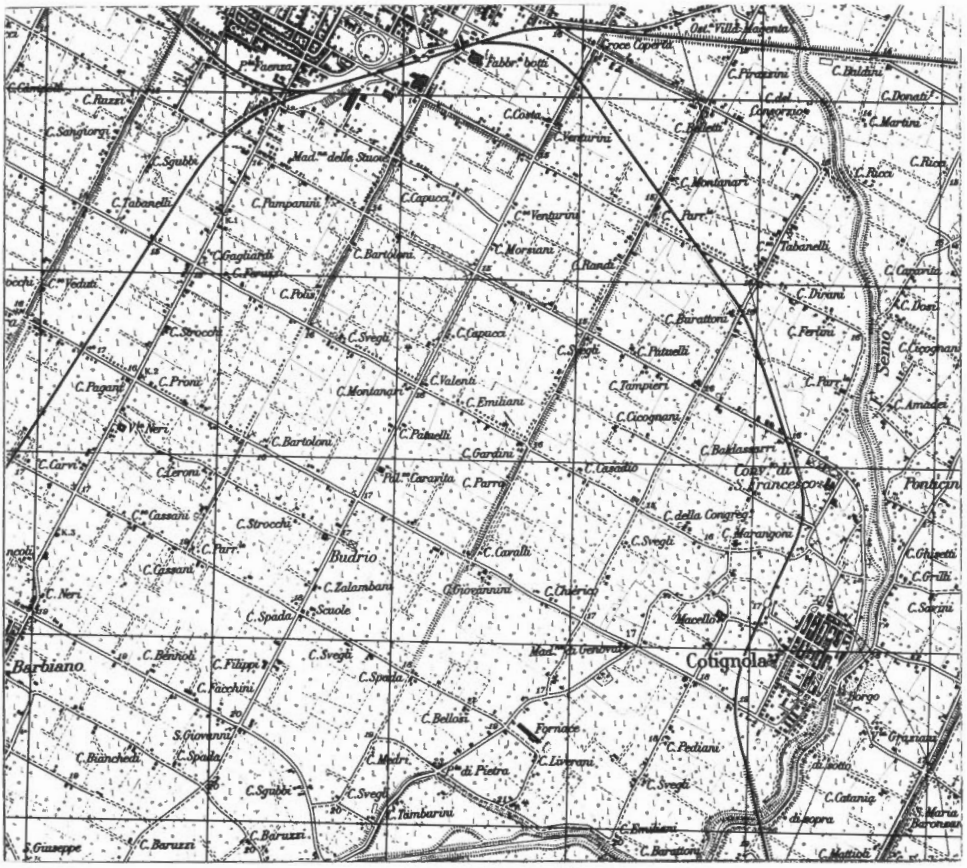


FIGURE 2. Remnants of the Roman survey south of Lugo, Italy. From the *Cotignola* sheet.

the principal coordinate running at right angles to it, the *cardo*. Law and custom regulated the width of roads which commonly formed initial survey lines. Usually these were 40 feet wide. The law of those days provided that all of the principal roads forming part of the survey grid should be declared public thoroughfares. Roman law also required that corners of a *centuria* be clearly marked. On one of the Roman boundary markers found in modern times in North Africa was the inscription that the survey had been executed by the Third Legion "Augusta" in 29-30 A.D.[2]

The actual division of the land was known as *forma* and the surveyor's rough field notes as *commentarii*. In their more permanent form, whether on bronze, marble or wood, these notes were known as *typus* or *pertica*. Apparently one copy of the notes and of any accompanying sketch or sketches were deposited in a local archives as well as in the central archives or tabularium in Rome.[3]

The surveyor's craft was founded by Julius Caesar, according to writings of land measurers of the Roman Empire. Cicero refers to Saxa as an expert surveyor, a *peritus metator*. After 70 A.D. surveyors became state employees. A department or office of surveyors was headed by a chief, *primicerius mensorum*. Applicants for posts as surveyors were required to pass examinations and, if successful, to be formally accepted

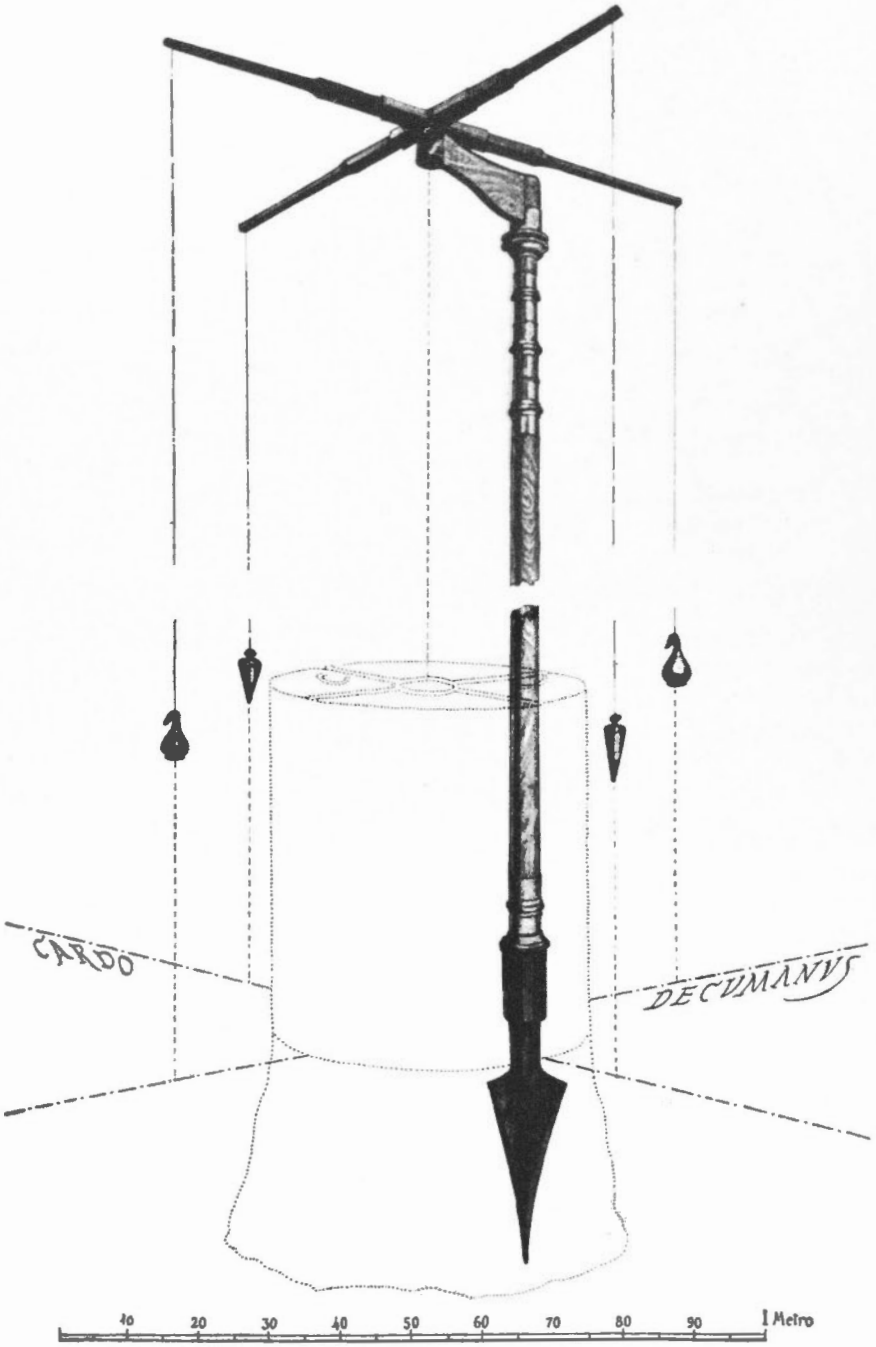


FIGURE 3. Reconstruction of Roman surveyor's instrument, the *groma*, from parts found in Pompeii. Two pairs of plumb lines are suspended from two horizontal rods set at right angles to each other.

for membership in the craft. These successful ones were known as *mensores*, *agrimensores* or *gromatici*. The latter title arose from the most important instrument then used by surveyors, the *groma*. The *groma* was employed in the field in much the same manner as a transit. In 1912 a complete *groma* was discovered in Pompeii, in the house of a surveyor named Verus.

The chief interest for Canadians in the Roman surveys lies in the reflection that more than twenty centuries ago, a system of surveying land in rectangular blocks was in effect in Europe and Africa and that its influence persists today, particularly in our prairie provinces. In a very real sense the vast Canadian land measurements stand with those of many of the states of the United States as a New World tribute to the achievements of surveyors of Roman times.

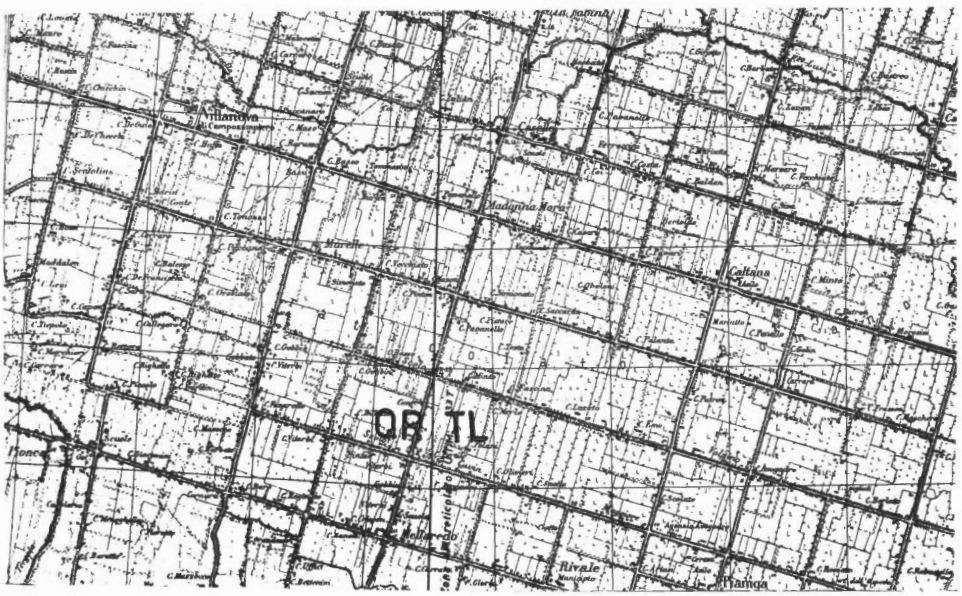


FIGURE 4. The Roman survey grid northeast of Padua, Italy. From the *Dolo* sheet. The words *graticolato Romano* (Roman grid) appear on this map.

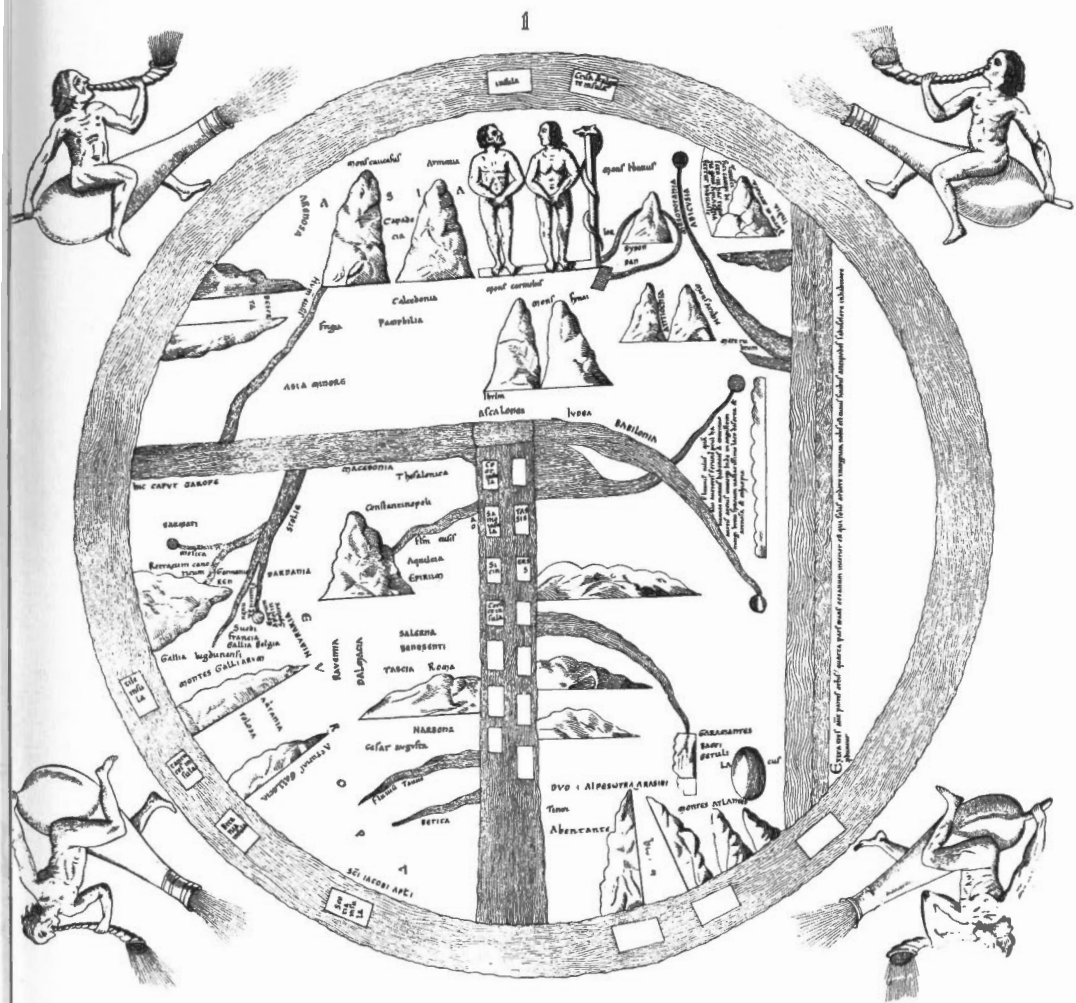
3

MAPPING IN THE MIDDLE AGES

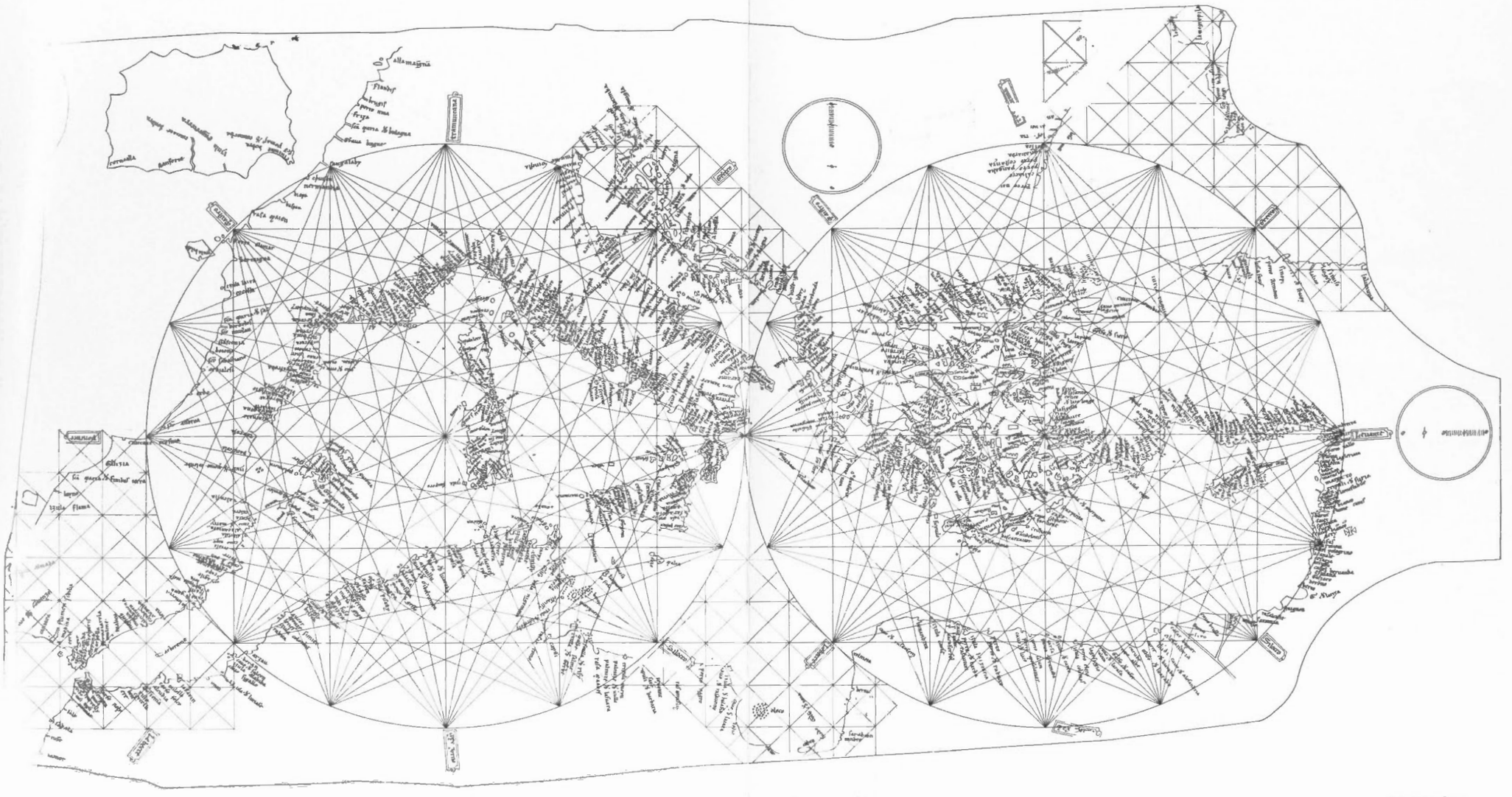
Although the Romans helped greatly to lay the foundations of modern surveying, the part played by them in the improvement of navigation practices in ancient times was not a very large one. The Romans, in fact, were not particularly impressed by Greek accomplishments in the realm of cartography, especially on the theoretical side. There is in existence a road map of the Roman Empire but it is a map that may be unique rather than typical of Roman achievement in this field of activity. The map does provide details of distances between various points depicted thereon but is quite indifferent to the need for information on directions and on orientation generally.

But in literary records of military campaigns one finds references to the use of maps by the Romans. There are references as well to a map of the world, *Orbis Terrarum* by Agrippa, son-in-law of Emperor Augustus. This world map was constructed shortly before the birth of Christ and may well have supplied a model for cartographic efforts throughout the Middle Ages. In any event Roman maps had a much more practical application to daily travel needs than did any Greek cartography. Small T-O maps, popular in later Roman times, were much in evidence in the Middle Ages. These were circular in form, sometimes called "wheel maps" and were usually divided into three parts. This partitioning was accomplished by a vertical 'T' design within an 'O', the latter representing the boundary of the known world. The horizontal stroke of the 'T' indicated the meridian from the Don River to the Nile. The perpendicular of the 'T' represented the axis of the Mediterranean.

By 1300 scientific cartography was beginning to emerge from its hibernation during the Dark Ages. The expansion of knowledge, improvement in communications and the increasing desire for more information on the nature and dimensions of the world, spurred fresh interest and activity in both surveying and mapping. Marco Polo's adven-



MAP 4. "Turin" map of the twelfth century. This is the best known example of a strictly "dark-age" ("T-O") map. The original is in Biblioteca Reale, Turin. Reproduced from Giuseppe Ottino, *Mappamondo Di Torino*, Torino, 1892.



MAP 5. "Carte pisane", 14th century, one of the earliest extant portolanos. Anonymous and undated, it is believed to have belonged originally to an old family of Pisa. The original is in the Bibliothèque Nationale, Paris. Reproduced from M. Jomard, *Les Monuments de la Géographie*, Paris, 1859.

tures in Cathay had their influence also in stirring up public curiosity and a spreading demand for facts concerning parts of the globe far away from the centres of European civilization.

One interesting innovation of medieval cartography was the introduction of color to maps as well as ornamentation, including human heads used as symbols of wind directions.

Following the break-up of the Roman Empire and during the greater part of the Middle Ages cartography certainly suffered from the church's intolerant and forbidding attitude towards the sciences generally. But Christianity in those uninformed, narrow-minded times was not completely unhelpful to the progress of mapping. The 'strange' doctrines of such pagans as Strabo and Ptolemy were frowned upon, it is true, by medieval Christian leaders but the multiplicity of Holy Land pilgrimages and military expeditions involved in the crusades (1096-1270) inspired the publication of travel guide books on an ever-expanding scale. As Brown states in *The Story of Maps* (p. 100): "To the majority of Christian worshippers the Crusades were a God-given opportunity to liberate the Holy Land from the power of the infidel. To the science of cartography they were the first step towards a permanent enlargement of the habitable world. The rumoured wealth of the Indies, Cathay and India became a known fact." The probing of Asia about 1300 and the resulting revelations had about the same explosive impact on Europeans as the discovery of America by Christopher Columbus two centuries later.

The general upheaval resulting from the Christian crusades did serve to shake the complacency and self-sufficiency of many Europeans and there was a consequent broadening of outlook and of thought. New lands, and new things had come to light and there had been the opportunity to see how other peoples lived, moved and had their being. The post-crusades European had learned to tolerate, to compare and to assess. He reacted favorably to fresh stimuli for scientific research. The disposition of Europe changed irretrievably after the crusades.

Prior to the discovery of America there were in Europe three broad categories of maps, namely, ptolemaic, ecclesiastical and portolan. In a general way it could be stated that these productions were respectively for the use of the scholar, the general public and for mariners. Our modern maps and charts have developed from the ptolemaic and the portolan types.

No true sea charts have survived to the present day from the first thousand years of the Christian era. So far as the history of surveying and mapping is concerned, the 14th century is noted for the widespread use of portolan charts and portolanos, some of which have been preserved for posterity. The portolan chart is a type of medieval map delineating coasts for the guidance of mariners. These charts appear to be closely linked with the expanding use of a brand new navigation instrument, the compass. Just how these charts were made remains a mystery. They were confined, in the main, to coasts of the Mediterranean and Black Seas. The term 'portolanos' applied not to charts nor anything in the nature of a map but referred rather to documents resembling what later came to be known as "sailing directions". Of the twenty portolan charts of the 1300s that escaped oblivion, the best known is the Catalan Atlas (1375).[1]

The portolan charts were drawn on parchment with the coastlines usually in black, now quite faded, bearing an incredibly lengthy and detailed list of place names of ports and features. Other colors employed were gold and red, important harbors being depicted in the latter color. These charts bore a system of radiating lines of direction and constituted the working tools of a danger-filled profession.

Names of two chart makers of the 14th century are noteworthy, Petrus Vesconte and Angellino di Dalorto. On a Vesconte chart (1311) there is a cross within a circle indicating in all likelihood the four cardinal points of the compass and containing as well a map scale. Vesconte also produced an Atlas (1318) and another chart about 1325 that is very well drawn and beautifully colored. Dalorto is known for his portolan chart of about 1325 on which the north is indicated by a star.

In the famous Catalan chart (1375) there is a complete compass-rose forming part of an arrangement of radiating or rhumb lines representing compass directions (loxodromes).

Navigation in the 14th century, in addition to enjoying the advantages of improved charting and sailing directions, benefitted from new or improved instruments. The magnetic needle or compass had come into fairly general use and the cross-staff by which latitude could be ascertained and the angle between two stars measured had been introduced.[2] Towards the close of the century map makers were becoming more realistic and practical. For the first time in medieval mapping Asia was assuming something resembling its actual shape.

These twilight years of the Middle Ages marked the beginning of the most significant period of exploration and discovery in the world's history. In some part this upsurge in man's questing zeal was the result of Christian enthusiasm to spread their gospel across the whole world. Other factors contributed also, including the purely profit-seeking urge of European rulers and merchants. They sought to find an acceptable route to the legendary wealth of the Indies.

In the rise to popularity among mariners of the portolans and portolanos the map makers of Northern Italy played a highly useful and influential role.

4

THE GOLDEN AGE OF DISCOVERY

The period from about 1420 to the end of the 15th century could well be described as the golden age of exploration by Europeans, and especially by the Portuguese. In Portugal the reign of John I (1385-1433) was, on the whole, a peaceful one. If that reign was also epochal it was mainly because of the ambitions and actions of the King's youngest son, the Prince whom the world was later to know as Henry the Navigator. It was a time of great intellectual ferment in Europe. It was in these buoyant years that the compass began to be combined with the wind-rose in active use on shipboard. The invention of printing and its rapid development as an industry speeded up the processes of civilization and revolutionized the dispersion of knowledge, including its distribution by means of maps. In 1450 four cartographers were busily employed on the continent in multiplying copies of Ptolemy's *Geographia.* New instruments, including the quadrant, were entering into use by mariners. All of these dynamic events foreshadowed the arrival of a turning point in world history, the official discovery of America by Christopher Columbus in 1492.

The discovery of the Azores in 1427 was one of the first fruits of the era of Prince Henry the Navigator (1394-1460). Henry had been made governor of the southernmost province of Portugal in 1419 and spent most of the remainder of his life there. He displayed, for those medieval days, a most remarkable interest in matters of navigation. He was the first European statesman to realize that the sea was not a limitation upon man's activities but a highway for his trade and fuller life. It was mainly through Henry's genius and persistent effort that Portugal, out of her own resources and at least a half-century before her more powerful neighbors, led the way in oceanic exploration. One of the important factors in this development was the establishment of a settlement of Portuguese in the Azores, a most significant step in the progress of long-range navigation.

Seven years after the discovery of the Azores, one of Henry's ships commanded by Gil Eanes, rounded Cape Bojador and returned safely from the 'dreadful' areas beyond it. The following year another vessel sailed fifty leagues past the cape and managed to survive the awful Sea of Darkness! By 1446 Fernandez had sailed almost as far south as Sierra Leone. Prince Henry did not live to see the climax of Portuguese exploration and discovery. The peak achievement came in 1487, some 28 years after his death. In August of that year Diaz sailed from Lisbon with a fleet of three ships, making his way southward along the west coast of Africa. By early 1488 he had rounded the long spit of the Cape of Good Hope. The writers of those times had been drawing discouraging word-pictures of the utter emptiness and unspeakable hazards of the region beyond Cape Bojador. This cape, now part of Spanish West Africa, is on the African mainland, south and somewhat east of the Canary Islands. Southwards beyond that point, it was claimed by publicists, no humans could be found, neither trees nor fresh water. Shallow seas with fearful currents offshore and lifeless deserts inshore represented the best that could be expected.[1] In the light of these general beliefs and fearful warnings, the towering nature of the Diaz exploit in the annals of discovery by sea may be more readily realized today.

Prince Henry of Portugal proved to be a natural leader of men, brilliant in the fields of diplomacy and finance. From the Moors the Portuguese had inherited some knowledge of the sciences as well as much sailing lore from the Italians. In addition Portugal had a great maritime asset in its relatively long coastline and excellent ports. By the vagaries of fortune it was a period in history of that nation that produced such an outstanding royal patron of navigators and navigation.

There exists a difference of opinion among historians as to whether Henry founded the School of Sagres (a town in southern Portugal) where astronomers and mappers mingled their knowledge and talents to improve navigation techniques, or whether he merely hired a few learned men to instruct pilots in the art of chart making, the production of improved nautical instruments and in navigation procedures generally. Whether or not he was the founder of this school of mariners, Henry contrived to keep Portuguese seamen knowledgeable in new methods of finding their way across broad oceans. His most important contribution to marine cartography of the Middle Ages was his emphasis on the scientific approach to problems of navigation. He stressed at all times the need for the use of mathematics and astronomy in charting and in steering a course on the high seas.

Reference has been made to the settlement of the Azores. By establishing the Portuguese there Prince Henry achieved much more, in the long perspective of history, than he realized. It was from the Azores that various Mediterranean nations began their voyages beyond all sight of land. It was in the Azores that Columbus lived with his wife's family and it was there that he became heir to the nautical instruments and maps of his father-in-law. Here it was also that he received information concerning geographical and nautical concepts which proved indispensable to the success of his most famous voyage.

It is likely that at this medieval western outpost Columbus first dreamed his dreams of discovery. He convinced himself thoroughly that, in the light of information available to him concerning the shape and size of the world together with the surveying instruments now at his disposal, he could cross the Atlantic to its unknown shores. By cleaving to his dreams, despite discouragements and open ridicule, Columbus made one of the most portentous journeys ever made in the long story of mankind.

Yet it was the Portuguese-born Magellan who achieved, in the circumnavigation of

the globe in 1519-20, what Columbus had failed to accomplish — the linking of Europe with Eastern Asia by crossing the Atlantic in a westerly direction, finding the southern extremities of South America and then sailing round Cape Horn.

Under the continuing influence of Prince Henry's wise concepts, immense and lasting glory was won by the pioneering, probing seamen of Portugal. In the process the royal treasury of the nation as well as man's store of knowledge were substantially enriched. Avenues of global travel were opened to the enterprise of European peoples who had become accustomed to regarding their one-eighth of the world as the whole of it. The land to become known as Canada was to experience the impact of Portuguese explorers and mappers on its eastern shores and waters as a direct result of this golden era.

Soon after Columbus returned home from his momentous voyage, the need for a settlement of a threatening international crisis became acute. Spanish claims to all new lands on the other side of the Atlantic were hotly disputed by Portugal and Spain was in no mood to give ground in any argument on the matter. Pope Alexander VI made a laudable attempt to mollify the rivals and to lessen tension between the disputants. His Holiness, in a Bull of Demarcation of May 3, 1493, two Bulls on May 4th, followed by another shortly afterwards, laid down the Papal law on the issue. He drew an arbitrary meridian from pole to pole on a north-south line one hundred leagues west of the Azores. The Spanish zone, in which all lands could be claimed by Spain, was to the west of that line, the Portuguese zone was to the east.

This was a noble, well-intentioned gesture by the Vatican in the interests of a peaceful settlement and represented an early important diplomatic effort in the Western World to delineate what has come to be known in the 20th century as national spheres of influence. But these Papal actions formed only the preliminaries to the main event, which was the Treaty of Tordesillas of September 5th, 1494. Following the move of the Vatican in the matter, the King of Portugal and the Spanish sovereigns commenced negotiations leading to a treaty. Thus the Papal Bulls became inapplicable and a new line of demarcation was established 370 leagues west of Cape Verde. The final arrangements on the disposition of the issue were made, therefore, not by the Pope but by the heads of the states directly concerned. Although the monarchs of England and France of that day paid little or no attention to the declared demarcation line of the treaty provisions, Portugal and Spain did respect, in the main, this formal agreement.

The Pope's preliminary action and the treaty itself served to emphasize the pressing need of a practical method for finding longitude aboard ship. The growing catalogue of marine disasters by shipwreck acted as an equally impressive spur to the now desperate search for some workable device. More and more it was becoming evident to leaders of western thought that the invention of an accurate timepiece, capable of reliable operation on a storm-tossed vessel, was the real answer to the longitude-fixing problem. But the world was as yet a century and a half away from the appearance of the Harrison Clock. Not that there was any absence of timekeepers in those far-off days. The earliest clocks in use in Europe appeared in the 13th century.[2] These clocks were corrected by sundials and by rough and ready astronomical observations. Stars remained the true timekeepers for man and his world as this globe rolled along in its sun-centred orbit.

Similar difficulties afflicted the finding of latitude on any ship in more or less violent motion. Martin Behaim, eminent navigator and cartographer, was appointed by King John II of Portugal to a special committee which achieved improvements in the astrolabe. Columbus in the journal of his first voyage notes:

"On February 3, 1493, the North Star appeared very high as it does off Cape Vincent. The Admiral was unable to take the altitude either with the astrolabe or with the quadrant because the rolling by the waves prevented it."[3]

We know that the astrolabe was in use by Persian and Arabian astronomers in very early times. Its invention is ascribed to Hipparchus about 150 B.C. and the instrument was improved by Ptolemy about 130 A.D. It was used to measure any angular height by sighting on a star or the sun. European seamen were using quadrants to determine latitude as early as the beginning of the 15th century. The quadrant was a simple instrument, held in a vertical plane then tilted so that the sun's rays penetrated the pinhole sights in the two plates set at right angles on the straight edge. The thread on the plummet would then indicate the altitude of the sun by the scale on the curved edge of the instrument.

Vasco da Gamma had a similar experience to that of Columbus. In 1497 on reaching St. Helena he went ashore with a large wooden astrolabe in order to fix his latitude.[4] His portable instrument had been unreliable on ship deck during the voyage as he tried to obtain the meridian altitude of the sun. But once firm ground was attained, the astrolabe afforded a fair working solution to the finding of latitude, allowances being made for the inexactitude of imperfect instruments.

On the mapping side of European geographical activity during the 15th century there had been a number of significant developments. Fra Mauro's world map, an incomplete copy of which survives today in Venice, marks the peak of medieval cartography and the transition from medieval to Renaissance map making.[5] This was the century that saw also a remarkable revival of Ptolemy's popularity. In 1492 the first edition of Ptolemy's *Geographia,* minus the maps, was published. Three years later the famous and very fine Rome edition of the *Geographia* appeared, complete with maps produced by the copper engraving process. In the page margins, degrees of latitude and longitude were listed. But the supreme height of Ptolemy's Renaissance influence was reached in 1513 with the printing of the Strasbourg edition of the *Geographia,* containing 47 maps produced by wood cuts.

By 1490, on the eve of the first Columbus voyage, Martin Behaim had produced a globe at Nuremberg. For the times, it was an impressive feat. But it was not free from serious defects. For example, Behaim placed Asia much too close to Western Europe.

In 1491 Christopher Columbus was occupied in petitioning the Spanish sovereign, Isabella, for royal sponsorship of an exploratory voyage across the western ocean. In that same year in the Brittany coastal town of St. Malo, Jacques Cartier was born, a man whose navigational skills and achievements during the following half century were to help to shape the future of the New World, so dramatically revealed by Columbus, and to profoundly influence the development of that part of it soon to be known as Canada.

5

THE RENAISSANCE IN THE ARTS OF MAPPING AND SURVEYING

Surveying

In the concluding phases of that rather indeterminate epoch called the Middle Ages, Europe experienced a remarkable flowering of the human spirit and intellect in a period described by historians as the Renaissance. During this span of time there was a shattering of mental and physical shackles imposed by an over-rigid traditionalism. In almost every sphere of human activity, in business, geographical discovery, the arts, engineering, astronomy, Christian beliefs and functions, there was a spectacular blossoming of new ideas, a seeking for fresh approaches and a revival of the classical concept of man and his world. It was at one and the same time a change to a more liberal and to a more practical attitude on the part of mankind in the Western World.

England had been well prepared to welcome the influence of the Renaissance. She had concluded a century and a half of turbulence from which had emerged so many of those characteristics that have since distinguished her nationhood; the institution of parliament, of courts of law, a system of land tenure and of local government and of a popular speech that became within the span of another century the agency and instrument of an imperishable literature.

The Renaissance was a period not to be defined within strict chronological limits. It was marked by such revolutionary events as the application of the invention of printing, the exploration of the Indian Ocean and the discovery of America, to extend immeasurably the scope of human thought and knowledge. By 1558 England's Elizabethan Age began to shine brightly across the turning pages of history. Her exploring mariners, dauntless scientists and literary giants began to accomplish formidable feats.

The 16th century was the century of Elizabeth. In the science and art of mapping it was the century of Waldseemüller, Ruysch and Behaim of Germany, of the Homems and Reinels of Portugal, of Ortelius and Mercator of Holland and of Agnese, Zalteri and Cantini of Italy. In the realm of surveying there were pioneers such as Frisius, Snellius, and Cole, the instrument maker. In exploration it was the time of the Cabots, the Corte-Real brothers, of Cartier, Frobisher and Davis. It was the age of Newton, Shakespeare and Luther. It was the century of Galileo and of the birth of the telescope which, in turn, meant the beginnings of a truly scientific approach to the solving of the increasingly urgent problem of finding longitude at sea as well as the baffling challenge of map projection. It was a flourishing age in terms of printing and publishing, with leaders such as Ortelius on the continent and Hakluyt in England. It was the century of the Atlas, of vast forward strides in the engraving of books and maps. The century ended with the outlining of Canada in crude cartographic style, depicting its three ocean boundaries.

The Middle Ages had given way to the Renaissance and novel industries and enterprises blossomed in a favoring climate of greater freedom of spirit and ideas. The persevering, confident attitude of Columbus had released vast human energies in many directions. He had overcome the paralyzing fear of the unknown as well as the baffling and disturbing behavior of a ship's compass on any long voyage. When Rodrigo de Triana on the *Nina* shouted out on the morning of October 12, 1492, that he had seen land — a New World was revealed and an Old World changed forever.

The events and developments of the second half of the 16th century left an indelible impression upon the affairs of men, including those of the rapidly expanding realms of surveying and mapping. In 1564 Galileo Galilei was born in Florence, Italy. The light of his genius illuminated many fields of human thought and activity but on none did it shine more brightly than on the science of astronomy. His concepts of this world and its relation to the universe opened doors to measureless research and unlimited discovery. Among his most significant contributions to science was the early improvement, if not the invention of the telescope. It was Galileo's methods, introduced in 1609 and subsequent years, of increasing the magnifying powers of the telescope that made possible the efficiency, reliability and accuracy of modern surveying.

At the time of his death in 1642 Galileo was blind, under official surveillance by hostile authorities and newly-bereft of a much beloved daughter. In that same year there was born in England a frail, undersized infant, a child who overcame severe physical handicaps to display in the prime of his long life one of the most powerful intellects the world has known. In the language of Wordsworth, as the poet reflected over a statue of Isaac Newton, with his prim and silent face, the memorial seemed to represent:

> "The Marble index of a mind for ever
> Voyaging through strange seas of thought, alone."

Like Galileo, Newton not only observed but comprehended some of the basic physical laws of nature. By his unexampled genius this Englishman ventured farther than any man had done in formulating concisely and understandably the fundamental principles that govern the operation of the universe.

The 16th century was indeed one of intellectual giants. The same year that Galileo first saw the light of day, a third child, christened William, was born in the month of April to John Shakespeare and Mary Arden in Stratford-on-Avon. In the course of 37 plays and numerous sonnets written during a rather abbreviated lifetime the Bard of Avon turned a most revealing searchlight on his fellowman, his innermost motives and outward behavior. He gave entertaining expression to many facets of life and living,

including more than a few appropriate observations on the arts of surveying and mapping.

In England in the latter half of the century there were some significant stirrings in the field of surveying. In 1567, for instance, William Bourne wrote a manuscript on triangulation and on astrolabes. This pioneer surveyor made his way down the River Thames using a mariner's compass as his only instrument. With the compass he got the direction of every reach of the river and fixed his position at the end of the reach by taking bearings on two objects already fixed by a triangulation of the area. When Bourne measured his base line, in order to guide him in setting the scale, the surveyor's chain or "wyer line" was in common use among map-making surveyors of the time. Incidentally, Bourne repeats in his manuscript the warning on compass variation, namely, do not tamper with the compass needle to make it balance and "stand due north".

It was in 1529 that Gemma Frisius, at the age of 21, published in Latin the first edition of *Cosmographia* by Peter Apian. In 1530 he issued a work notable for its description of arriving at longitudes by carrying a timepiece from place to place. In fact it was Frisius who also suggested that in order to solve the problem of ascertaining correct longitude at sea, astronomical observations ought to be combined with a standard of time carried by the observer. But it was in the second edition of the Apian work in 1533, also in Latin, that Frisius gave in detail what he claimed to be an entirely new method of surveying a large area without recourse to one direct measurement! The method was based upon the formula that if all angles and the length of one side are known, then the exact lengths of the other two sides of the triangle may be determined merely by calculations on paper.

It is true that Frisius was first in the publication field with a detailed description of the method but even this feat was preceded by an early 14th century English manuscript on the subject, a manuscript that has been reprinted by Halliwell.[1] But it may be safely assumed that even this English study was not the primary discovery on the triangulation method of surveying. It is altogether likely that the application of the principles of the triangle to practical measurements, originated in classical antiquity.

It was almost a century after the Frisius publication before another Dutch astronomer and mathematician got the idea successfully off paper and into actual practice. Willebrord Snellius, a Leyden University professor, laid down a base line surveyed by triangulation in the year 1615. He used a quadrant and a semicircle for required astronomical observations but did not employ a ground-measuring instrument. The speedy adoption of the triangulation method was hampered by the absence of any reliable table of logarithms. There were other impediments as well. The average surveyor in those days did not have the training or knowledge of mathematics demanded in the use of various geometrical devices involved in the practice of triangulation. It was to meet these needs that the plane table came into wide use.

The first stage in the plane-table development is found in the Holometer of Abel Foullon. In Paris in 1551 he published a full description of his instrument. The Holometer consisted of a table with a small compass inset at its centre and the four quarters of the horizon marked on it. Along one edge was a ruler divided into 1,000 equal parts representing 1,000 paces or toises or whatever unit of measurement the surveyor preferred to use. Besides rulers, there were attachments for horizontal sightings. The table was on a pedestal resting on a ball and socket device, permitting the table to turn horizontally. Foullon's great step forward was to provide on-the-spot sketching on a table in the field. The English surveyor, Ralph Agas, stated in 1566, at the beginning of his career, that he used the "plain table" but in 1571 abandoned it for a "theodelite".[2]

The surveyor's complete outfit in the latter part of the 16th century in England consisted of a "frame for holding down the paper covering the geometrical table", the table with pedestal, "a compasse, pencill, drumme, a stoole, a Squire [square] and a wyer line". The suggestion of the substitution of the drum for the plane table is perhaps a reminder of the efficacy of rapid surveying, even in those days, for military purposes. As for the wyer line or surveyor's chain, its history goes back at least as far as that of the plane table itself.[3]

The Renaissance did more than inspire signal improvements in the art of mapping and the business of map publishing; it marked advances in the theories and practices of surveying. In connection with instruments for use in both surveying and mapping there was a veritable stream of ideas for new devices and refinements of established tools. In addition to new methods of land measurement, including the introduction of the plane table, there was the appearance of the theodolite in crude form. With the improvements to the telescope made by Galileo it was but a matter of time before some bright mind would develop a theodolite that would measure accurately both horizontal and vertical angles by means of a telescope and graduated circles.[4]

The practical surveyor of the 16th century must have found from grim experience how inadequate was an astrolabe for the sort of field work expected of him. The astrolabe was equipped to ascertain what was, in some respects, quite useless to the surveyor, such as the location of the sun in the zodiac or the times of the conjunctions of the planets. Accordingly a simpler instrument for field measurement work had to be devised. Leonard Digges, an English surveyor, is credited with the invention about 1550 of what he called a theodelitus. By the use of this term Digges introduced a measure of confusion in the history of instruments because it was not until he later designed a more complex version that we have anything entitled to be regarded as the ancestor of the modern theodolite. Nevertheless the optimistic Mr. Digges conceived his new instrument to be one of perfection and declared that "no manner, altitude, latitude, longitude or profundity can offer itself, however it be situate, which you may not both readily and exactly measure". This was indeed a far-reaching claim. Unhappily there is no evidence in printed form indicating that such an all-purpose instrument had ever been constructed. But a drawing of it by Dooley was in existence in 1646.

The oldest extant example of a theodelitus of English make is dated 1569 and is a miniature of a larger instrument. It is believed that the instrument was made by H. Cole for Sir Francis Drake and would seem to have been an alidade combined with a circle, square and magnetic compass. Cole described it as a Geometrical Square or, in more modern parlance, a Circumferentor.[5] The incorporation of the telescope in the theodolite probably became widespread early in the 17th century.

There is a document in existence indicating that Cole supplied the first Frobisher expedition with at least £50 worth of instruments, including an astrolabrium. By profession Humphrey Cole was a die-sinker employed at the Royal Mint. But because of the low rate of pay in the craft at that time Cole was glad to get instrument-making jobs on the side. He was an excellent engraver of metals. In 1572 he constructed an engraved map of the Holy Land for the famous Bishop's Bible published by Richard Jugge.

In London in 1575 Humphrey Cole constructed a two-foot astrolabe weighing 30 pounds for the first Frobisher expedition. The astrolabe appears to be the instrument most used by English surveyors of that time. It was carefully adjusted in a horizontal plane and oriented by a magnetic compass and used as a circumferentor. The astrolabe was also used extensively in the first triangulation measurements attempted on the continent of Europe.

FIGURE 5. Title page of Aaron Rathborne's four-volume work *The Surveyor* (London, 1616). The upper drawing shows a theodolite; that below, a plane table.

FIGURE 6
Martin Frobisher.

But in the main, during the golden age of discovery, the principal nautical intrument available to man remained the ancient astrolabe. Aboard ship the use of the astrolabe could be a very cumbersome operation. Usually one man held the instrument by placing his thumb through its ring, a second man took the sighting and a third man read off the observations.

The revolutionary idea of mounting the magnetic needle on a compass card depicting the points of the principal winds was another product of Renaissance enlightenment. The compass makers of Nuremberg were responsible for introducing this highly significant refinement to the art of navigation. But it was essential to the ocean-going mariner to know his latitude as well as his general direction. By the middle of the 16th century, because of improvements to angle-measuring instruments it was possible to find one's latitude in two principal ways. One way was to find the altitude of the sun above the horizon; the other, by determining the height of the pole star. Both required the supplementary use of mathematical tables.

Thus by the opening years of the 17th century there were available to guide the mariner across the wastes of ocean such aids as the card-mounted compass, the astrolabe, cross-staff and quadrant. For his part the land surveyor by that time possessed the compass, chain, plane table, astrolabe, the telescope and a primitive type of theodolite. In addition there had been a growing use in Europe of the triangulation method of surveying, pointed up in 1615 by the achievement of Snellius of Leyden in measuring an arc of meridian in this way.

In the realms of mapping, English cartographic enterprise from 1542 to 1547

received strong impetus from the emigration to London of some sixty Huguenot cosmographers from France. To this stimulus was added the inspiration of Martin Frobisher's epochal voyages (1557-58) and those of John Davis (1585-87). In 1582 Richard Hakluyt printed in England a map by one Michael Lok illustrating the extent of English priorities in North America explorations of that time. Meanwhile in 1567 a boy, Samuel, was born to a Biscayan sea captain Champlain and his wife, in the town of Brouage, Saintonge Province. The lad was destined to play a highly influential role in the northern part of the New World to which his fellow-countryman, Jacques Cartier, had so courageously ventured only thirty years previously.

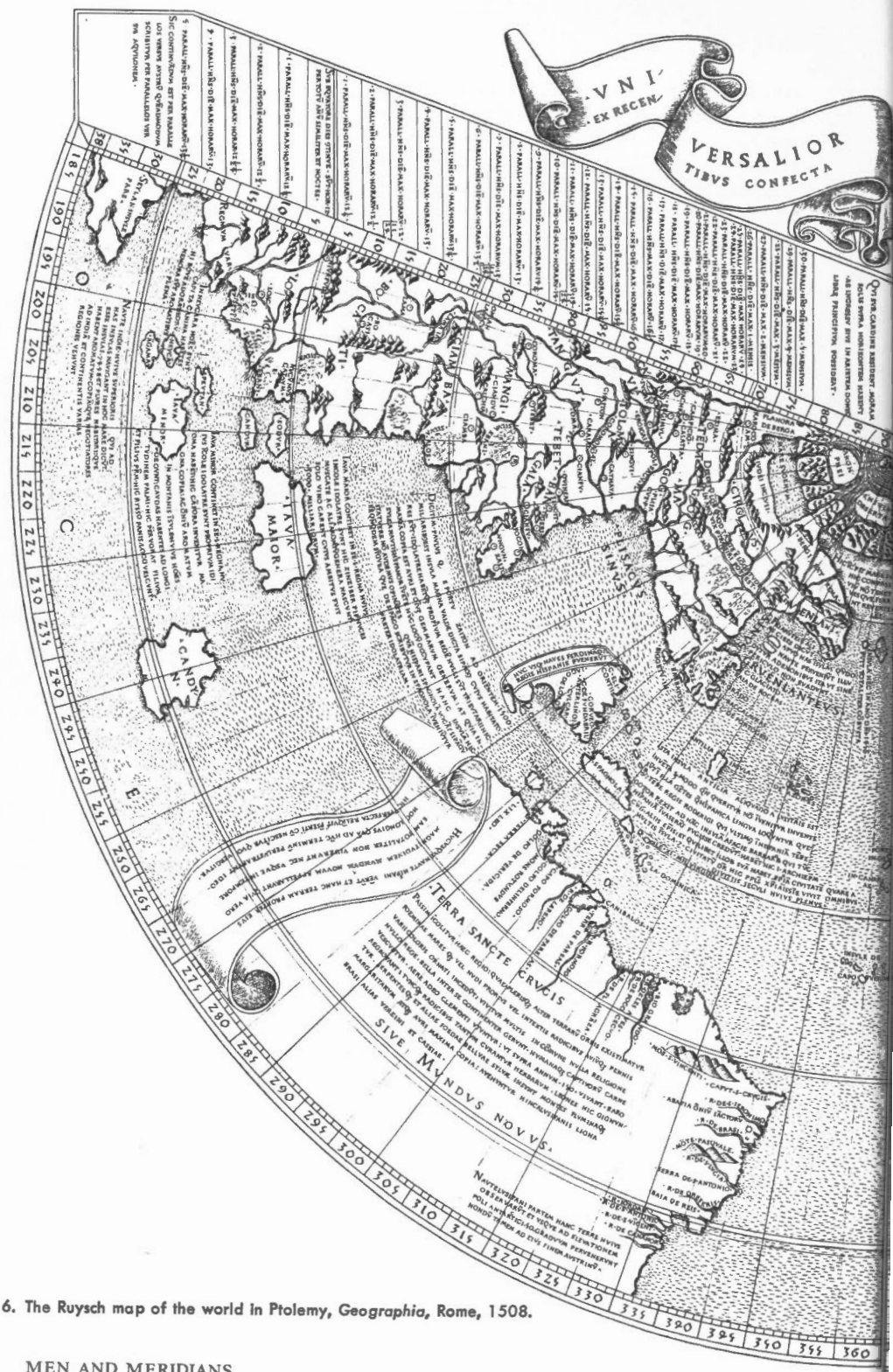
By the beginning of the 17th century and the coming of Samuel de Champlain to New France, many of the navigational hazards, though none of the foul weather risks, had been eliminated from Atlantic crossings. The ship's compass, as we have seen, had been vastly improved by the card-mounted magnetic needle. By means of better instruments and by the knowledge gained by the Cabots, by Cartier, Verrazzano, Frobisher and Davis, some of the mystery of the extent and character of the North American continent had been dispelled. More was known also of the true size and shape of the world. The invention of printing had resulted in the greater multiplication of maps and charts as well as of books. Means of fixing latitude were more readily available and men's minds were turning more and more to the solution of the problem of finding longitude. The art of land surveying was being widely practised in Europe and text-books on the subject had been published. Timekeepers were coming into wide use and their importance in relation to the longitude problem was at least being dimly recognized by leading thinkers of the times.

Two parallel themes may be perceived in the growth of 16th century cartography. Firstly, an evolution of continental outlines in the newly discovered Western World was slowly but surely taking place. Secondly, there was the appearance for the first time of the map of Canada. It is interesting at this stage of the 20th century to observe that several of the present members of the North Atlantic Community had important parts to play in the early exploration and mapping of this country.

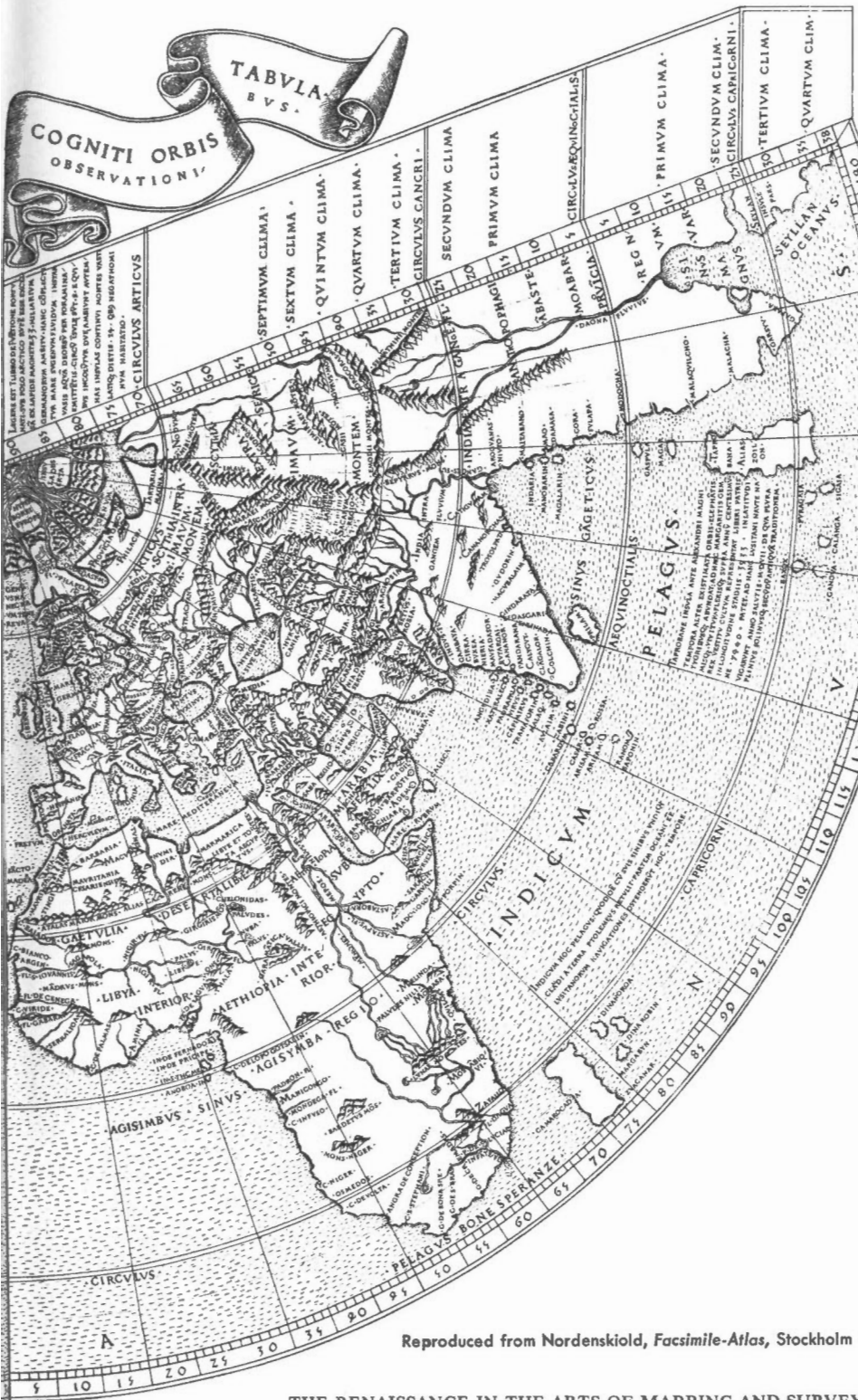
Many maps of the newly-discovered continent, including parts of Canada, had been printed and circulated during the 1500s. Even today, in libraries around the world, as many as 1,000 maps of 16th century vintage are preserved which, in one way or other, relate to Canada. As Theodore Layng of the Public Archives of Canada, Map Division, has pointed out — during the century between Cabot's initial voyage to the first venture of Champlain in Canadian colonization, the vast and intricate task of mapping Canada was well begun!

Mapping

The pre-Renaissance concept of a tripartite world (Europe, Asia and Africa) soon crumbled under a cataract of revelations. Geographical discoveries were multiplying with astonishing rapidity in the 15th and 16th centuries. Map makers and map publishers could not keep fully abreast of these new developments. Even so, a new era in mapping had dawned. The tools of the explorer and navigator were being augmented by new instruments or existing ones were undergoing refinements. The magnetized needle, by this time, had been ingeniously mounted on a compass card bearing wind directions. Positions at sea could be fairly well ascertained by use of the astrolabe. The coasts of the Mediterranean were being charted in detail. Portolan charts and portolanos had reached a high peak of attractiveness and utility. As early as 1490 a map by Henricus Martellus portraying the Diaz journey around the Cape of Good Hope had



MAP 6. The Ruysch map of the world in Ptolemy, *Geographia*, Rome, 1508.



Reproduced from Nordenskiold, *Facsimile-Atlas*, Stockholm 1889, pl. 32.

confirmed Marco Polo's report of an unenclosed Indian Ocean.

What maps, then, were in existence before 1492 that may have influenced Christopher Columbus to undertake his momentous voyage? Ptolemy's *Atlas,* translated into Latin at the beginning of the 15th century, had been fairly well circulated in western Europe. Although Ptolemy supported the theory of a spherical world, with a circumference amounting to eight times the length of the Mediterranean, he left open the question of the distance between the west coast of Europe and the east coast of Asia.

In addition there was Behaim's globe and the map of Paulo Toscanelli (1397-1482), a noted mathematician, astronomer and cosmographer of Florence. In his famous reply to King Alfonso V of Spain on June 25th, 1474, Toscanelli submitted that ". . . those who sail continually towards the West, when proceeding in this direction, will meet with the same lands as those who go by land towards the East". Toscanelli sent a map to the king to bolster his views but the map has never come to light.

Behaim's globe, which appeared in 1492, included an equator line divided into 360 degrees. It contained also lines representing the Tropic of Cancer and the Tropic of Capricorn, as well as one graduated meridian lying west of Lisbon. Developments of the near future were to reveal one substantial error in the Behaim globe. From Europe westward to Asia the distance was shortened on his globe to the extent of 103 degrees. According to Behaim the distance between the Canary Islands and Japan amounted to slightly more than 3,000 nautical miles rather than the actual 10,000 or more. Nevertheless the Behaim achievement represented a great forward stride in mapping during the era immediately preceding the initial Columbus voyage of discovery. It was among the first globes to incorporate the explorations of Portuguese mariners along the west coast of Africa.[6]

It is altogether likely that John Cabot on his first transatlantic voyage had available to him most, if not quite all, of the information provided in the first edition of *Regimento do Estralabio e do Quadrante,* published in 1509. This work contains corrections to the observed altitude of Polaris as a means of obtaining latitude. Cabot "kept the North Star on his right hand" as he pursued his westerly course. Melvin H. Jackson, in his perceptive study of the 1497 Cabot voyage, points out some of the factors that would affect Cabot's concept of his venture, such as the availability of astronomical tables for ascertaining latitudes. As early as 1464 one of Prince Henry's ship masters used a quadrant at sea for this purpose. Declination of the compass was also known by then and corrections could be applied by a shrewd navigator. Although there were no reliable chronometers in use at the time, dead reckoning was an art, as well as a well-developed instinct, among deep-sea mariners of the 15th century. John Cabot had studied cartography, knew of Marco Polo and could express his own ideas on maps or on globes. As Jackson has indicated, whereas the modern navigator views longitude determinations in terms of angular measurement from an established prime meridian, his medieval counterpart fixed easting and westing in terms of distances rather than by degrees, minutes and seconds.[7]

The discovery voyages of the 15th century unloosed a veritable stream of European-made maps during the 16th century. A significant change took place in this period in the realm of map publishing. Italy, particularly its northern cities, had been the principal area in Europe for the production of maps. Italy was the scene of the great revival of Ptolemy's works in the late 15th century, including the Rome editions of 1478, 1507 and 1508. But by the mid-1500s the map-making and map-publishing activities had shifted to the Low Countries. Antwerp replaced Genoa and Venice, partly because with

MAP 7. A reconstruction of Martin Behaim's globe of 1492 (the earliest extant globe). Reproduced from Kretschmer's *Atlas* of 1892.

the discovery of America there occurred a transfer of the world trading community to the western coast of Europe, and partly because of the switch made by publishers of books and maps from the wood-cut system of printing illustrations to the copper-engraving process. Once this technical change took place the die, so to say, was cast in favor of the Netherlands because that region had come to possess the best-trained and most skillful line-engravers in the world. The whole trade of map making was organized on a basis that, in present-day business jargon, would be described as an example of vertical integration. It was a business that was also highly capitalized.

It was in this new climate of map-producing activity that Gerard (Kremer) Mercator (1512-94) was raised in the Netherlands. Born at Rupelmonde in East Flanders in the year that Jacques Cartier attained his majority, Mercator grew into a brilliant scholar. After taking a degree course at Louvain University, as well as lessons in

advanced mathematics from Gemma Frisius, young Mercator became a cartographer, engraver and instrument maker. But Cartier was ordained by events to carry out his historic voyages without the benefit of the revolutionary invention of Mercator. Mercator's initial map appeared in 1537, three years after Cartier's first arrival in the St. Lawrence Gulf area. The publication of his new projection in 1569 did not take place until 14 years after Cartier's death.

By the middle of the 16th century the two leading map-makers of Europe, Mercator and Abraham Ortelius (1527-98) were living and working in the Netherlands within 60 miles of each other. But Ortelius was more a craftsman than a geographer. Mercator remains most famous in world history for his invention of a method of map projection, but his map work generally was distinguished by delicate precision and admirable control of detail. He did much also during the latter part of his career to free European cartography from the more stultifying errors of Ptolemy. In 1538 Mercator published his novel double-hemisphere map, the first to show North America and South America. This production preceded by only a few years the first effort of Roberval to colonize Canada, at a time when Cartier was returning to France for the last time. Within 10 years of the issue of the double-hemisphere map, Martin Frobisher was to sail from England on the first of his northern voyages.

Another Netherlander who did much to assist in the renaissance of European cartography was Petrus B. Apianus or Peter Apian (1495-1551). Born in Leisnig in Bavaria, Apian was considered to be the foremost cosmographer of his period. His chief work, *Cosmographicus liber* was used as a manual in universities for almost a century. First published in 1524 it was later revised and printed in a variety of languages. This editorial work was supervised by Gemma Frisius, one of Apian's pupils. Apian made two important innovations in cartography, Bacon's equidistant meridian projection and the stereographic polar projection. He was the first to propose determination of longitude by measuring moon distances.

Martin Waldseemüller, a geography teacher, effectively publicized the fact that North America was a separate continent. Waldseemüller compiled a large map of the New World and published it in two editions in 1507. This was the *Cosmographae Introducto*. It proved popular and was reprinted many times.

The Dutch, it is true, had overtaken and passed the Italians in the cartographic business but the Portuguese were not by any means dormant in map-making and chart production. The Homem family, for example, was responsible for an illustrious series of maps bearing their name, including Lopo Homem's of 1554 and Diego's of 1558 and 1568. These and other maps from this source presented an improved configuration of both Newfoundland and Nova Scotian coasts and for the first time in the history of cartography represented the outline of the Bay of Fundy. Another important feature of the Homem maps was the inclusion of North American Indian place names. Much of the nomenclature introduced to mapping by the Homems has survived to the present.

Another leading family of Portuguese cartographers in this period was the father and son combination of Pedro and Jorge Reinel. They flourished in the immediate post-Columbus epoch. Pedro was described as a "master of charts and of navigation compasses". Jorge was known as an "examiner in the science and art of navigation". Their charts of the Atlantic Ocean constituted some of their best work. Probably one of the most interesting of the earliest Portuguese charts is that of Cantino, drawn about 1502. It contains the lines of the equator and tropics. The Tordesillas demarcation line is also inserted.

Much of the work of these Portuguese cartographers was inspired by and based

MAP 8. Portuguese manuscript chart of the North Atlantic by Pedro Reinel, preserved in the Staatsbibliothek, Munich (c. 1516). Reproduced from a copy in the Public Archives of Canada.

upon voyages such as those by the Corte-Real brothers, Gaspar and Miguel, from 1500 to 1502. Both men lost their lives in these ventures but enough evidence of their voyages survives to indicate that they ranged from Greenland to Cape Race.

Juan de La Cosa, owner and captain of the *Santa Maria* and an expert Biscayan navigator, produced at the commencement of the 16th century his famous map showing an east-west named coast, in the latitude of Bristol, that has long been assumed to represent Cabot's discoveries. Originally drawn on oxhide, it bore a scale, so far undeciphered, in addition to a compass rose, and direction lines. Degrees of latitude or of longitude were not indicated.[8] There has been lively controversy among map scholars over the authenticity of the map itself. Experts have turned to a closer study of the Cantino (Portuguese) chart of 1502 that shows a north-south line of coast, territory

GLOBUS DES JOHANNES SCHÖNER VOM JAHRE 1520.

STADT-BIBLIOTHEK ZU NÜRNBERG.

MAP 9. An early representation of the Americas from a map in Kretschmer's *Atlas*, 1892.

claimed by the King of Portugal on the basis that it was discovered by Gaspar Corte-Real. In the view of T. E. Layng, whether the La Cosa or Cantino maps contain the first line may well depend upon the final interpretation of a third chart of this period, the Oliveriana of Italian origin, completed about 1506.

French interest in the New World began with the Verrazzano expedition of 1534, a venture followed up by the Cartier voyages so memorably portrayed by the handsome and impressive charts produced by the newly-formed Dieppe school of hydrography. It was this school of hydrographers that first recorded on maps the beginnings of a French empire in America. Map makers of this school included Jean Rotz, Pierre Deceliers and Desliens. The important Mercator maps of 1538 and 1541 failed to transmit any new geographical knowledge of the Gulf of St. Lawrence, beyond separating Newfoundland from the mainland by a north-south strait. Actually the St. Lawrence River did not appear on European maps until about 1542. And it was not until 1569 that Newfoundland began to resemble its true form in these representations.

Diogo Ribeiro (?-1533), another eminent mapper of the New World, was a Portuguese cosmographer in the service of Spain. At Seville he was responsible for revisions in the official map as new discoveries were reported. His 1529 map is noteworthy in the growing cartographic output of the early 16th century because it depicts for the first time a continuous coastline connecting the Portuguese and English possessions in the north with Spanish possessions in the south. By this map Ribeiro reveals more than ordinary awareness of the nature and extent of the newly-discovered territories. He records the finds of the explorer Gomez, who examined the Labrador coast and shoreline southwards in 1525. Due to this mapping record the Gomez venture, in terms of publicity, eclipsed the voyage made in the same regions one year earlier by Jean de Verrazzano, exploring in the name of France.

One of the outstanding men of the Renaissance in European navigation was Petro de Medina, described as the founder of the literature of seamanship. His *L'arte del Navegar,* published sometime before 1554, was printed in a number of languages and was the first publication of its kind to become popular among mariners. Frobisher carried a copy of de Medina's work on the first of his northern voyages.

In the Europe of the times the establishment of a family tradition of fine craftsmanship was not confined to cartography. In map publishing the name of Blaeu became synonymous with excellence of product. As a young man Willem J. Blaeu (1571-1638), destined to become Map Maker to the Republic (of the Netherlands) went to Uraniborg to study under the noted Danish astronomer, Tycho Brahe. Brahe appears to have had a well-equipped observatory at his disposal and he gained considerable prestige as an instructor. Willem Blaeu's initial cartographic efforts consisted of two globes, one completed in 1599, the other in 1602. He published his first atlas in 1631*. It was composed of 103 maps, accompanied by a Latin text. Willem's two sons, John and Cornelius, kept the Blaeu firm name supreme in map publishing for many years. Possibly the peak achievement of the Blaeus was the publication in 1663 of an *Atlas Major* in 12 volumes accompanied by a French text.

In England one of the outstanding names in the science of geography in the 16th century was Richard Hakluyt (1553-1616). He commenced at Oxford University (of which he was a graduate) the first public lectures in geography "that shewed both the old imperfectly composed and the new lately-reformed mappes, globes, spheares and other instruments of this art". Hakluyt's first published work (1582) was *Divers Voyages touching the Discoveries of America.* In 1588 he published *The Principall Navigations, voiages and Discoveries of the English Nation.* In the preface of the book

Section from a manuscript map of the world in the John Rylands Library, Manchester, made by Pierre Desceliers, 1546. (Reproduced from J. Jomard, Les Monuments de la Géographie, Paris, 1859).

MAP 11. Italian planisphere of 1601 by Arnoldo di Arnoldi. Courtesy of the Public Archives of Canada.

6

CHAMPLAIN—THE BROUAGE VOYAGEUR

The dean of land surveyors in Canada, "le père des arpenteurs-géométres du Canada" is undoubtedly Samuel de Champlain. Born at Brouage in Saintonge Province, 7½ miles west of Rochefort, France, Champlain could claim active service as a soldier and sailor before he was appointed a geographer by Henry IV. It is certain that by far the largest part of Champlain's surveys in the New World were related to land rather than to navigation. Yet he was a navigator by nature and instinct. In his writings he observes, "of all the most useful and excellent arts, that of navigation has always seemed to me to occupy the first place . . . This is the art which won my love in my early years. . . ." Champlain's name will be forever illustrious in Canadian history because of his pioneering achievements and outstanding ability in the fields of colonization, exploration surveys and mapping.

In the earliest years of the French regime, Royal Engineers and Royal Hydrographers carried out land surveys. Later, surveyors instead of receiving their appointments from the monarch, obtained licences to practise, documents in the form of certificates of competence granted by le Collège des Jesuites at Quebec. In the official membership listings of today's records kept by the Land Surveyors' Corporation of the Province of Quebec, Champlain is proudly accorded primary place, his formal admission being dated 1608.

It was in 1603 that Champlain made his first voyage to Canada in the service of King Henry. He accompanied the Huguenot aristocrat, Sieur de Pontgravé, to the St. Lawrence Gulf and River. Pontgravé was primarily interested in the fur trade and while he dealt with Indians, Champlain explored the impressive headlands and dark waters of the majestic Saguenay River. The following year Champlain, the Brouage voyageur, with a commission to explore the Atlantic coast, accompanied another Huguenot, Sieur de Monts. Champlain, a devout Roman Catholic, was none too happy that in these

exploratory ventures he was so closely associated with Huguenots. Yet he yielded again to Huguenot influence in 1607 when he married Hélène Boullé of Paris, daughter of a wealthy Huguenot. While Champlain went off again to Quebec, Hélène completed her education. Two years after the wedding she went to Quebec with him, the first Frenchwoman of gentle birth to sail up the St. Lawrence. Hélène Champlain was the first of many thousands of wives called upon to endure months of loneliness as their Canadian surveyor-husbands engaged in prolonged field work.

Sieur de Monts and Samuel de Champlain skirted the Nova Scotia coast to a river they named St. Croix and which, in time to come, was to provide a baffling puzzle for the international boundary makers. Champlain, as the ever-restless navigator, probed the Bay of Fundy, noting its tremendous tides and discovering the Saint John River with its reversing falls. Finally, sailing through a narrow gap on the Nova Scotia side of Fundy, a gap now known as Digby Gut, he found himself in an extensive protected basin of which he wrote enthusiastically, "two thousand ships could shelter in safety". He named the place Port Royal (Annapolis Basin). Thus in 1605 Champlain and his assistants started to build the first French habitation in North America.

In 1607 de Monts lost his fur trading monopoly and Port Royal had to be abandoned. By 1608 Champlain, with Pontgravé and de Monts, in the year of the discovery of the telescope, had returned to America and to the St. Lawrence. This was the same magnificent waterway travelled by Cartier nearly 75 years earlier and, in part, by Champlain himself five years previously. In his wisdom Champlain laid the foundations of a sett!ement at "the place where the waters are narrow" or "Kebec" in the Algonquin tongue.

Champlain possessed to a profound degree the insatiable curiosity for whatever lay just over the horizon or around the next riverbend, a curiosity indispensable to success in exploration, surveying or mapping. For a quarter of a century, whenever he could break away from administrative cares at Quebec, Champlain was happily engaged in searching out new country and new watercourses in the company of friendly Indians. His interest had been whetted by reports from tribes of the North who, on venturing down the Saguenay River with furs, claimed they lived near a salt sea. As Champlain speculated on these enticing tidings they renewed his dreams of finding an ocean route to the Orient. But Henry Hudson in his ship *Discovery* had found the Great Bay and wintered on its shores. He, too, had been seeking a Northwest Passage and, all too soon, paid for his ambitions with his life.

Champlain exerted every effort to build up a farm colony at Quebec. The mercantile companies of the time, however, interested only in trading in furs, showed utter indifference to the economic welfare of the permanent settlers. Champlain, in fact, was aghast over their apathy. In his own words "they had not themselves cleared an arpent and a half of land in the 22 years during which they were, according to His Majesty's intention, to have peopled and cultivated the colony of Quebec".[1] When he spoke or wrote, Champlain did so with a degree of influence and authority as he had, in 1608, received from the King of France the appointment of lieutenant-governor of the colony.

In 1617 Champlain induced a former Paris apothecary, Louis Hébert, to bring his family to the site of Quebec. Champlain, himself, surveyed and measured out the parcel of land allotted to Hébert. "C'est lui encore qui mit solennellement avec toutes les formalités voulues dans le temps, tous les nouveaux colons en possession de leur exploitation sur le rocher de Québec".[2] ("It was by his (Champlain's) own hand that every settler was solemnly established, with all the required formalities of the times, on his lot on the cape of Quebec."). Hébert was not a complete novice in the New World. He

had explored Acadia in 1604 with de Monts and Poutrincourt and had resided there from 1606 to 1613. The merchants were unhappy over the appearance of the Hébert group and went as far as to make matters disagreeable for them.[3]

Despite the fact that Hébert was the first colonist to support his family from the produce of his land at Quebec, the merchants persisted in making "many illegal claims upon him for his yearly harvests and compelling him to sell only to the company—and that at a specified rate".[4] Champlain, as reported in Laverdière's edition of his journals, states that the plow was first used in Canada on April 27, 1628, and was employed, likely with the aid of oxen, by Hébert's son-in-law, Guillaume Couillard. Hébert died on January 25, 1627, as a result of injuries sustained in a fall.

While the little colony at Quebec was struggling for survival, the Pilgrim Fathers (74 men and 20 women)—all English Puritans—were making a landing on New England shores at Plymouth Rock.

Up to 1620 Champlain's residence at Quebec was in its Lower Town, near the existing church, Notre-Dame des Victoires. In the early years of the 17th century Upper Town with its great oaks, walnut trees and majestic elms still formed part of the primeval forest, an area abounding in game. It was in these surroundings that Champlain, with due solemnity, surveyed and laid out new areas needed for development on the site of Quebec.

Nine years after Louis Hébert arrived at Quebec he received on February 4, 1623, what is regarded as the first seigniorial grant of land in Canada. The recipient was described in the grant as "head of the first family settled in the country".[5] The Hébert grant of Sault-au-Matelot was made by the Duc de Montmorency and confirmed on February 26, 1626, by the Duc de Ventadour, and was to be held "on such charges and conditions as shall be hereafter imposed" ("pour en jouir *en fief noble* aux charges et conditions que lui seront ci-après imposées"). This particular grant was one of a total of three seignioral grants made in 1623 and apparently the only such grants made during the period 1608 to 1627. Each of the three grants was made on the advice of Samuel de Champlain. The terms, or rather the lack of them, would indicate that no general land-tenure policy had been formulated by French authorities up to that time.

In laying out the seigniories of New France the linear arpent of 180 French feet was used as the unit of measurement and is variously computed as being from 191.83 to 192.3 English feet. This measurement is still the legal unit in all existing Quebec seigniories. The Quebec Department of Crown Lands of modern times computes the arpent as 191.85 French feet. A 1641 map of the St. Lawrence settlements from Quebec to Cape Tourmente reveals that each lot at that time had a river frontage of seven arpents and a depth of a French league (84 arpents) or more. Not all seigniories were oblong in shape. The title deed of Robert Giffard's seigniorial grant at Beauport from the Company of One Hundred Associates, dated January 15th, 1634, was one and a half leagues along the river front and the same distance in depth. This grant of land was on the north shore of the St. Lawrence River just below Quebec.[6]

But the assignment of land concessions in New France generally in the shape of long, narrow strips was obviously designed to secure for each settler a frontage on a watercourse, preferably a large river. In this fashion and by this means they would be adjacent to what was, in those formative days, a principal highway of communication between one another and the world outside. It was felt also that this settlement arrangement would serve to bring inhabitants of the new land into close proximity both for defence and for social purposes. As time and settlement proceeded in the St. Lawrence basin there began to develop misgivings over the wisdom of adhering to this unusual

pattern of land tenure, doubts that began to disturb official circles in France.

In Louis Hébert's first season (1617) at Quebec "he presently commenced", according to Abbé Ferland, "to . . . clear the ground on the site on which the Roman Catholic Cathedral and the Seminary adjoining now stand, and that portion of the Upper Town which extends from what is now Ste. Famille Street to the Hotel-Dieu. He constructed a house and a mill near that part of St. Joseph Street where it receives St. François and St. Xavier streets. These edifices appear to have been the first which were erected in the locality now occupied by the Upper Town."[7]

The matter of suitable roads early intruded upon the consciousness of the young colony. In this period (1608-1635) there could only have been narrow, twisting paths in the forested upper levels of the Quebec community. There is no evidence that Champlain or the Scottish invader, Sir David Kirke, troubled much with the improvement of paths.

On November 17, 1623, a 14-foot roadway or ascent to Upper Town had been improved. It was built of branches, covered with earth, possibly the first wholly man-built highway to be constructed in Canada. It was rendered unserviceable by a fire later on in the century and the inhabitants widened it by six feet. On July 16, 1665, a French ship brought 12 horses to Quebec.[8] It is altogether likely that soon after the arrival of these mounts for military personnel, the public thoroughfare ceased to be a preserve for pedestrians only.

In 1609 Champlain made his fateful decision to take sides in the Indian inter-tribal wars, casting his lot and the lot of the French in America with the Algonquins and the Hurons against the Iroquois. It was also in that year that he made his first penetration of the interior of the continent. In 1610 he sent the youthful Étienne Brulé on an exploratory probe survey with Indians up the Ottawa River. Brulé, in all likelihood, was the first white man to gaze upon Rideau Falls at the place where the river of that name drops into the Ottawa. From this natural attraction Brulé made his way to the shores of Lake Huron on Georgian Bay by way of Lake Nipissing and the French River, the names by which all these waters are now known. In 1611 Champlain established a port on the site of what is now Montreal.

Champlain provided great new impetus to the mapping of Canada. As we have observed, Champlain had the benefit of the revolutionary advances in map making in the 16th century in Europe. He possessed not only a more ample knowledge than his pioneering predecessors but better instruments and improved techniques. The topographical data contributed by Champlain, and others after him in the fields of exploration, were splendidly correlated and mapped by such famous Paris geographers as Sanson, Delisle, D'Anville and Bellin. With Champlain began an era of new development in the cartography of eastern Canada.

In 1613 a publication appeared in France entitled, "Les Voyages du Sieur de Champlain Xaintongeois, Capitaine pour le Roy en la Marine". This volume contained an ode to Champlain, verses in praise of his books and of his marine maps. The ode was signed by Motin. In the book two large maps of New France conveyed a fair idea of the lay of the new land, though the portrayal fell considerably short of complete accuracy. For his achievements Louis XIII honored Champlain with a lieutenancy. The Brouage voyageur, happy over this royal recognition, sailed from France for Canada on March 6, 1613.

In New France Champlain was on the move again, as restless and as curious as ever. He left the Island of Ste. Hélène on May 27, 1613, with four French companions and one Indian. Delayed by miserable weather conditions he did not leave Sault St.

MAP 12. Western half of *Novae Franciae accurata Delineatio*, 1657; probably drawn by the Jesuit, Francesco Bressani. Courtesy of the Public Archives of Canada.

Louis until two days later. On May 30th he took observations for latitude at Lachine.

"Je prins la hauteur de ce lieu, qui est par les 45 degrez 18 minutes de latitude". ("I located the position of the place at 45 degrees, 18 minutes latitude.") This was only about five minutes less than the true latitude of the place. For those times such a result indicates a relatively minor error, particularly since there were no verniers marked on his instruments as there are nowadays, for reading in subdivisions of degrees. True verniers had been invented but were not then in common use. On June 4th, ascending the Ottawa River, Champlain took observations for latitude at what is now Hull, opposite Ottawa. "Je prins la hauteur du lieu et trouvay 45 degrés 38 minutes de latitude". ("I located the position of the place at 45 degrees, 38 minutes latitude.") This result was only 12¼ minutes in excess of the true latitude—45 degrees, 25 minutes, 33 seconds.

At Cheneaux Rapids Champlain crossed over to the west side of the Ottawa River and portaged south by way of Muskrat Portage and Muskrat Lake to what is now known as the vicinity of Renfrew. "Nous traversames donc à l'ouest la riviere qui couroit au nord et pris la hauteur de ce lieu que estoit par 46-⅔ de latitude. . . ." This is an error of a full degree, even allowing for the usual adjustment for the relatively imperfect instrument he employed. The true position is 45 degrees, 35 minutes. This, apparently, was Champlain's final observation prior to losing his astrolabe. In his diary he mentions that his companions were heavily loaded and "more harassed by the mosquitoes than by their burdens". He refers to a rest stop and to building a "fire to drive away the mosquitoes".

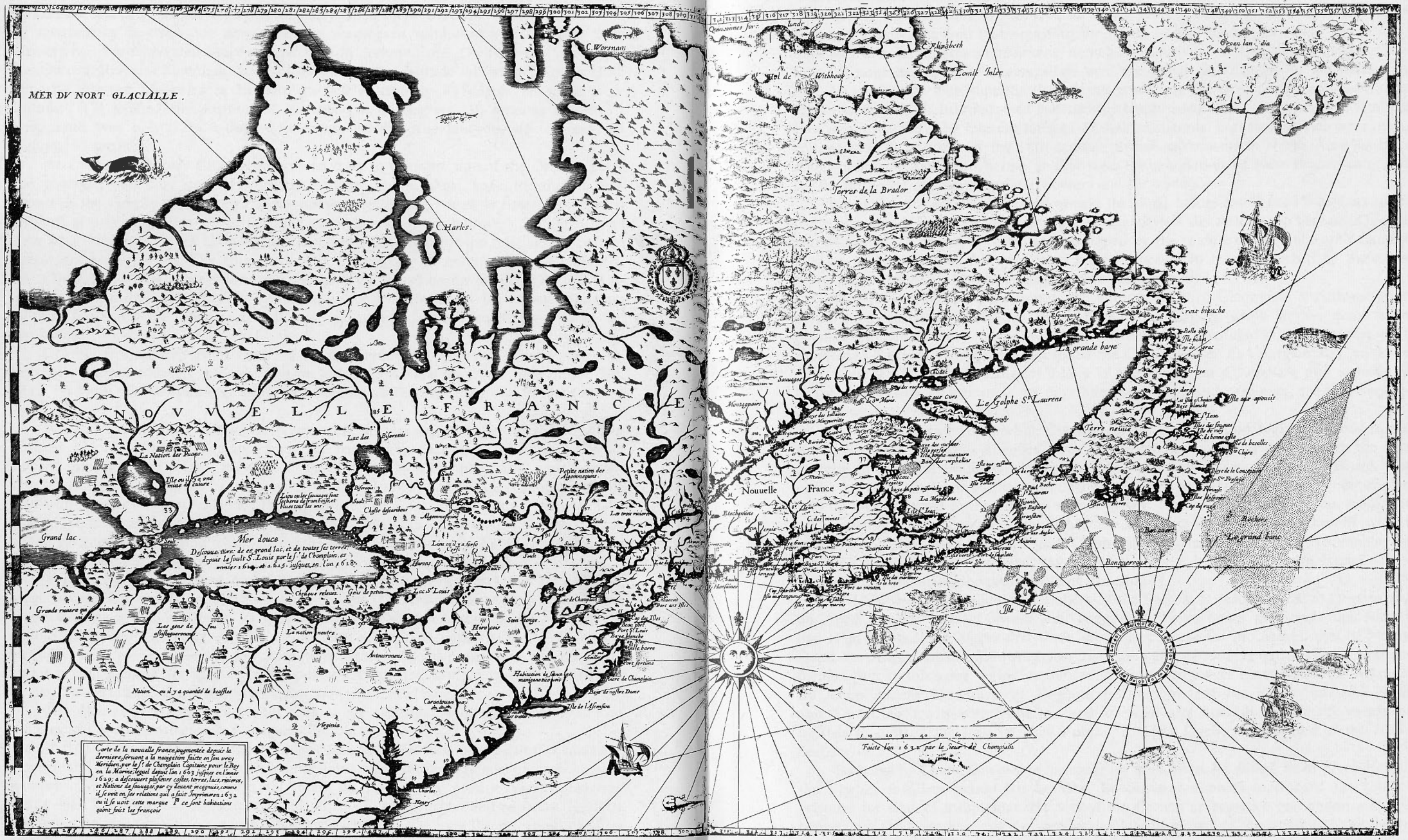
Champlain's rather serious error on his final reading took place below Portage du Fort. His journal contains evidence that he lost his astrolabe on either June 6th or 7th, 1613. Without his useful instrument he made no further observations for latitude on that journey.

In 1867 on the rear half of lot Number 12 in the second range of the township of Ross (North Renfrew County) near the road from Ottawa to Muskrat Lake an ancient astrolabe was found, believed to be that lost by Champlain 254 years earlier. The instrument was found by employees of the Ottawa Forwarding Company while cultivating a plot of ground under the supervision of Captain Overman. The astrolabe was of plate brass very dark with age. It was one-eighth of an inch thick at the top of the instrument increasing to six-sixteenths of an inch below. Probably this shape was designed to give the astrolabe greater stability, especially for use aboard ship.

The recovered instrument had a suspension ring at the top, attached by a double hinge, suggesting a sort of universal arrangement. Its circular form was divided into single degrees graduated from its perpendicular axis of suspension. By turning the double-bladed index directly into the sun at noon so that the same ray might shine fully through both eyelets while the astrolabe hung freely, the sun's meridian altitude could be taken and thereby the latitude of the position fixed to within one-quarter of a degree or less. This was as accurate as any of Champlain's observed latitudes.

The date 1603 is engraved on the face of the astrolabe. This was probably one of the very last of such instruments to be put to actual use.

In 1615 Samuel de Champlain brought four Récollet missionaries to Canada from France and set forth with French companions and Indian friends on yet another journey into the interior. He was still intent on seeking the elusive western sea that would lead Europeans on to Cathay with all its glittering prizes and rewards. He little knew that he was travelling a part of the world which, in the long future, would produce wealth rivalling that of the fabled Orient.



MAP 13. Champlain's map of 1632. Courtesy of the Public Archives of Canada

At one stage the French surge in the New World looked bright. The principal motivating drive supporting French colonization efforts was the desire to convert natives to Christianity. But closely connected with this primary motive was the economic factor. The Jesuit mission to the Hurons seemed to open for a time the way to French settlement of the lands extending from Quebec to the southwestern end of what is now Lake Erie and possibly beyond that area into the whole of the Mississippi basin. There was, however, one formidable impediment, namely, the ferocity of Iroquois resistance. The Iroquois confederacy had become allied with the Dutch and English to the south and east. In association with superior English sea power the flanks of the French-controlled region were continuously harassed and steadily compressed. Even their access to Hudson Bay was restricted. The internal lines of French continental communications were often endangered. By the end of the 18th century British settlements in North America consisted mainly of farmers whereas at that time the population of New France consisted for the most part of soldiers, priests, hunters and fur traders.

But it should be borne in mind always that long before the United States, as such, came into being, Canada existed as a cohesive entity on the fertile strip between Quebec and Montreal. In that area there had developed by the middle of the eighteenth century a spirit and a tradition that prevented New France from being absorbed by the more powerful and more rapidly expanding neighbor to the south.[9]

Thus is was that in the summer and autumn of 1615 Champlain was unwittingly preparing permanent limitations upon French sovereignty while at the same time opening up new country to the exercise of French influence and control. In that year he crossed Lake Nipissing and descended the French River to Georgian Bay on Lake Huron. In the Cataraqui (Kingston) area in the same year Champlain and a party of French companions spent some 38 days hunting, fishing and exploring, the first appearance of white men in that region.[10]

In the autumn of 1615, while Champlain was plunging into Indian territory to the south, Snellius, thousands of miles away in the Netherlands, was carrying out the first exercise in practical triangulation. In this foray Champlain accompanied a Huron war party to map rich lands to the south. However, in a brisk encounter with their Indian foes he was wounded in the knee by a stray arrow. The return journey to Cataraqui was an agonizing one and was accomplished on a warrior's back in a makeshift wicker arrangement. But with enforced rest Champlain recovered sufficiently to enable the party to cross Lake Ontario by way of what is now known as Wolfe Island. They landed somewhere near the present site of Kingston.[11]

In 1626 the first missionary members of the Society of Jesus arrived at Quebec and on April 6th the Jesuit Convent was completed. Three years previously the Society had been granted one of the first three seigniory concessions in Canada, that of Notre-Dame-des-Anges. In the following year the Company of One Hundred Associates was formed. But in this same period matters of some moment were afoot across the Atlantic. By letters patent Charles I of England had empowered the Kirke brothers, Louis and David, to trade with America and to seize any Spanish or French vessels as well as to destroy the forts of New France. In 1629 Quebec capitulated to the Kirke fleet.

Technically Champlain was a prisoner of war when he sailed from Quebec with the English invaders bound for London. But he was allowed to discard the role of prisoner for that of a diplomat. He visited the French ambassador in London and laid before him the Canadian case for development, with a copy of the treaty of capitulation and a map of New France as far as it had been explored. According to Champlain,

"This part of America which extends to the Arctic pole northward is called New France because Jean Verrazzano, a Florentine, having been sent by King François first to these quarters, discovered nearly all the coast, beginning from the Tropic of Cancer to the 50th degree and still more northerly, arboring (displaying) arms and flags of France; and for that reason the said country is called New France". Champlain, in pressing the issue, even made visits to Paris. Louis XIII was suitably impressed and demanded from England restoration to France of the fort at Quebec and the forts on the Acadian coast which, in His Majesty's view, had been captured after the signing of the peace between England and France. Mainly for fiscal reasons Charles I of England finally yielded to the French position and the restoration was agreed upon.

In 1632 Champlain published in Paris the volume entitled, "Les Voyages de la Nouvelle France Occidentale dicte Canada faits par le S^{r} de Champlain . . . depuis l'an 1603 jusques en l'an 1629". ("Trips in Western New France named Canada by the Sieur de Champlain. . . . from the year 1603 to the year 1629.") This book, his last, contained his most famous map. In the same year Father Le Jeune commenced writing the Jesuit Relations. Only the previous year a Frenchman, Pierre Vernier (c.1580-1637) published at Brussels a treatise in which the instrument associated with his name was described. This measuring device invented by Vernier permits the reading of linear or angular magnitudes with much greater accuracy than had been possible with any scale as then divided and subdivided. The invention was based on the principle that the eye can more closely determine when two lines coincide than it can establish the distance between two parallel lines.[12]

When, on July 13, 1632, the flag of France was seen by the inhabitants of Quebec, its whiteness floating above a vessel entering the harbor, they rejoiced exceedingly. For their good fortune they owed more than they could realize to Champlain. Mass was celebrated in the home of Madame Hébert for the first time in three years. In the interval, under English domination, one child had been born, a daughter to the Guillaume Couillards. But no death was recorded save the murder of an Iroquois prisoner by a drunken Montagnais.[13]

In June, 1633, with experience in successful Old World diplomacy as another badge of accomplishment, Champlain returned to Quebec as the first Governor of New France. In the New World, in the land he loved and in which he had fulfilled himself, his days were now numbered. He had little more than two years of reasonably good health remaining in which to complete his life work. In 1634 several developments of significance to the growth of surveying and mapping in Canada took place. In that year a settlement was founded at Three Rivers by La Violette. In the same year also one Robert Giffard obtained a tract of land from the Company of New France, a tract one league in depth and a league and a half in breadth. It was situated between the rivers Montmorency and Beauport, bounded in front by the River St. Lawrence and at the rear by the Laurentian hills. Also granted as a special favor were two acres situated near the fort for the erection of a residence with suitable grounds.

It was on August 8th, also in 1634, that a remarkable man arrived at Quebec from France, namely, Jean Bourdon then 33 years of age. This man was destined to become the "engineer and surveyor general of the colony — *ingénieur et arpenteur-général de la colonie*". Jean Bourdon was a man of unusual capacity who became, in turn, surveyor, engineer, cartographer, farmer, diplomat and lawyer in his new environment. In all, Bourdon served under eight governors — Champlain, Montmagny, Ailleboust, Lauzon, Argenson, Avaugour, Mézy and Courcelles.

Soon after his arrival at Quebec young Bourdon was called upon to prove his ability

as a diplomat. Champlain had been accustomed to the assumed status of self-made engineer-in-chief of the colony. Bourdon was now obliged to watch his own actions with care. Wisely he made application to Champlain for his plot of land and for permission to build. He chose to erect his habitation on high ground later to be known as Sainte-Geneviève.

In Champlain's period of service in New France there were in vogue three methods of carrying out surveys. Firstly, there was the use within settlements of compass and reference marks. Secondly, there was the use of telescope with compass and thirdly, the use of a wheel for the measurements of distances. It is interesting in this connection to note how Champlain instructs the surveyors of New France in the matter of drawing a meridian.

"Take a very well shaved small plank," he writes, "and in the middle fix a needle C three inches high, in an upright position. Expose on a sunny day in the morning at 8 or 9 o'clock. Mark the spot where the shadow of the needle C will fall. With a compass opened with one point on C and the other on shadow B, draw a semicircle AB. Leave all until the afternoon, when you will note the shadow falling on A. Thus, having determined the semicircle AB, apply a ruler on points A and D and draw a line as long as the small plank which remains firmly fixed in one position. CD will be the meridian of the region."[14]

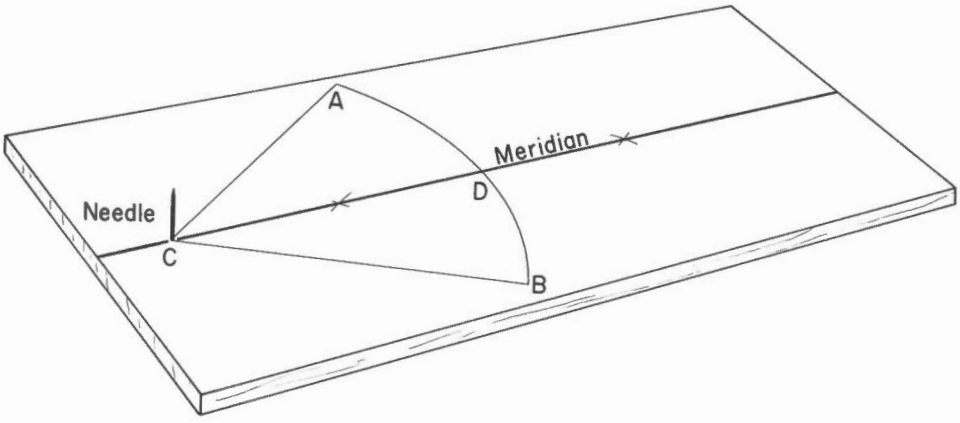


FIGURE 7. From *Works of Champlain*, ed. Charles Laverdière, v. 3, 1870.

To determine the local compass deviation from the meridian Champlain advised surveyors to set a sundial along the meridian as in the following diagram:
At the bottom of the sundial is a circle divided into 360 degrees. The circle is to be divided by two diameters, one giving the North section and South section, as shown by EF and the second, giving East and West sections by GH. Then observe the pointer which rests on a pin and note the direction of the deviation from the fixed meridian which is at the bottom of the sundial and note the number of degrees it moves to the northeast and to the northwest.

The earliest explorers in New France were skilled navigators so that the earliest surveys were those of rivers and lakes, the waterways into the mysterious interior. Explorers traced their travel routes on self-made maps. Survey operations in those formative times consisted for the most part of daily determinations of the the explorer's position, using astronomical measurements and compiling rough field notes.

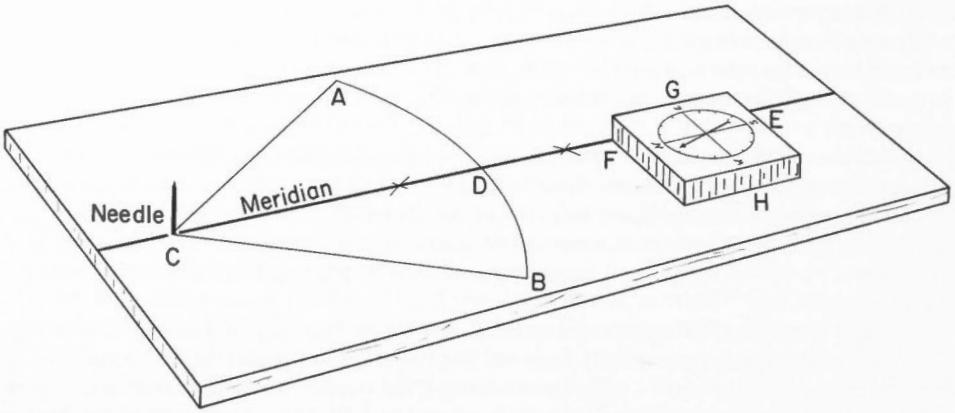


FIGURE 8. From *Works of Champlain*, ed. Charles Laverdière, v. 3, 1870.

The year 1635 was a particularly difficult one for the little colony. Supply ships from France were greatly delayed en route by rough weather and then by icebergs. In the early autumn, just two weeks after the last of the outgoing ships had left Quebec, Champlain, now aged 68, suffered a severe stroke. He failed to recover, lost ground steadily and passed away on Christmas Day.

Explorer, navigator, soldier, mapper, colonizer, surveyor, commander, author and administrator, Samuel de Champlain in the space of a quarter-century made an enduring contribution to the building of Canada. He was outstanding among that succession of men of special ability, courage and high resolve who served France and New France so well during the 17th century. Most of these men were inspired by a profound devotion to their motherland as well as by the lure of the unknown. Their vision of a French empire in America was mightier than that held by monarchs and court officials in Europe, authorities who often failed to provide deserved support of their ambitious undertakings.

Today in Canada Champlain's deeds and continuing influence are commemorated in names of rivers, lakes, mountains, towns and counties, as well as by many city streets and buildings. Important monuments at Quebec, Ottawa and Orillia, Ontario, perpetuate his fame. The Champlain Society is dedicated to the encouragement of Canadian historical works of excellence.

What then, in summary, can be justly said of the contribution by Champlain to the mapping of Canada? To some extent his earliest journeys in New France covered places Cartier had visited seventy years earlier. But Champlain's surveys were more exact and more thorough-going. He made more careful observations of harbors and penetrated the interior along St. Lawrence River tributaries quite unknown to Cartier.

Before arriving in any official capacity in the St. Lawrence area Samuel de Champlain had occupied himself during three summers in tracing more than one thousand miles of the Atlantic seacoast, including the Bay of Fundy, the shores of Nova Scotia and New Brunswick as well as those of New England. In the intervening winters he worked on the production of a general chart of the entire region he had travelled. His local and general maps were not the result of elaborate surveying techniques. He lacked precision instruments and his measurements were often inaccurate. Nevertheless his maps are creditable examples of the cartography of his day and generation. They

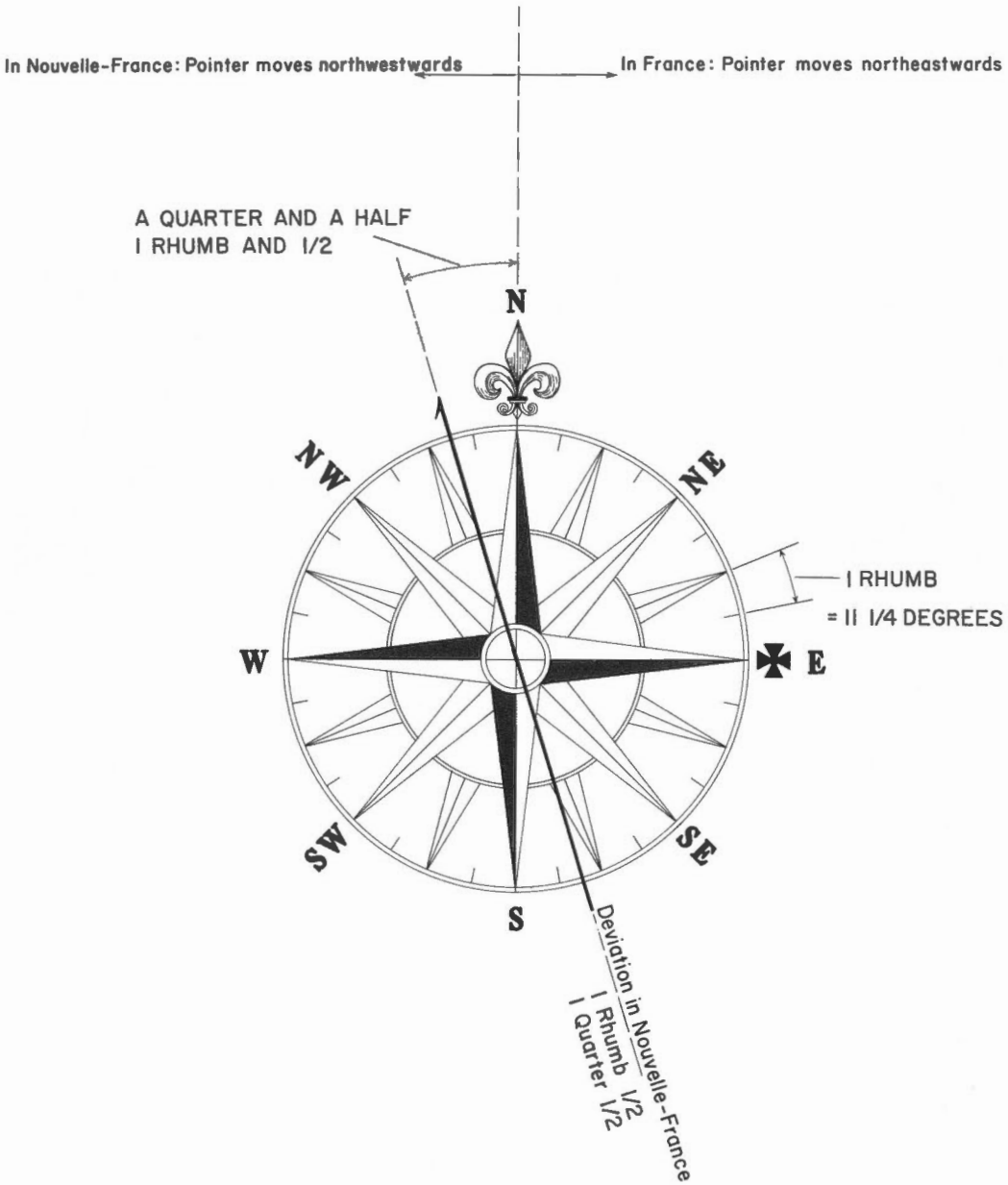
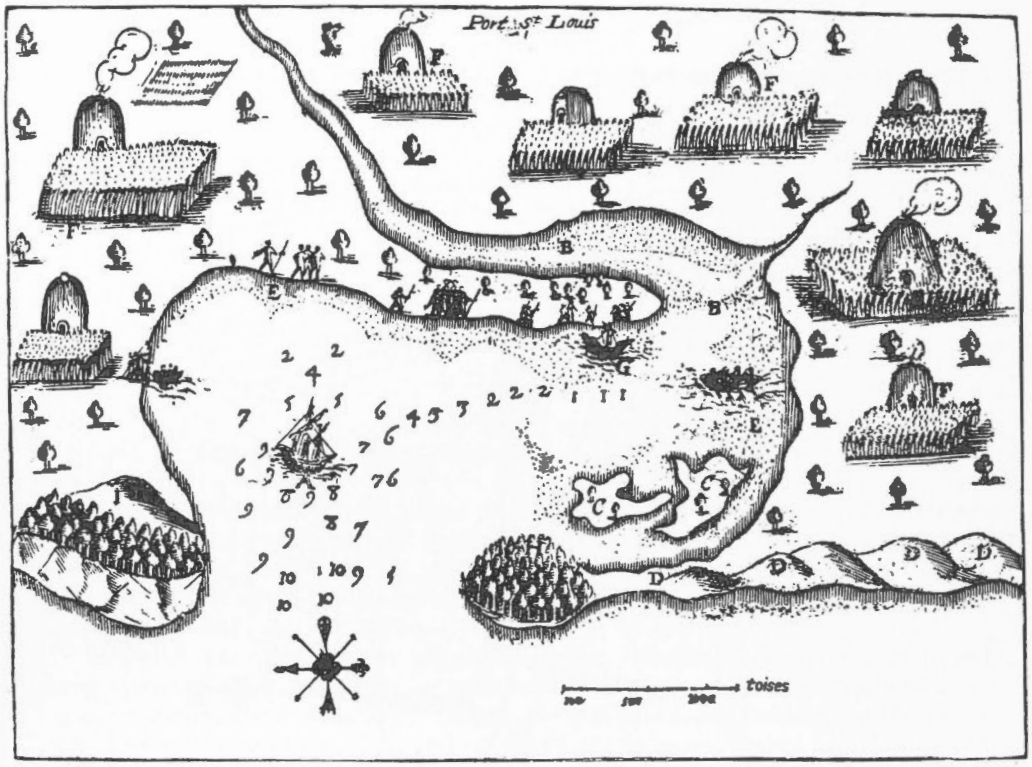


FIGURE 9. Compass Deviation in New France as Ascertained by Champlain. From *Works of Champlain*, ed. Charles Laverdière, v. 3, 1870.



MAP 14. Port St. Louis (Plymouth, Mass.) by Samuel de Champlain. From: *Les Voyages du Sieur de Champlain*, Paris, 1613. Courtesy of the Public Archives of Canada.

reveal a good grasp of mapping essentials and display a marked skill. His descriptions of the native people, the nature of the Canadian land and soil as well as of its natural products and resources are clear and well-defined. These writings could, in fact, be regarded as worthy prototypes of the reports to be made in the long future by Canadian surveyors, particularly in the latter part of the 19th century at a time when the prairie West was being prepared for extensive settlement.

Before leaving the Atlantic coast Champlain made a number of plans and sketches. In his "Voyages du Sieur de Champlain, Xaintongeois, Capitaine pour le Roy en la marine . . . ." published in 1613, some 22 of his maps and drawings are included along with a large map made in 1607, covering the territory he had personally surveyed. This latter map was the first to delineate the coastline of Acadia and New England with any considerable degree of accuracy. There was also included a geographical map, "carte geographique de la Nouvelle France en son vray meridian . . .", the first genuine attempt to lay down latitudes and longitudes on the Atlantic coast of North America. It might well be said of Champlain's cartography of this period that it marks the genesis of sectional mapping in Canada.

Two of Champlain's maps have not yet come to light — the map he claimed to have made in 1603, drawn to show King Henry IV the extent of his New World discoveries, and a map made for de Monts resulting from voyages made from May,

1604 to September, 1607. In addition there are several examples of his handiwork that do not lend themselves to classification. There is his chart of the St. Lawrence from the mouth of the Saguenay River to Quebec, with information from soundings. There is his sketch of the Long Sault near Montreal Island. This is not based on surveys in the modern sense of the term but is constructed, rather, from compass-aided sketches. There is also in existence Champlain's 1608 sketch of Tadoussac, published in 1613, including harbor soundings, and there is a plan of Quebec contained in his 1613 volume.[15] A map made by Champlain in 1616 has been found in recent years and shows the Great Lakes, as then comprehended, in rather crude outline. Hudson Bay appears in somewhat distorted form. But Nova Scotia and the Gulf of St. Lawrence are fairly well represented, even by the stricter standards of much later times. Although in some respects it is a copy of his 1613 product, the 1616 map illuminates the important stage in a slowly developing fund of European knowledge of New France in the first half of the 17th century. But Champlain's principal reputation as a cartographer must rest mainly on his major and best known map, published in 1632 in the fourth and last of his printed works.

The cartographic work of Champlain marks the transition in North America from a more or less speculative type of topographical mapping to maps based upon first-hand surveys by the mapper. In this respect the Brouage voyageur opened a new era in Canadian cartography. It is fair to say that Champlain was a true pioneer of modern geography in its application to the important parts of Canada he explored.

Champlain is rightly regarded as the Father of New France and a pioneer of civilized society in Canada. He lives on in the hearts and minds of Canadians not only as a daring explorer but as the revered founder of the most ancient of its cities. "Champlain, nom historique, nom symbolique de courage, de force et d'intrépidité, mais également nom qui a sa place dans les origines d'une profession qu'il a aimée et qui lui a permis de dresser les premières cartes que l'on possède de la Nouvelle-France. Les manuels d'histoire le désignent comme le père de la Nouvelle-France, mais, c'est à juste titre également que nous le reconnaissons comme le père des arpenteurs-géomètres du Canada. En effet, non seulement il fut un navigateur d'élite, mais un distingué cartographe".[16]

"Champlain, this historic name, symbol of courage, strength and fearlessness but also a name which appears in the birth of a profession he has cherished and through which he drew up the very first map known today of New France. History texts relate that he is the Father of New France but equally we recognize him as the father of land surveyors of Canada. Indeed he was not only an eminent navigator but also a distinguished map maker."

High on a promontory near Parliament Hill in Ottawa Champlain takes permanent sight for latitude with his now-famous astrolabe, a symbol in bronze of the explorer, surveyor, mapper and man of vision.

Table of Lineal Measurements
(New France)

1 Pouce	— 1.0666 inches		
12 Pouces	— 1 Pied	—	12.789 inches
6 Pieds	— 1 Toise	—	6.395 feet
3 Toises	— 1 Perche	—	19.184 feet
10 Perches	— 1 Arpent	—	191.838 feet
84 Arpents	— 1 League	—	3.052 miles

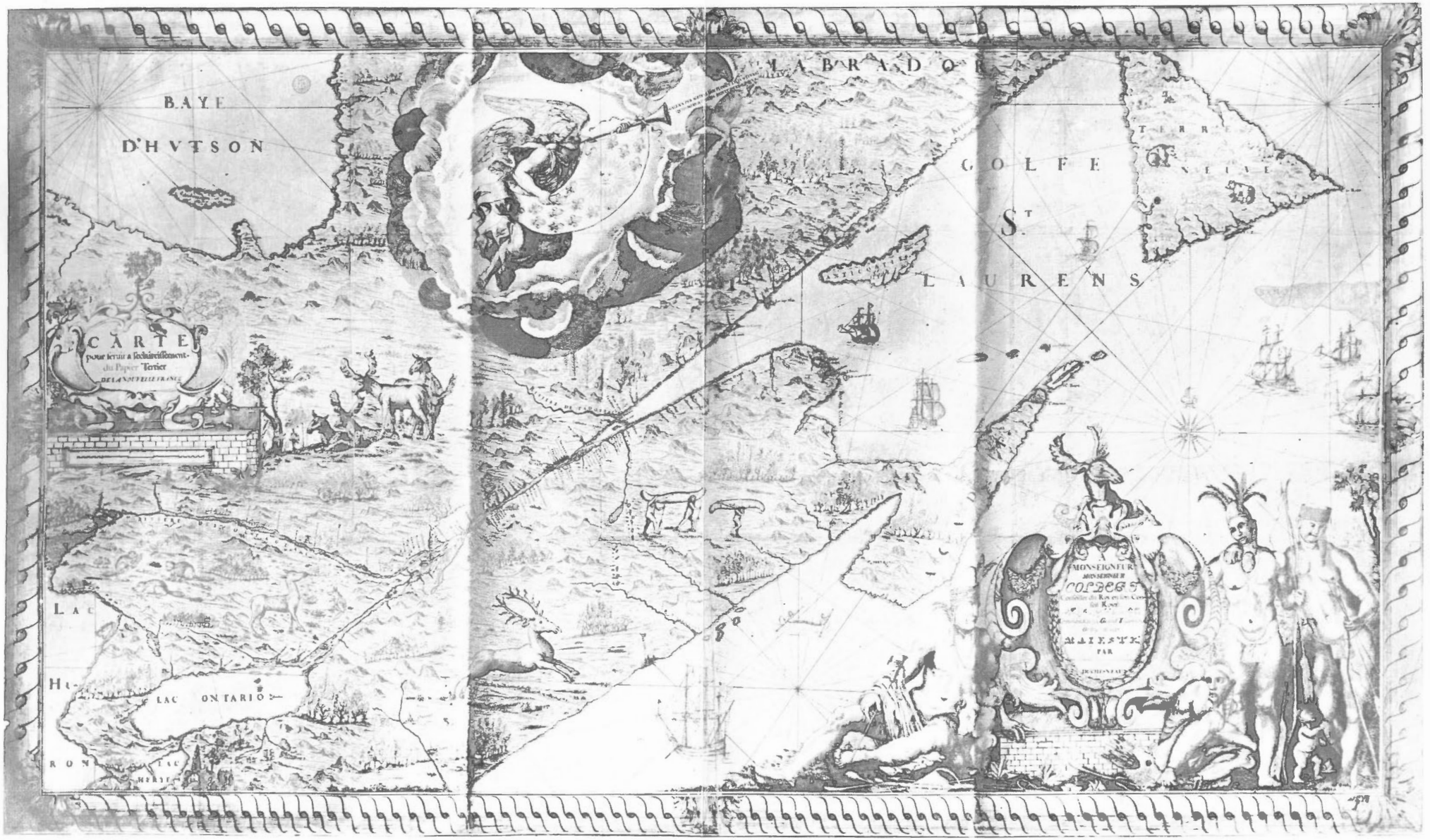
7

NURSERY FOR NAVIGATORS

On the arrival of Governor de Montmagny at Quebec, Jean Bourdon received swift official recognition. He emerged with alacrity from under the dominating influence of Champlain's work and reputation and was at once plunged into a period of intense activity and new responsibilities. Bourdon, described by some historians as "Canada's first engineer", was born at Rouen in 1601. That was the year when Fermat, destined to become an eminent mathematician of France, first saw the light of day. The previous year had witnessed the birth of Nicolas Sanson who, in his day, became a celebrated cartographer and initiated, about 1650, a world-famous school of French geographers.[1]

Bourdon, already in good repute as an expert surveyor and a wise engineer, came to Canada as Engineer of the Company of New France. This organization was the creation of Richelieu, made Cardinal in September of 1622. Two years later Cardinal Richelieu became chief minister to Louis XIII. For the next eighteen years the pale-faced, iron-willed cardinal worked to make the royal power of France absolute at home and supreme in continental Europe. By the formation of the new company, more widely known as the Company of One Hundred Associates, Cardinal Richelieu hoped to extend the power of France in America. But the Kirke brothers, under the flag of England, entertained other ideas and neatly intercepted the company's fleet as it entered the St. Lawrence River in 1628. It was a spectacular seizure of company-chartered vessels as well as of hundreds of immigrants and large quantities of stores intended for the colony at Quebec.

Following Champlain's persistent diplomacy, given impetus by the fiscal needs of the royal treasury of England, the treaty of St. Germain-en-Laye was concluded between France and England in 1632. Under its terms the New World possessions of the French were restored to them. The Company of New France had almost been ruined by the action of the Kirke brothers and by other calamities but now experienced a pronounced



MAP 16. "Carte pour servir à l'éclaircissement du Papier Terrier de la Nouvelle France" by J. B. L. Franquelin, 1678. The original is in the Bibliothèque Nationale, Paris. Reproduced from a copy in the Public Archives of Canada.

revival. This resurrection was the beginning of a period when the Society of Jesus as well as the Company provided the principal guidance and leadership of colony affairs.

In 1632 also, the Jesuit Superior at Quebec, Father Le Jeune, began writing the Jesuit Relations. This publication was designed to keep the people of France informed of conditions in the colony and to help attract stronger support for the work of the Jesuits from the State as well as from private benefactors. In addition the Relations provided a useful means of advocating increased settlement of French people in Canada, its propaganda in this regard being directed to that large part of the home population, the people of "moderate means". It was at this stage in the colony's development that first signs of what is now known as town planning appeared in Canada. "The outlines of a town are being drawn up in order that future building shall be done systematically," wrote Father Le Jeune in the Jesuit Relations.[2] The location of buildings and the boundaries of land grants at the time were made subject, by order of the Governor, to Jean Bourdon's approval.

During the months he spent under Champlain's government Bourdon had felt impelled to function discreetly, but under Montmagny he was given much freer rein to exercise his undoubted engineering and surveying talents. The change in governorship resulted, therefore, in a drastic upsurge in Bourdon's fortunes. He began to accompany Montmagny on official trips. One of his first actions in the Montmagny regime was to stake out the location of a new fort at Quebec.[3]

Following the summer's activity in 1636 Montmagny and Bourdon travelled to the mouth of the Richelieu River. A survey was made there before they proceeded to the island of Montreal and as far as the Lachine Rapids. After returning to Quebec they made a visit to Beaupré. During these travels Bourdon accumulated information for his 1641 map of the St. Lawrence coastline from Quebec to Beaupré.[4]

In succeeding years Bourdon functioned in the combined roles of engineer, surveyor and public works supervisor. In addition, as a town planner, he had an ambitious concept of the future of Quebec as a city. He laid out on paper various streets. In fact, one of the first projects of the new Governor was to prepare a city plan, after having attended to its fortifications, and to lay out new streets as well as to straighten or widen existing streets. The first mention of St. Louis Road occurs in 1637 and not until thirty years later was the St. Foy Road declared open. Action to improve the highways was by no means premature in the late 1630s. Roadways leading to the level of the Upper Town were made less hazardous. Neither Champlain nor the English occupiers (1629-1632) had done much, if anything, to improve the roads of the colony. Quebec streets, far from being paved, were more often than not made of branches, covered with earth.

Fear of the Iroquois was a dominant emotion in the colony at that time. The Five Nations were about to launch their last and greatest campaign of attack and terror. Montmagny was as desperate as the white colonists were alarmed. He despatched Bourdon to Paris to construct a map or maps portraying the military situation. Father Le Jeune accompanied him, stressing in high official quarters the military requirements for the safety and success of the Jesuit missions.

During that winter of 1641-42 spent in France, Jean Bourdon made at least one map, his "Carte depuis Kébec jusques au Cap du Tourmentes".[5] This was the first map of importance to be made of New France since Champlain's noteworthy efforts. It also served to show the expansion potential of the Quebec area. That same winter he made a second map, it is claimed, covering the area from Quebec to Montreal along the St. Lawrence.[6] It is possible that Bourdon's undated map, "Rivière St. Laurent depuis Montréal jusqu'à Tadoussac" was made at the time of this Paris visit also.

One year after Cardinal Richelieu's death in 1642, Louis XIII died and no military aid or funds were forthcoming from France for the struggling colony in Canada. Bourdon, in this time of great trial, won the esteem of colonists and the Jesuit fathers. On New Year's Day, 1646, the Superior at Quebec presented to him an instrument described as "a telescope mounted with a compass".[7] Hans Lippershey, with two associates in Holland, had invented the telescope in 1608, and in the year following Galileo had vastly improved its magnifying powers. It was a discovery that revolutionized surveying and mapping in the western world.

In 1646 Bourdon made a daring trip into Iroquois country in company with Father Isaac Jogues of the Jesuits. Montmagny had asked Bourdon to go on this peace-seeking mission in order to sketch a map of the Richelieu River. The Governor made sure that Bourdon carried with him a compass and quadrant. This journey, from its start at Three Rivers until the return to that point, occupied forty-four hazardous days. Father Isaac reported, "We made a fairly exact map of the country through which we passed". Bourdon commented, "The good Father was indefatigable". It is likely that Father Isaac, in his statement, had reference to field notes together with a rough sketch.[8]

The peace pact entered into between the emissaries and the Iroquois failed to last a full year. In 1647 there were raids on French settlements and in the following year Governor de Montmagny was replaced by Louis D'Ailleboust who continued in that office for three years. In 1650 Bourdon made the second of a total of four visits in his lifetime to France. On each of his visits to Paris Bourdon made maps of parts of the New World and it is likely during the winter of 1650-51 he made a map of the Richelieu River country through which Father Isaac and he had made such a dangerous journey a few years previously. In 1651 one Martin Boutet arrived in Canada from France, a man destined to play a significant part in the development of surveying and mapping in New France.

Bourdon's good relations with the governors of the colony continued under the regime of the successor of D'Ailleboust, namely, Jean de Lauzon, whose term extended from 1651 to 1657. Initially Bourdon had come to Canada under the patronage of Jean de Lauzon, at the time a director of the Company of New France. Over the years of his governorship there were several happenings closely linking the Lauzons and the Bourdons. Governor Lauzon attended the ceremony in Quebec in 1652 when Bourdon's oldest daughter, Geneviève, took the veil at the Ursuline Convent there.[9] Actually Geneviève Bourdon was the first Canadian Ursuline. Also, when Jean Bourdon, a widower, married again in 1655, the wedding took place in the private chapel of the Governor's residence in Fort St. Louis. The Governor and his son Charny were witnesses at the wedding ceremony.

In the spring of 1657 Bourdon was commissioned to find a sea route to Hudson Bay in the interests of trade with the natives. On May 2nd he sailed from Quebec in the *Petit Saint-Jean* with sixteen Frenchmen and two Hurons. Bourdon's expedition was reported in the Jesuit Relations.

"On August 11th M. Bourdon's bark appeared (having returned to Quebec). It had followed the northern shore of the great river (St. Lawrence) .... to the 55th degree (not far from Hamilton Inlet, Labrador)".[10] The expedition had turned back following an unprovoked Eskimo attack on the party resulting in the death of two Hurons and the interpreter. Without the services of the latter, Bourdon felt that the expedition could not succeed and turned back.

Bourdon was back again in France in 1660, the year of the founding of the Royal Society of England. He was in Europe to lend support to Governor d'Argenson's plea

to the home authorities for greater military aid to the colony against the increasing Iroquois menace. While in Paris on this mission Bourdon made the acquaintance of a young student, Sebastien Vauban who, at 27 years of age, had hopes of becoming an ingénieur du roi. As matters turned out, he became a Maréchal de France. While in Paris Bourdon drew a plan of Quebec—"vray plan du haut et bas de Québec comme il est en l'an 1660".[11] In this same year the antecedents of Samuel Holland, Protestant refugees from the consequences of religious strife, which had tarnished the reigns of James I and Charles I, moved from England to the Netherlands. In later years Samuel's brilliant career in England and subsequently in America influenced profoundly the growth of surveying and mapping in Canada.

It was an eventful year in Canada as well. Dollard des Ormeaux and his sixteen French companions fought a gallant but losing fight against the Onondagas at the Big Sault, near present-day Hawkesbury, Ontario. This brave example may well have discouraged the Five Nations of the Iroquois from conducting a wholesale attack upon the settled parts of New France. Farther west the intrepid Jesuits were busily mapping Lake Superior. Closer to the centre of things, in the vicinity of Quebec, an embryo settlement was being established at Charlesbourg. But, on the whole, the colonizing efforts of the Company of New France had met with dismal failure. The company had promised to land at least 4,000 settlers by 1643. Actually the total white population in the Quebec area was little more than 300 at the time.

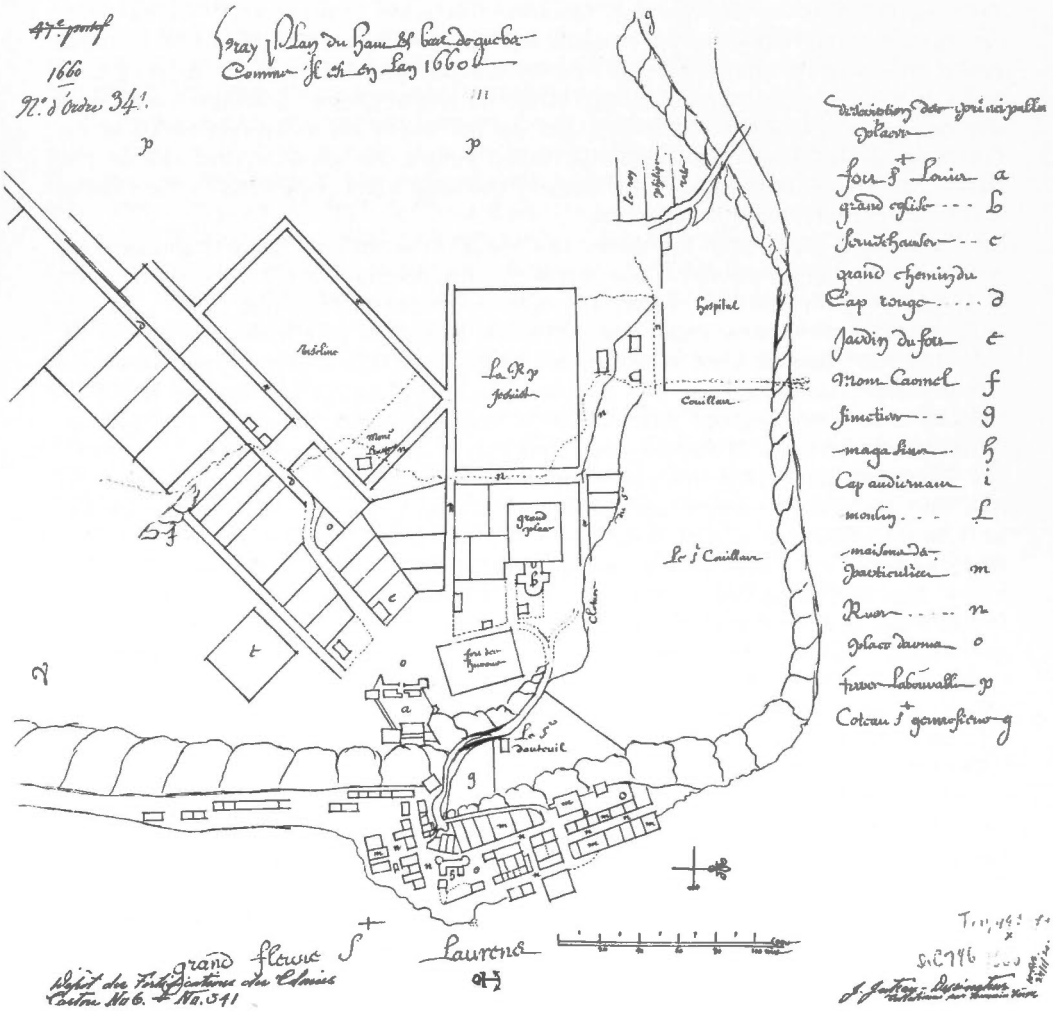
Some four years after his return to Canada Bourdon's ability to maintain good relations with the governors of New France finally deserted him. He quarrelled with Governor de Mézy and was ordered out of New France in September, 1664. Accordingly he sailed for Europe but Louis XIV took Bourdon's part in the dispute. In the following year Sieur de Courcelles replaced de Mézy. It was at this critical juncture in colony affairs that Jean Talon was appointed Intendant for his first term of service in Canada. Here was a man of position and influence who was more than ordinarily interested in the progress of mapping and surveying in the developing colony.

On December 6, 1666, the Governor also announced that His Majesty, King Louis XIV had approved the permanent appointment of Jean Bourdon as Procureur du Roi au Conseil. This was a high post with responsibilities of a law officer, a sort of Attorney General to the Supreme Council. This action served to mark the beginning of a new dispensation in the colony. The French court at Versailles was beginning to realize the true importance of Canada and thus raised its administration to the status and dignity of a royal government. From this time on its Governors were appointed by commission direct from the King. It was from this time onward, at least until the middle of the 18th century, that the colony became generally known in Europe as Canada or as La Nouvelle-France. Its total white population at the time was about 7,000.

Bourdon did not long enjoy the fruits of this high public office. Well within two years from the initial announcement he had been gathered to his fathers. His death occurred in Quebec on January 12, 1668. As had Samuel de Champlain before him, Jean Bourdon had played a vital part in establishing the tradition in Canada of land surveyors serving unselfishly in public life and community affairs. As a mapper Bourdon, like Champlain, made a highly significant contribution to the advancement of New World cartography. In that scientific field he laid the foundations of the work that was so ably carried on in later years by Franquelin, Jolliet, Deshayes, Father Bonnécamps and others.

Four years after the death of Jean Bourdon the Quebec colony received a youthful

immigrant of great promise in the person of French-born Jean Baptiste Louis Franquelin. The son of Guillaume Franquelin and Catherine Vitas he was born about 1651 at St. Michel de Villebernin in the Archbishopric of Bourges, France. There appears to be no authentic record of the exact day or year of his birth but in the 1681 census of Quebec, Franquelin gave his age as thirty years.[12] Refined and learned, yet unpretentious in manner, Franquelin had been admirably trained in the art of cartography in the Department of the Marine in Paris. It is not clear from existing records just what, in 1672, induced this talented map maker to come to Canada, and it was not until 1678 that his name appears for the first time as author at the foot of a map. It was a production designed to explain the register of surveys in the colony. From that time on Franquelin



MAP 17. Plan of Quebec attributed to Jean Bourdon, 1660. The original is in the Bibliothèque Nationale, Paris. Reproduced from a copy in the Public Archives of Canada.

was kept fully occupied with hydrography and mapping.[13]

In the last half of the 17th century there occurred a signal upsurge in surveying and mapping activity in New France. In order to better comprehend the nature and scope of this development it is necessary to consider the flow of events within France itself at this time. The outstanding French administrator during the reign of Louis XIV was Jean Baptiste Colbert (1619-83). The King, coming to the throne at five years of age, was compelled to wait until he reached twenty-one before he could acquire actual governing power. In the meanwhile Colbert, a man of affairs with a flair for administering public finances, had become one of the monarch's most trusted advisers. Not all Colbert's subsequent administrative acts were unblemished by iniquities or cruelties but the catalogue of his constructive achievements is impressive.

Colbert engineered sweeping financial reforms in the business of government. Roads and canals were improved. He established the French Marine in 1669, but three years previously he had founded the Académie Royale des Sciences and provided it with an observatory. He gathered together in Paris at the Académie the best scientific minds of 17th century Europe. He brought from Italy in 1669 that eminent scholar, surveyor and astronomer, J. D. Cassini (1625-1717), to supervise in fact if not in name the programs of the new institution.

It was Colbert, in his ambition to introduce principles of orderly administration in the New World, who sent his favorite Jean Talon, not yet 40, to Quebec in 1665 as the first Intendant in Canada. Urbane, clever, dapper in appearance the self-confident Talon was one of the brightest gems in Colbert's crown of young administrators. But he was so young that he did not have sufficient practical experience.[14]

Colbert desired that the haphazard ways of the French settlers in the New World give way to a more sensibly organized form of community life. Settlement, he felt, should be contiguous and in the form of parishes, villages and towns, although he conceded that farming ought to form the chief occupation of the inhabitants (habitants). The basic concept of the Colbert-Talon plan involved twin goals of increased population and more concentrated settlement. These men felt that from almost every point of view the traditional link-in-chain pattern of settlement along the St. Lawrence was undesirable. By bringing together the settlers in more compact villages not only would defensive measures be easier to carry out but it would be much easier to govern and police the communities and serve them with clergy. Talon, in his day, actually established three model villages at Bourg-Royal, Bourg-la-Reine and Bourg-Talon respectively. Jesuits planned their village of Charlesbourg along the same lines with farmlands spread out from the community centre like leaves of a fan with ends cut off at right angles. Today Bourg-Talon has vanished from sight and the other two experiments in settlement were finally merged in Charlesbourg. After Talon's recall the whole idea was abandoned. His was the last attempt to create compact villages and by 1750 the pattern of land occupation had been firmly set in New France, so far as its French inhabitants were concerned.

The longer Jean Talon remained in the St. Lawrence country with its immense vistas of land, forest and water, the more deeply he came under the spell of the majestic surroundings. This kind of osmosis, in turn, worked a strange change in the chemistry of his nature. In harmony with his environment Talon developed uncharacteristic visions of a vast French empire in the New World. In the passage of time these expansive and expensive fantasies at first disturbed and then confounded his friend and patron Colbert in distant Paris. But at the outset Talon's enthusiasms evoked tolerance, if not encouragement. Bourdon's cartographical work and ability, for instance, were well known to both Colbert and Talon.[15] In fact Colbert, in March, 1665, during a visit of Jean Bour-

don to France, gave detailed orders to Talon in regard to the construction of a chain of forts along the Richelieu River. The instructions must have been based on a Bourdon map or memorandum. In addition, by the time of his first arrival at Quebec, Talon had been impressed already by the practical value of accurate surveying and mapping in the context of French America. As time elapsed the uses to which these arts could be put fitted more and more naturally into the pattern of Talon's grand design.

One of the first aspects of New France to catch Talon's attention was the Jesuit College at Quebec patterned after its Old World counterparts. Teaching had commenced in the institution in 1635, the year of Champlain's death. Nearly all the Jesuit Fathers on the College staff had either studied or taught at the Collège Henry the Fourth de La Flèche in France. Graduates of the astronomy, hydrography and mathematics courses included such distinguished persons as Descartes and Merseune.

Talon soon adopted a fault-finding policy towards the colonial institution. In this pose he may have been reflecting the attitude of Colbert who wished to see the power of the Jesuits in the New World curbed somewhat. It was Colbert who, in 1670, authorized the re-entry to New France of the Récollets. Ten months after his arrival at Quebec Talon was invited to attend a debate in the Jesuit College. He could not refrain from entering the discussion with spirit and displayed special knowledge and forensic ability. He revealed to the Jesuit Fathers his profound disappointment over the lack of any full-term teaching of mathematics at the College. He felt that such a course was not just a luxury but could be very practical, especially in the realm of navigation and hydrography. He thought the latter subject should be taught throughout the entire year. He was convinced that with the growth of the colony there would develop a steadily increasing need for ship captains well-versed in hydrography. In this respect Talon was certainly far-sighted.

The Jesuit professors rose to the occasion. Since about 1651 a lay professor of mathematics, one Martin Boutet, had resided at the College. He was willing to teach hydrography on an extra-curricular basis. Thus in 1666 Boutet began to lecture in the new course. As a teacher of marked ability his reputation grew. In 1671 Talon wrote, "The young men are taking eagerly to the school for the teaching of science, arts and trades and especially navigation so that with a little encouragement in that direction there is reason to hope that this country will become a nursery for navigators, fishermen, sailors and mechanics. Le Sieur Saint-Martin (who is with the Jesuit Fathers in his capacity of "frère donné" and who is well-versed in mathematics) had consented, at my request, to act as teacher".[16] Evidently Talon hoped for nothing less, in time, than a marine institute at Quebec. Boutet lectured tirelessly, training pilots, granting certificates in surveying and, in any spare time available to him, doing some surveying himself.

Boutet had time, in his earlier years in Quebec, for non-mathematical pursuits. He had some knowledge of church music and was well acquainted with the ceremonies of the church. Thus he served as master of the choir and taught chants and rituals. By his contract with the Jesuits he was also to board two children in his house for 300 livres each. In 1659 the number of boarders in his home was increased to four.

By October, 1676, Father Jean Enjabran, writing from Sillery near Quebec, stated in reference to Martin Boutet, "he has instructed captains of most of the ships which come to this country".[17] It is altogether likely that Boutet taught mathematics and hydrography to Louis Jolliet. Boutet's residence on Trésor Street still stands, close to what is now the central square in the City of Quebec.

In January, 1674, a development of considerable interest to the surveyors of New

France took place. A complaint was lodged with the "Conseil de la Colonie" that the compasses and instruments used by surveyors for laying out property boundaries and lines had not been uniformly accurate. As a result some rather bitter disputes were occurring among land owners. The Council ordered surveyors to bring their compasses and instruments to Martin Boutet, the professor of mathematics, for any necessary adjustments. He was to standardize their measuring functions. It was provided that surveyors should set four boundaries on the large square of Lower Town, Quebec, two on the north-east and south-west rhumbs and two on the south-east and north-west rhumbs and correct the variations caused by compass deviations. It was also provided as a condition to be met before entering practice that any new surveyor offer his instruments to Martin Boutet for the purpose of equalizing the same.

In France, inspired by the enthusiasm and leadership of Colbert, scientists were turning their attention to some of the more pressing problems in surveying and mapping. By 1669 the newly-founded Académie Royale des Sciences (now the Institut de France), had become increasingly active in this developing field. The experts in geography had become convinced that in order to bring about any worthwhile improvement in maps and mapping it was necessary to ascertain more precisely the number of miles or leagues in a degree of latitude or of longitude. Some scientists concentrated upon the construction of new or better instruments of measurement, others relied upon telescopes, compasses and other surveying tools in an effort to obtain a more accurate measurement of the earth's circumference, and correspondingly, the true value of a degree of arc around the circle of the earth. The Royal French surveyors adopted the same approach to the problem as that employed by Eratosthenes. But instead of estimating the distance between two selected points on the earth's surface, every foot of the ground along the base line was measured by the most accurate instruments then available. Jean Picard was the expert in charge of the project and he relied on the triangulation method. As his base line he selected the distance between a point near Paris and ran his line northward to Amiens, a distance of 32 French leagues. This survey occupied two years and when all calculations were completed, the results were found to be remarkably accurate.

In England interest was also growing in matters scientific. The nation's leaders wished to keep England in the running for the solution to the longitude puzzle. In 1675 Charles the Second ordered the construction of a Royal Observatory at Greenwich, overlooking the Thames, as a means of aiding in the advancement of nautical astronomy and navigation in particular.

From shortly before Jean Talon's arrival in New France until shortly after his departure there was a mild flurry of appointments to the post of surveyor in the colony. In 1663 Bénigne Basset received his commission and ten years later assumed the title of "first surveyor in the seigniory of Montreal". On July 27, 1696, he added an impressive flourish to his title, namely, "master legal surveyor in New France, resident at Ville-Marie". Basset died in August of 1699. On May 1, 1672, at a time when the total population of New France was under 7,000, Talon named Louis-Marie Boucher dit Buibuisson as a measurer and surveyor. M. Boutet signed the commission. In November of that same year Jean Le Rouge was commissioned and in 1673 the name of surveyor Jean Guyon began to appear on records of the colony. Martin Boutet died in 1683.

At the time of Martin Boutet's death the ineffective Joseph Antoine Lefebre de La Barre was Governor of New France. Mercifully he was in that high post for only one year. He showed no interest whatever in surveying and mapping facilities and services. His successor, Marquis de Denonville, was cast in a different mould. He had been only three months in Canada when he discerned the lack of any course in hydrography in the

curriculum of the Quebec Jesuit College. He did not lose any time in seeking to remedy the situation. On November 13, 1685, de Denonville wrote to the then Minister of Marine in France, Marquis de Seignelay, drawing attention to the pressing need for such a course and suggesting that the King should appoint a teacher of navigation at Quebec. In this connection he recommended J. B. L. Franquelin or, alternatively, Louis Jolliet.

"It would be useful," wrote the Governor, "for the service of the King if someone here were appointed to teach principles of navigation. I think we have some worth-while students here, and also a man very capable of teaching this subject. His name is Franquelin and he is at present engaged in drawing maps. He knows many good things (worth teaching); he would be very useful if you were kind enough to give him some subsistence; he could teach writing, drawing, navigation and arithmetic. Canadians have all the qualities for becoming good pilots provided they be given the means of learning".[18]

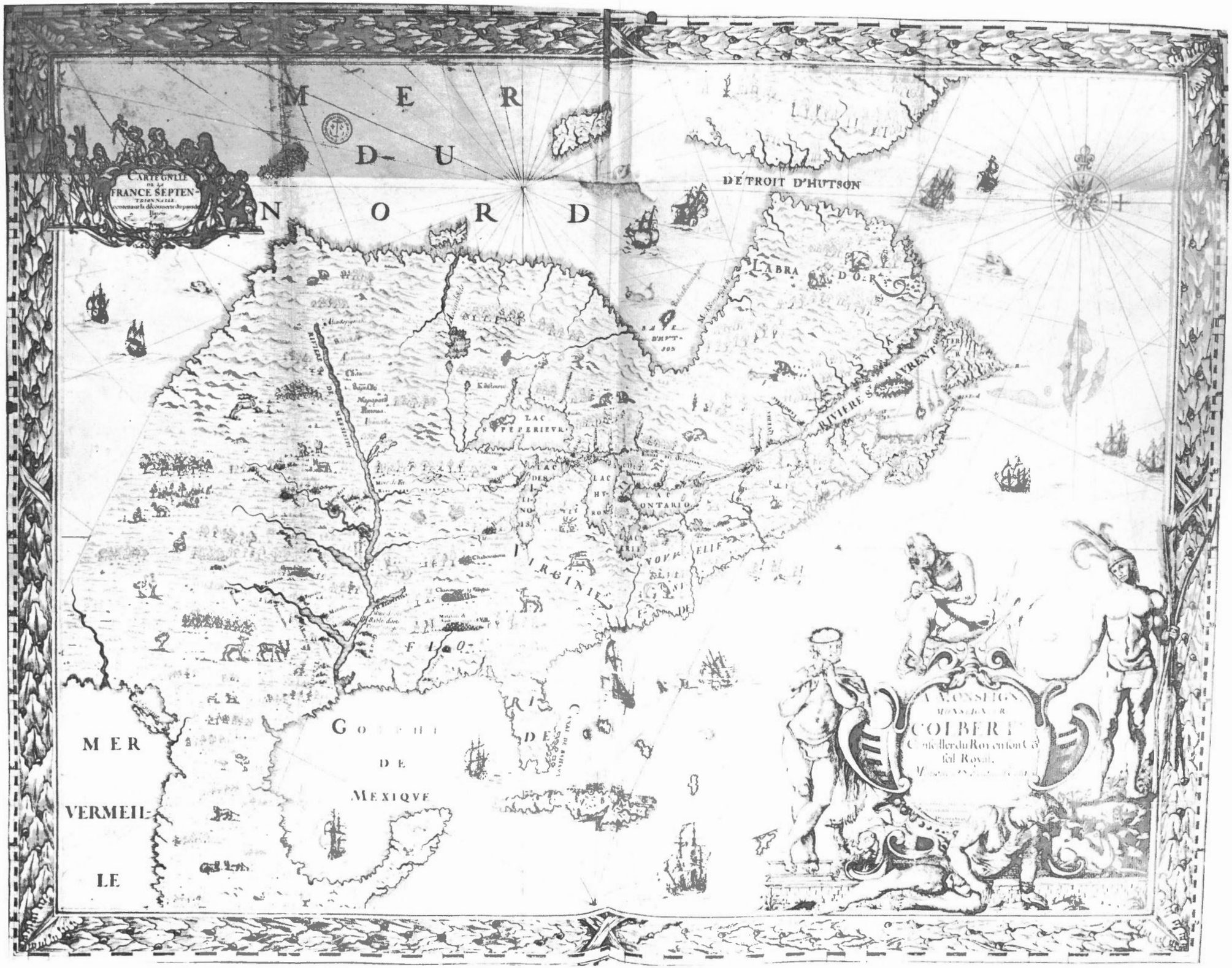
On the subject of Jolliet the Governor writes on the same occasion to the Minister, "I have had Sieur Franquelin make drawings of sketches of Sieur Jolliet. The latter is seriously interested in his work and has made a thorough study of our river. He has had a great share in many of the discoveries made in this country. He is a good man and could also teach navigation and form pilots in this country if you were kind enough, my Lord, to give him some subsidy each year."

On May 8, 1686, de Denonville followed up with a second plea, "The Jesuit Fathers have had one . . . who informed all those whom we have, who understand navigation and who serve our merchant ships. It is some time since this man died. Unless the King does something, we shall have no one. Meanwhile we need pilots, five having died in the past three years . . ."[19]

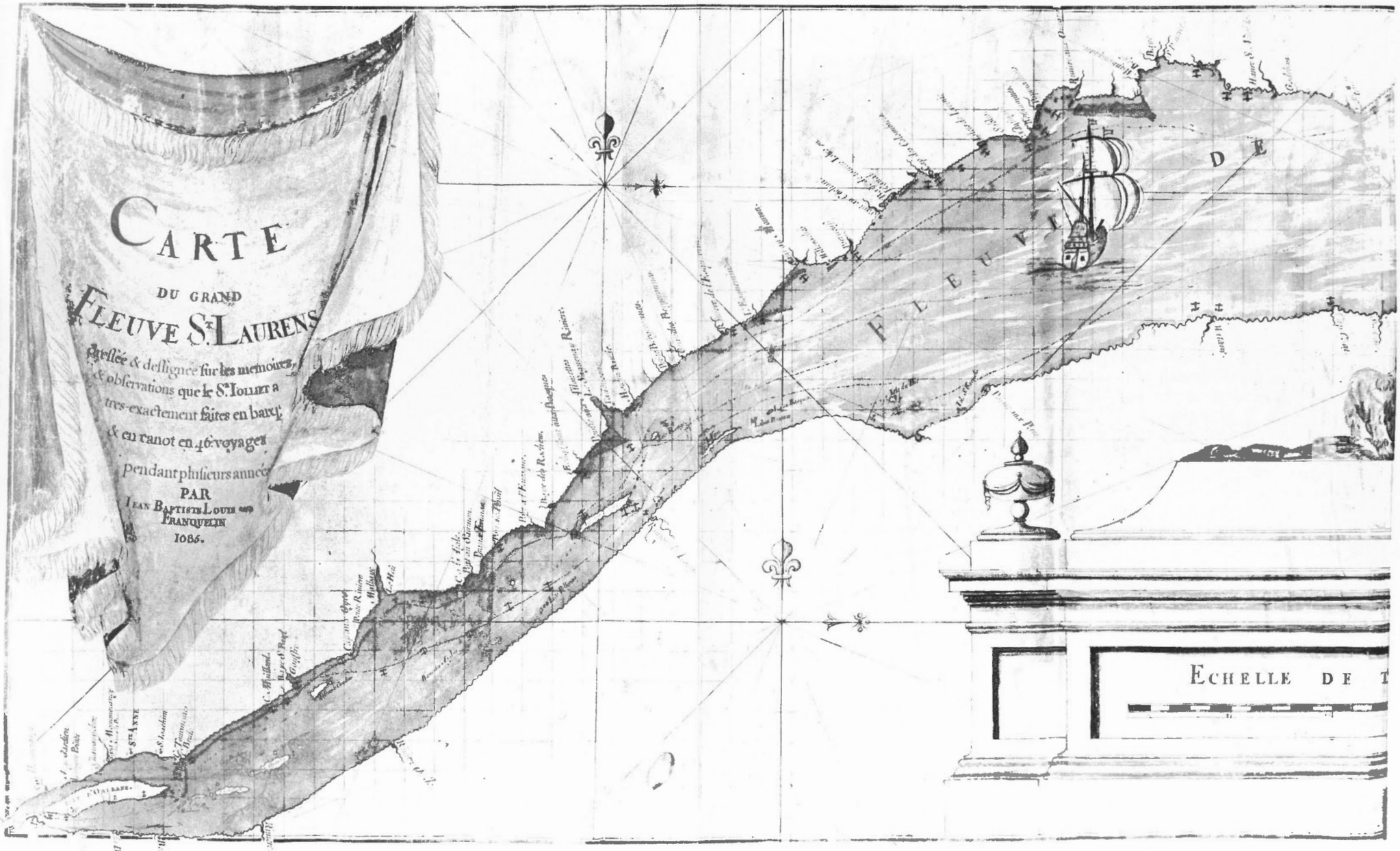
But unknown to de Denonville, Seignelay had already acted. In 1685 he had appointed Franquelin hydrographer at Quebec with a salary of 400 livres per annum. But Franquelin had not been the only candidate for the post. Louis Jolliet had applied also to be named teacher of hydrography at Quebec. Evidently the Minister of Marine, without much hesitation, preferred the French-born Franquelin to the Canadian-born Jolliet. It is likely that Franquelin had more influential friends than Jolliet had in the French court. In any event Franquelin was more of a cartographer than he was a teacher. It would seem that fitness to teach was not, for this time and in this place, the supremely important qualification.

In 1674 or 1675, several years after Franquelin's arrival in Canada, Count Frontenac and Intendant Duchesneau persuaded him to devote his time to map making as "the only one in the colony equipped for this work and in view of the growing demand from France for maps of the colony". Franquelin was, in all probability, the most expert map maker in New France, if not precisely the only one in the country. But he did not receive any government salary for twelve years, until 1686, after he had commenced drafting work! He must surely have been in business as well either as a merchant or trader, or both, in order to have survived during this period.

As time went on it became increasingly evident that Franquelin was not entirely happy in his professorial role. His discontent was communicated, by friends or by himself, to his superiors in the colony. Under date of November 6, 1687, de Denonville wrote jointly with Intendant de Champigny to the Marine Minister, Marquis de Seignelay, asking that Franquelin be employed exclusively as a map maker and that his teaching duties in regard to navigation be left with the Jesuit Fathers. These requests, however, seem to have been ignored, as were later representations of a similar nature.



MAP 18. "Carte Gnle de la France Septentrionale Contenant la découverte du pays de Ilinois Faite par le sieur Jolliet" by J. B. L. Franquelin, 1678.
The original is in the Bibliothèque Nationale, Paris. Reproduced from a copy in the Public Archives of Canada.



MAP 19. Reproduced from a copy in the Public Archives of Canada. The original is in the Bibliothèque Nationale, Paris.

In a letter by Father Chabaud, a missionary in Quebec, dated November 29, 1688, there is an indication that Franquelin was in France for at least part of that year. "Our mathematician Franquelin," the good father wrote, "is going to the Court; he takes away a very large map which you can see at M. de Segnelé's". This was a map on which Franquelin had worked for sixteen years.

When the venerable Count Frontenac came to New France for the second time as its Governor (1689) Franquelin renewed his efforts to break away from teaching duties and made known to the Governor his aching desires in that regard. The situation was handled by Frontenac with shrewdness and delicacy. The newly returned Governor persuaded home authorities to recall Franquelin to France in order to make a report on his special field of instruction. Once in Paris Franquelin pressed hard to be relieved of his burdens. Thus it came about that he was appointed a cartographer in Paris. He urged the appointment of Louis Jolliet as his successor. But it was not until 1695 that Franquelin's resignation from his teaching post at Quebec was officially accepted.

It is interesting to note that in a memoir to the French court in March, 1689, Franquelin made certain recommendations on surveying in New France. He emphasized the importance of drawing correct lines along the outer limits of the King's domains, of establishing boundary posts and of making exact maps of the lands surveyed. "It appears necessary," he wrote, "to divide this huge country into provinces which would be delimited and designated by permanent French names, as well as special rivers and spots; for this we would suppress all Indian names which bring confusion only because they are changed very often and because each tribe gives its own designations, so that one place has always many names". His complaint foreshadowed the submission of many similar grievances by Canadian cartographers of the future!

When Franquelin's resignation as teacher of hydrography at Quebec was finally accepted in 1695 the sagacious Count Frontenac found a reason to send Louis Jolliet to France. From this and other subsequent happenings it would appear that in order to obtain such an appointment as Jolliet was seeking, it was essential not only to be a skilled cartographer but to possess friends in France whose recommendations were well regarded by the Minister of Marine in Paris. At any rate Governor Frontenac and Intendant de Champigny wrote to the Minister that they had promised to employ Jolliet as cartographer and that Jolliet had begged to be appointed to the post of hydrographer at Quebec which "had been held by Sieur Franquelin". After Jolliet returned to Canada with the appointment, the Minister, Sieur Lagny, received a letter from Frontenac in October, 1696, thanking him for the action he had taken.

Jolliet died suddenly in 1700 and once again the mails to France carried urgent official representations regarding the vacant professorship. Louis Hector de Callières had succeeded Frontenac as Governor. With Intendant de Champigny a joint letter was written to the Minister in Paris praying that His Majesty the King would see fit to grant to the Jesuit Fathers at Quebec 400 livres per annum, the amount Jolliet had received, because the Fathers had offered to teach the subject of hydrography. But the response to these representations brought only dismay to the college at Quebec. Word was received that Franquelin had again been appointed professor of hydrography!

But Franquelin never did re-occupy the professorship. Just what changed his mind over the appointment or prevented his return to Quebec, remains an unsolved mystery. His absence from Canada led to another joint letter to Pontchartrain from the Governor and Intendant, dated October 5, 1701: " . . . as Franquelin . . . is not coming this year to this country . . . seeing that the Jesuits have been teaching (hydrography) since the death of Sieur Jolliet and have even begun to teach it at Montreal in the hope that they

may be given this post, we believe, my Lord, that it would be only just that they be paid for the year during which they have taught the subject".

The real reason for Franquelin's failure to make the trip to Canada can only be surmised. It may have been the result of his wife's uncooperative attitude, a fear of renewed privations, the hostility of creditors or a combination of all these factors. Also it is quite possible that Vauban might not have wanted him to leave France and his employ. In any event Franquelin lingered on in Paris after his formal appointment. Finally he prevailed upon His Majesty to appoint Jean Deshayes to the teaching post and to be royal hydrographer at Quebec.

It may be stated that, viewing the world from the European stage, the reign of Louis the XIII was the age of eminent French family firms monopolizing by merit the map publishing industry in that country. The Sanson family, headed by Nicolas (1600-67), began to build a reputation for map making and map printing that stood very high in the world of cartography for a period of about 150 years. This family group, consisting of the father and sons Nicolas, Guillaume and Adrien, commenced about 1650 the publication in Paris of an impressive series of printed maps of North America. The first attempt, in fact, to depict the Great Lakes with fair accuracy is embodied in Sanson's map *Amérique Septentrionale* of 1650. In this production there is clear evidence of the strong influence of Jesuit explorations and geographical reports upon cartography related to the New World. The outlines of Lakes Ontario, Erie and Huron are very well drawn. In their relative proportions and locations this early map of the lakes resembles the work of modern surveyors. Lakes Michigan and Superior, however, were less correctly delineated. In his Relation account of 1647-48 Father Ragueneau made an elaborate geographical survey of Canada, as it was then comprehended, providing much useful information.

The Sansons remained foremost in the map-producing field in France until the early 1700s when the Delisle family came into prominence. Guillaume Delisle, the father, who trained his four sons in the craft, is regarded by some authorities as the founder of modern geographical science. Both Nicolas Sanson and Guillaume Delisle were, in their time, named royal geographers. The greatest care was exercised by C. Delisle in the use of numerous Jesuit sketches as a guide in his map making.*

During this general period Father Coronelli was regarded as the dean of Italian geographers. He was named geographer to the Republic of Venice in 1685 and while in that position compiled a number of maps, among them an excellent portrayal of the Great Lakes and Mississippi Valley, published in 1688.

In the Netherlands the Blaeu family became very active in the map publishing business in the 17th century. Willem J. Blaeu (1571-1638) set up his own map engraving shop in Amsterdam in 1600, introducing his two sons, John and Cornelius, to the profession. Willem had studied astronomy and geography under the learned astronomer, Tycho Brahe. By 1603 Willem had constructed a pair of globes, his initial ventures in the cartographic realm. The Blaeu firm flourished and by 1637 had moved into larger premises, employing the best pressmen, engravers, color artists and clerks in Holland. Probably the best known product of the Blaeu press was their *Atlas Major* in 12 volumes, a geographical work that was, in many respects, the most artistic ever published. This accomplishment marked the completion of 30 years of distinguished publishing in the world of mapping.

In so far as Franquelin's cartography is concerned, it may be said that the ten years

*In the Map Division, Public Archives of Canada, Ottawa, file JJ 75, consists of Jesuit sketches used in compiling the Delisle master map of 1700.

1681 to 1691 were the most productive of his career in New France. During the governorship of de Denonville (1685-1689) he produced the largest volume of completed maps of his entire stay in the New World.

In 1681 Franquelin combined three well-known maps to complete his "Carte Contenant une Part du Canada". He employed Sanson's map of 1650, the Jesuit's map of the Great Lakes 1670-71 and Jolliet's map of 1674 made following the latter's exploration of the Mississippi with Marquette. This 1681 map represented the peak of mapping developments of the initial French period of intensive cartography in the New World. This map also foreshadowed mapping at a steadily increasing pace of the interior of Canada because it included such new geographical features as the Lake of the Assiniboels, Severn River, Lake Nipigon and Nipigon River as well as the Albany River. It marked the beginning of a second period in what might be termed the mapping of the Canadian Near West.

This was almost wholly a period of French mapping. England, limited for the most part to Hudson Bay and adjacent regions, contributed relatively little to the cartography of this era. There can be no doubt that Franquelin in his time drew by far the greatest number of maps, both general and sectional, of any cartographer of that part of North America now known as Canada. Even so, as far as is known, he did not travel west of Montreal. Jolliet, on the other hand, frequently made maps based on actual surveys or personal observations in distant parts and, on occasion, strictly from memory of what he had perceived.

In 1683, the year of his marriage to Elizabeth Aubert at Quebec, Franquelin produced a splendid plan of Fort St. Louis, also a plan of Upper and Lower Town (Quebec). These are the only examples of his cartography of that year known to have survived to this century.

In 1684 Franquelin drew a general map of America and of Louisiana. This map is not of great significance to Canada. Acadia, for example, is depicted in an erroneous fashion. In 1685 Franquelin produced a map of the St. Lawrence River based on the notes and observations of Louis Jolliet and in 1686 he designed and revised a map of 17th century North America. This could qualify as a "mother map" of many to follow. For instance for the first time the Severn River was depicted in a relatively accurate location. Franquelin's artistic and professional competence had increased noticeably in his years in Canada. Francis Parkman, the historian, had remarked of one of his earlier maps, "This map, early effort of the engineer Franquelin, does more credit to his skill as a designer than to his geographical knowledge which appears in some respects, behind his time".[20] It is a criticism that could not, with justice, be applied to Franquelin's work in the 1680s.

Before his departure for France in 1688 for a visit there, Franquelin had been commissioned by the Governor and Intendant "to go next year to the Ottawa country and draw a map of that region". We know that in 1689 he drew a map of North America in which Quebec, as viewed from the east, is included.

Although Franquelin did not travel much in New France, he managed to make a number of voyages to Europe while he was domiciled in Quebec. Not the least astonishing aspect of these transatlantic crossings was his ability to finance them. In 1683, for example, he travelled to the French court, bringing the maps and plans that had been requested of him. He journeyed at his own personal expense, a project that involved an outlay of 1,500 livres and for which he received no reimbursement. For one who was almost constantly in debt to others, this is a considerable triumph. In 1688 he made another voyage to France which cost him 1,600 livres and in this case he was granted

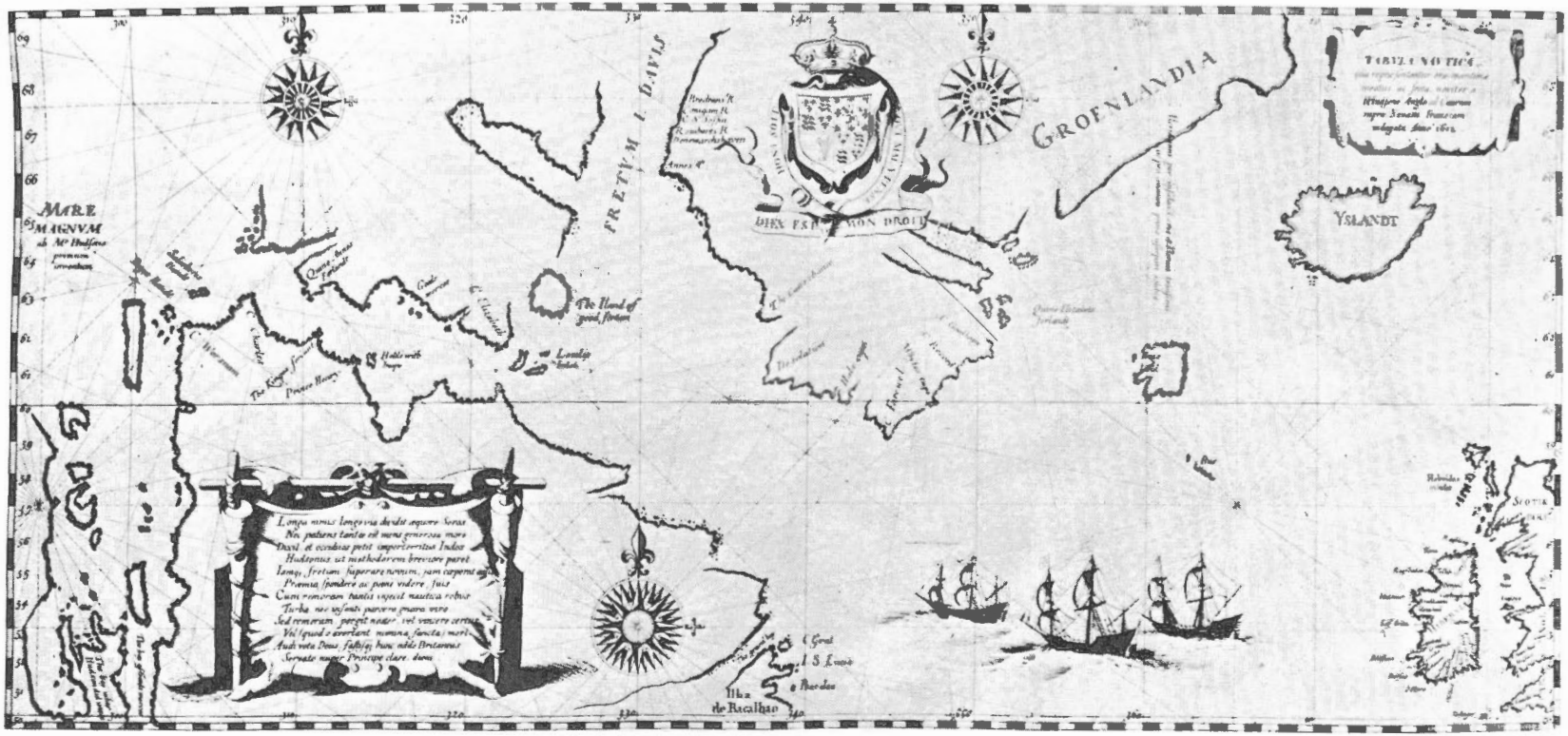
400 livres towards travel expenses despite the fact that he had made the trip on orders from the Governor.

But there were some revealing glimpses of financial stress. During his 1688 stay in Paris there was an incident not only eloquent of fiscal strains but also an indication of the presence in Canada at that time of two engineers, Robert de Villeneuve and Jean Deshayes. Franquelin, it appears, approached the Minister of Marine for a formal commission "and the same salary as that of engineers in Canada in addition to his present salary" as he "will have to pay a draftsman in Quebec to draw the maps so that these can be sent to France each year". It is considered by historians of this period in Canada that these references could only apply to de Villeneuve and Deshayes. In his memorandum Franquelin also urges that the work of determining the boundary line between French and English territory ought to be undertaken first in the Iroquois country but it is just as important "to settle limits between French and English possessions in the Hudson Bay region". In this regard Franquelin showed commendable foresight but events soon combined to prevent any action on his sound advice. The terrible massacre of French settlers at Lachine as a result of an Iroquois attack led to the departure of de Denonville in November, 1689. He was replaced by Count Frontenac, recalled from retirement in France at this time of awful emergency for the colony. Frontenac arrived at Quebec in the evening of October 12, 1689 while the colonists were still in a state of severe shock from the outrage. The matter of determining jurisdictional boundaries would have to await calmer times.

We know that in 1692 Franquelin produced a map of New France and in the following year one of New England. But it was in 1692 that Frontenac decided to send Franquelin to France with maps. For lack of funds Franquelin was "unable to return to Canada". In the following year Madame Franquelin with several of their children sailed to join him in Paris. Franquelin did not return to New France in 1694 as expected in Quebec and, in fact, never set foot in Canada again.

All the information available indicates that Franquelin was a mapper rather than a teacher. He was also more a cartographer than an engineer. Not that he was incompetent in the latter occupation. Frontenac attests that Franquelin did perform duties as an engineer during the first siege of Quebec by the Kirkes and that Franquelin in his work on that occasion "acquitted himself perfectly". This siege, in fact, prevented Franquelin from sending any maps to France in 1690. But de Denonville in January 1690, after his return to France, wrote that "The school of hydrography would be better in the hands of the Jesuits than in those of Sieur Franquelin who does not bother much about forming the pilots the colony greatly needs".[21]

Although Franquelin was a map maker of exceptional skill and capable of production of maps in large quantities, he failed to achieve the wide and lasting fame he and his works deserved. This is just another example of an exceptionally able but modest man being lost in the competitive scramble of more aggressive, if not more gifted rivals. As a mere draftsman in the employ of the Governor of New France his manuscript maps were sent to the home government in Paris where others made use of his work and incorporated his accomplishments, without any credit lines, in their productions. Peculiarly, none of Franquelin's maps were published under his name. His achievements were always overshadowed by the reputation gained by others in Europe in the same field of endeavor. Finally, six years after his arrival in Quebec, his name appeared for the first time as the artist on a map . . . "dans les cartons des archives de Paris dix-sept cartes inedites (par Franquelin)". In the first period of French mapping of the New World, the name of Sanson was supreme. In the second period, 1681



MAP. 20. The first map to delineate Hudson Bay. Printed in H. Hudson and others, *Descriptio ac delineatio Geographica Detectionis Freti . . .* (edited by Hessel Gerritz), Amsterdam, Hessel Gerard, 1612.

to 1731, Franquelin, Delisle and Jaillot were the most eminent French cartographers of territories in North America. In the period to follow, N. Bellin's work was to prove exceptionally important. Du Val and De Fer were two other French geographers who were very active towards the end of the 17th century and the beginning of the 18th. At this time French knowledge of Hudson Bay rested almost entirely on a 1612 map by Hessel Gerritsz, chronicler of early English expeditions into the Bay. His map, published in the Netherlands, was copied by Champlain in his 1613 and 1616 maps. Most of the leading French cartographers of the 17th century were interdependent. Sometimes they worked with each other closely, and often borrowed from each other cheerfully. But the unassuming Franquelin, as far as we know, was the only one of this distinguished coterie of map makers ever to live in New France.

Because he depended upon the sketches and field notes of others and sought to reconcile them as best he could, certain weaknesses mar Franquelin's best work. On all of his maps the east-west length of the Great Lakes is much too great. On his 1684 map, for instance, the spread between Duluth and the outlet of Lake Ontario is 27 degrees of longitude, or 1,323 miles, whereas the actual distance is 767 miles! Nevertheless one of the most important contributions made by Franquelin to the cartography of his time consisted in expressing in an artistic manner on flat surfaces, the sketches and field notes of explorers, surveyors and missionaries.

It is one of the strange coincidences of history that in the case of both Jean Baptiste Louis Franquelin and his successor in the post of royal hydrographer at Quebec, Louis Jolliet, the precise times and places of death remain unknown. Franquelin is thought to have died in France sometime between 1712 and 1730. Jolliet is reported to have died on one of the St. Lawrence Gulf islands in 1700, but the exact date and place are a mystery to this day.

8

DIRECTION FINDERS OF NEW FRANCE

By the middle of the 17th century French settlement in the St. Lawrence River basin was being matched by growing settlements of English and Dutch along the Atlantic seaboard to the south. In New England, after prolonged disputes between England and France over the right to colonize certain areas, England finally gained supremacy. But the pattern of occupation was haphazard. Frequently settlers located and developed sites without first establishing their title to the land. Such was the course followed by the Pilgrim Fathers and others along the shores of Massachusetts Bay. Settlement usually developed in the form of closed communities or towns in which some land was held and used in common. As colonization grew, it became necessary in time to regulate and regularize land-acquisition procedures. As early as 1634 committees of settlers were appointed to fix boundaries in dispute. In 1641 each town was ordered to mark properly the boundaries of its grant within a year's time.

The size of community land grants in New England for town settlement varied. Earlier town areas extended over 8 to 10 square miles. With the advantage of actual experience in administration it was found that 6 square miles represented as much land as a community could absorb effectively and conveniently. Accordingly 6 square miles, or its equivalent acreage, became the customary size of a New England township.

In the New Netherland (or New York) area, as settlement gained momentum it followed no preconceived pattern or order. To eliminate some of the confusion that resulted and to reassure prospective immigrants, the Dutch secretary under Stuyvesant wrote to home authorities in Holland in 1650 assuring the people of that country that suitable village sites would be selected and made available to newcomers. Before buildings were erected, the village site would be surveyed, streets and lots laid out and the land outside the village limits divided into tracts for cultivation. Tracts of woodland and pasture not allotted to individuals were, by tradition, used in common.

These, then, were some of the surveying and settlement developments taking place to the south of New France during the period when Champlain's immediate successors in office, Montmagny, D'Ailleboust and Lauzon, were directing the affairs of the French colonists and when Jean Bourdon acted as chief authority over land surveys and hydrography.

At about the same time that the grateful Jesuit Fathers of the Quebec College were making the presentation of a telescope with compass to Jean Bourdon, Louis Jollyet was born at Beauport near Quebec.

Information on the youth of Louis Jolliet (or Jollyet) is scanty. It is known that his father died before Louis reached the age of six years. There are indications that Louis attended courses at the Jesuit College, Quebec, in the late 1650s. During these college days his musical talents were in demand as an organist. Record of his participation in a college debate on July 2, 1666, is additional evidence of his versatility. The year following proved to be an important one in the career of the young Canadian. So favorably did he impress Bishop Laval that the churchman arranged a voyage to France for him. The 22-year-old Jolliet, without means of his own to pay the costs of such a formidable trip, borrowed from Bishop Laval for the purpose.[1] In addition to this Laval suggested to Louis that he see the bishop's friend in Paris, M. de Charny, youngest son of the fourth Governor of New France, Jean de Lauzon.

Louis Jolliet commenced his exploration surveys in the New World at a relatively early age. At 25 he was travelling in Indian country as far west as Lake Superior in search of a copper mine. Reports of its existence had reached Talon, the Intendant who had been eagerly searching for mines along the St. Lawrence River since his arrival in New France in 1665. The prospecting errand proved fruitless and Jolliet, it is thought, spent the winter of 1670-71 at Sault Ste. Marie.

The year 1672 was marked by the arrival in Canada of Count Frontenac to serve the first of two terms as Governor of New France. It was a year of significant events. Among other developments Talon commissioned Jolliet to search for a water route to the so-called Sea of the South. The same frugal fiscal policy of which Jean Bourdon had been a victim and which Franquelin (who arrived at Quebec in this same year) was destined to experience, was applied to Jolliet. Although officially instructed to undertake this mission of exploration, the administration did not pay any of the expenses of the journey. Rather he was to recoup himself from surplus proceeds arising out of the use of a fur-trading permit.

Geographical concepts of the time concerning the interior of the North American continent, appear odd to 20th century eyes. Mention of a great river in the West is to be found in the Jesuit Relations 1666-67. In the journal of Father Allouez we find reference to ". . . a great river, which as far as I can judge, empties into a sea toward Virginia. . ." And later in a letter the good Father remarks, ". . . it is hard to believe that the great river discharges its water in Virginia; we think rather that it has its mouth in California". Here the fervent wish may have been the father of the thought. The principal searching in those times was directed towards the shores of the Pacific, the access-way to the Orient.[2] In part the estimate of Father Allouez was colored by the fact that in maps of that period a high mountain range was shown, surrounding the southwest region of what is now the United States of America. Father Allouez would probably reason that the course of the great river might well be bent westward in a vast detour around the alleged mountain barrier.

Jolliet was accompanied on his southern survey by an interpreter, Father Jacques Marquette. Born in Laon, France, Father Marquette had, in 1669, replaced Father

Allouez at the mission on the southwest tip of Lake Superior, the same year that Picard began laboriously to measure his meridian line near Paris. In June of 1673, travelling down the Mississippi, the pair reached the latitude of 33 degrees, 40 minutes. On questioning Indians near the junction of what is now known as the Arkansas and Mississippi rivers, Jolliet learned that the latter continued to flow due south. Accordingly the expedition returned to Canada. As he approached Montreal Jolliet's canoe, which had raced safely through numerous dangerous cataracts, suddenly overturned in a series of turbulent rapids. Although he managed to survive, his priceless journal and papers of the trip were never recovered.

Nevertheless, in the following year, Jolliet drew from memory maps of his Mississippi journey, dedicating the principal map to Governor Frontenac in a letter inscribed thereon. Jolliet also wrote on October 10, 1674, probably to Laval, indicating the southernmost limit of his exploration. No portages had been required along the route and the river he described as "wide as the St. Lawrence at Sillery (1,650 feet . . . about half of its width at Quebec)". One of the main results of this mission was the conviction in French geographical circles that the "Father of Waters" discharged into the Gulf of Mexico rather than the Pacific, known as "Sea of the South".

Three years after his marriage in October, 1675, to Claire-Françoise Bissot, a revised version of the Jolliet map was dedicated to Colbert by Intendant Duchesneau. It bore the impressive title, "Carte Gnlle de la France Septentrionale Contenant la découverte du pays de Ilinois Faite par le sieur Jolliet".

Father Marquette also made a map on his return and the manuscript version of this product is now in the archives of Collège Sainte-Marie, Montreal. The latitudes, 30 to 48 degrees, are numbered on both margins of the map but the longitudes are not numbered. No existing map of this section of the Mississippi River made in Europe or Canada before 1700 proved to be as accurate as that of Father Marquette's. The original Jolliet map, sent to France, has since dropped out of sight. But some five maps based upon it are in existence, one drawn by Franquelin. The text of the Jolliet-Marquette journey down the Mississippi was published in Paris in 1681 under the title: "Voyages et Déscouvertes de quelques Pays et Nations de l'Amérique septentrionale".

In the year of Jolliet's marriage, La Salle, who achieved eminence as an explorer of the French regime, was busily occupied at Cataraqui, rebuilding its fort and constructing four vessels, the first constructed by white men to be launched on the Great Lakes. By 1679 La Salle had embarked on an expedition that took him to the mouth of the Mississippi nine years after Jolliet's journey on its broad waters. La Salle formally claimed for France the region drained by the river and named it 'Louisiana' after King Louis XIV. He met his death trying to found a permanent colony at the great river's mouth.

In spite of La Salle's impressive achievements, nothing could detract substantially from the heroism of Jolliet's exploratory ventures into the North American wilderness or from his scientific approach to the unknown. If it can be said that Jolliet had a valid claim to the title of hydrographic surveyor in his day, then he was indeed the first Canadian-born member of that valuable fraternity. In this connection a rather revealing letter, dated November 10, 1685, was written by Louis Jolliet to the Marquis de Seignelay in Paris, then Minister and Secretary of State.[3] Incidentally, we know that in 1684 Jolliet had drawn a map of Hudson Bay as the result of an expedition in 1679 he had conducted to the Bay, leaving Quebec on May 13th with eight men, returning on October 5th of the same year.

The letter to the Minister has been translated as follows:

"It is not without reason that from the very beginning ship captains coming to New France have always been apprehensive of the entrance of the Gulf of St. Lawrence and of the navigation from Anticosti to Quebec, a distance of more than 130 leagues (about 393 statute miles). It is known, my Lord, that several ships sent by His Majesty as well as by merchants, have been shipwrecked in the said river for lack of accurate and reliable navigation maps.

"Since I completed my studies in philosophy and mathematics 18 years ago I have acquired much experience during voyages made to the Mississippi River, Illinois country, . . . Lake Superior in the Ottawa country, . . . Hudson Bay, Anticosti and Newfoundland, always with dividers or compass in hand, noting every cape and spit, as well as the bearings from one to the other. This experience emboldens me, my Lord, to present to you this map which is (the result of) my work during the past six years. You will see marked on it all the coves, islands and islets, all of the coasts and sand bars from Quebec to Newfoundland. The pilots of the ships of His Majesty and of other ships have nothing to fear if they use this map and navigate by it.

"I do not hesitate to say that this map is complete, for I inserted in the final draft the information and the noteworthy details observed during 46 voyages on a barque and three in a canoe. Coves and anchorages, good and bad as well as the bearings are faithfully entered.

"I am not adding the map of the Illinois country, of the Mississippi, or that of the overland route to Hudson Bay, because the maps of these regions which have been sent to His Majesty these past years were all based on my memoirs, and those very enterprises which are now in progress in Canada are the result of information which I brought back. (Hence) it only remained, my Lord, to give you a map of the St. Lawrence River, as accurate and trustworthy as possible, for the navigation of barques and vessels, made by a man with several years experience . . ."

The hydrographic history of Canada might well be said to have started with this letter of Louis Jolliet to his Minister, Marquis de Seignelay, in 1685.*

In 1680 Intendant Duchesneau had written that the Anticosti Island seigniory (including the entire two-and-a-half-million-acre island) had been granted to Sieur Jolliet partly "in consideration of the discoveries made by him in the Illinois country of which he has given . . . a sketch which served as a basis for making the map sent two years ago to my Lord Colbert. . ."

After Jolliet's return from Hudson Bay and his subsequent letter to Seignelay, we have only fragmentary information on his activities, with the exception of his 1694 expedition to Labrador. It appears that he divided his time between Quebec and Anticosti during these late years of the 17th century. Assuredly he was in Quebec from November, 1693 to April, 1694. In 1694 he made a five-and-a-half-month voyage to Labrador. It is surmised that the expedition was the fruit of a realization that the exploration, survey and mapping of Labrador was sadly lagging. On April 28th Jolliet sailed from Quebec, returning in mid-October.[4] In his journal of the trip is this entry:

"On August 15th at noon, in clear weather, I measured the height of the sun above the horizon with the astrolabe and found 47 degrees, 45 minutes which means that we were at latitude 56 degrees, 11 minutes." (Zoar, the point where this reading took place is actually at 56 degrees, 8 minutes.)[5]

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*From very early times sailing charts were compiled from observations of navigators. Because of this close connection the French word "hydrographie" became largely synonymous (especially in the 17th century) with "navigation" rather than with hydrographic surveys. Nevertheless "sondage" (soundings) commonly formed an important aspect of "hydrographie".

It had been a long and frustrating battle that had been waged by Louis Jolliet and his Quebec friends in the effort to win for him the post of Royal Geographer and professor of hydrography on the Jesuit College staff. Finally success came in 1697, his commission being dated April 30th.[6] In the winter of 1698-99 he drew a map of Anticosti Island and the Gulf of St. Lawrence, a chart designed for the use of pilots entering the Gulf through Cabot Strait. It seemed that at the age of fifty-five Jolliet yet had in store many years of service for his king and country.

But fate sometimes displays a stolid, if not entirely heartless indifference to the loftiest ambitions and cherished hopes. Jolliet, despite willing and, in some instances, highly placed friends, despite undoubted talents as a cartographer and long practical experience in exploratory surveys, did not long enjoy the advantages of his important position. He passed away some time during the summer of 1700, little more than a year after the death of Count Frontenac and barely more than three years after his effective appointment to the post he had sought so long and fervently.

Louis Jolliet died in poverty that his large land holdings did little or nothing to allay. His widow died destitute. The location of the grave of the man who made widely known the existence of the Mississippi River and opened the way to an empire in North America, remains a mystery. In Canada the separation of hydrographic surveying from navigation is foreshadowed during Jolliet's career but the ultimate division of functions did not actually occur until 1720 with the formation of the Depôt des Cartes de la Marine et des Colonies, an institution from which the Service Hydrographique of France traces its growth.

Following a hiatus of four years Jean Deshayes succeeded Louis Jolliet as Royal Hydrographer and teacher of that subject at Quebec. Franquelin had taken on the job in name only but Deshayes took over the duties in name and in fact. We are without details of the date of birth or of the parentage of Jean Deshayes but it is reasonable to assume that he was at least fifty years of age at the turn of the 18th century, six years prior to his death. The family surname suffers from a variety of spellings in documentary reports referring to his career. Sometimes it is spelled DesHayes, Deshaies or, occasionally, Des Hayes. But in Canadian records, for the greater part, the name appears as Deshayes.

Jean Deshayes never did have a suitable opportunity to root himself very deeply in New France. He spent no more than four years in the colony, spread over two visits. The first stay extended from the spring of 1685 to the autumn of the following year. His second visit was from sometime in 1704 to his demise on December 18, 1706, in the Hôtel-Dieu at Quebec. Despite the brevity of his sojourn in Canada Deshayes, because of his exceptional reputation as a cartographer and astronomical surveyor, made a brilliant contribution to the development of those activities in the colony.

On both his visits to Canada Jean Deshayes met with cool receptions. In 1685 he was instructed to proceed to New France by Seignelay. The Governor of the colony, de Denonville, regarded his presence at that time as somewhat less than welcome. At that stage in the growth of the colony Franquelin was solidly in the Governor's good graces and had just received the appointment of Royal Hydrographer at Quebec. The Governor was therefore determined to preserve what he considered to be the best interests of Franquelin and, for that matter, the interests as well of the defeated candidate for the same position, Louis Jolliet, in preference over the new arrival from Europe. In addition Deshayes appeared to be in frail health, unprepared to meet the rigors of 17th century travel in the North American wilderness. When de Denonville took Des-

hayes with him on a canoe trip to Cataraqui during the mapper's first season in Canada to chart the river shoreline between Quebec and their destination, Deshayes became so violently ill he could not continue to work at his sketching. The Governor, in fact, thought that the newcomer would die before the outgoing journey was completed.[7] Nevertheless Deshayes produced a remarkably accurate outline of the St. Lawrence from Quebec to Lake Ontario, a work that became the basis for some of the best early maps of that part of Canada.

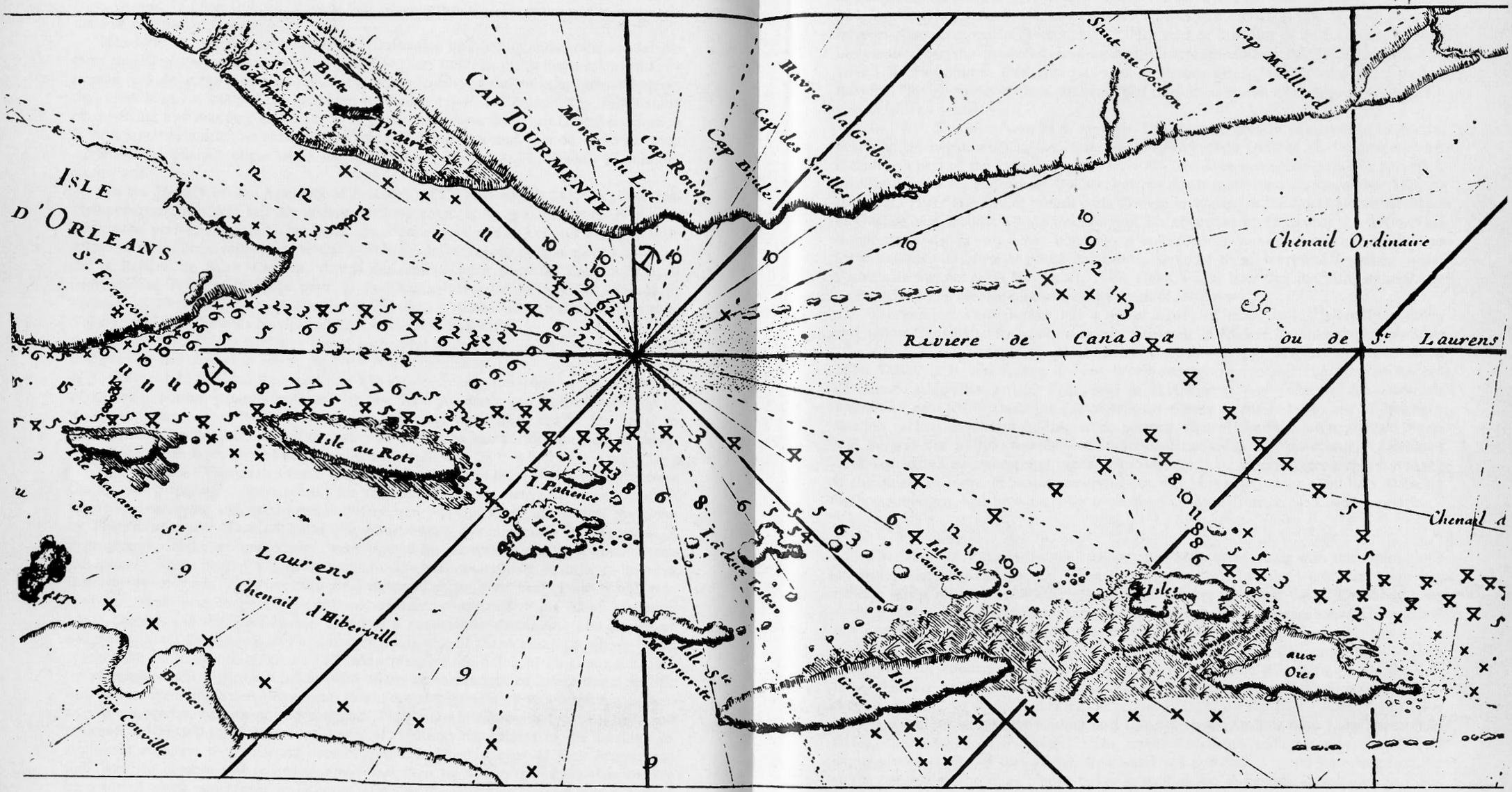
On June 17, 1685, Seignelay wrote to Intendant de Meulles concerning the assignment that Deshayes was sent to New France to carry out. His instructions related mainly to map making at the mouth of the St. Lawrence River and the minister included orders that a rowboat be obtained for Deshayes for that purpose. J.-Edmond Roy, in his study of surveying and mapping under the French régime, claims that Jean Deshayes came to New France primarily to make astronomical observations and that in 1686 he took advantage of a lunar eclipse to fix the longitude at Quebec at 72 degrees, 13 minutes from Paris.[8]

In the History of the Academy of Sciences, 1699, volume 38, 281, we read, "M. Deshayes, qui avait déjà fait des voyages de long cours, et un grand nombre d'observations, pour perfectionner la Géographie, ayant été envoyé par le Roi en Canada dans le même dessein, en a rapporté une Carte Marine de sa façon, qui comprend le cours de la Rivière de Saint Laurent, depuis son embouchure jusqu'au Lac Ontario. Il demanda au Roi un Privilège pour la Publication de cette carte et Sa Majesté fit l'honneur à l'Académie de la lui envoyer à examiner. L'Académie l'a jugée forte exacte et d'une grande utilité pour la Navigation de la Rivière St. Laurent".

At this point in our narrative it may be helpful to revert to developments in France that provide the context in which the New World services of Deshayes were performed. J. B. Colbert had founded the Académie Royale des Sciences in 1666, a prime favorite of all the important projects instituted by him. The Academy was formed with one of its avowed purposes... "to correct and improve maps and sailing charts". In order to carry out such a program it was necessary to find some satisfactory method of determining longitude, especially while on the high seas.

The foremost European expert at the time in such matters was Jean-Dominique Cassini. As a leading Colbert recruit for the staff of the Academy he inaugurated, in the 1680s, surveying and astronomical observation work in many quarters of the globe by French scientists. Two of Louis the Fourteenth's commissioners or engineers of hydrography, Deshayes and Varin, were trained by Cassini at the newly-built Paris Observatory where the two young men could make trial observations in order to improve their survey methods. They received final instructions on their part in the world-wide plan for ascertaining longitudinal positions, namely, to proceed to the island of Gorée (near Dakar) and the West Indies. This was a particularly demanding and important assignment since their work involved the long crossing of the Atlantic on whose broad reaches the most disturbing errors had taken place in the fixing of longitude lines.

Deshayes and Varin had taken with them an assortment of interesting scientific instruments including a large quadrant, pendulum clock and a 19-foot telescope as well as a thermometer, barometer and compass. They were at Gorée in March, 1682, and returned in the following March to Paris, after observing eclipses of the satellites of Jupiter in an effort to fix correct lines of longitude. Also as part of their instructions they were to observe and record compass variations as well as gathering data on the behavior of clock pendulums in latitudes close to the equator. The pendulum actions seemed to support the Newtonian theory of a diminishing gravity force within the areas



MAP 21. Insert on a map based on Deshayes 1685 survey of the St. Lawrence. Courtesy of the Public Archives of Canada.

in which the earth bulges out. These activities in Africa and the West Indies extended over 1681, 1682 and 1683 and won for Jean Deshayes a firm place in the scientific hall of fame.

His health improved greatly during the winter months in Canada in 1685-86 and in the spring he was supplied with a barque for surveying the Gulf, "s'est fort promené le long des rivages du fleuve au-dessus de Québec, en attendant que la navigation fut ouverte pour descendre à l'embouchure". That part of the Gulf of St. Lawrence appearing on the chart he produced was evidently surveyed during the summer season of 1686.[9] In the autumn Deshayes returned to France to . . . "rendre compte . . . de son travail". Though much of the Gulf remained uncharted he did not return to Canada for some eighteen years.

In 1704 Deshayes was back in New France with greatly enhanced prestige and position. He began working again on his long-unfinished Gulf of St. Lawrence chart, including a part of the Labrador coast. By 1706 Deshayes was either giving or preparing to offer lessons on pilotage at Quebec but his death intervened on December 18th of that year. There are files of notary de la Cotière in storage in the Court House Archives in Quebec that include a long inventory of his effects as of December 22, 1706. This inventory refers, among other items, to a collection of surveying instruments and to forty volumes on surveying and navigation, some of them borrowed from the Jesuit Fathers. It was not until November, 1707, about a year later that the Minister in Paris, de Pontchartrain, learned officially of the death of Deshayes.

The eminent cartographer left a useful legacy of maps to his fellow-Frenchmen and fellow-Canadians. In addition to his "Carte de la Rivière de St. Laurens" and his "Carte des Côtes habitées du Canada par Paroisses et par Seigneuries" both dated 1686, Deshayes is best known in New World cartography for his "La Grande Rivière de Canada (Appellée par les Europeans de St. Laurens)" of 1695 and his "Côte de Labrador" of 1704.[10] Deshayes conducted, on a truly scientific basis, one of the New World's earliest important hydrographic projects, that of the St. Lawrence River basin and he was one of the founders of functional surveying in this country. Deshayes bestowed increased stature and prestige upon the title of Royal Hydrographer, making it significant in terms of actual surveying practice. Even so, up to 1750 no systematic harbor soundings had been made in more than a dozen Gulf of St. Lawrence ports.

The labors of Fathers Dablon, Allouez and Marquette, along with the explorations of Brulé, Nicolet, Radisson and Groseilliers demonstrated to the world that there was no east, direct route to the Western Ocean after leaving the Great Lakes. For it had been a rather widely held assumption prior to about 1660 that such an ocean could be reached just west of Lake Superior. Now the conviction was steadily growing that there was, in fact, a vast land-mass intervening. The Jesuit map of 1672, the result of more than thirty years of Jesuit exploration, was particularly useful in its portrayal, for the first time, of rivers leading west from Lake Superior to the country of the Sioux, as well as its presentation of the complicated bays and islands on the north side of the lake, including the Nipigon River leading into Lake Nipigon. On this map Lake Superior is styled, "Lac Tracy ou Supérieur". The amount of detail indicates that Jesuits had explored every part of this inland freshwater sea and had a good knowledge of the straits connecting the three Upper Lakes as well as the shorelines. In addition to maps drawn for publication in the Relations, Jesuits such as Father Fénélon with his map of the Bay of Quinte; Father Raffeix and his map of New France extending from the

Atlantic to Lake Erie and a map of Lake Ontario with surrounding regions; Father Aubry's 1713 map of Acadia*, Father Laure's map of the Royal Domaine — all contributed to the mounting treasury of cartographical material originating in New France.

In the St. Lawrence basin it was becoming obvious that in some important respects the colony needed navigators, engineers, mappers and surveyors during this formative period more than it needed artists, men of letters or even politicians. It is not surprising, therefore, to learn that the King maintained at Quebec in addition to a Royal Hydrographer, a surveyor whose duties involved both the making of surveys and the drafting of plans. A protégé of Frontenac, an engineer named Raudin, took a special interest in mapping, but information about him is sparse. Parkman ventures the opinion that Raudin may have drawn the map titled, "Carte de l'Amérique Sept-entrionale depuis l'embouchure de la Rivière St. Lauren jusques au Sein Mexique" now in the possession of Depôt des Cartes de la Marine et des Colonies, Paris. Raudin was succeeded in 1685, at least for a limited time, by the military engineer, Robert de Villeneuve.

When Jean Deshayes died, late in 1706, the Governor of the colony, Phillipe de Rigaud, Marquis de Vaudreuil, and the Intendant pleaded with home authorities to request that the Jesuits "take the place of Sieur Deshayes". This time Louis the Fourteenth yielded to pressure. Since the first appointment of Franquelin 22 years had elapsed. More than 70 years had gone since the death of Champlain. For the next half-century (1708-59) a succession of Jesuit Fathers carried on at the Quebec College as Regius Professors of Hydrography.[11]

In 1717 the Marine Council advised the Governor and Intendant that the Jesuit professor who taught hydrography at Quebec was entitled to issue certificates licensing young men as pilots on completion of the required courses. These certificates were to be paid for by the recipients. The professor also had the right to issue licenses certifying that the bearer named therein had all the necessary training in theory and practice to enable him to carry on surveying efficiently and reliably.[12]

Jesuits who came from France to Quebec for the special purpose of teaching in hydrography included Fathers François Le Brun (1708-21); Charles Messaiger (1722-23 and 1736-41); Joseph Deslandes (1726-36) and Joseph-Pierre de Bonnécamps (1742-59). Others who deserve mention in this connection are Fathers Raffeix, Allioux, Lauzon, Silvy, La Chauchetière and Guignes. The salary during this period for the work of the professorship was set at 800 livres per annum.

Father Charlevoix had been instrumental in securing the appointment of Father Bonnécamps who came from France under obligation to take charge of the class in hydrography at the Jesuit College. The new professor soon discovered that the equipment available at the institution was inadequate for proper instruction, and applied to the home minister, M. Hocquart, for more and better instruments. M. Hocquart submitted a petition to the French Court, suggesting that it would be relatively easy and exceedingly useful to install on the college roof an observatory costing not more than 1200 francs. The requested instruments failed to arrive as expected and in 1748 Intendant Bigot returned to the assault on ministerial citadels. Finally the minister, at the end of 1749, just ten years before the transition to the British regime, sent out a second-marking clock, a telescope and a portable quadrant, among other items. Shortly before this happened, Father Bonnécamps had been instructed by Comte de la Galissonière (interim administrator of New France and curator of the map archives) to accompany a party despatched to take possession of the Ohio River Valley for France. That party

*Father Aubry's map was used as a reference in the negotiations leading to the Treaty of Utrecht.

was in charge of Céloren de Bienville and the Jesuit professor was to provide the skill in mathematics required to plot positions and to do mapping. On his return to Quebec early in 1750, Father Bonnécamps found that the instruments he had asked for so long ago, had at last arrived. He was heard to remark bleakly that his observations on the long journey had lacked something in precision for want of a quadrant. Several years later there must have been some comfort for him to report that at Fort Frontenac (Cataraqui) he had checked the latitude "with a quadrant which the Minister has had the kindness to send me".[13]

Father Bonnécamps being absent in 1753, Father Billard on July 27th was named Royal Geographer in the interim. In 1757 Father Bonnécamps applied for leave of absence and went to France, returning in 1758. In the interval, on November 27th, 1757, Sieur Pellegrin was appointed professor of hydrography in his place. This turned out to be the last such nomination under the French regime. On September 14, 1757, the office of Royal Hydrographer ceased to exist. After an additional year of professorial work at the College, Father Bonnécamps left Canada for the last time. He had held the post of Hydrographer at Quebec for the better part of 17 years (1742-59), a period longer than any of his predecessors in that office. A map which he made to accompany the text of his Journal was lost as well as astronomical instruments he had collected over the years. The map was in the archives of the Marine Ministry in Paris until it mysteriously disappeared in 1892.[14] It had been drawn in connection with the Ohio Valley expedition. His Journal of these explorations, including journeys to Cataraqui, Niagara, Detroit and the Ohio River, was not a strictly chronological account but a narrative divided into legs or stages of his travels.

It is apparent that from the opening of the Collège des Jesuites de Quebec in 1635 until the end of the French regime in 1759, a period of 124 years, the European influence in Quebec in surveying and mapping was completely French in character. It was an influence shared by the Jesuit Fathers in the colony with the Ministry of the Marine in Paris. The latter body recommended for appointment, if it did not actually appoint, teachers of hydrography and the Fathers determined the nature, scope and application of the courses to be given, the procedures followed being similar to those of Jesuit institutions of education in France itself. Long before Jean Talon began to dream of a marine academy in the New World the Jesuits were teaching mathematics and hydrography. Thus Father Germain wrote in 1711, "In regard to the college of Quebec it is just like our colleges in Europe, both in what it is and in what it does".

From 1686 to 1707 preference in the selection of hydrography teachers was shown to cartographers. From 1708 ability to teach the subject was also given serious consideration along with greater emphasis on academic qualifications. The excellence of the instruction and the zeal and ability of the college professors was so outstanding that even after the fall of Quebec there may have been a definite influence exerted on French mapping and surveying by the example and experience of the institution at Quebec. Father Bonnécamps, on returning to France after the transfer of Canada from French to British administration, went to the staff of a Jesuit college at Caen, a centre possessing a good reputation for instruction in science. His career as a teacher of mathematics there was terminated abruptly by the 1763 expulsion of Jesuits from France. When the Peace of Paris in February of the same year restored the island of St. Pierre to France Father Bonnécamps was appointed chaplain there by a Marine Ministry with a retentive memory and a sense of gratitude.

After the suppression of the Jesuits generally by the official decree of Pope Clemens XIV in 1773, Admiral Ollivier de Trongolly offered him the tutorship of his children.

During his closing years Father Bonnécamps lived at the chateau of Trongolly in the Black Hills of Finistère, dying there in the 1790s, well over the age of eighty. In all of his New World travels Father Bonnécamps wrote a Relation as well as a Journal. The Relation, in fact, is a letter he wrote to La Galissonière when forwarding his Journal and map dated October 17, 1750. The Relation gives a logical, as well as chronological, account of his journeyings. In the Journal Father Bonnécamps did his best to determine his positions accurately.[15] For each stage the routes followed, as well as the directions and distances involved, are set forth along with the latitudes and longitudes of salient points. The latitudes are given to the nearest second of arc. It was his custom to view from time to time his "butterfield" (Journal, p.58) meaning the compass of his butterfield (the portable sundial with gnomon mounted on a compass). This instrument was in vogue in the early 1700s, and continued in wide use for most of the period during which Father Bonnécamps was the dedicated and worthy leader in the mapping and surveying of New France.

9

SEIGNIORIES AND SURVEYS

The seigniorial system of land tenure, as established in New France in Champlain's time, provided a chain of colonial responsibility linking the lowliest subject of the state to its sovereign head. Canada had become, through the daring of French explorers, an overseas dominion of the King of France. Accordingly it was part of the royal prerogative to grant lands and other privileges within its boundaries. Large grants of land were made by the King directly, often to men of the nobility but sometimes to members of the yeomanry or of the farming classes. Grants were made also through the King's personal representatives in the New World or through large trading companies formed to develop French colonies.

Grants of seigniorial land were made on specified conditions. First, there was the obligation of fealty and homage to the Crown. Second, there was the obligation to perform military service when required and thirdly, there was the persistent need to settle and develop the land itself. The grantee from the King (the seignior) was under obligation to parcel out his seigniory in relatively small individual farms. The farm occupant was a tenant or *censitaire,* the term deriving from "cens" signifying an acknowledgment of domain, a sort of quit-rent. The *censitaire,* in turn, rendered homage and rental amounts to the seignior.

Probably the first reference made to application of the principle of seigniorial tenure to Canada was in the commission given by the King to a Breton nobleman, Sieur de la Roche, conferring on him in 1598 the title of lieutenant-general of French possessions in North America and with "authority to . . . grant (lands) to all whom he considers persons of merit, in the form of fiefs, seigneuries . . . on condition they shall aid in the support and defence of the territories . . . to others on such dues and annual rentals as he may deem just".[1] This commission was given a quarter-century before

Cardinal Richelieu rose to political power in the realm. The de la Roche experiment in colonization came to nothing.

The first mention of actual grants of seigniories in New France occurred in the 1620s. These first grants, naturally enough, were made in the vicinity of the larger centres of population and on the north side of the St. Lawrence River. The settlement process under this pattern of progress proved to be surprisingly slow. Up until 1634 only three seigniories had been established, two granted to colonial laymen and one to a clerical order, the Society of Jesus.

In 1626 Louis Hébert received his Sault-au-Matelot grant, the earliest seigniory in Canada. The grant was made on February 4, 1623, by the Duc de Montmorency and confirmed on February 21, 1626, by the Duc de Ventadour.[2] But Hébert never did exercise any seigniorial rights or authority over his bush lot of 10 square arpents. Guillaume de Caen, a Huguenot trader, was granted a seigniory a year or so later at Cap Tourmente. At about the same time the seigniory of Notre-Dame-des-Anges was bestowed upon the Jesuits. All three holdings were located near Quebec. Not until eight years later was another grant of the kind made. In 1634 Robert Giffard, a surgeon, was granted a seigniory "one league wide and one league and a half deep" at Beauport by the Company of One Hundred Associates. Giffard was the first genuine seignior in New France and was very much in earnest over the fulfilment of his obligations. The grant he received had a three-mile frontage along the St. Lawrence River and in 1634 he brought from his native Montagne in France forty stalwart future inhabitants. It was their task to clear and cultivate this rather choice land. He ceded the fief (dependant area) of Buisson to Jean Guyon, a mason, and the fief of La Clouterie to Z. Cloutier, a carpenter. Soon the first seigniory village in New France was in the making.

Jean Bourdon was at least nominally a beneficiary of the seigniorial system. There is no evidence that he profited from his holdings. In the course of a quarter century (1636-1661) he or his family were allotted no less than six seigniories. The first (La Rivière-au-Griffon) was granted by Governor de Montmagny on July 30, 1636. The second (Dautray) was a grant from the Company of New France on December 1, 1637. The third (Dombourg or Pointe-aux-Trembles) was granted on December 15, 1653, for his son Jean-François. A few days later, on December 21, the fourth (La Malbaie) was granted by Governor de Lauzon in the name of the Company of New France. The fifth (Saint-François) was granted on April 25, 1655, and the sixth (Saint-Jean) on March 19, 1661.[3]

The allotment of seigniories, in turn, involved the establishment of land boundaries. The precise method followed by surveyors in laying out these lines is never made clear in any existing documents. The contents of a deed dated more than a half century later than the period with which we are dealing, sheds some light on surveying procedures of the early 18th century in New France.

"In 1726, March 11, at the request of M. de Ladurantaye, Seigneur of Kamouraska, and of all people living in the said Seigniory of Kamouraska, I, Noel Beaupré, a commissioned surveyor in the Nouvelle-France, undersigned, have on purpose come to the said lands of Kamouraska and on being there, I started from the line which is between Gabriel Paradis and Pierre Roy dit Degeardins, in the presence of my said Sieur de Ladurantaye and of Sieur Sanssoucy. . . . I have chained northeastwards 4 arpents less a perche for Gabriel Paradis, 3 arpents 4 perches for the widow Laplante, 3 arpents 6 perches and 12 feet for Pierre Beaulieux. . . . Which I separated by parallel lines which lay in the southeastward-northwest direction with a deviation of 16 degrees; and on each of them I set up two boundaries of stones, with bricks, clinkers and pieces

of earthenware pots, in the presence of the said Sieur de Ladurantaye who has signed, and of the above-mentioned Gentlemen who declared they don't know how to write their names . . ."

We know from descriptions given by Samuel de Champlain that sundials and marine compasses were in fairly common use in the earliest days in the colony and it may be assumed that in surveying work some type of chaining or pacing was employed to mark off lineal distances. Apparently there was a custom among pioneer surveyors to add a rod on each lot measured. This customary addition was referred to as "le robinet" or "le retour du baton" and was devised in order to make certain that the property owner was not being deprived of any land rightfully his. There may well have been in use also something resembling the "wyer line" as known in England in the 16th century. It is hardly surprising that, in relying on relatively primitive instruments, the work of the early land measurers of New France was less than perfect. Boundary disputes arose in the mid-17th century in the colony. For example, in the reports of the Superior Council of New France in 1664 the following entry occurs for August 20th:

"Guillaume Bonhomme et Jacques Bertheume demandeurs Eustache Lambert fermier de la terre et Seigneurie de laisson defendeur. Party es ouiges le Conseil a ordonne que le sieur Dombourg se transportera sur les lieux en litige pour mesurer et arpenteur deux arpents au dessus de la pointe qui est en la dicte seigneurie laquelle regarde la d'icelle R^{e} du cap rouge Et Luict arpents, au dessus d'icelle pour estre dans le dict espace de terre faict pesche d'anguille par les demandeurs au desir du bail notaire 20 juillet".[4] "Guillaume Bonhomme and Jacques Bertheume, plaintiffs; Eustache Lambert, farmer of the land and Seigniory of . . . defendant. Both parties having been heard the Council ordered Dombourg to go to the places in dispute in order to measure and survey two arpents from the point which is in the said seigniory facing . . . Cape Rouge . . . and eight arpents from this one so that the plaintiffs (can) fish eels in the said area according to the lease executed and authenticated by notary, July 20." It will be recalled that not later than 1674 disputes between land-owners arose in the colony because of discrepancies between compasses and other instruments used by surveyors in measuring individual plots and that these instruments were required by law to be tested and corrected by Martin Boutet. This law applied to newly-appointed surveyors as well as the veterans.

In France the homeland, surveying as an occupation had steadily grown in stature and prestige. This development, in turn, was reflected to some extent in the New World. In the mid-17th century land surveys commenced in the Montreal region. Deeds of plots were drawn up as early as January, 1648. But who made the surveys? The name of Gilbert Barbier appears on records in this regard. Certainly he was practising surveying by 1684. In earlier years it is more likely the surveying tasks were performed by Sieur de Maisonneuve who gave the impression of great versatility. He administered the seigniory, acted as the garrison's commandant, presided as a judge and drew up contracts. Being an officer of fairly high rank he would know something of geometry and the rudiments of surveying. As far as can be discovered no surveyor actually studied and trained in surveying at Montreal (Ville-Marie) before the time of Bénigne Basset. We know that on June 8, 1663, Sieur de Maisonneuve, in the presence of property owners, ordered the placing of boundary markers on any unbounded concession. A few days later, on June 14, M. Basset was instructed to survey each property owner's land and install boundary posts. Ten years later, in a document dated November 28, 1673, Basset signed as "first surveyor of the Seigniory of Montreal" indicating that he had received an official appointment to that position.[5]

In the Old Land surveying received its first important official recognition when Henry II of France in 1554 appointed an official of his court to be "Arpenteur Royal" or "Surveyor to the King". The word "arpenteur" is derived from the measure "arpent", unit of length and area found in the French system. The Arpenteur Royal delegated powers to subordinates in each judicial district. These junior officials were required to have a fair practical knowledge of arithmetic, geography and mensuration as well as a working familiarity with the general customs and property laws of their home districts. In 1668 Louis XIV discarded the title "Arpenteur Royal" and reserved to himself the right to appoint surveyors. To those so honored he awarded diplomas following assurance from his advisers of the fitness of the surveyor for his office. The King also instituted oaths of office and enjoined the oath-takers to conduct themselves strictly by law and conscience under penalty of the loss of their commissions. These officers were known as "Arpenteurs jurés" or "sworn surveyors" and were obliged to measure lands and to settle disputes between owners. One of them was chosen by the disputants or by a court of justice to establish the lay-out of properties involved in the quarrel and for the fixing of permanent boundary lines.

These basic innovations in procedure and organization took place in the same year that Jean Bourdon died in New France (1668), the year that Father Allouez discovered Lake Nipigon and Jolliet was preparing to penetrate westwards to the Niagara country. It was the same decade that Sieur de la Salle arrived in Canada and that Hudson Bay was reached overland by Radisson and Groseilliers. It was also the decade in which Molière wrote his first play (1662). Only a few years later the Sulpicians were granted a seigniory at Montreal, the island on which Paul de Chomedey, Sieur de Maisonneuve had founded a settlement a quarter-century earlier.

In its role as a feudal overlord the Company of New France had granted large tracts of land *en seigneurie* to persons of some substance and standing on the condition that they settle the property with colonists. Colbert's basic objectives for French America continued to be increased population and concentrated settlement. Despite all that he or his officials in New France could do to alter the trend, settlement continued to follow the basin of the St. Lawrence River. From 1666 to 1676 most, if not all, seigniorial grants were made by the Intendant. Talon, just before his term of office expired in 1672, made sixty grants of seigniories. Of these sixty a few fronted on the Richelieu River but by far the largest number were located on the St. Lawrence between Quebec and Montreal. The habitant farms into which these seigniories were divided as development progressed consisted of narrow strips following the general outline pattern of the seigniories. Settlers avoided rear locations, away from the riverfront. The tendency, therefore, was to sub-divide in the same general shape as the dominant or parent grant.

It is an exercise in futility to try to trace the institution of the oblong habitant farms or seigniories to any individual, although Sulte attributes the principal credit (or blame) to Jean Bourdon. In several respects the special shape of these Canadian land holdings of the early 17th century was dictated by natural environment. Long and narrow properties enabled the greatest number of settlers to have easy access to main river courses, the water highways and chief communication links of the times. There were other advantages also, such as proximity to neighbors in case of Indian attacks, as well as nearness for purposes of sociability.

In the light of conditions peculiar to the Canadian scene, the pattern of square or rectangular holdings adopted in the English colonies to the south did not seem to meet the needs of Quebec colonists. Flowing from southwest to northeast the St. Lawrence River bisected the areas best suited for cultivation. In order to establish a dominant

geometrical design of land holdings it was essential that the property boundaries be arranged along the directional lines dictated by the presence of the river. Thus we find long, narrow river lots arranged generally in a northwesterly, southeasterly configuration.

In Colonel Joseph Bouchette's *A Topographical Description of the Province of Lower Canada* (1815) there is an interesting reference to a provision that "most of the seigniorial lines of the province ought to run northwest and southeast, reckoning from the astronomical meridian" . . . in conformity to an ancient ordinance of the province, namely an "arrêt et règlement du conseil de Québec" dated May 11, 1676. A careful search of Quebec provincial archives has failed to uncover such an ordinance although it should be added that the records of that year in the possession of the archives are incomplete.

Many traces of this distinctive pattern of land holdings may be found in modern cartography portraying the province of Quebec. Present-day outlines of Montcalm, Joliette and Berthier counties derive, for example, from the manner in which the original seigniories in those areas were laid out. There were exceptions to the general rule, of course. Rivers such as the Ottawa and Richelieu dictated certain departures from the normal arrangement as did the presence of Lake Champlain. Even along the St. Lawrence River not all seigniories are oblong in shape. Some are square or nearly so. In the main the exceptions are to be found in areas remote from rivers and where hilly country requires the establishment of property and seigniorial outlines other than the oblong type. Some of these rear seigniories resemble in shape an elongated trapezoid. The seigniory of St. Gabriel is a case in point. Or they may be found in the form of an irregular triangle such as the seigniory of Bourgmarie.

Not all parallel properties were of uniform width. The Company of One Hundred Associates and the state itself did not always grant exactly similar amounts of land in each seigniory. Large seigniories are relatively few and include Beaupré, the Island of Montreal, Batiscan and Cap-de-la-Madeleine, all of which extend at least 20 leagues into the interior. Lauzon, another extensive grant, extends for 36 leagues. All of these larger seigniories were granted in the early part of the 17th century. After 1695 the seigniories became much smaller. The main exceptions to this later policy included Beauharnois in 1729, Saint Hyacinthe in 1748 and Rioux in 1751. Viewing the whole spectrum (and excepting the earliest grants) the smallest seigniory would be about a mile square; the largest 1,000 square miles.

The average size farm had a frontage of three or more arpents and by a depth of thirty or more arpents, but here again there were variations. Although the frontage and depth lines of the first range or tier of lots usually followed the sinuosities of a river, nevertheless a straight line was generally drawn to mark the frontage of the second range so that a geometrical pattern would result. Where boundary lines failed to meet evenly the surplus strips of land between the ranges "abouts" (*gores* in the English terminology) were allotted to *censitaires* or tenants in the form of additional acreage. Once the first range of land holdings had been settled the seignior placed tenants on the second range, and so on. Cultivation continued to be the principal goal of settlement. In 1711 Louis the Fourteenth served a reminder to colonial authorities by an order to abolish all seigniories in which the title-holder had neglected land development. This was not an empty threat. In 1741 alone, eighteen seigniorial grants were revoked for non-observance of this requirement.

The grant of the seigniory at Beauport to Robert Giffard was soon followed by similar grants, most of them located near Quebec. From 1635 to 1645, however, settlers pushed steadily along the north shore of the St. Lawrence beyond Three Rivers, a settle-

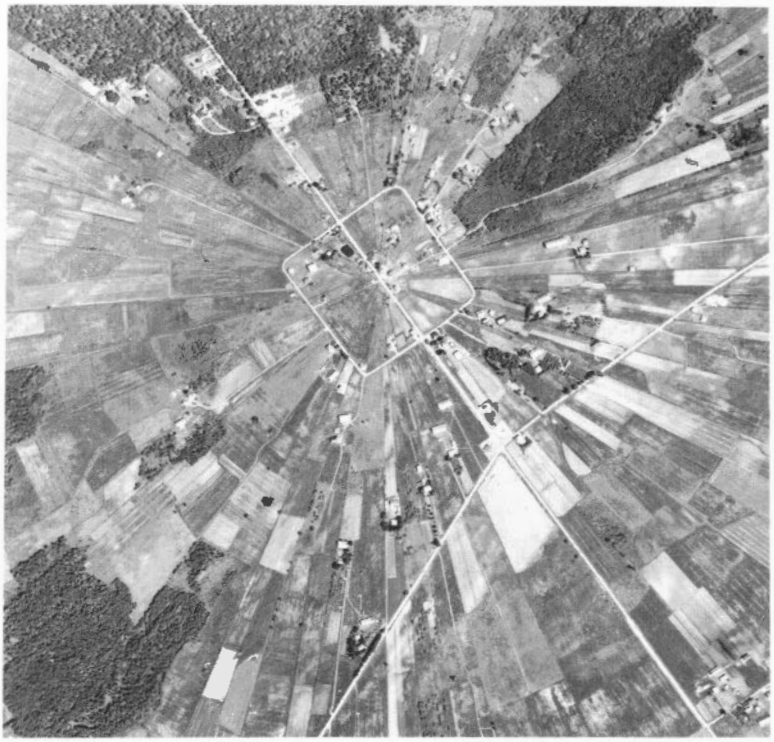


FIGURE 10. Airphoto of present-day Bourg-Royal, near Quebec City. The village is in the form of a square of 40 arpents a side (c. 1 ½ miles). Each side forms the bases of 40 triangular-shaped farms of 40 square arpents (34 acres). In case of sudden Indian attack the pioneer settlers could speedily reach the fortified central square, shown bounded by a roadway.

ment established, as we have noted, in 1634. After the founding of Montreal in 1642 some seigniorial concessions were made in the area surrounding the confluence of the Ottawa and St. Lawrence Rivers. From 1634 to 1663 at least sixty seigniorial grants were made by the Company of One Hundred Associates. But along the entire south shore of the St. Lawrence there was hardly a farm to be seen during this period. Dissatisfaction with the company's dismal record of settlement led to the cancellation of its charter and to the substitution of a new form of civil administration in the colony including a Council, a Governor, Bishop and Intendant.

In 1665 the King sent to New France the Carignan-Salières regiment, a display of military power calculated to help over-awe the menacing Iroquois. After this unit had completed two years of service in New France, Intendant Talon proposed that officers of the regiment should be allotted generous tracts of land in the colony as an inducement to settle, such lands to be held as seigniories, and that each officer should be required to sub-grant parts of his grant as farms within the seigniory to such non-commissioned officers and men as might wish to remain in Canada. The King approved this inspired proposal and about 25 officers and some 500 non-commissioned officers and men proved willing to stay on in the colony. Authorities decided to locate most of these soldier settlers along the Richelieu River or near to it. Most of the title deeds related to

these transactions are dated 1672. For example, a seigniory was granted under the arrangement to Sieur de Saurel, captain of the regiment, being a tract of land at the confluence of the Richelieu and St. Lawrence Rivers where now stands the city bearing his name in somewhat modified form. The settlement of the military in New France stimulated the seigniorial system generally as well as agricultural development in the colony.

During the last quarter of the 17th century seigniories were awarded in the colony with a lavish hand. Upwards of ninety grants were made. Undoubtedly abuses occurred in the distributive process. Because of certain excesses and other factors an official re-examination of the whole system and of its operation became imperative. At this juncture in the colony's affairs a man was found, qualified by experience, training, ability and temperament to undertake a thorough-going survey. Gédéon de Catalogne (or Catalougne) was born in Bearn, France, in 1662. At an early age he enlisted in the French army engineer corps and quickly rose to the rank of lieutenant. He was a Huguenot and when the Edict of Nantes was revoked in 1685 he found that he had to renounce his faith or leave France. He chose the latter course and emigrated to Canada only to reverse his decision and, in due course, become a Roman Catholic.

De Catalogne led an eventful life in New France. He was one of the leaders of the 1686-87 expedition sent by the French against the English posts in the Hudson Bay area. Later he showed great gallantry in helping with the defence of Montreal settlers against Iroquois attacks. In 1690 he was placed in charge of work designed to strengthen the defences of Quebec. In 1700 he supervised a canal project at Lachine. In despatches to the minister in 1708-09 de Catalogne's zeal, industry and ability were commended warmly by Intendant Jacques Raudot who also transmitted to Paris maps of the Montreal, Three Rivers and Quebec areas which de Catalogne had prepared with special care and accuracy. In 1711 he resumed the task of improving Quebec's fortifications and six years later was appointed to supervise engineering work at Louisbourg, where he was stationed until his death in 1729.

The three maps ostensibly forwarded to France were prepared in connection with a request of the Intendant directed to de Catalogne to make a report on the state of the seigniories in New France. The result of this survey was a lengthy document entitled, "Mémoire sur les plans des seigneuries et habitations des gouvernements de Québec, les Trois-Rivières et de Montréal", dated at Quebec, November 7, 1712.[6] The assignment required two years to carry out. Though the writing lacks literary style this massive document is of the highest historical value, revealing in reliable detail the development stage reached by the various seigniories during the early part of the 18th century. Only two of the three Canadian districts represented by de Catalogne maps were later found to be recorded in this manner in French archival files. Maps of the Montreal district are still missing despite a diligent search for them by Canadian scholars through the important French archives. It is possible, of course, that the map or maps of the Montreal district were not forwarded with the others, or if so, may have been lost at sea.

In the Map Division of the Public Archives of Canada in Ottawa there are excellent copies of these 1709 maps, five in all, three of the Quebec district and two of the district of Three Rivers, complete with seigniory outlines and map scales. They appear to have been drawn by Jean Baptiste Decouagne based upon the surveys of de Catalogne. The inscription on one of them is: "CARTE DU GOUVERNEMENT DES TROIS RIVIÈRES QUI COMPRENT EN DESCENDANT LE FLEUVE ST. LAURENT DEPUIS LA SORTIE DU LAC ST. PIERRE JUSQU'À STE. ANNE. LEVÉE EN 1709 PAR LES ORDRES DE MONSEIGNEUR LE COMTE DE PONTCHARTRAIN, COMMANDEUR DES ORDRES DU ROY MINISTRE ET SECRÉTAIRE

DESTAT PAR LE SR. CATALOGNE LIEUTENANT DES TROUPES ET DRESSÉE PAR JEAN BAPTISTE DECOUAGNE".[7]

Upwards of 90 seigniories were considered in the survey and report. Each is described in painstaking detail. Some sweeping conclusions were reached. It was evident from the examination, for example, that so much land had been granted that even four times the amount of available farm labor in the colony could not have cultivated the area properly. An excess of holy days during the relatively brief crop-growing season unduly reduced working time in the fields, de Catalogne found. The attractions of the profitable fur trade served to undermine the farming industry. De Catalogne proposed that the *grand voyer* (chief road supervisor) be instructed to proceed with greater zeal in the construction of roads and bridges. The streets in Montreal and Quebec, according to the author of the report, were so full of boulders and mud-holes as to be impassable. He recommended that a fund be set up for the improvement of roads.[8]

In the matter of land boundaries de Catalogne reported with obvious spirit and emphasis. If His Majesty desired "to root out a hotbed of strife and bad feelings between seigniors and their dependants, he will take measures to ensure peaceable possession to those settlers who have held their lands for long periods in good faith, and *this* without too much regard to the *exact boundaries* as these may have been defined in the original title deeds" (author's italics). De Catalogne asserted that the whole question of property boundaries was in hopeless chaos (1712) and since surveying had been done by unskilled persons, any attempt to adhere rigidly to the lines laid out would only mean a victory of chicanery over justice but in some cases at least would encounter physical impossibilities. Catalogne was not the only critic who deplored the haphazard way in which metes and bounds had been laid out in New France and the resulting flood of ill-tempered controversy over demarcation lines and posts. But his complaints won a wider and more attentive audience. Incidentally, of the three main classes of seigniories—ecclesiastical, military and secular — de Catalogne found that the church-owned lands were among the best cultivated and best managed properties as well as the least afflicted by trivial disputes.

It is likely that the de Catalogne report influenced the final decision of French authorities in the homeland to institute, a few years after the formal submission of the survey, far-reaching policy changes. Orders were issued to the Governor and Intendant that no further seigniorial grants were to be made in New France without the personal approval of the King. This order was apparently communicated to the Governor in June, 1716. Accordingly no seigniories were allotted in Canada during the decade 1717-1727. In addition vigorous measures were adopted to expedite the clearing of land. These steps resulted in a doubling of the cleared area within the ten years from 1720 to 1730.

When Colbert and Talon held office there was real concern in the governing circles in France over the popularity of the narrow oblong farms within the seigniorial boundaries. Talon's abortive efforts to alter the trend and to establish compact separated villages, rather than adhere to the concept of the endless main street along the river bank, have been recounted. In 1676 the King made one final attempt to bring about a distribution of population in the colony more amenable to efficient administration by ordering all seigniories in New France to be placed contiguously, and not scattered here and there across the wilderness.

Apart altogether from geographical considerations there were solid advantages of the seigniorial system of land tenure that won favor for it among the habitants. As adapted to Canadian conditions this essentially feudal structure possessed most of the

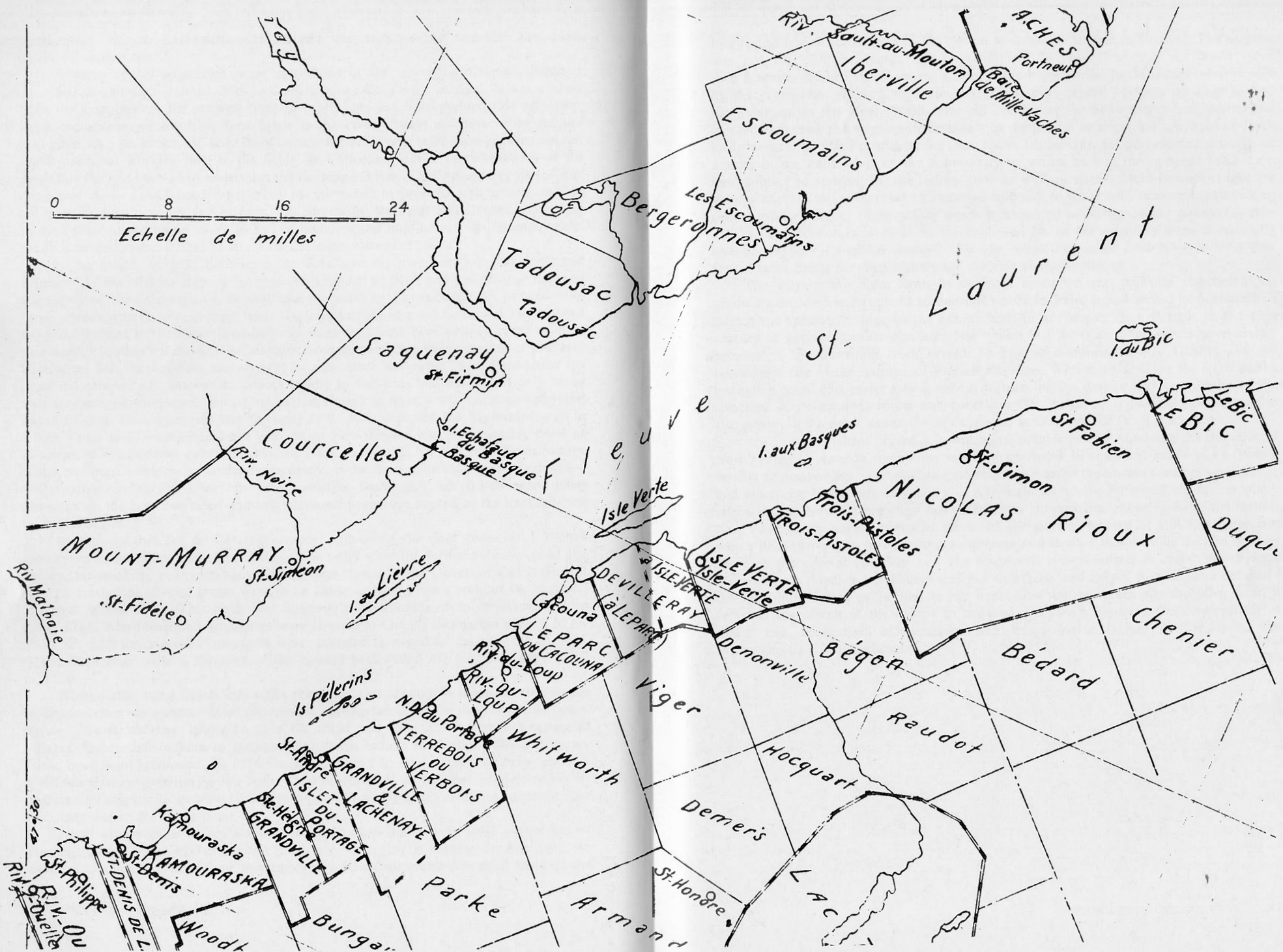


FIGURE 11. Seigniories on lower St. Lawrence River. From Manuel des Fiefs et Seigneuries, Arrière-fiefs. (Prov. Que. Bur. Cadastre, Que., 1923).

merits and few of the defects of the system as it had developed in France.[9] The seignior was not the dominant lord, European version. In reality he was not much more than a senior tenant himself, owing duties to the King similar to the duties owed to him by the *censitaires*. Often a very fine, congenial spirit existed between the seignior and the habitants in the New World. The old order was feudal in theory and patriarchal in execution. But the seignior in Canada was neither an autocrat nor an absentee landlord. In rank he was not usually very far above his tenants. He participated actively, as a rule, in the hard labor of the community of which he was the nominal head. In a land subject to sudden, savage Indian raids as well as attacks from hostile whites, the system enabled the authorities to summon colonists to arms with relative rapidity. This purely military aspect of feudalism was a pronounced advantage under pioneering conditions. The economic burdens on the rank and file of the seigniory were never really onerous in their Canadian context, although complaints arose from time to time over forced labor drafts for such community projects as road-building.

The seigniorial system, with its chain of economic and patriotic responsibilities, gradually declined and came to an end in Canada in 1854. It had served its purpose well during the formative stage of the colony and, in any event, showed signs in the 19th century of becoming quite obsolete. The system lost its vitality and significance mainly because of the transition from French to English administration in Quebec and the consequent rise in the number of English seigniors. With this transition the spirit of the institution itself had undergone a radical transformation despite the continuance of the structure in its external forms and functions. The value of seigniorial land tenure to the growth of French Canada is best expressed in the words of W. B. Munro:[10]

". . . seigniorialism played a useful, even notable role in moulding the destinies of New France. It gave to the colony much of its vigour in arms and much of its characteristic aggressiveness . . . It did little, however, to expand the human faculties of initiative and enterprise in the arts of peace . . . Although not all the industrial stagnation which characterized New France from first to last may properly be laid at its door, the institution was unquestionably part and parcel of the general scheme of stifling paternalism which held the colony in its economic tutelage and it must therefore be debited with its share of the general outcome . . . The seigniorial system helped to make New France homogeneous, loyal to her church and her sovereign, and helped to give her a defensive strength quite out of proportion to her population and resources. On the other hand it retarded the march of the colony to material prosperity, hindered the development of moral and intellectual independence and interposed a formidable barrier to the institutions of free government".

10

THE AGE OF THE EARLY ENGINEERS: REDUCTION OF LOUISBOURG

"Let us survey the vantage of the ground . . ."
King Richard III, Act V, Sc. 3.

By the beginning of the 18th century France had built up an overseas empire that was the most impressive the world had seen up to that time. On the North American continent the French claimed, if they did not actually exercise, authority over the vast Mississippi basin, the Great Lakes region, the Upper and Lower St. Lawrence areas, Acadia and islands in the West Indies. The North Atlantic fisheries formed an integral part of this imperial domain. In appearance the empire was a majestic and awe-inspiring edifice but the passage of time and the force of events revealed it to be more facade than solid structure.

At home France was alert to the advantages of accurate surveys and mapping. A meridian line was run to the Pyrenees from Dunkirk and in 1718 a chain of 28 triangles was established from Paris to Dunkirk. Jacques Cassini, son of the illustrious Jean Dominique, calculated the value of a degree on the basis of the Paris-Dunkirk measurements as 56,960 toises. By 1733 the latitude and longitude of many points in the country had been redetermined, a clear outline of the nation was available along with a fairly accurate set of charts of its Atlantic coastline. A first-rate topographical map of Paris and vicinity was in print.

But France was not the only power in the Western World indulging in expansionist activities and increasingly aggressive national ambitions. In the half-century 1650-1700 Britain had achieved an entirely unprecedented position of power and prestige in Europe. Strengthened internally by constitutional revolution and consolidating against foreign threats by a union of the kingdoms of England and Scotland, Britain was experiencing a period of vigorous revival. Soon her impressive military triumphs in the Old World

struck a shattering blow to the French possessions in the New. The Treaty of Utrecht, 1713, was a foreboding document for the imperial future of France. Within the span of the next half-century the imposing facade would crumble into debris and dust. But the vital flame of the French spirit in the New World, far from being extinguished by the cataract of violent events, was destined, in its Canadian setting, to cast a steadily increasing glow in the long years ahead.

Nor was England indifferent to the growing need to draw more accurate map lines across the earth's surface. In 1714 Parliament at Westminster by legislation provided "a publick reward for such person or persons as shall discover the longitude" including £10,000 for any practical device capable of determining longitude within one degree and £20,000 for any device determining longitude within 34 miles of being correct. The same legislation established a permanent body called the Board of Longitude to encourage these scientific efforts and to administer the prize monies. But another half-century was to pass before the longitude-finding mystery was adequately solved.

As the French population grew in the St. Lawrence basin, the work of surveying and mapping the land in advance of settlement kept pace with demands for these services. A study of seigniory documents and other ancient Quebec deeds reveals that from the beginnings of the colony it was considered essential by the people that each lot and subdivision of it should be surveyed, measured and bounded before owners entered into possession. Surveying tools at the time included portable box compasses, plane tables with alidades, odometers for measuring irregular lines, such as a river course, and semi-circles for measuring angles.

Messrs. Buibuisson and Le Rouge, appointed by Talon, as well as Jean Guyon and François de la Joue (a Franquelin student) were among the outstanding land surveyors in the colony in the latter half of the 17th century. The busiest of them all, however, was one who was also qualified as an architect, Hilaire Bernard de la Rivière. From 1669 to 1725 la Rivière surveyed most of the government lands in New France.

In the first two decades of the 18th century the ranks of these pioneer surveyors were swollen by a number of talented recruits. In the summer of 1710 Jean Boutin was appointed a measurer and surveyor by the Intendant, on the recommendation of Sieur de Catalogne who was about to undertake his survey of the seigniories. The resulting 1709 maps of M. Decouagne are the best examples of settlement maps made during the French regime. Louis Quentin of L'Ange-Gardien in 1710 and J.-B. Pottier of Trois-Rivières in 1711 were other Quebeckers sworn in as surveyors. In the period 1711-30, ten additional surveyors were named, including Alexander Bourque of Port Royal in Acadia. Bourque also functioned as a judge and notary, having been appointed a surveyor on the recommendation of a Récollet missionary, Father Bonnaventure. Three years later, in 1714, Charles du Bled was appointed, followed by Noel Beaupré in 1718.[1] Beaupré became an exceedingly active and well-travelled land surveyor. In 1721, for example, he was pursuing his vocation energetically in the Gatineau region. Although he resided at l'Ancienne-Lorette near Quebec, Beaupré performed most of his surveying in the county of Kamouraska, some 80 miles distant. In 1726, in particular, he was in great demand in that area as he sought by his decisions to help mollify angry land owners disputing property boundaries.

During the last half-century of the French regime in Canada the name of Chaussegros de Léry was prominent in the engineering and mapping fields. Both the father, Gaspard-Joseph (1682-1756) and a son of the same name (1721-97) practised the same profession. Many of their maps and plans, a number of which relate to fortifications, are in the Quebec and Ottawa Public Archives. The father came to Canada from

France in 1716 in order to design and supervise construction of various military and civil public works. His career extended over 40 years despite occasional stormy relations with Governor Vaudreuil and Intendant Bigot. In 1742, for example, the plans of a new dry dock and new shipbuilding yards on the St. Charles River at Quebec were drawn up by him.

The son was also actively associated with military organizations and undertakings. He was made a lieutenant in 1748 and sent to Detroit the following year to make astronomical observations. He was promoted to captain in 1757 and worked during that year on Quebec fortifications. For a period he was a Grand Voyer and a member of the Executive and Legislative Councils of the province. In 1748 he was relieved of his position and Sieur de Couagne was sent from Louisbourg to be Assistant Engineer in his stead. Because of the duplication of Christian names the son signed some maps in the unusual manner "de Léry fils" which, in the English fashion, would correspond to "de Léry Junior".

In the first half of the 18th century in New France a growing trend to specialization became evident in the twin fields of surveying and mapping. Draftsmanship revealed increasing skill, especially in portraying details. In addition to the de Lérys, père et fils, there was Levasseur de Néré, known to have performed excellent work as a draftsman of plans. Several of these drawings are in the possession of the Map Division of the Public Archives of Canada, dated 1700, 1704 and 1709.

Louis Franquet (1697-1768) was a highly esteemed military engineer and draftsman who produced his best work in this pre-Louisbourg period. Some experts value his plans, for perfection of workmanship, above those of Verrier or the de Lérys. In 1750 Franquet was appointed "ingénieur français inspecteur des fortifications et des travaux militaires". In addition to his activity at Quebec he is known to have been in Louisbourg in 1751 and again in 1754, when that fortress was being improved.

In this same half-century the most impressive cartography of New France, as distinct from engineers' plans or surveyors' sketches, was produced by Jacques-Nicolas Bellin (1703-72), a geographical engineer of Paris and Versailles. In addition he was the first official hydrographic engineer attached to the French office of marine maps and plans. His *Mémoires sur les côtes de l'Amérique septentrionale* was published in Paris in 1775.

Differing from land surveyors, both in the nature and purpose of their work, were the military engineers of the French regime. These men, trained in surveying and mapping, arrived on the Quebec scene fairly early in the history of New France. Settlement involved the institution of defence measures against the raids of Indians and the onslaughts of hostile Europeans. Robert de Villeneuve, if not the first military engineer to arrive in Canada, undoubtedly was one of the best-known of these pioneering professionals. Nothing much is known of the date or circumstances of his birth and early upbringing. We know that he came to Canada as an Engineer of the King in the summer of 1685. It will be recalled that in 1688 Franquelin, Royal Hydrographer, while in France pressed Paris authorities for the same rate of pay "as the engineers (now) in Canada". This reference has been interpreted by historians to indicate the presence in New France, at that time, of Jean Deshayes and Robert de Villeneuve.

Governor de Denonville at Quebec, for reasons already examined, received de Villeneuve and Deshayes with a coolness that must have seemed to them a chill foretaste of Canadian winters to come. On May 8, 1686, the Governor wrote to Marine Minister Seignelay in Paris: "J'ai dessein d'envoyer à Niagara cette année le sieur Dorvilliers avec le sieur de Villeneuve, dessineur [sic] que vous m'avez donné afin d'en lever le plan,

et après que j'aurai vu les Iroquis à Villemarie, en l'isle de Montréal, et que nous saurons a quoi nous en tenir avec eux, je verrai ai je ne pourai point moi-même y aller faire un tour pour pouvoir vous en rendre compte plus sûrement, car pour s'en fier au sieur de Villeneuve, seul, il est très bon, très sûr et très fidèle dessineur, mais pour le reste il n'a pas l'esprit assez arrangé, et l'a trop court pour pouvoir donner aucunes vues pour l'établissement d'un post, et pour en avoir la conduite de son chef".[2]

"I intend to send to Niagara this year sieur Dorvilliers with sieur de Villeneuve, a mapper you have sent me, who should make a survey of this place; after my meeting with the Iroquois at Villemarie on the island of Montreal and definite arrangements with them, I will consider whether I can go there and see for myself in order to give you a definite report because it is risky to have implicit confidence in sieur de Villeneuve alone; he is in some way deranged and is of such limited understanding that he could not give any mature observations upon the founding of a post and assume leadership of it".

In a report to the minister from de Denonville the latter states, "De Villeneuve has sent to you two maps he has made of the vicinity of Quebec and of the Isle of Orleans. I would have wished very much that he would have done also those of Ville-Marie, Isles des Prairies and the seigniory of Chesnaye and the remainder of this region of the colony but he made only sketches, having had no time to make neat copies. However, it would have been important for you to have had these this year in order that you could better see the need for sending troops to occupy the outposts at those places in order to defend the country.[3]

It did not take long for de Villeneuve to become embroiled in trouble in his new surroundings. Soon he was making a variety of charges against Prévost, the commandant at Quebec. By June 8, 1687, de Denonville could restrain himself no longer. He wrote to de Seignelay in regard to the accusations:

"Our engineer is a fool, a libertine and a pervert, all of which we endure because we need his services". The Governor warned the minister not to trust de Villeneuve and that the fellow might frequently write disparagingly of associates, creating charges entirely out of his imagination. The Governor also branded the engineer as a stooge but once the Governor's vocabulary of abuse was quite exhausted he had some good things to say about the man:

"Cependant il travaille admirablement bien de la main et forte vite quand il veut". (However, he works very well and very rapidly by hand when he wishes to do so.) The Governor indicates that M. de Vauban would likely testify to de Villeneuve's intelligence.[4]

Nine months after de Denonville's broadside, His Majesty, 'le Roy Soleil', ordered de Villeneuve to sail for France. The obedient engineer left sometime after June 27, 1688, returning to Canada in March, 1691. Intendant de Champigny accorded him a hearty reception at Quebec. . . . "ce refus procedait de ce que pendant cinq années précedentes que le dit sieur de Villeneuve avait demeuré au pays en qualité d'ingénieur par ordre de feu le marquis de Seignelay il s'était toujours oppose aux dépenses superflues qui s'y faissaient tant pour la construction de l'Intendance, qu'autres ouvrages que monsieur l'intendant faisant faire par des gens incapables. . . ."

"This non-acceptance originated in the fact that for the five preceding years the said Sieur de Villeneuve had spent in the country as an engineer in obedience to the Marquis de Seignelay he was constantly opposed to the unnecessary expenditures devoted to the construction of the Intendance as well as to other works built by inefficient people chosen by the Intendant".

As a result of his Canadian observations de Villeneuve completed a plan of the

town and of the chateau of Quebec in 1685; a map of Quebec environs "mesurée sur le lieu Très exactment en 1685 et 1686"; also a map of St. Lawrence county, 1689, and a plan of Quebec and vicinity "under siege by the English, October, 1690". There is evidence that de Villeneuve also drew two maps of the Isle of Orleans.

In 1688, 1689 and 1690 de Villeneuve revised his 1685 plan of Quebec. His maps gave the names and surnames of citizens of the town and of surrounding parishes. Actually he drew many maps and plans and did not seem to suffer much from his less than exemplary personal reputation. Sieur de Villeneuve left Canada for the last time in 1693. It is probable that de Villeneuve was succeeded in his work by Hyacinthe B. de Beaucourt who made the plan for the construction of a redoubt on Cape Diamond as well as town gates and the old fortifications. In turn, de Beaucourt was replaced by Jacques Levasseur de Néré.

In the first half of the 18th century the most spectacular, if not the most memorable, surveying and mapping work carried on in Canada was that accomplished by the military engineers. In addition to the constant improvements made to the defences of Quebec the French decided, within the terms of the Treaty of Utrecht, to establish a heavily fortified point on Cape Breton Island, re-named by them Île Royale. In time the place selected came to be known as Louisbourg. The decision to fortify helped to bring into sharper focus the activities and achievements of the military engineers in New France.

In the negotiations leading up to the conclusion of the Treaty of 1713 the English at first took the stand that the French should not be allowed to fortify the island. But gradually this position in debate was relinquished. The French, for their part, were casting about with some concern for a place suitable for fortifications, a place so situated in a strategic sense as to guard effectively the seaward entrances to the Gulf and River St. Lawrence as well as the deep sea fisheries of the region. Such a port, ice-free and with some natural protection, could only be found at Havre à l'Anglois (English Harbor).

For a time Port Dauphin to the north on the island was a rival for the distinction of becoming the military, political and administrative capital but the existence of an extensive sandbar at the harbor entrance turned the scales in favor of Havre à l'Anglois which was also a more sheltered place. Under the Utrecht arrangements the French were compelled to leave Newfoundland while the English took over. Two years prior to the death of Louis XV in 1715 some 180 settlers were transferred from Placentia to English Harbor, soon re-named Louisbourg. Not until 1717, however, was the firm decision taken at Paris to erect military works of magnitude at this place.

The first qualified engineer to become associated with the Louisbourg military projects was Major l'Hermite, who was also a geographer. He had made at least two excellent sketches of Placentia while stationed there. When orders came from Paris to evacuate Newfoundland, he was transferred with Placentia's inhabitants to Île Royale. In the severe winter of 1713-14 l'Hermite worked to complete plans of proposed defences of the island and submitted his drawings to Governor Vaudreuil and Intendant Begon at Louisbourg in May, 1714. In June, 1715, l'Hermite was instructed to lay out works at Port Dauphin and also at Port Toulouse, to the south of Louisbourg. Again, in 1716, he made plans of fortifications at Louisbourg. The major was likely unaware that he had offended Paris authorities with what they considered excessively high estimates of fortification costs. At about this time an officer named Bourdon, unrelated so far as is known to the illustrious Jean Bourdon, arrived at Louisbourg in the vessel *Affri-*

cuain. He submitted a memoir on the location of the port and his map of Île Royale was in considerable use during this period. The advantages of Louisbourg were strongly underlined by Bourdon in his report, partly because of its relative freedom from winter ice and, in the spring months, from drift ice. On his return to Île Royale the unfortunate l'Hermite was again subjected to official criticism, this time for his slowness in making reports. He was finally stationed at Trois-Rivières. The major made yet another voyage to France but on his return in 1725 aboard the *Chameau,* lost his life in a shipwreck that occurred, ironically enough, not far from Louisbourg.

In the years 1700-1716 affairs declined to a wretched state on Île Royale owing to neglect and general incompetence on the part of home authorities. These were years of dire poverty, lack of commercial activity and isolation. The ill-clad peasantry suffered greatly during the severe winters of the region. Jean Maurice Beaucours had succeeded l'Hermite on Île Royale. He was not a qualified engineer but contrived to submit to superiors what were regarded by them as an engineer's reports. Like his predecessor in office Beaucours came under the disapproval of home authorities over what they considered to be inflated estimates of costs involved in building military works at Louisbourg. In time Beaucours was moved to Port Toulouse and ultimately to the colony in Quebec.

W. B. Munro in his *Documents Related to the Seigniorial Tenure in Canada* (p. 96) observes that Sieur de Catalogne, following his epochal survey of the seigniories of New France, had been sent to Louisbourg in 1717 where he was "put in charge of engineering work". On the face of it this statement seems to be opposed to reliable information that the Louisbourg fortifications, built by private contractors employing soldier labor, were designed and supervised by the military engineers, de Verville and Verrier.[5] The official records indicate that the plans made by the former, a superior type of engineer, as well as cost estimates and specifications for the fortifications were accepted at Paris and work began in earnest on the project on July 3, 1717. The de Verville plans called for completion of the fortifications within five years, at a cost of five million livres. There is a profile of the fort made by de Verville, dated 1722, at the Depôt des Fortifications des Colonies, Paris. A fair idea of the appearance of the town within its walls is obtainable from a Verrier water color now on display at the Fort Louisbourg Museum.

De Verville left for France in 1722 and in the following year his place was taken by Verrier, a prolific producer of maps, sketches and plans during the twenty years to follow. In 1730 he made a drawing of the town from the harbor side. More than a score of his mapping works are available today in various collections. The structures within the fortress were imposing compared to buildings then to be found in any of the English colonies. The disparity was eloquent of the differences in attitude and method of the two peoples. The French authorities evidently felt that the large size of the colonial structures at Louisbourg were suitable under all the circumstances, if somewhat expensive. Life at times must have been rather dreary for the inhabitants of the town, though there were periods of excitement. About 150 vessels called during a sailing season. The weather was variable. In the late autumn the drab earth had its counterparts in leaden skies and seas. In winter months the ground was usually deep in snow and the sea was sombre. The uninspiring prospect combined with general torpor resulting from chronic malnutrition rendered the cold months well-nigh unbearable. In the early springtime the waters outside the harbor glistened with drift ice. When the equinoctial gales ceased and calmer weather returned, Louisbourg was often afflicted by heavy fogs. But in the late spring and summer when the air was clear, when the waves

sparkled in the warm sunshine and the surf tossed high against rocky shores, the picturesque coast was at its most attractive and life in that part of the New World seemed very good indeed.

Pierre-Jerome Lartigue, the King's storekeeper at Louisbourg and a member of a local family of prominence, regarded himself as a good engineer of amateur standing. He displayed a certain amount of engineering skill during the first siege of the fortress in 1745. In a subsequent civil suit Verrier testified to this fact. Lartigue, like all members of the family, was adept at making maps. It is said that the Lartigues left their lawyers loaded with maps of their possessions in connection with their last wills and testaments. In any event Pierre-Jerome has left us a memento of the 1745 siege in the form of an admirable map of Louisbourg.

In March, 1744, after 31 years of peace, France declared war on England. The appearance of French privateers off New England shocked the English colonists into dynamic action. Under Governor William Shirley of Massachusetts plans were developed for an armed expedition against Louisbourg, the base of French naval operations. William Pepperrell, a Maine merchant and militia officer, was given command of the attacking land forces. Commodore Peter Warren was placed in charge of the naval contribution. On March 24, 1745, accompanied by some armed colonial ships, some 4,000 men sailed from Boston in 19 transport vessels.

On April 30, the armada arrived off Louisbourg and anchored in nearby Gabarus Bay. The morale of the French garrison had been affected by a serious mutiny among the men during the winter months. But in the face of an approaching enemy a fair degree of unity was attained among the fort's defenders. A successful landing of invaders was achieved at Flat Point and within a short time the Grand Battery was captured.

By June 17, after 46 days of siege, Louisbourg's garrison capitulated. The colonials had shown courage, dash and resourcefulness as well as a distinct fondness for rum and plundering. Losses among the English colonials were relatively light, not exceeding 150 from all causes. But subsequent months of occupation took a fearful toll of lives. In the meantime, however, the colonists celebrated this hour of triumph, the capture of a fortress considered by the world to be well-nigh impregnable, by a pick-up army of nondescript colonials!

Warren was made an admiral for his participation and Pepperrell a baronet. The two leaders spent the winter months at Louisbourg as joint administrators of the occupation. From fever, dysentery and scurvy some 890 New Englanders died before the spring of 1746. When in April, 1748, under the Treaty of Aix-la-Chapelle, Louisbourg was restored to France, the anger of the New England colonists knew no bounds. Their supreme effort to eliminate the French threat to their security, the terrible losses encountered while occupying Louisbourg, their bold capture of what had generally been regarded as a supremely important stronghold, all appeared to be lightly bargained away by remote negotiators engaged in some unfathomable diplomatic chess game. By July, 1749, at a time when a youthful George Washington was qualifying as a commissioned surveyor for Culpeper county in Virginia, the white and gold flag of France was being raised once again over the battlements of Louisbourg. But so far as North America was concerned the peace period was never more than a time of uneasy truce. Each side prepared, more or less openly, for a renewal of hostilities.

Acadia, until mid-18th century days, had suffered from the absence of accurate marine charts and topographical maps. A Lieut. Blackmore of H.M.S. *Dragon* unworthily assuming the role of a surveyor general, made a very rough and highly

unreliable draft of the Acadian coastline about 1715, petitioning the Board of Trade and Plantations to permit him to survey the same. This survey, if authorized, was never carried out. But the draft, unfortunately, fell into the hands of a map publisher who printed and issued it as an actual survey. This type of inaccurate information led to protests, one of which is on record, ". . . In short, we do not find a single spot hardly justly laid down in these our New Maps of Nova Scotia. We are so far from improving them in the Geography of America that we see it made worse and worse for want of certain observations which we have endeavored to collect and thus represent in one view . . ."[6]

In this context the carefully conducted Acadian coastal and hydrographic surveys made in 1750-51 by Joseph Bernard M. le Marquis de Chabert are all the more noteworthy. His activities were designed to achieve a scientific revision of existing erroneous maps and charts. Sieur de Chabert, in fact, did produce some remarkably fine maps, some of them including information on soundings. Some of his maps and charts along with an excellent account of this survey project are contained in a volume entitled: *"Voyage fait par ordre du roi en 1750 et 1751 dans l'Amérique Septentrionale pour rectifier les cartes des côtes de l'Acadie, de l'Isle Royale et de l'Isle de Terre-neuve".*[7]

In the text of a certificate reproduced from the records of the Royal Academy of Sciences of France the main purposes of the Chabert project are outlined: ". . . il etoit nécessaire pour la perfection de la Géographie et la sûreté de la Navigation, d'avoir des observations de longitude sur les côtes qui sont à l'orient de Boston et dont la position étoit absolument incertaine; donne le résultant des observations qu'il a faites en divers endroits de ce continent et principalement à Louisbourg, auxquelles il a joint les opérations de Geométrie-pratique qu'il a été obligé d'employer pour découvrir les vrais contours de ces côtes, dont il a dressé une nouvelle carte, en se servant aussi quelquefois des moyens que fournit l'Hydrographie, lesquels étoient seuls pratiquables, lorsqu'il s'agissoit de fixer la situation des Isles et des Caps . . . .".

In the narrative of the book M. de Chabert points out, "J'avois principalement à fixer avec exactitude la longitude de Louisbourg, soit pour en faciliter l'abord aux Vaisseaux qui viennent dans ce port, soit afin que dans la construction des cartes on pût partir de ce point pour placer tous les autres des côtes de cette partie de l'Amérique septentrionale dans leurs véritables méridiens, ce qui dépendoit de la juste détermination de celui-ci".

In a further passage M. de Chabert describes his method of surveying: "Je commencai à prendre des hauteurs correspondantes du Soleil, et je répétai la même opération tous les jours de temps clair, pour me bien assurer de la marche de la pendule et me trouver toûjours en état de savoir l'heure à chaque observation que j'aurois faite: l'assiduité de ce soin, souvient superflue dans tout autre pays, et très-pénible dans celui-ci, étoit cependant indispensable, parce que le froid excessif arrêtoit souvent la pendule, quoique son mouvement fût d'ailleurs bon et uniforme".

". . . Improved geography and secure navigation required that observations for longitude [be] made on the coasts situated east of Boston and whose locations were completely uncertain . . . reported results of observations made in some places on this continent, mainly at Louisbourg, to which he annexed the processes of practical geometry he used, in order to draw the exact coastline of these regions of which he drew a new map, using sometimes as well hydrographic data applicable when places to be located were islands and capes . . ."

*"Trip made by order of the king in 1750 and 1751 in Northern America in order to rectify the Maps of the Coasts of Acadia, of Isle Royale and of Newfoundland."

"I had in the main, to determine with accuracy the longitude of Louisbourg either to make the approach to it easy for vessels entering this harbor, or in map making to use it as a starting point to fix all the other points of the coast in this region of North America in their true meridians, all of which depended on the right position of that place [Louisbourg] . . ."

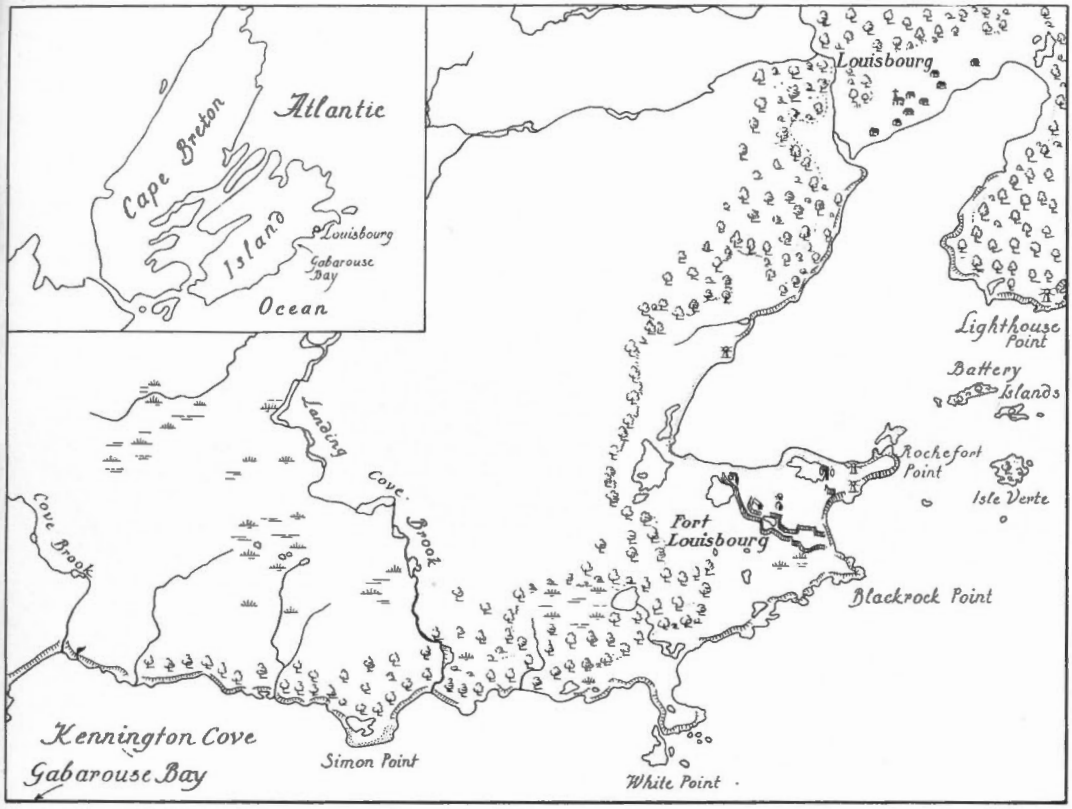
"I began to note corresponding heights of the Sun and I repeated the operation each clear day in order to make sure of the movement of the clock and to be able to recognize the right hour of each observation we would make; this constant care, often useless in any other country and very difficult in this one, was nevertheless essential because the cold, rigorous weather often stopped the clock though otherwise its movements were good and unvarying".

At about this same period a Virginia physician and botanist began working on a map of North America. So far as is now known this was the only map he ever made but it proved to be a masterpiece of 18th century cartography. John Mitchell was not only a doctor, he was an authority in his time on yellow fever. But his name is perpetuated not because of any botanical or medical achievements but for the famous Mitchell map. There is evidence that the map was first drawn in 1750 but over a period of five years it was revised and improved before delivery to the printers. The map is dated 1755. During the following 20 years it was published in at least 3 editions. The foundation of the map consists of several manuscript maps, also charts and surveys made in the colonies and it portrayed most of the principal places between the Atlantic and Mississippi.

The Mitchell map provides a fair representation of the courses of the St. Lawrence, Ohio and Mississippi Rivers as well as of the Great Lakes shoreline and includes relative distances between settlements of the North American interior. The map was a highly useful part of the standard equipment of British officers during military campaigns preceding the formation of the United States. It became a much consulted reference work in the possession of international commissions deliberating over Canada-United States boundary lines. The map was assembled under the direction and authority of the British Board of Trade and Plantations. "This map was undertaken," states a communication over the signature of the Board Secretary, John Pownal, himself a surveyor, "with the approbation and at the request of the Lords Commissioners for Trade and Plantations — and is chiefly composed from draughts, charts and actual surveys of different parts of His Majesty's Colonies and Plantations in America . . ." The title box or map legend contains the following statement: "A map of the British Colonies in North America with the Roads, Distances, Limits and Extent of the Settlements, humbly inscribed to the Rt. Hon. the Earl of Halifax and the other Right Honourable the Lords Commissioners for Trade and Plantations . . Jn. Mitchell".

In the age in which it was made, Mitchell's map was a first-class cartographical production although more extensive geographical knowledge was actually available at that time than Mitchell was able to obtain. His collation of details relating to eastern North America, and especially to the seaboard colonies is most commendable but knowledge of the vast Canadian West apparently was so scanty that the map extends to just west of the Lake of the Woods and to just north of the Albany River system. It was drawn to a scale of about 43 miles to the inch.

By 1755, as Mitchell was completing his great map, squadrons of French men-of-war under Du Blois de la Motte arrived to strengthen the defences of Louisbourg. This new leader had been instructed to secure Louisbourg from attack. He used sailors and soldiers alike to construct earthworks at all coves in the vicinity of the fortress. A map



MAP 22. Louisbourg Harbor and vicinity c. 1717. Reconstructed sketch, courtesy of Department of Mines and Technical Surveys, Ottawa.

by de la Motte is still in existence and it shows the extent of the new protective works. On May 18, 1756, England declared war on France, and that country returned the compliment on June 9th. By the spring of 1757 William Pitt had reached the summit of British affairs as well as full control of the nation's renewed military effort, by virtue of his special genius for leadership and organizaton. Not only did a contagious spirit of confidence permeate the whole of the armed forces, a new sense of direction prevailed throughout the realm. A great new campaign was launched to reduce Fort Louisbourg, the capture of which meant acquiring the key to the very gates of Canada, the St. Lawrence entryway.

In the spring of 1758 a fleet of 23 ships under Admiral Boscawen brought troops to Halifax, commanded by Major-General Amherst and his three brigadiers, Whitmore, Lawrence and the 31-year old James Wolfe. By June 2, a total of 108 English ships carrying 1,842 cannon and immense quantities of war supplies brought 13,142 officers and men of the land forces to Gabarus Bay. In this rather formidable expeditionary force were two newly-appointed, relatively obscure young lieutenants. But these officers were destined during the approaching action not only to establish reputations of some military significance but also to launch lifetime careers in mapping as well as in land and marine surveying. Both Samuel Jan Holland(t) and Joseph Frédéric des Barres were

FIGURE 12
Samuel Holland.

lieutenants in the 60th Regiment of Foot, the Royal Americans. Both were European-born, talented engineers and gifted in the arts of map making and sketching. Both young men proved their bravery and resourcefulness under fire. In America their names became Anglicized to Holland and to DesBarres.

Samuel Jan Hollandt was born near Nijmegen, Holland (not far from the frontier with Germany) in 1728. At the age of 17 he joined the Dutch army at a time when Holland was being invaded by the French. He was in active service for about three years, including participation in the siege of Hulst in 1747 when the French were repulsed. He became a lieutenant in the Dutch artillery. In 1754 he parted company with his wife, the former Gertrude Hasse, after five years of marriage. They were childless and the separation, so far as is known, was amicable. The 26-year-old officer proceeded to England, never to return to the continent. In time he dropped the letter "t" from his surname although the original spelling persists in British military records throughout his army service.

From the outset Samuel Holland seems to have had easy and effective access to highly placed and influential persons in England. Soon after his arrival in London the Duke of Richmond befriended him and obtained for him a lieutenancy in the 60th Regiment of Foot. Officers of the Royal Americans, as this unit was called, were being recruited for service in the New World. Soon after Holland's appointment he was introduced to Lord Loudon by whom he was employed for a time as a map draftsman. This was only four years prior to the second siege of Louisbourg, a fateful turning point in

Holland's life. When Lord Loudon came to America in July, 1756, to take over the chief military command from Governor William Shirley of Massachusetts, Lieut. Holland accompanied him.

Fortune seemed to smile happily on Holland at every turn of his career. He had special gifts, quite apart from inborn diplomacy and an unusual facility for making true friends in high places. He was an excellent draftsman, well-trained in military engineering, familiar with several languages and he possessed some years of army service in the field. He never avoided a hard challenge or dangerous adventure and was, above all, intensely ambitious.

Not long after his arrival in North America, Holland won recognition of his abilities and quickly rose in rank. On May 21, 1757, he was made a captain-lieutenant.[8] He never experienced much difficulty in impressing his superiors, whether on scouting missions or in the drawing of maps and plans. Holland was attached in due time to the command of Brigadier James Wolfe as an army engineer qualified to make surveys, to prepare maps and to take soundings of waters in the vicinity of Louisbourg for the purposes of the siege of that fortress. Wolfe was not any more immune than others from the aura of confidence and reliability that Holland managed to exude. The brigadier deferred to him in engineering matters, an attitude all the more impressive because of Wolfe's antipathy to engineers and engineering generally. At Louisbourg Holland was entrusted with the leadership of an initial attack on the northeast part of the harbor.

At Louisbourg, also, with the Royal Americans was the Swiss-born Joseph Frédéric des Barres, born in 1721. Like Holland he came to England early in his career and also like Holland won a commission in the 60th Regiment, attracted by the idea of going to North America. Unlike the young Dutchman he attended the Royal Military College at Woolwich in preparation for his overseas service. Hard on the heels of the staggering defeat suffered by General Braddock's British regulars in 1755, the high command in England decided upon a change in army tactics by recruiting men more knowledgeable in backwoods lore. Such men, mostly Americans, were to be enrolled in a regiment of four battalions of a thousand men each. In this connection Lieut. DesBarres was ordered, on his arrival in the New World, to raise recruits in Pennsylvania and Maryland. He managed to enrol more than 300.

In his native Switzerland DesBarres had been given a thorough grounding in the sciences. A highly trained sketcher, he possessed robust health and a superabundance of energy. He was capable of prolonged intensive effort and his courage was never in doubt. But, unlike Holland, he was frequently impetuous, intemperate in speech and action under stress. Where Holland made friends easily, DesBarres managed to stir deep antagonisms. His was a tempestuous life and promotions in military rank came to him slowly. In 1771, 13 years after Louisbourg, he was still a lieutenant!

When the British armada, under Boscawen and Amherst, arrived at Gabarus Bay on June 2, 1758, thirteen years had passed since the successful conclusion of the first siege of Louisbourg. Adverse weather, however, prevented any landing attempt until June 8th when Wolfe's men got ashore in Kennington Cove. DesBarres, with the second battalion of Royal Americans, was one of the first of the invading forces to land and he captured a French entrenchment on the first rush. Brigadier Wolfe was suitably impressed and saw that the Swiss-born lieutenant accompanied him as an engineer to the siege of Quebec the following year.

Although H.M.S. *Pembroke*, under the command of Capt. J. Simcoe, had arrived too late to take any part in the troop landings, the vessel did form part of the blockading fleet. Aboard, as 30-year-old sailing master of the ship, was James Cook. Born

in a Yorkshire village in the same year as Samuel Holland (1728) James Cook was in every good sense a self-made man. Extreme poverty was his lot as a child but young Cook educated himself in mathematics, astronomy, navigation and cartography. He joined the Royal Navy in 1755 at the age of 27, serving H.M.S. *Eagle* and H.M.S. *Solebay* until he joined the *Pembroke*, one of Admiral Boscawen's ships of the line, in October, 1757. On that stormy and prolonged voyage across the Atlantic the following year he had seen 29 crewmen of the *Pembroke* die from disease.

The second siege of Louisbourg lasted about as long as the first. The French defenders, about 6,000 in all, fought gallantly against very considerable odds. The English naval blockade resulted in rapidly dwindling ammunition within the fortress, and English batteries pounded the town and fortifications mercilessly. On one day alone a single English battery of six guns fired 600 cannon balls at their targets. At one stage of the siege the French tried, without success, to block the harbor entrance by sinking five of their ships at its entrance. On Lartigue's map the topmasts of these sunken vessels show above the surface of the water.

On July 27th, following a day-long discussion of capitulation terms, British troops marched into the battered fortress through the Dauphin Gate. French losses in personnel killed in the siege amounted to 411, the British, 195. Boscawen and Amherst decided it was too late in the season to proceed against Quebec. The courageous defenders of Louisbourg had managed to purchase some precious time—they saved Canada for a year for the French empire. A decision was made at the highest levels in England, after much deliberation, to demolish Louisbourg's defences and by October, 1760, the extensive demolition work had been completed.

In a letter written 34 years after these momentous events, Samuel Holland, who had become Surveyor General of Canada, relates to John Graves Simcoe, first lieutenant-governor of Upper Canada, how he first met the governor's father, then captain of H.M.S. *Pembroke*:

"The day after the surrender of Louisbourg, being at Kennington Cove, surveying and making a plan of the place . . . I observed Captain Cook (then sailing master of H.M.S. *Pembroke*) particularly attentive to my operations and as he expressed an ardent desire to be instructed in the use of the plane table (the instrument I was using) I appointed the next day in order to make him better acquainted with the whole process—he accordingly attended with a particular message from Captain Simcoe expressive of a wish to have been present at our proceedings and his inability, owing to indisposition of leaving his ship—at the same time requesting me to dine with him on board, and begging me to bring the Plane Table pieces along . . . I remained that night on board, in the morning landed to continue my survey at White Point, attended by Captain Cook and two others whom your father wished should be instructed in the business . . . During our stay in Halifax, whenever I could get a moment of time from my duty, I was on board the *Pembroke* where the great cabin, dedicated to scientific purposes and mostly taken up with a drawing table, furnished no room for idlers. Under Captain Simcoe's eyes Mr. Cook and myself compiled materials for a chart of the Gulf and River St. Lawrence . . . Another chart of the River, including Chaleur and Gaspé Bays . . . was compiled and drawn under your father's inspection, and sent by him for immediate publication to Mr. Thos. Jeffrey, predecessor to Mr. Faden. These charts were of much use, as some copies came out prior to our sailing from Halifax to Quebec, 1759.

"By the drawing of these plans under so able an instructor, Mr. Cook could not fail to improve and thoroughly brought in his hand as well in drawing as protracting,

etc. and by your father's finding the latitudes and longitudes along the coast of America, principally Newfoundland and the Gulf of St. Lawrence, so erroneously heretofore laid down, he was convinced of the propriety of making accurate surveys of those parts.

"In the necessity of having surveys of these parts and astronomical observations made as soon as peace was restored, he would recommend him to make himself competent to the business by learning Spherical Trigonometry with the practical part of Astronomy, at the same time giving him Leadbitter's works, a great authority on astronomy . . . Mr. Cook fulfilled the expectations entertained of him by your father —in his survey of Newfoundland.

"Mr. Cook in London in 1776, after his several discoveries, confessed most candidly that the several improvements and instructions he had received on board the *Pembroke* had been the *sole foundation* of the services he had been enabled to perform . . ." (author's italics). Samuel Holland then closes the letter with regretful references to his lost journals, which he claimed had been stolen from him in a London bus.[9]

Captain-Lieutenant Holland continued his surveys in the vicinity of Louisbourg until the end of the 1758 season. He then proceeded to Halifax and was employed there on the plotting of his summer's surveys and in drawing up plans. Lieut. DesBarres, after the fall of Louisbourg, obtained from French officers a number of documents and plans concerning the Gulf and River St. Lawrence. During the following winter months in Halifax he prepared a large-scale chart of the river that was of great service to the British fleet on its expedition against Quebec. As indicated in Holland's letter of 1792, James Cook was also in Halifax during that winter and there is evidence that he was instructed by DesBarres in mathematics, astronomy and surveying.

"A plan of Quebec and Environs with its Defences, during the Siege of that place in 1759." Surveys made by Lieut-Colonel Debbieg, Major Samuel Holland and Captain DesBarres. Courtesy of the Public Archives of Canada.

ection from a "Plan of Canada in the Province of Quebec. . surveyed by order of his Excellency, Governor Murray in the years 1760-62". Courtesy of the Public Archives of Canada.

and surveyors, notably Major Patrick Mackellar, Major Samuel Holland and Lieut. Joseph DesBarres. Mackellar, who had been a prisoner of the French at Quebec in previous months, compiled a detailed plan of its defences. In accuracy and completeness, however, this plan left something to be desired. Holland, as might be surmised, seemed to be the most solidly installed of these three men in Wolfe's esteem and affections. He was promoted, on Wolfe's recommendation, to the rank of full captain on August 24, 1759, just a few weeks before the Battle of the Plains of Abraham.[1] In addition to the timely promotion Holland received from General Wolfe a brace of duelling pistols suitably inscribed. The pistols were to play a gruesome part in a tragedy that marred Samuel Holland's later years.[2]

Holland was less than convinced, as he grew older, that his very active and prominent part in the 1759 siege of Quebec had been properly recognized. Writing to a friend 25 years after the events of that fateful summer, he complained, "In the battle of September 13 (Plains of Abraham) your memorialist lost his protector (Wolfe) while holding his wounded hand at the time he expired . . . for reasons best known to Mr. West, the painter, your memorialist was not admitted amongst the group represented but others are exhibited in that painting who never were in the battle".

After the battle Capt. Holland laid out the meridian line and established stone monuments in the vicinity of the spot where Wolfe fell. Even with the death of his distinguished benefactor Holland's special abilities continued to win favorable attention from his superiors. In the action at Ste. Foy late in April, 1760, when Lévy soundly defeated Murray and pushed the British troops back behind the walls of the town of Quebec, Patrick Mackellar was wounded and it was Capt. Holland who was appointed by Brigadier General James Murray as Acting Chief Engineer of the garrison. But Holland was never fully accepted by the military professionals in that capacity. After all he never belonged to the Royal Engineers as did Major Mackellar.

It was about this time in the history of England that George III began to make most remarkable use of the special opportunities he enjoyed to collect maps of both a topical and permanent value. In his royal collection he made topography and North American geography conspicuous. Maps were gathered for him from military and civilian surveys as well as in the form of charts that were the work of official hydrographers. The collection is now a highly prized part of the contents of the British Museum. The "George the Third Map", as it is known (and probably the most celebrated item of the royal collection), is a 3rd edition of the Mitchell map of 1775. The monarch, despite his contribution to the permanent loss of the American colonies, helpfully intervened some 12 years after the fall of New France to make certain that John Harrison received his richly deserved cash reward for solving the problem of finding longitude accurately at sea. In addition George III took a very active interest in surveying projects in England leading up to the establishment of the Ordnance Survey in that country.

In 1760, 1761 and 1762 Capt. Holland was employed by General Murray in surveying the settled parts of what had formerly been known as New France. In a report to home authorities dated June 5, 1762, General Murray wrote, "I ordered Captain Holland to make an accurate survey of the ground and I have the honour herewith to transmit the several plans he has drawn in consequence . . . He is an industrious, brave officer and an intelligent Engineer, in which capacity he would be desirous, and deservedly merits, to be advanced . . ."

In the Public Archives of Canada, Map Division, there is a "Plan of Canada or the Province of Quebec from the uppermost settlements of the Island of Coudre as Surveyed

by Order of His Excellency, Governor Murray, in 1760, 1761 and 1762 by the following gentlemen:

Captain Holland, Captain Spry, Lt. Montrefors, Lt. Peach, Lt. Fuzer, Lt. Haldimand and Ensign Pittman. Captain Holland was assigned the area from Montreal to St. Therese Island on the north side of the St. Lawrence River; on the south side of the river from Longueuil to Becancour, parts of Rivers Sorrel [sic], Yamaska, St. François and Nicolet with the Islands in that extent; also from St. Augustin to Quebec, Rivers of Cape Rouge and St. Charles with all the back settlements to the River of Montmorency on the north side; also the town of Three Rivers and River St. Maurice. Captain Spry was assigned the Isle of Orleans; Lt. Montrefors, from Montreal to LaChine and the island St. Paul from Repentigny to Berthier on the north side. Lt. Fuzer had the remainder of the Island of Montreal, also the Lake of Two Mountains and the "coast" of Vaudreuil; Lt. Haldimand, who later was to play an important part in Holland's maritime provinces' surveys, was assigned to the area from the Chaudiere River to the uppermost settlements of Satigan—from St. Joachim to Les Eboulements on the north side . . ."

In the reports of these surveyors it is interesting to find such revealing observations as "Quebec when it fell into the hands of the English on the 18th September was in a most ruinous condition, there being hardly a house in Town that was not hurt either by Shot or Shell or was habitable without repairing . . ." and, again, "The fortifications which consisted of little more than the fronts towards the land were not much above half finished, there being neither Ditch covered nor Outworks, the Scarp Wall was seen in many Places from the Top of the Parapet to the Foundation notwithstanding these and a variety of other Difficulties, it was resolved to keep possession of it — and all possible measures for the Security and Accommodation of the Garrison were entered upon without delay . . ."

The maps resulting from these surveys, for detail, were the best produced in Canada in that period. The Murray Atlas, in fact, represents probably the most elaborate topographical survey and mapping project to be found anywhere within the British Empire up to that time. Beautifully drawn, these maps were mounted on 44 linen sheets. The exacting work that filled these postwar days did not, however, abolish all opportunities to show gallantry towards fair ones among the new subjects of the British Crown. During the years immediately following the transfer of Canada from French to British rule, officers in Major-General Murray's army fraternized with the best French Canadian families at Quebec. Partly because Capt. Holland spoke French fluently he made a somewhat more favorable impression on les Canadiens than did most of his military colleagues. In any event he completely won the heart of a woman of remarkable beauty, the youngest daughter of François Rolette and Thérèse Grenet, namely, Marie Josephte Rolette (dit Maure). The father was adamant in refusing to permit his daughter to marry one of Wolfe's army and the couple found it necessary to elope. No record of the marriage ceremony has been found but the next best evidence available points to the conclusion that this 1762 wedding took place aboard a ship in Quebec harbor. Incidentally, Thérèse Grenet's son by a previous marriage, namely, Jean Baptiste Bouchette became the father of Joseph Bouchette, who, in time, succeeded Holland as Surveyor General of Lower Canada.

In February, 1763 the great Peace of Paris was signed and Canada was ceded to Great Britain. In fact, all of the French possessions in North America with the exception of Louisiana now became part of a British empire in the New World, extending from Florida to Labrador. The province of Quebec was created and its western boundary was to run north-west to Lake Nipissing from the point at which the 45th parallel of

latitude crossed the St. Lawrence River. The boundaries of Nova Scotia were extended. The first census in New France under the British revealed a population of 60,000. Brigadier General Murray was appointed the first British civil governor of the province of Quebec, the first of three military men to occupy that post. It was in this crucial year that Augustus Jones was born, a man destined to play a most influential part in the surveying of Upper Canada. And it was on December 7, 1763 that Governor Murray received Royal Instructions in regard to Land Grants in Canada.[3] These particular orders were part of more general instructions and are contained in paragraphs 41-59 inclusive and based upon the terms of the Peace Treaty. Some extracts are significant:

"You are, therefore, as soon as conveniently may be [to] cause an *accurate survey* to be made of the said province . . . you are therefore to lay out townships of a convenient size and extent in such places as you in your discretion shall judge most proper. And it is our [Royal] will and pleasure that each township do consist of about 20,000 acres having, as far as may be, natural boundaries extending into the country and comprehending a necessary part of the river St. Lawrence when it can be conveniently had . . . reserving proper quantities of land in each township for the following purposes: for erecting fortifications and barracks where necessary or for other military and naval services, and more particularly for the growth and production of naval timbers . . . a spot in or near each town set apart for the building of a church and 400 acres adjacent . . . for maintenance of a minister and 200 [acres] for a schoolteacher.

"And you are to give strict orders to the surveyors whom you shall employ to mark out said townships and towns, to make returns to you of their surveys as soon as possible, with a particular description of each township and the nature of the soil within the same. [It was from the institution of this good habit that the surveyors of the western prairies more than a century later produced such a wealth of informative and comprehensive reports.]

"And you are to oblige all such persons as shall be appointed to be surveyors of the said lands in each township to take an oath for the due performance of their offices and for obliging them to make exact surveys of all lands required to be set out.

"And whereas nothing can more effectively tend to the speedy settling [of] our said colony, *the security of the property of our subjects* and the advancement of our revenue, than the disposing of lands upon reasonable terms, therefore (conditional upon satisfactory qualifications being shown by the applicants) you are to *cause a warrant to be drawn up directed to the Surveyor General* empowering him . . . to make a faithful and exact survey of the lands, petitioned for, and to return the said warrant within six months . . . with a plot or description of the lands so surveyed thereunto annexed. (author's italics)

"In all surveys the surveyor [should] be required to take particular notice . . . how much of the land surveyed is plantable, and how much of it is barren and unfit for cultivation, and accordingly to insert in the survey and plot by him to be returned to the registrar's office, the true quantity of each kind of land . . ." Also, the surveyors were required to report upon what lands were considered by them fit for the production of hemp and flax and what land ought to be reserved for the cutting of timber to supply masts for the British Navy.

These 1763 instructions contain features of what was, in essence, the first land-use plan to be applied in Canada. These orders to the Governor also served to emphasize the indispensable partnership of surveying and mapping in relation to the development of Canada's natural resources and, in particular, to its resources of agricultural land. The need for strong personal leadership in this area of activity had become urgent. Capt.

Holland's experience and special competence, his marked ability to get along with his superiors, again stood him in good stead at this critical time for the country and for himself. He had not been idle in England. In 1762 he had submitted a plan to the Lords Commissioners of Trade and Plantations urging the launching of a scientific survey of British possessions in North America as a means of facilitating land settlement.

On February 4, 1764 a memorial, signed by four Lords of the realm, was submitted to His Majesty King George III: "We, your Majesty's Commissioners of Trade and Plantations humbly represent to your Majesty that, in consideration of measures proper for the dividing, laying out and settling such parts of . . . American dominions . . . we find ourselves under the greatest difficulties arising from *the want of exact surveys* of those countries, many parts of which have not been surveyed at all, and others so imperfectly that the charts and maps thereof are not to be depended upon . . . For these reasons . . we recommend . . in strongest manner that no time should be lost in obtaining accurate surveys of all your Majesty's North American dominions . . . and to effectuate this purpose submit . . that such dominions should be divided into a Northern and Southern District with a Surveyor General of Lands to be appointed for each . . . lay before your Majesty for your consideration the annexed proposals offered us by Captain Samuel Holland who has great knowledge of the northern parts of North America, who is a brave and active officer, able engineer and a skilful surveyor, as shown in the accurate map he has made of the settled parts of . . . Quebec . . . [and] these proposals arise entirely from Captain Holland's zeal for your Majesty's service, *as he desires no additional emolument,* being well satisfied with your Majesty's gracious intention of appointing him to the office of Surveyor General in the Colony of Quebec . . . the extraordinary expenses which he proposes for this service are perfectly reasonable and necessary [so] we recommend that two sets of instruments in his estimates [see below] should be allowed, lest the work should be interrupted by any accident happening to any of them . . ." (author's italics)

"Estimate of Expenses Attending General Surveys of His Majesty's Dominions in North America for the year 1764:*

	£	s.	d.
"To an allowance for a Deputy Surveyor at Quebec during the time the Chief Surveyor is employed in making surveys in other parts of the northern district	100	0	0
"To two assistant surveyors to be employed in the general survey at 7s per day each	254	10	0
"To one draughtman at 5s per day	91	5	0
"To extraordinary expenses for horses and guides	100	0	0
"To an allowance for two sets of proper instruments for the surveyor of the northern districts	416	15	0

In the light of these strongly worded, detailed and urgent representations George III moved swiftly. On February 10 the King approved the submission, adding his royal directions to the Admiralty to furnish an armed vessel and boats for this service. It was an impressive example of kingly wisdom managing to provide a challenging job for an able man. Holland was instructed by the Board to survey Prince Edward Island, or, as it was then known, Île St. Jean, as well as the Magdalen Islands and Cape Breton Island in that order. He was to submit a full report to accompany the completed survey

*Capt. Holland's salary was set at £365 per year.

maps. These lands were given precedence in the matter of surveys and mapping because of the importance of their fisheries. With four principal assistants, including Thomas Wright (later to become Surveyor General of Prince Edward Island) Holland and a crew of forty sailed from England on the *Canceaux*, a 200-ton vessel fitted out by the Board for survey work. The *Canceaux* was placed under the command of Lieut. Henry Mowatt.

Holland had been entrusted with the signal task of carrying to Governor James Murray royal instructions on the procedures to be followed in organizing the civil government of the province. When the *Canceaux* was delayed in the Gulf of St. Lawrence by stormy weather, Holland impatiently pressed on to Quebec by boat and on horseback, reaching the capital ten days ahead of the survey vessel. Murray must have been suitably impressed by these dramatic developments and by Holland's part in them. In any case the Governor lost little time in appointing Capt. Holland a member of the newly-established Legislative Council of the Province of Quebec. The Council's first meeting on August 13, 1764, was attended by the Surveyor General.

Within three weeks of that meeting Holland made one of the shrewdest choices of his life when he appointed, on September 8th, John Collins of Quebec as Deputy Surveyor General "for the admeasurement, surveying and setting out of roads and lands in the Province of Quebec agreeable to my instructions . . . as annexed. . ."[1] Although this appointment was not formally confirmed by commission from the Governor until May 2, 1775, no more satisfactory man could have been found to perform the deputy's duties competently and conscientiously.[2] Incidentally, power was given to Collins on May 17, 1784 by Governor Haldimand, to administer oaths.[3]

Information on the early life of Collins is scanty. He is most often described as an English merchant who came to Quebec in 1759. Yet it is certain he must have had some previous surveying experience. A revealing glimpse of some of the factors which influenced Holland to select Collins is found in a letter of November 20, 1764, written to John Pownal by the Surveyor General when in Fort Amherst: "Mr. Debares [sic] who I had proposed to have been my Deputy surveyor in the Province of Quebec, is employed by my Lord Colville at 20 shillings per day, in surveying that part of the Coast of Nova Scotia between Halifax and Cansoe, and as the province could not be Without a Surveyor I have appointed in his room Mr. John Collins, a Gentleman qualified for the business. He has been imployed for many years as a Deputy Surveyor in the Southern Colonys and was recommended to me by Governor Murray and several other Gentlemen. He will be always Ready to receive your commands during my absence". When Holland travelled in the field on various survey projects John Collins administered the office in Quebec and while Holland was out of the country on business, Collins acted as Surveyor General. In addition he conducted numerous surveys himself and continued to perform in these roles until his death on April 15, 1795.

Following the completion of his special mission to Quebec, Holland and his staff of surveyors proceeded to Île St. Jean which the English already were calling St. John Island. Not until the end of the century was the name Prince Edward Island formally bestowed on this "Garden of the Gulf". The *Canceaux*, which had undergone repairs at Quebec, carried them to what is now known as Hillsborough Bay, named in honor of the then British Secretary of State. The party arrived on October 5, 1764. On this undertaking Holland's assistant surveyors were Lieuts. Robinson, Haldimand, Carleton and Wright. Holland's formal instructions declared "that in the survey the greatest precision and exactness will be required and expected, the latitudes and longitudes of the most important places must be settled by just astronomical observations; the

depths of water and soundings, as well as the coast within the harbours, must be taken with the greatest care and every remark made which contend to the security and information of such of His Majesty's subjects as may navigate those seas".

At the time of his first landing on St. John Island Capt. Holland had no clear conception either of the true size of the island or of the number of its bays and rivers. At about this stage of the project serious difficulties began to crop up between Holland and Mowatt, the ship's commander. Holland had applied to Mowatt for the use of some small craft, to be manned by seamen from the *Canceaux,* to assist in the prosecution of the surveys and the soundings. But the Surveyor General was told by Mowatt that he had orders himself from the Admiralty to make observations of his own and that he could not spare either men or boats. Holland was angered over this pronouncement. He seriously doubted the commander's ability or capability to make proper surveys. Mowatt's motives in adopting this hostile attitude remain obscure but the trouble may have had its main source in the fact that whereas Mowatt was operating under the Lords of the Admiralty, the Surveyor General was being employed by the Lords Commissioners of Trade and Plantations. Initially, then, jealously and rivalry may have been at the root of these clashes.

Capt. Holland, already somewhat experienced in the bitter results of lack of co-operation between two branches of the armed services in wartime conditions, immediately made known the unhappy situation to Lord Hillsborough in London, to Lord Colville, Naval Commander of His Majesty's warships in North American waters and to Governor Wilmot of Nova Scotia in Halifax. It was evident that Holland was not prepared to take lightly any challenges to his authority. Lord Colville promptly extracted the heat from the conflict by letting Lieut. Mowatt know in very clear terms just where his duties rested in connection with this survey project. "Your people were raised," wrote His Lordship, "to be employed by Captain Holland and I can see no reason whatever why they should expect to be put on a footing with his other assistants in regard to pay . . . [I] recommend to you in the strongest terms *to maintain perfect harmony with Captain Holland,* to look upon yourself as a joint labourer with him and to suffer no such distraction as ship's duty and surveyor's duty to exist, but one and all, with heart and hand, to pursue a cause which is so much the object of His Majesty's attention and care". (author's italics)

This excellent and timely advice completely mollified Holland and had a salutary and lasting effect upon the commander of the *Canceaux.* After that effective communication the Chief Surveyor had no more trouble with Mowatt and, in fact, later on in the project expressed sincere gratitude for the valuable help he had received from the commander and crew.

It was Capt. Holland's original intention to conduct his surveys on the ice during the winter months but the weather proved so severe that one soldier was frozen to death and several lost fingers and toes from frostbite. But Holland and his aides were not kept completely inactive during this period and occupied themselves in the tasks of completing original maps of Quebec lands that the Surveyor General had brought along. Thus on March 4, 1765, Holland wrote to Secretary John Pownal: "I also propose to send a set of plans of the survey of Canada by a scale of two thousand feet to an inch with an index by a small scale. It will contain 62 sheets . . . Having found the great expedition of and convenience of the plane table in the survey of harbours and rivers preferable to the Theodolite or Circumferentor, I have wrote [sic] to Mr. Cumberland to provide me with three for the ensuing season, there being many surveys in the hands of the provincial surveyors".

Again in the following month Holland wrote to the Secretary of the Board of Trade and Plantations: "The cold here has been as intense as in any part of America I have seen, with sudden intervals of rain and soft weather. In this place snows are frequent, attended by thick weather, which makes astronomical observations very difficult; at other times when it is clear, it has been at the same time so severe as to oblige us often to quit the telescope to prevent the ill consequences of being struck by the frost . . ."

Frost was not the only affliction of the flesh that they were called upon to endure. Holland reported to Pownal: "I am also informed that in The Summer the Musquitos are so very plenty and troublesome that neither Man nor beast can withstand them in the woods. However I shall endeavor to get the better of all these difficulties . . ."[4]

On February 15 Holland commenced the island surveys, employing four parties in all. Lieut. Robinson and Holland himself finished the North East River section, surveying the carrying place, Savage Bay to St. Peters. Lieut. Wright surveyed from St. Peters to Governor's Islands, then proceeded to Malpeque. Lieut. Robinson surveyed towards Bay Fortune eastward and from thence to Three Rivers, later Georgetown.

As part of his April letter to Secretary Pownal, Holland states: "Our travelling equipage consists of a sledge of a foot in breadth, by six feet in length, upon which are beaver skin coats, a buffalo or bear skin, a blanket, canteens and about eight days' provisions, each drawn by a single dog, which we have purchased for that purpose from the Acadians, but as the chainmen are not able to carry their provisions . . . I have found it necessary to hire an Acadian for each of the gentlemen". In the previous October Holland had written: "My whole party for carrying the chain, camp, colors, etc., amounts to fifteen men, myself and assistant surveyors, gentlemen, volunteers and servants, thirty-one in all".

A serious breach of army discipline was recorded during this period of the survey when a soldier, John Haddock, of the 60th Regiment, who had charge of Lieut. Wright's instruments, was ordered by his superior to go about a mile for some missing parts. He replied, "Damn my blood if I will!" During the subsequent court martial the man admitted his guilt and was sentenced to 400 lashes by the cat o' nine tails. On the intercession of Lieut. Wright, however, the sentence was not carried out. Thus on July 16, 1765, ended what was probably the first British court martial on the island.

The hard conditions of weather and wilderness posed some formidable problems for Capt. Holland apart from those related directly to the survey operations. Not the least of these "unofficial" problems was the provision of a dwelling resistant to icy winds and deep snows. The presence of Mrs. Holland on the island lent some urgency to the task. She had insisted on accompanying her husband and must have been one of the very few wives of Canadian Surveyors General who achieved the ultimate distinction of travelling with her husband "to the field". Official records indicate that this structure cost Holland £50. It was heated by a stove brought from Quebec. As soon as adequate living quarters had been constructed at Observation Cove (now Holland's Cove) across the harbor from Charlottetown, the couple moved in. This modest structure continued to be their home during the course of most of these pioneer maritime surveys. Two children were born to the Hollands on the island, a son, John Frederick, and a daughter, Charlotte. The birth of a son marked him as the first British subject to be born on St. John Island.

"In many parts around the island is rough steep coast from 40 to 60 feet high", Holland reports, "composed of stratas of soft red stone which, when exposed to the air for some time, becomes harder and is not unfit for building. Wherever this sort of coast is, it diminishes considerably every year upon the breaking up of the frost, which

moulders away a great part of it. It may probably be owing to this cause that the sea betwixt the island and the continent is frequently of a red hue, and for that reason by many people called the Red Sea; on the north and southeast side it has received some additions by the banks of sand which the sea has thrown up . . . With proper care the (soil) produces most kinds of grain, barley, wheat, oats, peas, beans, etc., also cabbage, cauliflowers and potatoes — very good in abundance, carrots, turnips, etc." Holland goes on to describe the best harbors for trade and fisheries as well as reasons for the location of principal towns: "The capital, called Charlottetown, is proposed to be on a point of the harbor betwixt York and Hillsborough Rivers, being one of the best, and nearly a centrical [sic] part of the island, has the advantages of an immediate and easy communication with the interior part of the island by means of three fine rivers of Hillsborough, York and Elliot. The ground designed for the town and fortifications is well situated upon a regular ascent from the water-side; a fine rivulet will run through the town; a battery or two, some distance advanced, will entirely command the harbor . . ." There were recommendations also from Captain Holland regarding the establishment of sites for Georgetown and Princetown. The latter, however, was never built.[5]

By October 4, 1765, the island surveys had made such progress that Holland was able to send Lieut. Robinson to England with large and small maps of St. John Island as well as with a complete plan of the Magdalens and a set of completed maps of the settled areas of the St. Lawrence River basin. Following the completion of the survey operations on St. John Island, it was divided into 67 lots or townships, each lot of 20,000 acres. Holland's reports had served to stir up a certain amount of land speculation fever in England and the requests for grants of land on the island became so numerous that with the exception of two or three townships, a drawing was arranged and the holdings distributed to favored personages by lots drawn in the course of a single day. Surveyor General Holland was awarded Lot No. 28, fronting on the Tryon River. This property remained with his descendants for generations. Holland discontinued residence on the island after 1769.

Capt. Holland and his assistant, Lieut. Frederick Haldimand, had completed the survey of the Magdalen Islands in the season of 1765. In December of that year, while surveying Cape Breton Island, Haldimand "was drowned". This promising young man, only 24 years of age, was a nephew of Major General Frederick Haldimand, a future Governor of Canada. Holland was deeply affected by the passing of the youthful surveyor. He regarded Haldimand as an accomplished mathematician and he mourned for years the loss "not only of a friend but my principal assistant in astronomy in which he [had] made surprising progress".

Back in Quebec Collins had not been idle. He reported on May 21, 1765, to Governor Murray that he had fixed the point on Lake St. Francis where the 45th parallel of latitude intersects the southeast shore of the lake. Apparently Collins also proceeded with the survey of the boundary between the provinces of Quebec and New York in 1765 and 1766. He was also employed on surveys in the Gaspé and in the vicinity of Baie des Chaleurs.

By July, 1767, Holland had sent completed survey plans of Cape Breton Island to London, England. Following this action he worked along the west coast of the Gulf of St. Lawrence and along the St. Lawrence River. During his Cape Breton surveys Holland arrived in Louisbourg on October 26, 1765, some seven years after his landing under hostile fire in that same locality. He was joined there by Lieut. Pringle and Lieut. Wright, a pair who had surveyed the west coast of Cape Breton Island.[6]

In Louisbourg Holland was well received by the garrison commander who provided

66° 00

66° 66

45° 20

45° 15

The River St. John, has sufficient depth of Water for large Ships to the Falls. Whence it continues Navigable, 80 Miles up into the Country for Vessels of 100 Tons. At Fort Frederick, common Tides rise 18 Feet, perpendicular, and Equinoctial Spring Tides 25 Feet, above the Falls, it seldom flows more than 4 Feet. When the Tide has risen 12 Feet, at the Fort, the Falls are Smooth, after which during about 20 Minutes, they are passable. At times of great Freshets, which generally happen between the beginning of April & the middle of May, from the melting of the Snow, the Falls are altogether impassable, to Vessels bound up the River, as the Tide does not rise to their Level.

A. Partridge Island NE ½ N 7 Leagues distant

B. Musgrave Island

The Entrance of the River St. John

COURTNEY BAY

Point Debbeg

Fort

Bayeres Point

Partridge Island

Point William

Point William Island

Meogenes Island

GREVILLE COVE

Point Charles

Var. 14° West 1776

JOHN

RIVER ST.

POINT MASPECK

GRANTS HEAD

Waltham Creek

ROBERT CREEK

CAPE SPENCER

BAY OF FUNDY

Statute Miles

Nautical Miles

Published according to Act of Parliament Nov.r 14, 1776, by J.F.W. DesBarres Esq.r

West Longitude from the Royal Observatory at Greenwich.

66° 6

66° 00

65° 55

MAP. 25. The River St. John by J. F. W. DesBarres, 1776, published in *The Atlantic Neptune*. Courtesy of the Public Archives of Canada.

him with "the best quarters in town". While in Louisbourg Holland made arrangements for the provision of necessary equipment and for supplies for his various survey parties. He also added Ensign Sproule of the 59th Regiment to his staff of helpers, continuing astronomical observations on Cape Breton Island. In the spring of 1766 three survey parties were set in motion and by autumn the general outline of the island had been traced and the facts gathered for a proper description. Ensign Sproule remained with Holland to finish the survey of Bras d'Or Lake and other lakes in the region. Holland himself did not complete work in Cape Breton until the summer of 1767. In all, by 1767, he had sent to the Board of Trade and Plantations five complete plans of Cape Breton Island, three on a scale of two miles to the inch; two on a scale of 4,000 feet to the inch. Incidentally, none of these sketches are to be found anywhere today.

In 1767 Lieut. Wright led a party to survey on Anticosti Island. In 1768 the north side of the St. Lawrence from Baie St. Paul to the Saguenay River and up that river as far as Lake St. John, was surveyed by Lieut. Blaskowitz. The south side of the St. Lawrence from Mount St. Louis to the Gaspé was surveyed by Ensign Sproule and later Sproule and Wright surveyed a stretch of Labrador coast.[7]

Today at Holland's Cove, across the harbor from Charlottetown, a plaque recalls the early labors of surveyors on what is now Prince Edward Island. Mounted on an attractive stone cairn the plaque declares: "Following the Treaty of Paris, 1763, the British Government ordered a systematic survey of its possessions in North America. Captain Samuel Holland was placed in charge of the district north of the Potomac and because of the importance of its Fisheries, was instructed to begin with Prince Edward Island. In October, 1764, he established headquarters at Holland Cove and completed his survey in 1765".

Surveyor General Holland will be remembered always as the author and finisher of the first organized scientific land and water surveys on the northern half of North America. Thus far in our narrative we have followed him and his associates through the initial surveys of Prince Edward Island, the Magdalen Islands and Cape Breton Island. These achievements were, of course, in addition to surveying accomplishments in the settled parts of Quebec province. Later on in this account Holland's activities as Surveyor General of the Northern District[8] are evaluated as he travelled along the Nova Scotian and New England coasts and as far south as New York and New Jersey. The American Revolutionary War, now looming darkly on the horizons of the New World, was to exercise a profound influence on Holland's personal fortunes. Ahead of him lay renewed administrative efforts as provision had to be made for the influx into Canada of the United Empire Loyalists. Nova Scotia, New Brunswick, the Eastern Townships of Quebec, Prince Edward Island and, ultimately, Upper Canada, were to feel the welcome impact of the newcomers. Presiding to a large extent over their fate in the new land was this remarkable man, Samuel Holland, destined to give much needed leadership during a most significant formative period in the development of Canadian nationhood as we know it today.

After the capitulation of Quebec, Lieut. Joseph F. W. DesBarres was employed on surveys in that town and in its immediate vicinity. On paper he made a representation of the Battle of the Plains of Abraham and took soundings in Quebec harbor and basin. This work was later incorporated in a larger plan and published in *The Atlantic Neptune,* a work that was to establish for DesBarres a permanent name in the realms of surveying and mapping. After the capture of Montreal early in September, 1760, DesBarres was dispatched to Nova Scotia with Col. Bastide to make surveys and plans

and to complete estimates concerning the fortifications and dockyard at Halifax.

When Col. William Amherst in 1762 led a successful English expedition against French-held St. John's, Newfoundland, Lieut. DesBarres served under him, probably with the Royal Americans, as an engineer and as Quartermaster General. Col. Amherst, commanding troops in New York, had mustered a force of some 1,700 men. On ten transport vessels the expedition made rendezvous with Admiral Colville's squadron off St. John's on September 11. On September 13 a landing was made at Torbay and by September 19 the French surrendered. This was the last battle in the Seven Years' War between French and English in North America. DesBarres, after this action, returned to Halifax carrying with justifiable pride official appreciation of his services in the campaign and its aftermath.

In a petition DesBarres submitted in later years (January 28, 1794)[9] to the Lords of the Admiralty he modestly drew attention to his services with Wolfe at Louisbourg mentioning that "in the course of the siege I was ordered to join the Corps of Engineers wherein I had frequent occasions to apply my small talents". Continuing in that same communication DesBarres states, "Then in 1762 I was ordered under command of Colonel [William] Amherst in the expedition for the retaking of St. John's in Newfoundland where . . . after alternate duties in the line as an engineer and as Quartermaster General I had the honor to be particularly thanked and, at the close, sent to survey some of the principal harbors and posts of that Island and to project designs for their Defence".

In 1763 Rear Admiral Spry, in command of the fleet in America, represented to the Admiralty that the coasts of Nova Scotia and of the American colonies were very imperfectly charted. He proposed that accurate surveys be made and recommended that DesBarres undertake supervision of this formidable project. Lord Colville, who succeeded to Spry's command, was instructed by the Admiralty to employ DesBarres on these surveys. The surveyor's salary was established at twenty shillings a day with certain added allowances for equipment and other items essential to the prosecution of the surveys. DesBarres was occupied on this project for ten years, 1764-1774.

This same ten-year period featured the appearance in Canada of the first newspaper, the *Quebec Gazette* (1764), to be published in the province of Quebec; the appointment of Sir Guy Carleton as Governor General of Quebec (1768); of Samuel Hearne's journey to the Coppermine (1769-72); of the birth of David Thompson in London (1770); of Capt. Cook's famous first and second voyages of discovery; of survey work on the 45th parallel between Quebec and New York provinces; and of land surveying work in Virginia by George Washington. It was a ten-year period that ended in the passing of the Quebec Act; in the building by Samuel Hearne of Cumberland House (a Hudson's Bay Company interior post) and by the birth of W. F. W. Owen who contributed so greatly to Canadian hydrographic achievements.

On the advice of Lord Howe who impressed King George III (crowned in 1761) with the vast importance of the Atlantic coast surveys not only to naval vessels but to merchant ships, the sovereign ordered that charts and sailing directions of these waters be published. The surveys occupied ten years, as did the work of compiling, editing and printing. In fact, at one stage of this prolonged and exacting task, namely in the years 1776-79, DesBarres supervised a staff of more than twenty assistants. From 1774 to 1784 DesBarres remained in London revising and improving his own material as well as that provided him by army and naval officers who assisted in the actual coastal surveys.

The practical value of *The Atlantic Neptune*, as the published compilation was

entitled, is beyond precise calculation. The charts became a standard guide for navigators in waters off the eastern coast of North America. The production, compilation, printing and engraving of *The Atlantic Neptune* must surely be regarded as one of the most remarkable products of human ingenuity, determination and industry to appear during the 18th century. The artistic excellence of the sketches is very high and this quality was solely due to DesBarres. It must be admitted, however, that he incorporated in the publication the work of others, including that of Major Holland, without always attributing it to its proper source.

The several editions vary considerably in their content. No two copies contain exactly the same collection of plates. In fact, no complete list exists of the plates issued from time to time under the title of *The Atlantic Neptune*. One does not need to rely upon the not-too-objective assessment of DesBarres of his own accomplishment, nor, for that matter on any British valuation of his work. *L'Esprit des Journaux*, Paris, 1784, published this eloquent tribute: "There has recently been placed on sale at The Hague by P. F. Gosse, Court bookseller and printer, a superb Atlas which we take this first opportunity to describe in detail. This work, which is indispensable for the navy, is the result of 19 years labour and has cost the English government more than £100,000 sterling, in addition to the considerable expense which the author himself has discharged for its execution. The work is in the highest degree of beauty and superior in every thing to the kind that has heretofore been published."

The Public Archives of Canada possesses in Ottawa what is known as the Amherst Copy of *The Atlantic Neptune*, a presentation to the Canadian Archives by Earl Amherst. Volume One of this edition includes the sea coast of Nova Scotia, with soundings, together with remarks and directions for navigation and pilotage. In addition it contains similar survey work along the coasts of New England, New York, Jersey [sic] and the "Gulph" of the River St. Lawrence, published in 1778. There are sketches or views of the North Point of Grand Manan Island, of Camp Belo [sic] Island and of Mechios Mills, published in 1777. Volume Two of the Amherst Copy contains material on the sea coasts of Nova Scotia including the southwest coast (1779) and Halifax harbor (1779). Volume Three contains charts of the coasts and harbors of New England from surveys of Samuel Holland and his aides Charles Blaskowitz, James Grant and Thomas Wheeler.

The title page of Volume One announces: "The Sea Coast of Nova Scotia exhibiting the diversities of the Coast and the Face of the Country near It. The Banks, Rocks, Shoals, Soundings, etc. Together With Remarks and Directions for the Commencing of Navigation and Pilotage. Surveyed by Order of the Right Honourable the Lords Commissioners of the Admiralty by Joseph Frederick Wallet DesBarres, Esq.".

The Preface is interesting. "Whatever has a tendency to perfect the Theory or facilitate the Practice of Navigation, must ever merit the Attention and cannot fail meeting with the Protection of a People, whose Prosperity is so especially connected with Maritime Commerce, and whose very Existence as a great and powerful Nation must ultimately, if not solely, depend upon the superiority of its Navy—Impressed with the justness of this Idea the Author ventures, with greatest Confidence, to lay before the Public the present laborious and useful Work—Nova Scotia is situated between 43 and 48 degrees Latitude North and between 60 and 80 degrees Longitude West from London" . . . DesBarres then proceeds to discuss forest wealth, agricultural potential and the fisheries. He continued: "The Dangers to which the Author has often been Exposed in the Execution of this important and arduous Undertaking, as well as for the sake of greater Accuracy, Perpescuity and Dispatch, put him in the Necessity of

Furnishing himself with repeated Sets of Instruments, Astronomical and Geometrical, constructed to his Purpose, and rendered more perfect from the many Improvements and additions the long course of his experience suggested . . . The Climate not admitting to the Use of Instruments more than Six Months in the Year, added to the Frequent Interruptions by Fogs and precarious weather, unavoidably made tedious a Performance in which Accuracy and Certainty were the *prima desiderata* and has rendered many years necessary to compleat it for Publication . . . It is also of great and lasting Importance to have the correct Survey of the Isle of Sable, composed of Sand, with two Bars often breaking mast-high for Seven Leagues, exposed to the Western Ocean and covered with Wrecks, where thousands have perished for want of knowing the Soundings . . ."

Then DesBarres provides a glimpse of the dangers he faced in the performance of his task: "This Survey the Author has accomplished at the Hazard of his life, the Surf upon the Shores admitting no Boats to approach without the greatest Risk . . . a considerable part of Two Years was employed in Sounding around the Island and landing at different times to survey and ascertain the Latitude, Longitude, etc. . . . After 16 years of unremitting Exertions of the Author's Diligence and Abilities (there) is now ready . . ."

In a page of General Remarks is found an echo of more martial days: "The Lighthouse and Town of Louisbourg, on making that part of the Island (of Cape Breton) are immediately seen. The Coast to the Westward continues Rocky on the shore with a few banks of red earth and appears less barren".

Not only James Cook but the second man to be named Hydrographer to the British Admiralty, Capt. Thomas Hurd, benefitted immeasurably by lessons in nautical surveying received early in their careers from Samuel Holland and Joseph DesBarres. DesBarres may have lacked the tactfulness of Holland, the scholarly imagination of Dalrymple (first Hydrographer to the Admiralty), and the exploring zeal of Cook but for sheer skill and versatility as a surveyor and draftsman DesBarres had no equal in his time. Delicacy of touch and of balance featured all his sketching work. By 1784 this productive side of his life had nearly concluded and he entered into another sphere of public service. He had yet to serve as the Lieutenant Governor of Cape Breton Island (1784) and as Prince Edward Island's third Lieutenant Governor (1805-13) but his chief claim to fame and his greatest contribution to Canadian progress must remain his production of *The Atlantic Neptune.*

Of the triumvirate of notable pioneers who dominated surveying and mapping on Canadian land or in Canadian waters for the years following the Peace of Paris (1763) Capt. Cook was the only one to survey on both the Atlantic and Pacific coasts of Canada. James Cook was the second child of a large family living in the village of Marton-cum-Cleveland in Yorkshire. From modest economic circumstances he rose, chiefly by his own abilities, dedication and exertions, to the rank of Captain in the Royal Navy and also to the highest place in his age as a navigator, marine surveyor, scientific observer and discoverer of new lands.

Born on October 27, 1728, Cook's career spanned the period between the death of Newton and the birth of Darwin. In the years represented by these three influential lives there occurred a revolutionary unfolding of fundamental scientific facts and laws of nature pertaining both to this world and to the universe. There was, as well, a growing comprehension by educated people of the significance and inter-relationship of these basic facts and principles.

Cook's father was a day laborer and James found it necessary, in order to realize

his ambitions, to educate himself in mathematics, astronomy, navigation and cartography as well as in the rudiments of medicine. A career in the British Navy appealed strongly to him. In addition to an eager and gifted intellect he had two helpful assets, namely, good health (so far as is known Cook was seriously ill on only one occasion)[10] and that rare quality in seafarers of his day, the uncanny ability to "smell" land in what appeared to be unbroken ocean.

After a period of training in the merchant service of his country Cook joined the Royal Navy in 1755 at the age of 27. His first tour of duty was aboard H.M.S. *Eagle* and he soon rose from the rank of able seaman to that of sailing master, a warrant officer who specialized in navigation and ship-handling. Though not technically a Lieutenant, a sailing master or Master was usually allowed by custom to live and eat with ship's officers of that rank or higher.

Cook joined H.M.S. *Solebay* as Master on July 30, 1757 and was transferred to H.M.S. *Pembroke* in that capacity in October of that same year. He stayed two years with the *Pembroke*, serving as Master under Capt. John Simcoe at the sieges of Louisbourg and Quebec. While with the *Pembroke* Cook assiduously studied mathematics, Euclid, astronomy and marine surveying, greatly helped by the guidance and instruction provided by Samuel Holland and Joseph DesBarres.

Following the transfer of Canada to the British Crown, it was realized by Commanders of the Royal Navy that available hydrographic information and coastal mapping generally was quite inadequate for safe navigation in the eastern waters of northern North America. Lord Howe and other leaders of the navy pressed energetically for immediate publication of any maps and charts based on accurate surveys of these areas and forwarded to London. It was this growing and urgent need that made possible the remarkably productive activity in surveying and marine charting in the last half of the 18th century on the part of Holland, DesBarres and Cook.

Admiral Saunders at Quebec ordered James Cook to be transferred from H.M.S. *Pembroke* to H.M.S. *Northumberland* following the capitulation of Quebec. Cook was thus enabled to remain in Canadian waters and to continue his marine surveying work. In 1760, while with the *Northumberland* as its Master, Cook studied carefully the St. Lawrence River in the general area of Quebec. In fact, chart work on the river attributed to Cook's operations in 1759 was actually accomplished in the summer of 1760. The navigation of the St. Lawrence River was so studded with hazards at the time, especially for English captains and pilots, men strange to these parts, that Cook was ordered to survey stretches of the river below Quebec. He executed the whole business with characteristic diligence and skill. The resulting chart was published in London, complete with soundings and sailing directions. As additional evidence of his rising reputation as a surveyor there appeared in R. Sayers' *North America Pilot,* published in London in 1775, an introduction by Cook as well as surveys in Newfoundland waters by him and his assistant Lane. So excellent was their work that the information remained in use until Kerr's amendments were made almost a century later.[11]

In a letter written by Lord Colville in January, 1761, the Admiral made direct reference to Cook's surveying in the St. Lawrence. He mentions that he, the Admiral, "had directed the storekeeper to pay the Master of the *Northumberland* £50 in consideration of his indefatigable industry in making himself master of the pilotage of the River St. Lawrence".

From 1760 to 1762 the *Northumberland* was based on Halifax and during this period James Cook employed his opportunities to survey Halifax harbor and adjacent coastal parts during summer months. In September, 1762, the *Northumberland* sailed

to take part in Admiral Colville's naval action in the Newfoundland campaign. In a despatch to the Lords of the Admiralty dated October 25, 1762, Lord Colville states that "an army engineer called DesBarres was sent to the Island of Carbonera to plan its refortification. Mr. Cook, Master of the *Northumberland,* accompanied Mr. DesBarres. He had made a draught of Harbour Grace and the Bay of Carbonera, both of which are in a great measure commanded by the island, which lies off a point of land between them. Hitherto we have had a very imperfect knowledge of these places but Mr. Cook, *who was particularly careful in sounding them,* has discovered that ships of any size may lie in safety both in Harbour Grace and the Bay of Carbonera". (author's italics)

This particular survey, in fact, played an important and influential part in Cook's subsequent career. As a result of his exemplary conduct in the Newfoundland campaign and its aftermath, Cook was made a 3rd Lieutenant in 1762. In the following year, with an assistant, Edward Smart, he spent the summer and early autumn surveying St. Pierre and Miquelon, transferring from H.M.S. *Antelope* to H.M.S. *Tweed* as required. In fact Thomas Graves of H.M.S. *Antelope* had approached the Admiralty on at least four occasions in 1763 to have Cook appointed a full-time surveyor in Newfoundland waters. He was so appointed on April 19, 1763.

In 1764 Capt. Hugh Palliser was appointed Governor of Newfoundland. Palliser realized how vitally essential marine surveys were to the proper use of the island's coastal waters. He knew Cook well and entertained a high regard for him. Governor Palliser lost little time in locating a schooner *Sally* as a vessel suitable for surveying operations. He re-named it the *Grenville* and had Cook appointed as its sailing master and as naval engineer on June 14, 1764, for the purpose of carrying on the work of a "marine surveyor of the Coast of Newfoundland and Labrador". In addition Cook was provided with two able assistant surveyors, William Parker and Michael Lane. Cook spent the summer of that year surveying the northern parts of Newfoundland, returning to England for the winter months. In the 1765 season he surveyed waters of the Gulf of St. Lawrence as well as those along the Newfoundland coasts, returning to Deptford, England, where he spent the winter period completing work on his charts and in writing up related descriptions. It was in February, 1766, that he received Admiralty permission to publish these charts.

In April he returned to Newfoundland waters, surveying along the south and southwest coasts. On August 5th he observed an eclipse of the sun at Burgeo. His description of that phenomenon, submitted to the Royal Society and published in its *Philosophical Transactions* of 1767,[12] resulted in the bestowal on him of a society fellowship. This recognition proved to be the turning point of his naval career.

The scientific progress in the 18th century allied with an intensive British drive towards expansion, aroused in great measure by the resounding victories of the Seven Years' War, was providing the financial means for far-reaching sea explorations. What was equally important was the fortunate timing of these developments. Cook had succeeded in making a deep and favorable impression on both the Royal Society and the Admiralty at a time when the need for seamen-scientists was most urgent.

At the age of 39 Cook returned for the last time to Newfoundland waters in April, 1767. He had but eleven years of life left but he made every one of those years count in a very large way on the calendar of human achievement. His three world-famous voyages of Pacific discovery were yet to take place. But Cook's reputation as a navigator and surveyor of special genius had been firmly established in the Atlantic waters of British North America. That reputation had not been made without personal mishap. Sometime during this period of service the explosion of a powder horn maimed one of

Cook's hands.

Cook's maps and charts of Newfoundland were the first to provide an accurate representation of its west coast on which, for the first time, Point Riche was correctly placed. Cook also ventured, on his explorations, some distance inland in order to trace the Humber River as far as Deer Lake. Cook pioneered in giving a true delineation of the island coasts and the Strait of Belle Isle. On Burgeo Islands and at other places along the Newfoundland coast his survey markers may still be observed.[13]

Governor Palliser, in a letter dated February, 1767, wrote to the Admiralty summing up Cook's survey work: "Mr. Cook, appointed by . . . the Admiralty to survey the seacoast of Newfoundland and Labrador under my direction, having finished his chart of the southeast coast of Newfoundland, adjacent to the islands of St. Pierre and Miquelon . . . and upon a large scale of one inch to a mile, you will herewith receive the said chart, which he [is] pleased to lay before the Lords . . . of the Admiralty. He, having also the last year delivered to the Board his survey of the same scale, and having now prepared a chart of that part, together with a chart of the opposite part of the coast of Labrador, including the island and straits of Bell Isle; likewise another of the abovementioned surveys of a part of the south coast of Newfoundland, both upon a proper scale to be useful to the trade and Navigation of His Majesty's subjects, therefore, as the publication of the same I am of opinion will be a great encouragement to *new adventurers in the fisheries upon these coasts,* be pleased to move their Lordships to permit Mr. Cook to publish the same". (author's italics)

Cook sailed for England on October 23, 1767, and arrived at Deptford on November 15th. He began to prepare his charts for publication. Thus ended his connection with Newfoundland and the east coasts of Canada. It was eleven years, and in the year of his tragic death, before he returned to Canadian waters . . . over 4,000 miles distant and under circumstances vastly different from those governing his Atlantic activities. Admiral William J. L. Wharton, a distinguished Admiralty Hydrographer, speaking of Cook's Newfoundland surveys stated, "The charts he made during these years on the schooner *Grenville* were admirable. The best proof of their excellence is they are not yet superseded by the more detailed surveys of modern times. Like all surveys of a practically unknown shore, and especially when that shore abounds in rocks and shoals, and is much indented, they are imperfect in the sense of having many omissions. But when the amount of ground covered and the impediment of fogs and bad weather on that coast is considered and that Cook had at the most only two assistants, their accuracy is truly astonishing".

R. A. Skelton, eminent English student of cartography, has observed, "Cook's Journals testify to his flair for predicting the trend of a coastline and for discovering and interpreting its principal features . . . his charts are in general notably correct in outline and accurate in their latitudes". Errors that Cook made in calculating longitudes were minor, Skelton points out.

The British Admiralty was to continue for another century as the agency chiefly, if not entirely, responsible for hydrographic work in Canadian waters. But James Cook, in his four years in the vicinity of Newfoundland as well as in previous surveys in the River and Gulf St. Lawrence, so solidly established the traditions of devotion to duty and of reliability and precision of work that his high example continued to inspire and influence Canadian marine mapping for generations to come.

12

MARITIME PROVINCES SURVEYS AND THE LOYALIST INFLUX

"Peering in maps for ports, and piers, and roads . . ."
The Merchant of Venice, Act 1. Sc. 1.

The decade following the completion of Captain Holland's surveys in what are now known as Prince Edward Island, Cape Breton and the Magdalen Islands, was one of great political and economic upheaval in North America. For the purposes of this history possibly the most effective way to indicate the true nature and extent of the convulsions of that ten-year period, is to observe how these influenced the career of Canada's first Surveyor General.

In July, 1770, Holland set out from Quebec with all his assistants for the eastern coast of New England to continue a survey commenced by DesBarres. In December of that same year he wrote to Lord Hillsborough from near Portsmouth, New Hampshire. The concluding paragraph of the letter, in which he refers to what is now New Brunswick, has a prophetic strain:

"Supposing a Province to be erected there [actually this event came to pass just 14 years later] the Happiest Boundaries for it . . . would be the River St. John in the Bay of Fundy to the East and the Saco River with the New Hampshire Eastern Boundary to the west, agreeable to the sketch I inclose . . ." This report indicates that Holland and his aides were occupied on surveys along the coasts of Maine and New Hampshire. Holland's work connected up with that of DesBarres at the Strait of Canso and at the St. Croix and St. John Rivers. By 1773 this survey project had been extended as far south as Boston. Holland kept reporting from time to time to the President of the Board of Trade and Plantations on his progress. During this period he made Portsmouth the headquarters for his field operations.

In 1772 Holland resigned his army commission to concentrate upon his civil employment. The following year he resolved to make Perth Amboy in New Jersey his new survey headquarters and announced the intention to extend the surveys around Cape Cod to New London. The boundary between New York and New Jersey occupied his attention at this time as well as the boundary between Massachusetts and New York. At this stage of the project the Surveyor General felt that six more years would be required to complete the coastal surveys. While Holland was concentrating upon his boundary surveys in the States, the Quebec Act of 1774 was passed by the British Parliament, a measure extending the boundaries of the province and confirming the validity of the feudal landholding system there. The Act marked the failure of British authorities to unify and consolidate its North American colonies of Quebec and Nova Scotia.

In 1775 Holland was ready to run the line between New York and Massachusetts and was actually employed on this task when the Revolutionary War broke out in earnest. Holland rejected with indignation offers of certain military commands in the rebel army. Before long he was forced to make a dash for the coast to escape arrest. He managed to get away safely on a British vessel under the command of General Tryon, and by November, 1775, reached the shores of England. In his haste he had left his family and property at Perth Amboy "to the mercy of an unrelenting and enraged multitude" according to the language of a letter he wrote to General Tryon in later years (1784). His wife and children were removed to Boston where they remained until the city was evacuated by the British in March, 1776. It is thought that the Hollands then headed for Quebec.

An example of the vicissitudes experienced by his wife at this rather desperate time is disclosed in a letter written by Holland in 1791.[1]

". . . I should be loth [sic] to trust to any unskilful hands my capital set of instruments, consisting of all sorts necessary for carrying on a general survey, or making astronomical observations; [instruments] made by the best artists in London. They have already been proved by me in settling the longitudes and latitudes in the Northern District of North America, as inserted in the Philosophical Transactions, and with which Mr. Sproule and Mr. Wright ascertained the longitude and latitude of Gaspé and Isle of Anticosti. As they [the instruments] were much deranged by being removed from their boxes by Mrs. Holland to prevent them being carried off by the Americans, while she and her family were their prisoners in 1776, I was under the necessity of taking the principal ones with me to England where they underwent thorough repair in Mr. Ramsden's hands, except a quadrant of the old construction, which was left in my office, where it had been nearly ruined".

It was during his abbreviated exile in England that Samuel Holland found time to contribute four important papers to the Proceedings of the Royal Society of London, three of them related to astronomical observations near Quebec in 1769 and 1774.[2] During the winter of 1775 in England, Holland was employed by Lord George Germaine in compiling and preparing maps from his field notes. In March, 1776, His Lordship proposed that Holland return to America as an aide, with the rank of major, to General Heister, commanding Hessian troops. Holland promptly accepted and was commissioned a Major on March 4. He served in various capacities under Sir William Howe, Sir Henry Clinton and General Tryon, all stationed at New York.

In August, 1776, the Continental Congress decided to send an army down Lake Champlain and the Richelieu River with the aim of capturing Montreal. Not many months after the Quebec Act became legally effective, Montreal was occupied by

American forces on November 13. At this time a rather stirring escapade took place, one which involved several personages of significance in the story of Canadian surveying and mapping. Guy Carleton, who had been appointed Governor General of the province of Quebec in 1768, was in Montreal at this time but escaped down river evading American patrols, including vessels on watch at Sorel. The success of this stratagem is mainly attributed to the cool courage of J. B. Bouchette, the half-brother of Mrs. Holland. It was he who commanded the boat on which Carleton was hidden. After several narrow escapes Bouchette landed Carleton safely at Quebec. In a minor but none the less helpful way this feat marked the turning point in the grim struggle for the control of the destinies of Canada.

The separate armies of General Benedict Arnold and General Montgomery joined in an assault on Quebec, which they were ill-prepared with armaments to besiege effectively. A blockade of the city proved fruitless. A desperate attack in a fierce blizzard on the last day of 1775 reached its bitter climax in the death of Montgomery, the wounding of Arnold, the death of one hundred Americans and the capture of 400 others. Thus ended, in bloody strife and profound failure, this attempt to force Canada into a continental union and make it, in effect, the 14th of the original States.

So far as the Quebec habitant was concerned, Americans were regarded not as liberators but as likely oppressors. This attitude astonished and dismayed the invaders. They lingered on near Quebec until the spring of 1776 when a British fleet sailed up the St. Lawrence. Discouraged by this development the Americans made haste to depart for their homeland. By June 15 Montreal had been evacuated.

Just as their War of Independence proved to be a successful one for the United States, so did the experiences of 1775-76 mark an equally successful campaign for independence from any continental power by Quebec and Nova Scotia. The war left a heritage of bitterness among the English-speaking peoples of North America. If a Loyalist residing in the States had fought for the British side in the Revolution then his home and private property were confiscated. The plight of the non-belligerent who refused to side with the rebels was not greatly different. As a result Loyalists gathered in British-held towns or followed British armies. Others joined fighting units such as Butler's Rangers, the Queen's Rangers or any of the over fifty units organized during the Revolution to fight for the British cause.

On July 4, 1776, the rebellious American colonies made known to the world their Declaration of Independence. At this time Major Holland, in all probability, was serving with Sir William Howe's forces in the New York and Philadelphia areas. On the day of the Battle of Bunker Hill in 1775 a 23-year-old ensign of the 35th Regiment, one John Graves Simcoe, landed at Boston. Both young Simcoe and Samuel Holland, who had served with the ensign's father at Louisbourg seventeen years earlier, were now under the same British commander-in-chief. Despite the difference in their ages it is likely that these two struck up a friendship during this campaign, a close relationship that continued to flourish in later years.

Major General Sir Frederick Haldimand, late in 1777, had been named Governor General of Quebec Province in succession to Sir Guy Carleton. In the following year he requested that Major Holland come to Quebec to resume his duties as Surveyor General, duties interrupted so abruptly three years before. Holland returned to Quebec in 1779 and began to organize his office there as well as his program of surveys. In 1780 he purchased the Holland farm, a property of 200 acres, northwest of the Plains of Abraham. It was land belonging to M. Jean Taché, author of what has been regarded generally as the first published poem by a Canadian, *Tableau de la Mer*. The mansion

of the estate had been occupied as his headquarters by General Montgomery during the unsuccessful American siege of Quebec.

Peace negotiations between the British and Americans continued until November 30, 1782, and the Treaty of Paris was signed on September 3, 1783. The boundary line between the province of Quebec and the United States was defined in the treaty but differences in the interpretation of terms employed in the treaty text resulted in a series of disputes not finally settled until a half-century later.

When hostilities ceased, Loyalist refugees began to assemble in large numbers. In and near New York, under the supervision of Sir Guy Carleton, they swarmed into accommodation camps. During the open navigation season of 1783 fleets of transports sailed from New York. Some carried nearly 30,000 Loyalists to Nova Scotia, many of them to the boom city of Shelburne. Smaller numbers sought homes on the Island of St. John and on Cape Breton Island, but the largest contingent sailed for the mouth of the St. John River. There was a much smaller and more gradual trickle of such refugees into the province of Quebec. A goodly number penetrated into Upper Canada, along the St. Lawrence as far west as Cataraqui. This widespread and, in the case of the eastern provinces, large-scale influx of new settlers gave an impetus to organized surveying and mapping of the country unexampled in the history of this nation up to that time. The development brought about an upsurge of activity in these fields not matched in nature and scope until the introduction of the extensive surveys of the prairie West almost a century later.

Nova Scotia

The hardships experienced by Major Holland and his family in America in the 1770s were typical of those suffered by people in the thirteen colonies who cherished their British heritage and citizenship. The temper of the revolutionary times was harsh, however, and the bitter hostility encountered in their American neighborhoods by the Loyalists drove the latter in large numbers to seek a new land and a new life. It was natural that these United Empire Loyalists, as they came to be called, regarded Canada as their logical destination. Many were attracted to Nova Scotia where relatively little land settlement and development had been achieved (at least in that part which is now New Brunswick) since Sir William Alexander's abortive 17th century colonization project at Port Royal. Halifax and Lunenburg had been founded in 1749 and 1753 respectively and a number of farming and fishing communities, largely Scots and New Englanders, had come into existence from 1760 to 1780.

Seigniories represented the land-holding pattern in the St. Lawrence Basin from the earliest days of European settlement but the seigniorial system was not entirely unknown in other parts of Canada. Several seigniories had been established in Upper Canada in the early 18th century and by 1703 some fifty seigniories were to be found in what we now know as the Maritime provinces, exclusive of Newfoundland. Some of these holdings had never been effectively settled and had been abandoned. The seigniorial rights of Charles de la Tour, for example, comprised two seigniories in the Cape Sable region; also the seigniory of Annapolis and that of Minas. There was also the important seigniory of Chignecto and the tiny one at Cobequid. Between the years 1699 and 1703 the French government conducted a review and revision of seigniorial titles in Acadia, culminating in the royal decree of March 20, 1703.[3]

About 20 of the 50 aforementioned seigniories did not come under the 1703 decree. Those excepted lay, for the most part, along the St. Lawrence Gulf coast, extending

from the Strait of Canso to Gaspé. The decree dealt mainly with seigniories situated along the St. John River.

Following the cession of Acadia to England under the Treaty of Utrecht (1713) it was not the policy to dispossess Acadians remaining in the region but it was felt at London that terms of land-holding might be made to accord with Anglo-Saxon usage, with unimproved lands considered as Crown Lands. But the new rulers of the territory never fully grasped the extent of French seigniorial land grants in Acadia.

Any serious study of Nova Scotia land settlement during the first half of the 18th century cannot be divorced from consideration of the timber-cutting policies of the British government in the province. The British Admiralty made certain that its vital requirements would prevail and so it was decreed that Nova Scotia lands would not be opened for settlement until a total of 200,000 acres of woodland suitable for the production of mast timber for the Royal Navy was first "marked out by Her Majesty's Surveyor General of the Woods in America in one or more parcels". The provision of such an immense acreage for this purpose was unique to Nova Scotia.

The earliest official reference to any proposed British survey operation along Nova Scotian coasts is a rather fragmentary one. It is found in a communication dated August 16, 1721, from Governor R. Philipps to the Board of Trade: "Government sloop arrived only three days ago. No time for survey of eastern coast this summer".[4] This message had reference to the *William Augustus* built in Boston earlier in 1721 as a survey vessel for use along the coasts and in the harbors of Nova Scotia. The sloop had been constructed on the advice of a naval captain, Thomas Durell. In subsequent seasons this survey was carried out under Capt. Durell who prepared maps and charts related to his examinations. In doing so he revealed special gifts as a cartographer. Two of his productions are still on record. In the Public Archives of Nova Scotia there is "A Draught of Torrington Harbour" (the earlier name for Halifax Harbor) on a scale of 3 miles to 2⅜ inches. This is regarded as the finest map of the port and of Bedford basin ever made up to the establishment of Halifax in 1749. Durell's "A Chart of the Sea Coast of Nova Scotia Accadia and Cape Breton . . . 1736" on a scale of 5 miles to 1¼ inches, is in the Colonial Office records, London, England. These surveys and resulting maps form a noteworthy link in the chain of developments culminating in the founding of Halifax and the beginning of British settlement in Nova Scotia.

Probably the first recorded grant of Nova Scotia land relates to the issue to a Major General Cosby, Lieutenant Governor of His Majesty's garrison at Annapolis Royal, of a plot of ground on Canso Island, an area of about an acre, granted on the basis of a yearly rental of two shillings and sixpence, payments beginning on August 24, 1722.

What may well constitute the earliest existing legal description of real property in any English-speaking part of Canada is to be found in the minutes of October 8, 1731, of His Majesty's Council of Nova Scotia: Governor Armstrong had advised the Council that Major Paul Mascarene had presented him with a petition for a "Plott of Ground Scituated W.B.N. ½ N. from the fort of Annapolis Royall Distance 371 Yards by 67 Perch Containing in the Whole Eight Acres and five Perch as *per* the Plan thereof Upon file lying Upon the N.N.E. Side of the Road going up the Cape Bounded on the WBN Side by the Whitehouse ffeild and on the ECS Side by Ground belonging to Anthony Bellivo . . ."[5]

On October 14, 1731, the Council provided for the publication of the Governor's order among inhabitants of the area and provided that *"Governor* Armstrong should Explain to the Deputys y^{t} part thereof Relating to their Employing the Kings Surveyor that none of them may be made to believe *that he is to do it for Nothing"*. (author's

italics) Apparently all Council members felt that in order to avoid vexatious legal actions over property boundaries as well as to better ascertain the boundaries of each man's property, the lands ought to be first surveyed in line with royal instructions.

The first casual indication of the presence of a Surveyor General in Nova Scotia is found in a letter dated August 4, 1738 from Governor Armstrong to Council Secretary Shirreff.[6] "This is therefore to Acquaint you that for the future You are not to make Out a Patent or any Other Survey or Estimation then made by the Surveyor Gen. Col. Dunbar or One of his Deputys . . ." This isolated reference probably relates rather to a military rank of those days than to any civil government official.

It should be noted that two years before the signing of the Treaty of Utrecht one Charles Morris was born in Boston (June 8, 1711), the child who was to become the first of a line of distinguished surveyors of that same name and the founder of a family dynasty of Nova Scotia surveyors general. Young Charles grew up on his father's farm near Hopkington, Massachusetts. In all probability Charles was trained in surveying under Governor William Shirley of that New England state. The history of Nova Scotia land surveys from 1749 to 1781 is to a large extent the story of the first Charles Morris.

On Governor Shirley's instructions Capt. Morris proceeded from Massachusetts to Nova Scotia in 1745 to undertake a survey of all that region with a view to providing information and guidance to the authorities on any proposal to populate the province with English settlers. This survey proved to be of the utmost value to the colony and to the Board of Trade and Plantations. Governor Shirley in writing to the Duke of Bedford, highly recommended Morris for further service in Nova Scotia. Doubtless this action led to the Bay of Fundy survey by Morris three years later. At the first siege of Louisbourg (1745) Morris served under Pepperrell as Captain of the Provincials. He narrowly escaped death when he and his troops were ambushed in 1747 at Grand Pré by the French.

In 1748 Capt. Charles Morris re-enters upon the stage of this narrative when on December 8 he was ordered by Governor Shirley of Massachusetts to take the sloop *Eagle* for a survey expedition into the Bay of Fundy. With Morris on this undertaking was John Gorham, later to play a significant role in the general development of Nova Scotia. After the expedition Morris submitted a comprehensive plan of his survey to the Governor who, in turn, transmitted it to the Board of Trade and Plantations in London.[7]

British efforts to bring about settlement of Acadia met with little success in the more than quarter-century following the Treaty of Utrecht. Not, in fact, until advertisements appeared in the English press in 1749 did the settlement situation improve. These advertisements held out "proper encouragement" to discharged army and navy veterans to emigrate to Nova Scotia. Parliament voted £40,000 in support of the movement and on May 9, 1749, the aristocrat Col. Edward Cornwallis was named Governor of Nova Scotia. With an advance party of settlers he arrived in Chebucto Bay, now Halifax harbor, in June, 1749. By July 1 some 2,500 more immigrants had arrived on 13 transports. On July 14 a civil government had been organized. Among the Governor's first councillors was Capt. John Gorham, fresh from the Bay of Fundy survey.

The new town of Halifax, named in honor of George Montagu, Earl of Halifax and president at that time of the Board of Trade and Plantations, was located on the west side of the harbor. The formidable task of fortifying the dominant hill, clearing the forest, and constructing dwellings was commenced. On August 8 a proclamation was issued calling a meeting of heads of families for the purpose of allotting farm land and town lots. The townsite was selected and laid out by Capt. Morris and John Bruce,

FIGURE 13. Founding of Halifax. Governor Cornwallis plans settlement's fortifications with John Bruce, engineer, following arrival on *Sphinx*, July, 1749.

a military engineer. On September 25, 1749, the first Charles Morris was made Surveyor General of the province.[8] In that same year one George Washington was commissioned a surveyor in Virginia and the year marked the birth in Winston, Durham, of Aaron Arrowsmith, who became the most famous map publisher of his time.

Land registry records of ancient vintage indicate that the peninsula on which most of Halifax is located was initially subdivided in eight parts and laid out in lots in 1749. The eight subdivisions were named Collier's, Foreman's, Ewer's, Galland's, Callendar's, Foreman's North, South Suburb and Fish Lots (on the North West Arm). The pattern consisted of blocks of lots, identified by letter and number. Cards were issued bearing these symbols and land ownership was determined by lottery. When drawn by a settler the card conveyed legal title to the holder of the lot indicated thereon.

The streets of original Halifax were made 55 feet wide and were not designed for vehicular traffic. In fact, at the time these streets were laid out sedan chairs were still in use. Vehicular traffic did not appear in Halifax until the end of the 18th century.

Newly-founded Halifax had become the site of the provincial capital, the transfer being made from Annapolis Royal in 1749. At that time the province consisted not only of the peninsula of Nova Scotia but also of what is now known as New Brunswick and Prince Edward Island but not Cape Breton Island. Not until 1759 was the peninsula part of the province divided into five counties, namely, Halifax, Annapolis, Kings, Cumberland and Lunenburg. With the establishment of Halifax as the seat of the provincial government the granting of lands began in earnest and reached a peak between 1759 and 1765. During that period at least each of 20 individuals received holdings of 100,000 acres or more. In 1759 alone some 1,200,000 acres of Nova Scotia lands were granted

and in 1765 more than one-fifth of the total arable area of the province, or some 1,500,000 acres, was distributed. It should be noted that in that same year more than a million acres were granted in what is now New Brunswick.

By 1752 the population had grown to 4,000. That was the year in which Canada's first newspaper appeared. A plaque in Province House, Halifax, today proclaims that "nearby is the site of the first printing press in British North America, established in 1751 by Bartholomew Green. On it was printed on March 23, 1752, the first newspaper *The Halifax Gazette . . .*"

At this significant stage in Nova Scotia's growth the name of a pioneer surveyor and mapper comes into prominence. In 1733 Governor Armstrong had ordered George Mitchell "to survey the woods and lands lying on both sides of the Annapolis river from the Gutt upwards, duly distinguishing between . . . the cultivated and uncultivated parts."[9] As a result of this survey Mitchell produced a remarkable map of the Annapolis Basin and River. The map legend: "Surveyed in the year 1733, correction from other surveys-1753". The scale of this map is one inch equals one mile. The map is sufficiently accurate to enable identification to be made of the principal Acadian settlements of that time. The name of the surveyor is not inscribed on this map but it is without doubt the work of George Mitchell. However, as pointed out by W. F. Ganong, the eminent New Brunswick authority on early Canadian cartography, it is uncertain just how much of the map is his own work and how much belongs to the "other surveys" of 1753.

On October 2, 1758, the first Nova Scotian Assembly met, the first gathering of its kind in English Canada. As early as 1761 Acts were passed by this body involving services of surveyors. Examination of this legislation reveals that the term "surveyor" in those days had a much wider connotation than the modern word. There were "surveyors" of fish and of lumber as well as of highways and land. In 1761 an Act (ch. 14, George III) was passed concerning "the repair and mending of Highways, Roads, Bridges and Streets and for appointing Surveyors of Highways Within the Several Townships of the Province".

Chapter 2 of the statutes of 1765 provided for the *appointment* of Surveyors of Highways. A jury was to be summoned to view and lay out needed public highways, such highways not to be less than 100 feet wide. A 1762 Act (ch. 8, George III) dealt with the appointment of officers to survey barrels, staves, hoops and boards in connection with the exportation of fish. The materials were to be viewed, surveyed, measured and marked by these officers. It is clear that the term "surveyor" appearing in these laws, is not being used in the modern technical sense of the word.

During the years 1760 to 1765 an all-important movement of settlers into the Nova Scotian peninsula took place. This New England of pre-Loyalist immigration, as it is commonly known, exceeded in lasting influence within the province the Loyalist influx a score of years later. The New Englanders came with enthusiastic governmental blessing. Before the Seven Years' War ended the administration of Nova Scotia began to cast about for fruitful sources of suitable immigrants for large-scale settlement of the province. The dispersion of the Acadians had greatly sharpened the need for newcomers. New England was regarded as a most promising recruiting ground because the people there were accustomed to pioneer life. In addition, many of them knew Nova Scotia from first-hand experience and could more readily visualize conditions and possibilities.[10]

Hundreds of New England farmers and fishermen showed keen interest in coming to Nova Scotia but cannily obtained government guarantees of religious and civic freedoms before making their move. The first such settlers arrived in the spring of 1760.

For several years thereafter others followed in a steady stream, most from New England. Their roots grew deep in their new surroundings. Many of the communities they formed have continued in existence to the present day.

By this stage in provincial history the granting of land by townships had become accepted practice. Generally these townships consisted of 100,000 acres and were granted to settlers collectively. Following a survey of external lines of the township, government responsibility in the matter of land division ceased. These townships consisted of individual shares or rights, often representing 500 acres. But the actual division into lots was left to the settlers themselves, frequently operating through Proprietors' Committees for this purpose. But the size and nature of the lots differed with various townships. As a rule lots were reserved in townships for church and school purposes and for parade grounds to provide for militia training and displays. For any lot surveys, whether farm or town, the surveyor was responsible, not to the government, but to the township committee. For this reason plans and field notes of those early surveys were, more often than not, burned or lost.

In general, then, New Englanders replaced Acadians in the Annapolis Valley, Minas, Cobequid and Cumberland districts. Usually each settler received, in addition to his basic grant of land, a part of cleared upland and a woodlot. The marshlands of the Chignecto Isthmus received, in relation to its area, the smallest number of New England settlers. But New England fishermen, families from Cape Cod and Nantucket, settled in large numbers along the south and west coasts of Nova Scotia, in townships such as Yarmouth, Barrington, Liverpool and Chester.

People from the Old World also came during this period to make new homes in the province. Some one thousand Yorkshire immigrants came in eleven ships to settle in the Chignecto country. Some two hundred Highland Scots on the ship *Hector* landed at Pictou in September, 1773, the commencement of important Highland immigration to Nova Scotia, and especially to Cape Breton. Scotch-Irish people, some of them from New England, others straight from Ireland, settled in the townships of Truro, Onslow and New Dublin. All settlers in pre-Loyalist areas were Protestants. These settlements were separated from Halifax and from each other by dense forests. Communications were very poor although Halifax and Windsor were connected at that time by a road of sorts.

In 1765 an Act (ch. 1, George III) for the Choice of Town officers and the Regulating of Townships provided that "the original boundary lines of each and every township or district . . . shall be run betwixt township and township and marks renewed once in three years by the surveyors of lines and bounds appointed for respective townships" (section 3). Section 4 of the Act provided that each and every proprietor of lands "shall once in two years run the lines, make and keep up the boundaries of such lands by stones or other sufficient marks, on penalty of 20 shillings fine". In this section there is reference also to Fence Viewers, a term that appears in later legislation in other parts of Canada and pertaining to the task of maintaining property boundary lines in good repair. Also in this Act the various types of surveyors are listed for each township: 2 [land] surveyors; 4 surveyors of highways; 4 fence viewers; 4 surveyors of fish; and 4 surveyors of lumber and cordwood. Boundary lines in each township were to be run and marks of same renewed every three years, or two years in the case of privately owned land.

It is likely that in the drafting of these pioneer measures on surveying Charles Morris, Nova Scotia's first Surveyor General, was carefully consulted. A reliable and experienced surveyor he was, however, without any legal training. He is probably the only man ever to become a Chief Justice anywhere in Canada without having been a

member of the bar. If such an achievement does not represent a fulsome tribute to the legal profession, neither is it any reflection on the versatility of a well-qualified surveyor.

Charles Morris, in 1752, was appointed a judge of the Inferior Court of Common Pleas in Halifax. It should be pointed out that a judgeship in those far-off days did not possess the elevated status it acquired much later. In relative prestige the position could best be compared to that of a present-day magistrate. On December 30, 1755, Judge Morris was appointed a member of the Executive Council of Nova Scotia. Then in order to fill a temporary gap in the succession of Chief Justices of the province he was named Acting Chief Justice for a period of two years, 1776 to 1778.

The place of Charles Morris and his direct descendants in the survey history of Nova Scotia is a unique one. For more than 100 years, with hardly a day's interruption, four Morrises held the post and title of Surveyor General of Nova Scotia. That distinction was never bestowed upon any other person in the history of the province as the title was abolished before the last member of the Morris dynasty passed from the scene. The second Charles Morris was born in New England on December 31, 1732. It is recorded that he was named Surveyor General of Nova Scotia the day of his father's death, so that there was no hiatus whatever in the succession. The day after the second Charles died (January 26, 1802) his son, Charles Morris the third succeeded him. He retained the office until some months before his death in 1831. On April 6, 1831, his commission was revoked and his son, John Spry Morris (born in 1795), was appointed Surveyor General the same day.[11] The post of Surveyor General of the province was merged with that of the Commissioner of Crown Lands in 1851. Actually, John Spry Morris had been Commissioner of Crown Lands (exclusive of Cape Breton) since 1827.

An interesting sidelight on the Morrises is that the second Charles, despite the fact that he was Surveyor General, became a candidate for election in Halifax in 1788 and won by a majority of 141 over his opponent, Mr. Sterns. But as a result of the bitter class feeling to which reference has already been made, a serious riot followed on the election result. The older settlers battled the recently-arrived Loyalists in a wild free-for-all and many persons suffered injury.

Another notable figure in the surveying and mapping story of early Nova Scotia was an Englishman, Capt. William Owen, R.N.* Capt. Owen accepted an invitation from Sir William Campbell to accompany him to Nova Scotia as secretary when Sir William was named Governor of that province in 1766. On May 29 of the following year he toured Cape Breton and St. John Islands with the Governor and in September, 1767, accompanied Sir Thomas Rich on a tour of the province, exploring lakes and streams of the Shubenacadie River system and the south shore of Minas Basin.[12]

In 1761 the British government, as has been noted, instituted a policy of conveying large grants of American colonial lands to retired army and naval officers as reward for their services and to aid in promoting settlement of the colonies. In the winter of 1766 Capt. Owen petitioned the government at Halifax for a grant "of land at Passamaquoddy" and this was granted on March 13, 1767, and included Passamaquoddy (Outer) Island in the Bay of Fundy. Capt. Owen lived at Campobello in the years 1770 and 1771 only, but he did bring English settlers to the island. A son, later to become Admiral Sir Edward W. C. Rich Owen, was born on Campobello Island on February 19, 1771. A second son, who became Admiral William Fitzwilliam Owen was to play a notable part in the marine surveys of the Great Lakes during the early years of the

*Capt. Owen was a veteran of the Indian Campaign and had lost an arm at Madras.

19th century. Probably the greatest contribution made by Capt. Owen to the development of surveying in British North America was his custom of keeping a Journal of his explorations and travels, an account that never failed to stir the imagination and ambition of his son William during his boyhood days.

Another outstanding personality in 18th century Halifax was Sir John Wentworth (1737-1820) who made exciting history in many ways, not the least interesting being his dual accomplishment as Governor of New Hampshire and of Nova Scotia at different periods of his career. Sir John was the son of a wealthy merchant of Portsmouth, N.H. He was named Governor of the American colony on August 11, 1766, in succession to his uncle Benning Wentworth. At the same time he received a novel commission as Surveyor General of the King's Woods in all North America.* He took the latter assignment very seriously, landing at Charleston, South Carolina, in March, 1767, and travelling northward, registered his commission as special surveyor in each of the colonies, reaching New Hampshire in June. Like Samuel Holland, John Wentworth was a zealous Loyalist. Like Holland also he was treated very roughly by the revolutionists. His home was pillaged in 1775 and he was compelled to seek refuge in Boston. Eventually he left America, remaining in London until 1783 when he received a new and somewhat modified commission as Surveyor General of the King's Woods. On May 14, 1792, Wentworth was made Lieutenant Governor of Nova Scotia, and three years later was created a Baronet. A popular figure in Nova Scotia, his administration of its affairs was marked by energy and skill. He invited some criticism, however, by filling his council with his own close connections, but he was extremely loyal to anyone whom he regarded as competent and in whom he had become interested.[13]

As Loyalists continued in large numbers to pour into Nova Scotia from New York, the demands for surveys grew apace. Land allotment and land tenure procedures were formulated in great haste. In the development of land regulations during the early 1780s, in essence six documents were required in the rather involved process of obtaining a simple grant of land. In brief, the steps to be taken in this connection were as follows:

1. The prospective grantee petitioned the Governor for land, sometimes specifying the particular plot desired.

2. The Governor, sometimes after consulting his Executive Council, initialled the petition and sent a warrant or order to the Surveyor General to survey a certain tract of so many acres.

3. The Surveyor General, or more usually one of his deputies, having surveyed the same, returned a description of the land to the Governor and also sent a copy of the surveyor's report to the Surveyor General of the King's Woods to discover whether any or all of the land in question had been reserved for naval purposes.

4. The Surveyor General of the King's Woods issued a certificate which was sent with the warrant to survey and the surveyor's report to the Provincial Secretary's office where the actual grant was made out, signed by the Governor. Only then did the patient grantee acquire legal title to the land.

The documents involved, therefore, in this procedure included the petition, warrant to survey, surveyor's description, surveyor's report, surveyor's certificate and the draft of the grant itself. Today in the surviving records of the province it is not often that all of these papers are available as proof of legal title. Quite often the petition and the surveyor's report are missing. After 1785 the Attorney General of the province usually affixed his fiat on the back of the warrant to survey.

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*The official responsible for conserving woodlands to insure a reliable supply of masts for the Royal Navy.

Some 1,488,871 acres in all were escheated (forfeited) to the Crown in the right of the province between 1783 and 1788 and on these lands along with one million additional acres legally re-vested in the Crown, the Loyalists and disbanded army and navy veterans of the Revolutionary War were settled.

The Loyalists who, at the outset of the great movement, flooded into Canada were from many professions and trades including jurists, physicians, lawyers, surveyors, bakers, wine-merchants, wig-makers, snuff dealers, gunsmiths, silversmiths and barbers. There were ladies in silk and in homespun, the dignified and the flippant, the useful and the not so useful. But all demanded properly surveyed lots, and in a hurry. Winter would come all too soon and action from surveyors was expected within a month or two. Surveyors at their careful work were badgered by the impatient and occasionally assaulted by irate settlers. But it is likely that no surveyor suffered more at the hands of those he tried to benefit than Benjamin Marston (1730-92).[14]

Marston was a Tory and therefore a true Loyalist. He was born in Salem, Massachusetts in 1730 and educated at Harvard College, obtaining a degree in arts in 1749. It is not evident from any existing record that Marston was a fully trained surveyor. He may have picked up the fundamentals of surveying at Harvard and with a natural aptitude for the profession, could perform creditably in the role. In any event the first Charles Morris, Surveyor General of Nova Scotia at the time, engaged Marston as a Deputy Surveyor. In a diary faithfully kept by Marston the April 21, 1783, entry reads: "This day Charles Morris, Esq., engaged me to go to Port Roseway [Shelburne] to assist in laying out a new Township there". On that same day Governor John Parr of Nova Scotia approved the plan of the town. The streets were to be 50 feet wide and laid out at right angles.

The Loyalist descent on Shelburne, located near the southeast tip of the Nova Scotian peninsula, is one of the most impressive incidents in the long history of Canadian surveying and settlement. At the peak of the influx of Loyalists (1784) the population in this locality reached 12,000. This concentration of people made Shelburne not only one of the largest towns in British North America but was exceeded in total population only by Philadelphia, New York and Boston on this continent. Within one year after its founding Shelburne equalled in population Montreal, Quebec and Three Rivers combined and was considerably larger in that respect than a combination of Halifax, Saint John and Charlottetown. At one stage of its development Governor Parr seriously considered moving the seat of provincial government from Halifax to Shelburne. John Parr (1725-91) had become Governor of Nova Scotia in 1782, remaining in office until his death. He was the last to hold the title of Governor, as the title of the position was changed to Lieutenant Governor in 1786.

In the Shelburne area in 1783 hopes and enthusiasms as well as tensions ran high. On April 28 Marston, along with one William Morris, embarked for Port Roseway. Next day they called at Lunenburg for a set of surveying instruments. They arrived at their destination on May 2 and spent the following day exploring the vicinity. Marston found soil conditions better than he had anticipated.

The first rumblings of possible trouble in the embryo community are found expressed in Marston's diary entry of May 8: "The multitude object to the place which the Captain and Chief Men have chosen for the situation of the town because, they say, 'tis a rough, uneven piece of land . . ." Marston showed a rigid Tory attitude toward the tendency of the settlers to attack all their problems by committees. "This cursed republican, town-meeting spirit has been the ruin of us already . . . Mankind . . . oftentimes [possesses] too much liberty. Today surveyed the shore on the Eastern side

of the N.E. harbour where it was determined to fix the town". On May 9 Marston's diary entry notes: "According to the determination of Thursday, laid out centre street of the new town and the people began very cheerfully to cut down the trees, a new employment to many of them".

The diary continues. May 14: "Ran one line today. People turning very indolent, some parties not at work until 11 o'clock". May 16: "This day began to mark out some blocks into house lots. People inclining to be mutinous". May 18: (Stephen Binney, custom collector, having joined Marston and Morris in their surveyors' tent) Marston comments: "He won't live long with us, our fare is too hard, our apparatus too indelicate and coarse". Saturday May 24: "Thursday last the people drew their town lots . . . Some grumble, some are pleased." May 29: "The idea of owning land is some how or other exceedingly agreeable to the human mind. Some whose lots have fallen to them in not so pleasant places are much out of temper, and some designing ones who have missed the advantageous situations, are likewise dissatisfied. Came home late in the afternoon, smutty and fatigued".

During May and June of 1783 William Morris directed survey operations. Later this function was transferred to Marston who by then had Messrs. Mason, Lyman and Tully as assistants. At this stage of proceedings Marston stood high in the esteem of Governor Parr. It was Parr who named the new settlement Shelburne in honor of Lord Shelburne, the cabinet minister at London directly responsible for the peace negotiations under which the 13 original American colonies obtained their independence. Naturally

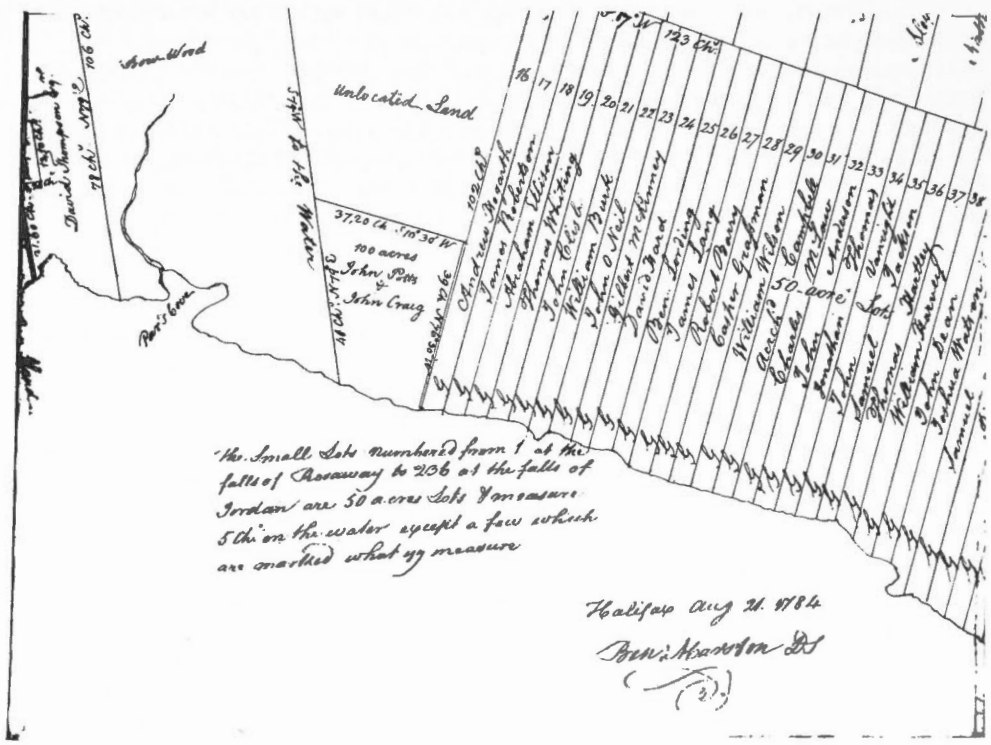

FIGURE 14. Part of Benjamin Marston survey of Shelburne Townsite, Nova Scotia, 1784.

enough not all the Loyalists shared the Governor's enthusiasm in this respect. Marston's diary resumes: Aug. 10: "Rec'd a packet from the Surveyor General's office, got two blank commissions for our Deputy Surveyors, the form of oath and a new plan of the town and its environs. The reserves in the new plan entirely deranges all that has yet been done towards settling persons in the farming line . . ."

Entries in Marston's diary up to the end of 1783 reveal increasing difficulties of surveyors and others engaged in settlement activities. For one thing the number of people who actually came to Shelburne greatly exceeded the most optimistic expectations of Nova Scotian authorities. As new arrivals increased the first modest town plans had to be enlarged. The most undesirable elements were among the last to arrive from the States and these drove Marston to complain in his diary that "These people are the very worst we have had yet; they murmer and grumble because they can't get located as advantageously as those who have been working hard these four months".

The spring months of 1784 brought a lively resumption of surveys, including the environs of Shelburne. May 1: "In the woods till 4 p.m. running the base lines for lots to be laid out". July 26: "Great riot today. The disbanded soldiers have risen against the Free negroes to drive them out of Town because they labour cheaper than they—the soldiers". July 27: "Riot continues . . . This morning I went over to the Barracks by the advice of my friends who find I am threatened by the Rioters and in the afternoon took passage to Halifax . . . arriving on 29th. August 4: "If I had been found, I . . . should have been . . . hung, from all I have heard".

August 18: "A ship from England, by which we learn this Province is to be divided, and a new government erected on the western side of the Bay of Fundy by the name of New Brunswick. If I can get some employment in the new Province, I shall choose my residence there . . ." August 31: "The Governor [Parr] returned from Shelburne, where he has been to settle the disturbances which have arisen. To answer some purpose with his Dear Shelburnites he has been pleased to throw a great deal of blame on my conduct". Sept. 7: "Presented a memorial to Governor Parr this day and date requesting a publick inquiry to be made into my conduct while Chief Surveyor at Shelburne. He says only in general that every body accuses me of the most corrupt partial conduct while in my office of Chief Surveyor".

Actually Benjamin Marston had many friends and sympathizers at Shelburne but the Governor's mind was firmly made up and he reported adversely to Lord Sydney concerning Marston's conduct. Governor Parr, in all likelihood, was over-hasty in passing judgment on Marston who, whatever his faults, was not self-seeking. He had left Shelburne, as he had come to it, a poor man. The letter to Lord Sydney resulted in his dismissal from the public service. Marston could be excused for feeling that this strong action was based more upon motives of expediency than on principles of justice.

Despite considerable social unrest, development of the settlement at Shelburne continued to be rapid. The first location of people on town lots occurred on May 23, 1783. By the following February some 1,130 houses had been built. By the autumn of 1784 the total number of house, store and wharf lots exceeded 3,000. In addition, 800 county lots of from 500 to 750 acres each had been occupied. Fortunes were recklessly spent on extravagant structures. The land surrounding the townsite was not particularly favorable to cultivation. In any case most of the newcomers were quite unfit for farming or fishing. In the space of two years it is estimated that upwards of £500,000 had been poured into this unpromising community venture.[15] As the hard realities of life in that locality gradually replaced the rosy dreams of the town's founders,

its people began drifting away to other parts of Canada, leaving behind them a ghost town of crumbling homes, weed-infested streets and a depressing aura of decay and desolation. Today's Shelburne, a solidly based, attractive community of modest proportions, is in marked contrast to the almost completely abandoned town of the waning years of the 18th century.

The Shelburne surveying and settlement project must be considered as a special case. It had a spectacular rise and fall. But for the most part Loyalists settled peacefully and permanently in Annapolis, Digby, Granville, Guysborough, Cumberland and other districts in the province. The need for establishing, on an emergency basis, suitable townsites for thousands of newcomers, provided Nova Scotians with new insights in regard to the problems and responsibilities of provincial surveyors. In 1793 (ch. 8, George III) the Council and Assembly passed "an Act to enable the Deputy Surveyors of this Province, to administer an Oath or Affirmation, if Quakers, to such Persons as may be employed under them, as Chain Bearers in Measuring Lands". This legislation provided that where there was no Justice of the Peace within two miles of the place where the survey was to be made, the land surveyor was authorized to swear in chain bearers.

In the previous year Governor Wentworth, through the Surveyor General, the second Charles Morris, issued interesting instructions to one M. Archibald, a Deputy Surveyor, ordering him to "proceed with two or three active men, from the Head of the Musquedoboit River, to the East River of Pictou, and Blaze the Trees all the Way, where it may be proper for the Road to pass". The importance of opening up this highway from Halifax to Pictou was strongly emphasized in the communication.[16]

Not a great deal is known about early survey methods in Nova Scotia but it is generally accepted that practically all such land surveys were accomplished by elderly seamen using marine compasses. Often property boundaries were described in field notes in marine terminology. Only occasionally, it seems, were pioneer Nova Scotia land measurers properly trained in surveying.

Entries in the Journal of Valentine Gillis during the course of his surveys for the Shubenacadie Canal System, 1814-15, vividly delineate in laconic terms some of the rigors of surveying in those rugged times:

"Monday, July 25, 1814. Began with Circumferentor subdivided and a statute four pole chain at Ervines Bridge. . . .

"Monday, February 20, 1815. Continued the survey of Lake William. From this proceeded to Cormers House on side of Lake having walked twenty miles and being much fatigued expected the consolation of a good fire and a good soft plank to stretch upon, but how great our disappointment and surprise on entering the Hut I found the Old Man John Shane who had been left to take care of the place, dead. He was frozen to death I suppose three weeks before that. . . . There was no alternative so I took my abode this night with John and early next morning continued the survey. . . .

"Thursday, July 11, 1815. This afternoon renewed the survey after one of the most dreadfull Thunder Showers I have ever experienced in my life. The hand of heaven was truly visible in protecting us, the trees over our heads was struck with lightning, we strongly smelled the sulphur and had we reached the shore one minute sooner, we must have been struck also as the lightning entered the ground at our landing place".

Among the Loyalists who came to the Halifax area in 1783 were two very close friends, the Congregationalist ministers, Reverend Theophilus (Theo) Chamberlain (1737-1824) and Reverend Titus Smith (1734-1807). Both had been students at Yale University, graduating within a year of each other. Chamberlain received a commission

in the British Army and on the evacuation of New York was given a special commission by Sir Guy Carleton to take a group of Loyalists to Halifax. Smith accompanied him. Chamberlain was appointed by the second Charles Morris as Deputy Land Surveyor and instructed to lay out Preston township near where Dartmouth now stands. Chamberlain, a warm friend of Sir John Wentworth, received a grant of 1,000 acres in the area, and Smith, 500 acres. Chamberlain took part in occasional surveys. He had several sons, one of whom became a Deputy Surveyor.

Reverend Titus Smith was more the philosopher than a man of affairs in the country of his adoption. During the early days of the American Revolution his knowledge of chemistry was brought to the attention of George Washington who asked him to make gunpowder for the Continental Army. But he refused, being opposed to war on principle. In Nova Scotia he, like Chamberlain, was befriended by Sir John Wentworth, who presented him with a complete set of botanical works of Linnaeus. These books greatly influenced the career of Titus Smith Jr.

Titus Smith Jr. was born at Granby, Massachusetts, on September 4, 1768, and lived with his father at Preston following his arrival in Nova Scotia at the age of 15. When not occupied in clearing land, constructing stone walls, and cultivating the farm, young Titus read the classics and studied botany. In the last decade of the 18th century he became a land surveyor, a profession he practised from time to time thereafter. Basically he was a farmer by occupation, a surveyor by avocation, a scientist, philosopher and writer for recreation.[17] As a skilful practitioner of surveying and map making he could also be described as a geographer.

As the 19th century dawned, the government of Nova Scotia found it needed urgently a good map as well as reliable information of the then largely unknown interior of the province. This interior wilderness, although travelled to some extent by hunters, trappers and timber-cutters, was the subject of conflicting and none too reliable reports. The sea and the forest provided the main sources of livelihood for new settlers. Industries were needed to develop these natural resources. Thus in 1801 the provincial government asked Titus Smith Jr. to make a tour of Nova Scotia to discover such places "as are best calculated for producing hemp and furnishing other naval stores, to report on the quality of the land and character of the timber, especially that suitable for masts, and to establish the quantity of acres which could be rendered fit for cultivation". In effect what was requested was a land-use and natural resources survey without the benefit of any of the modern equipment and methodology we take for granted in the mid-twentieth century, or even of a moderately good base map. For his efforts Titus Smith was to be paid at the princely rate of 11 shillings and sixpence, Halifax currency, or about $2.35 per day.

Titus Smith spent more than 150 days in the woods and more than 200 days away from his base of operations during the two field seasons of 1801 and 1802. He made the entire tour afoot, equipped with brief instructions, a compass, a rough sort of map and what he could carry to maintain himself throughout the journey over some of the most challenging wilderness areas in North America. His Journal of Survey and accompanying map are in the Public Archives of Nova Scotia in Halifax. The map, produced on a scale of 8 miles to an inch, he conveyed to the Governor of the province in his report. It remained the only reliable general map of Nova Scotia until 1835. In 1796, Titus Smith moved from Preston to Dutch Village, a suburb of Halifax. In subsequent years he became widely known as the "Dutch Village Philosopher". He lived for another half century in these surroundings and became an honored, respected figure in the colony. He gave evidence before Lord Durham's famous commission at Quebec in 1838. In addi-

tion to service as Secretary of the General Board of Agriculture in Nova Scotia, he wrote a weekly column for the *Acadian Recorder* over many years. He lectured and published learned papers on a wide variety of scientific subjects and became an authority on fisheries.

All things considered Titus Smith Jr. was an eminent surveyor, a wise observer of nature and a distinguished geographer of his times. But the work by which he is best remembered is his handwritten "Survey of the Eastern and Northern Parts of the Province in the Years 1801 and 1802 With General Observations thereon. Also a Survey of the lands between Sackville (Bedford) and Shubenacadie And Observations on the Western Parts of the Province with a list of trees, shrubs, grasses and plants. And Observations on the nature and uses of the trees". (Public Archives, N.S. Vol. 380)

In his physically active years, hardship was a constant companion of Titus Smith. His work as a surveyor often led him, for instance, into marshy land and it is said that whenever he obtained new boots he immediately bored gimlet holes into the soles in order to let out water that would seep in. In 1832 he surveyed and marked the then newly constituted boundary between the city of Halifax and the rest of the county, a straight line from the North West Arm to a brook at Fairview near Bedford Basin. He set up three survey monuments to establish the line. The last of these monuments was removed about 1914 to make way for a new railway line.

Not far from Dutch Village and near the suburb of Fairview is a simple memorial stone erected by friends of this grand old man of Nova Scotian surveying and mapping. The stone bears the brief and simple legend: "Titus Smith, died January 4, 1850, age 81".

There is no record of any protest by Titus Smith Jr. over the unimpressive rate of pay he received (for) surveying assignments but there were others in those times who were quite agitated over an issue of this nature when it affected them directly. While Surveyor General of Nova Scotia (1831-51) John Spry Morris wrote some lively letters to his superiors over what he considered to be grievously inadequate compensation for his combined duties as Commissioner of Crown Lands and as Surveyor General of the province. On April 2, 1847, he submitted a petition in regard to his salary to Earl Grey, Secretary of State for the Colonies.[18]

In the petition he observed that he had been appointed Commissioner of Crown Lands on May 4, 1827, and Surveyor General on April 6, 1831. He claimed that he was justly entitled to receive out of the proceeds of Crown Lands transactions an annual salary of £500 with an additional five per cent of surplus monies paid by him into the annual revenue of the province to an additional amount of £500 sterling. As his salary as Surveyor General was £150 together with certain fees imposed on all land grants (the latter amounts forming the chief source of his income) he was experiencing reasonable prosperity but in 1834, to his dismay, these fees were abolished. Surveyor General Morris complained that as he "was entitled to receive annually the sum of £1,150 from the united offices of Commissioner of Crown Lands and Surveyor General, yet it happened in consequence of the Sales of Land being of small extent, comparatively, that the full amounts to which he was entitled were never realized by him, but the average for the last two years has reached (to) £720 sterling".

The petition proceeded to point out that a recent provincial act provided that the Department on Cape Breton Island be abolished and its duties attached to the Halifax office. It also proposed to fix his emoluments at £400 . . . "a scale far below" that to which he had hitherto been accustomed to receive. He protested the unfairness of such a marked reduction "in view of his increased responsibilities and the impermanency of his salary".

Whatever hopes John Spry Morris nurtured, after the presentation of his petition, were rudely dashed by Bill No. 7 passed by the provincial legislature on November 29, 1851. This Act, relating to the Crown Lands Department, provided that the Surveyor General and Commissioner of Crown Lands shall hereafter be styled "Commissioner of Crown Lands". This marked the disappearance of the title of Surveyor General of Nova Scotia, never to be restored. The measure also provided that "it shall be the duty of the commissioner of crown lands to cause a survey to be made of all the crown lands within ten miles on each side of any line of railroad . . . such lands to be laid off in lots of one hundred acres each . . . and to prepare and cause to be lithographed, plans or maps of such lands, with the lots numbered, and the course of the railroad or of any streams or public roads running through same [to be marked thereon]". In so far as it dealt with surveys this legislation foreshadowed the establishment of a notorious railway belt on the other side of the continent in a province yet to be created. The British Columbia Railway Belt, more than a century later, bedevilled the politics and impeded the economic development of that part of Canada over a considerable period.

On December 9, 1851, Joseph Howe, the Provincial Secretary, wrote to John Spry Morris, calling attention to the passage of Bill No. 7, "a copy of which is enclosed for your information". Mr. Howe was a shade cruel in his accompanying comments. "The main object of the Legislature in passing this law", he stated, "was to throw on the Commissioner of Crown Lands and his deputies the duty and undivided responsibility of managing and disposing of the Crown Estate with a view to avoiding the uncertainty and delay which have hitherto characterized this branch of Provincial administration. With this in view, chapter 28 of the Revised Statutes has been repealed and the County Land Boards abolished".[19]

John Spry Morris replied to Howe with an air of injured pride. He took pains to explain, in a letter dated December 18, 1851, the difficulties that had prevented prompt performance of those heavy additional duties imposed upon him. "When a few years ago", he pointed out, "the duty of preparing grants of land fell on the Crown Land Office as well as the functions of the Department in Cape Breton, it is not surprising that business fell in arrears. It is not as if the whole Province had been correctly surveyed in lots, and plans of them were to be had. The fact is that from its first settlement there has been no regular, connected system of surveys, the lands generally were of so little value that the applicants hesitated about paying for the survey of them—and in order to induce them [to do so] they were allowed to be laid out in every variety of form, no fund being provided by the Government for this purpose.

"Another very serious evil in the Province is the constant intrusion upon the public lands by squatters who enter into possession and extend their improvements without any surveys being made. The consequences are in later years when circumstances oblige occupants to obtain titles, [we] have found it extremely difficult to lay out their lands in any regular form and until this [squatting] practice is put down, it will be almost impossible to prevent delay". John Spry Morris, in this melancholy recital, makes no protest over the disappearance of the title of Surveyor General!

In what turned out to be a valedictory of his career, John Spry Morris in concluding a Report dated February 15, 1853, wrote, "I have now been more than 35 years in this Department, of which period nearly 26 have been as head of it. During this long period I have always endeavored to discharge its onerous duties to the best of my ability, without reference to parties—and if circumstances should induce me to retire, shall carry with me the firm conviction that no person can justly accuse me of having done him wrong".

On September 19, 1853, he applied for leave of absence on the grounds of ill-health. On April 15, 1854, James B. Uniacke was named Commissioner of Crown Lands. John Spry Morris had been deposed. But he was not entirely crushed by this development and lived on until 1881, to the ripe old age of 86.

So much for quarrels on higher levels over rates of remuneration. It is interesting to look also at rates of pay received by those at the bottom of the survey staff structure in those days. Whitman Freeman, for example, was a very active surveyor in Nova Scotia in the early years of the 19th century. Some conception of the rates paid for survey work may be gleaned from a sample statement submitted by him on November 20, 1824, to the Surveyor General, the third Charles Morris. "For my time and Service . . . in surveying the Division Line of Queens and Shelburne Countys and part of the Rear Line of Lunenburg County . . . Surveyed between August 20 and November 5, 1824 . . .

"To hire of two Chainmen, one axeman and one Flag Bearer employed in the foregoing service, each 38 days at 4 shillings each per day . . . £30 8s.

"For Chopping and clearing the whole of the Dividing Line of Queens and Shelburne Countys four ft. wide distinctly marking the mile and half-mile posts (according to Instructions) 34 miles at 23 shillings 5 pence per mile . . . £39 16s. 2d.

"For my time and Service in the above Survey
38 days at 15s. per day . . . £28 10s. "

(Endorsed) "I do certify that the preceding account . . . appears reasonable, considering the nature of the Work thro a Wilderness remote from Settlements and intersected by Lake, Ponds, thick woods and other Obstructions and that all the persons employed found their own Provisions at their own expense . . ."

(Sgd.) Chas. Morris Surveyor General
Halifax, Dec. 7, 1824.

Prince Edward Island

In 1719 the first European colonists arrived on what is now known as Prince Edward Island, a land the Indians called "Abegweit" which has been translated "Cradled on the Waves". Two Normandy fishermen, Matthew Turin and Francis Douville, and their families, settled at East Point and St. Peters respectively. By the end of the 1720 summer season 17 families, or a total of 135 people, made their homes on the island. Eight years later there was a considerable influx of Acadians. By the time of the cession of the island to England in 1763 about 4,000 men, women and children inhabited the districts of Malpeque, Tracadie, Rustico and Souris.

Isle St. Jean, as it came to be known to the French, first fell into the hands of the English after the successful siege of Louisbourg in 1745 by the New Englanders. However, like Louisbourg, the island was restored to France by the Treaty of Aix-la-Chapelle, 1748. In the years immediately following the restoration some highly ambitious plans were made by the French to fortify the island but actual construction fell far short of official intentions. Col. Franquet, an officer of the engineers sent initially to help construct the fortifications at Louisbourg, visited Isle St. Jean and in connection with his 1751 report on its defences, drew a plan of Port la Joye (Charlottetown) and a copy of this map is in the Public Archives of Canada. Apart from his purely military activities Col. Franquet, with the trained eye of a surveyor, carefully noted and reported upon the appearance of the countryside, its products and potentialities as well as on the condition of the settlers themselves.

On returning to Port la Joye from a visit to St. Peters during that same year Col. Franquet found the French frigate *Gracienne* anchored at least a league outside the harbor. Her commander, fearful of grounding his vessel, was reluctant to enter the more sheltered but unknown waters. Col. Franquet accordingly arranged with the commander, Lieut. de Tourin, to sound the bay and prepare a chart of a safe course into the harbor. This is probably the first hydrographic chart made of this area.[21]

Following the signing of the 1748 treaty a fair number of Acadians came to the island. The exacting task of receiving the newcomers and assisting in their settlement fell upon Capt. Denis de Bonaventure. Letters from the captain to his superiors contain repeated appeals for a land surveyor, since the haphazard allotment of lands to settlers was creating distress and some strife. Apparently the island colony was without a competent surveyor and none was forthcoming from Isle Royale. Capt. de Bonaventure was supported in 1751 by Col. Franquet who recommended that the grievances of the inhabitants could be best dealt with by sending to them "an expert surveyor to settle land disputes here once and for all".

On Franquet's return to Louisbourg, Comte de Raymond was persuaded to visit the island. His visit instilled a general feeling of confidence among the settlers and he put an early end to boundary disputes by despatching surveyors to establish satisfactory property lines.

When Louisbourg fell in 1758 for the last time, Isle St. Jean was included in the terms of capitulation. Col. Lord Rollo and two companies of the 60th Regiment were sent by General Amherst to take formal possession of the island. This force arrived at Port la Joye on August 17, 1758. The nature and prospect of the land they found is well described by Capt. Holland in his reports connected with the 1764-65 surveys he supervised. Writing from his temporary residence at Observation Cove on October 5, 1765, Holland states: "Here is quick and frequent changes of weather, as rain, snow, hail and hard frosts succeeded each other in a very small space of time". Again later, in a letter dated August 19, 1766, Holland comments: "The soil on the south side of the island is a reddish clay, although in many places it is sandy, particularly on the north coast.... The Mountain Shrub and Maidenhair are also pretty common, of whose leaves and berries the Acadian settlers frequently make a kind of tea. The ground in general is covered with strawberries and cranberries.... In those places that have been settled and are still tolerably cleared, is very good grass but a great part of the island, formerly cleared, is so overgrown with brush ... that it would be extremely difficult to make it fit for the plough...."

In his October 5, 1765, report dealing with surveying activities Capt. Holland is at pains to explain that "the respective divisions of the island are, as near as possible, agreeably to my instructions. The divisions of the counties, parishes and townships, bounded by the magnetic north and south, or east and west lines, being the most easy way of running the lines for the survey is that which will be employed on this service, the natural situation of the island having favoured this method. It is not possible to divide the counties or parishes into more equal parts as the lines would otherwise have been too much confounded and confused ... it has also been observed in dividing the townships to give them a share of what natural advantages the place afforded. The two lots that could not be brought into any township are left undetermined. There are 520 acres reserved for the first lot.... The scale proposed to work with I was obliged to alter to that of 4,000 feet to the yard, as we found that (to be) sufficiently large and impressive ... but should any part be required to be of a still larger scale it shall be done whenever ordered — throughout the whole survey has been observed the greatest

exactness; and all rivers and creeks are surveyed as far as a boat or canoe could go, or the chainmen penetrate, but sometimes we were compelled to stop by inaccessible woods and swamps. . .".

Holland, in his reports, remarked favorably on the location of Port la Joye as being one of the best parts of the island for the establishment of a capital. In connection with his field work Holland received in 1766 several letters from important sources commending him. Secretary Pownal wrote on May 19: "I am happy in obeying the commands of my Lords Commissioners of Trade and Plantations to signify unto you their entire approbation of your conduct in the execution of the instructions you have received for the surveys of the Island of St. John, and of your diligence and despatch in the completion of this useful and laborious work". A letter in complimentary terms was also received that spring from one Richard Cumberland to whom Holland replied on August 19: "I can assure you it revived my spirits and gave me new strength to endure the fatigue I at this time underwent, as it was the first news of the arrival of my plans and therefore made me climb the rocks and wade the waters without thinking of dangers or weariness".[22]

As Holland's reports indicated, the Lords Commissioners of Trade and Plantations had ordered (on March 13, 1764) a survey and division of the island into counties, each as nearly as possible to contain 500,000 acres. The counties, in turn, were to contain parishes of 100,000 acres each. The parishes were to consist of townships of 20,000 acres each. In each county sufficient land was to be set apart for a townsite, with a proper location in that townsite of a church and a glebe for its minister.

It should be borne in mind that on October 7, 1763, by Royal Proclamation the Islands of St. John and Cape Breton were annexed to Nova Scotia. So far as St. John Island is concerned this condition existed for only six years. In 1769 the island was detached and despite its tiny population, was constituted a new province with a government established by authority of letters patent. This separation from Nova Scotia was one of the two main features of British imperial policy towards the island. The other feature was the decision in 1767 when the Lords of Trade and Plantations announced that 64 out of a total of 67 lots of 20,000 acres each would be made available to a number of favored applicants by lottery. Those successful in drawing one of the island lots would be expected, in return for the land, to encourage fisheries, pay a small annual quit-rent within five years, settle the land within ten years with at least one European Protestant to every 200 acres. In a single day of lottery, therefore, there was fastened upon this attractive island province a scandalous "absentee proprietorship" system of land tenure. This unfortunate imposition dwarfed the island's growth for a century and stirred up continuous friction and discord among its people until its abolition in 1877. Samuel Holland, for his services as Surveyor General was granted Lot 28. As a landlord he lived up to his responsibilities and settled a band of English farmers and disbanded soldiers on his property.

In May, 1768, Governor Michael Francklin of Nova Scotia took steps on instructions from Lord Hillsborough, Secretary of State in London, to have the sites of towns on the Island of St. John laid out. He directed the first Charles Morris, Surveyor General of Nova Scotia, and an assistant surveyor Isaac Deschamps, to proceed to the island to supervise the formidable task. The officer commanding at Fort Amherst, across the harbor from Charlottetown, was instructed to aid the surveyors by supplying troops. Morris proceeded to select the present site of Charlottetown for the principal town of the province and laid out the town plot and individual lots. Georgetown, designated as the capital of King's County, was surveyed at about the same time as Charlottetown and

on the same general plan, with all streets intersecting at right angles.

In a book published in England in 1806[23] the following description is given of the street system of the island's new capital: "the streets are laid out at right angles, those running from the river are 100 feet in breadth, the cross streets were originally laid out at 80 feet but have since been reduced to 40 feet in breadth. The building lots are 80 feet in front by 160 in depth. There is a common of 100 acres adjoining the town and with every building lot is granted a pasture lot of 12 acres".

Governor Francklin was happy to report to Lord Hillsborough on July 31, 1768, that progress was being made on the island surveys. He was satisfied that he was carrying out His Lordship's instructions as he understood them. After indicating the nature and scope of Surveyor General Morris's work at Charlottetown the Governor stated, "All officers of the (provincial) government have been hutted on the spot and are now building a little house, marked on the plan, to contain them during the winter. Some of the streets are opened, which will be attended with some expense to the government but it cannot be avoided and some few house lots have been taken up . . . Mr. Morris, by this time, has completed the laying out of the town for George Town whence he will proceed to Prince Town to do the same, in each of which an overseer will be left to execute any orders that may be given . . .".

But all was not clear sailing. Governor Francklin, in his administrative zeal, had incurred expenses in this survey project that had not been contemplated by Downing Street. Chilly disapproval was expressed in official terms and Governor William Campbell on his arrival in Halifax ordered the work so enthusiastically instigated and carried on by his Lieutenant Governor to be discontinued.

When the island became a separate province Walter Patterson, then a resident of England and part owner of Lot 19, was named its first Governor. He arrived at Charlottetown, the new name for Port la Joye, on August 30, 1770. Governor Patterson, whatever his faults, had energy and a clear appreciation of the value of surveys. It was not long before he had secured the services of one of Holland's pioneer surveyors, Charles Blaskowitz, to lay out a road from the capital to Prince Town. In his report to Lord Hillsborough in July, 1771, the Governor stated that he had "ventured, at my own risk, to have a road laid out from Charlottetown to Prince Town and although the surveyor avoids, by my instructions, all swamps, difficult rivers and steep hills, the road as measured was only ¾ mile more than if on a straight line, and it is only 33 miles (in all)". He gave as a reason for employing Blaskowitz that the latter had been wintering on the island and as he had been detained there by the late spring, he was induced to undertake the work on much easier terms than otherwise would have been the case.

In the same report the Governor explained the significance of changes he had made in the town plan as laid down by Mr. Morris. "I have taken the liberty to alter the plan of this town (along lines) I think best calculated for a northern climate, as every house will have a southern aspect, there being but one row of houses on each range, by which means likewise there will be a communication from every backyard into the street, which I look upon as a great convenience".

"I have enlarged the town lots by adding 24 feet in front and 20 feet in depth each . . . I have doubled the quantity of land in each pasture lot, as will appear by the plan. They were in the original only six acres each; besides which there is a large common left for the purpose of extending the town whenever that is necessary". The accompanying map shows the area of the entire development as 7,300 acres with 270 acres for the central town and 565 acres for the common.

A second road was undertaken "to connect George Town with the capital". The Governor lost little time in convening his Council and among those summoned to its first session was the surveyor Thomas Wright. Governor Patterson approached Wright to become Surveyor General of the province on the condition, however, that he become a full-time resident of the island. The condition was accepted and Wright continued to occupy this responsible position for more than 40 years until his death in 1812.

But the surveying activities of Thomas Wright were not, by any means, confined to the island province. In 1772 he conducted an important survey of New Brunswick coastal areas. In the words of the cartouche of the resulting map: "This survey was made agreeably to the Orders and Instructions of the Right Honourable the Lords Commissioners of Trade and Plantations to Samuel Holland, Esq., Surveyor General of Lands for the Northern District of North America. By his Deputy, Mr. Thomas Wright". This survey and map undoubtedly served as a reliable basis for the subsequent work of DesBarres in the same area.

After launching the new province on its career, Governor Patterson cast about for fresh opportunities to improve the condition of the people on the island. He had been shocked on his arrival to find that there were only five proprietors and 150 families on the allotments. But this was symptomatic of a condition destined to continue for many years. Most of the proprietors remained in England, indifferent to their holdings and making no attempts to obtain settlers, as they had promised to do. In 1773 the first island Assembly met, members numbering 18 in all. The one and only item on the agenda was that of land tenure policy. The Governor, unaware of the obstacles he would encounter, was eager to bring about reforms. When he discovered what little headway he could make on the island with his aims he visited England in 1775 and was successful there in having the island placed on the same constitutional basis as the other British North American colonies. Unfortunately, during his absence the province was raided by American privateers, frustrated in their efforts to engage British vessels in the Gulf of St. Lawrence as part of their Revolutionary War campaign.

Phillips Calbeck, senior member of the Governor's Council was interim administrator of the island government during the Governor's absence. The privateers, ordered to intercept two British brigantines carrying supplies and ammunition to Quebec, decided to raid Charlottetown. At the time the island capital was a totally unprotected village. After plundering the place and terrorizing the inhabitants the Americans, in returning to their ships, took Mr. Calbeck into custody and later made Surveyor General Wright also a prisoner "laughing" so one observer relates, "at the tears of his wife and sister, mocking them in their grief". The prisoners were conveyed to American headquarters located just east of Cambridge, Massachusetts. George Washington, on learning of the raid, was highly indignant. He soon made it clear to the American commanders of the raid, Nicholson Broughton and John Selman, that they had acted in a manner totally unauthorized by any orders they had received. The two officers were relieved of their commands. The prisoners were tendered the personal apologies of General Washington, released from custody and most kindly treated. All seized property was returned to them. "The plague, trouble and vexation I have had with the crews of all (our) armed vessels," George Washington remarks in a letter to the President of the Congress describing the incident, "are inexpressible. I do believe there is not on earth a more disorderly set".[24]

In 1784, as part of the great exodus from New York, some 600 Loyalists came to the Island of St. John. Their arrival served to intensify the need for a better land tenure policy on the island. After several futile attempts to persuade the Assembly to approve

forfeitures of neglected lands, Governor Patterson finally obtained its approval to escheat 9 full lots and 5 half-lots. Even this partial measure of success was snatched from his hands when this action was disallowed by the British Government. The following year Governor Patterson was recalled. Actually, during the winter of 1786-87 the island experienced the luxury of two governors. General Edmund Fanning, nominated to be Patterson's successor, made his appearance but Patterson was loathe to believe that his recall was genuine, and lingered on hopefully. In the spring of 1787 Whitehall made the situation abundantly clear and Patterson departed post-haste for England.

Land tenure policy under the new governor continued to be a source of bitter public controversy. During Governor Fanning's administration the Assembly passed a measure requesting the government to confirm the Loyalists in the possession of their lands. The government, however, evaded action on the legislation and kept postponing confirmation of titles.

In 1799 the name "Prince Edward Island" officially replaced "Island of St. John", an action honoring the Duke of Kent, father of Queen Victoria. By the following year the population of the island stood at about 5,000, of whom some 300 lived in Charlottetown, named after Queen Charlotte. The early years of the 19th century saw the arrival on the island of some 800 Scottish settlers under the sponsorship of Lord Selkirk. These highlanders, for the most part, settled near present-day Eldon.

In 1805 Colonel J. F. W. DesBarres, the eminent marine surveyor, at the age of 84, replaced Edmund Fanning as Governor of Prince Edward Island. DesBarres, in a series of provokingly slow promotions, had been raised to the rank of major in 1783, lieutenant-colonel in 1794 and full colonel in 1798. He had been appointed Lieutenant Governor of Cape Breton Island in 1784 but his term here had been abruptly terminated two years later. DesBarres, whose term of office on Prince Edward Island was undistinguished, save for the 1810 act relating to land surveys, was succeeded in 1813 by Charles D. Smith, who remained as Governor for 11 years.

DesBarres concluded his governorship of Prince Edward Island a half century after his former army associate Captain Holland arrived on its shores to supervise the first island survey. Captain Holland and his apt pupil Thomas Wright brought lustre to the title of Surveyor General in their respective jurisdictions. Under their capable direction a solid foundation of surveys had been laid and although land tenure policies continued to be a social and political irritant in the province, conflicts over property boundaries remained conspicuously absent.

In 1810 an act (49 George III) was passed by the Island Legislature "for the establishment of a meridional line to regulate surveyors in this Colony" but no action was taken on this legislation for more than a decade. In June, 1821, a three-man commission made its report on the establishment of such a line on the island. Today, in Charlottetown, it is possible to observe the tangible results of the commission's work. In Victoria Park, located in relation to Charlottetown's business district as Stanley Park is situated in relation to downtown Vancouver, one may readily see a squared stone standing about two feet above the ground on the shore side of the waterfront driveway. This may be described as the "angle stone" as it is the point of a right-angled survey triangle. As one faces the field of Government House nearby two other stones of similar shape may be observed in direct line with the angle stone. Sighting over these three stones it is possible to establish a perfect line to the astronomical north.

Sighting over a similar stone in the cricket field, which is in line with a stone at the edge of the road passing the Park's caretaker's house, one may find true west.

"A.D. 1820" is inscribed on the west face of the angle stone first mentioned. On its opposite face is found the inscription, "VAR. 20 degrees, 18′ 39″. On Prince Edward Island, at the time of Holland's pioneer surveys (1764-65) the compass pointed 15 degrees, 30 seconds to the west of true north. By 1820 compass variation on the island amounted to that indicated on the angle stone. By 1938 the variation had become sufficient to alter the reading to 24 degrees, 30 minutes.

New Brunswick

In 1603 Sieur de Monts received letters patent in which the word "Acadie" or "Cadie" is first used as the name of a region. His grant extended from the "40me degré de latitude jusqu'a 46me" thus including that part of what is now known as New Brunswick, south of the line between Fredericton and Bay Verte in Westmorland County.[25]

Several seigniories were granted to Sieur de Soulanges, including one at the mouth of the St. John River and one in what is now known as the Fredericton area. In the latter grant this area is described as at a place called 'Nashwaak' to be known thereafter as 'Soulanges' on the River St. John "15 leagues from Gemesk, 2 leagues on each side of said River and 2 leagues deep inland". Such a seigniory at the present time would include what is now the community of Marysville, the city of Fredericton and suburbs, the villages of Gibson and St. Mary's and a large tract of surrounding country, enough valuable real estate to make any owner a multi-millionaire. The seigniory at the mouth of the St. John was granted to Charles la Tour in 1635 and the entire shore was granted to Nicolas Denys in 1636. From 1672 on there was a series of great seignioral grants including those of Richibucto, the Upper St. John River valley and the Chignecto Isthmus.

The coasts of Acadia attracted, as we have seen, the curious attention of 15th century explorers from the Old World. These Europeans were primarily navigators rather than trained surveyors or mappers. As navigators their first surveys and sketches were of coastal parts and the mouths of the larger rivers. Samuel de Champlain excelled at this task. In the 200 years between 1570 and 1770 various surveys were carried out in the region by officers in the employ of the French or British governments, men like M. de Chabert and Samuel Holland. Maps were produced and distributed to a limited extent as a result of such surveys.

In 1715 a map by Moll shows Acadia divided into north and south districts. A 1733 map by Popple depicts the whole area as "Nova Scotia". The same term is employed by Mitchell in his famous 1755 map. Because of the unreliability of information sources in those times these maps not only differed from each other but were inaccurate in many details.

More accurate coast surveys of what is now New Brunswick began with the work of the first Charles Morris in 1749 and were continued by men like Lieut. Bruce (St. John harbor and vicinity); John Mitchel in 1764 (Passamaquoddy Bay) and of Thomas Wright in 1772, Joseph DesBarres from 1776 to 1781 and again by Wright in 1790.

The establishment of seigniories in Acadia by the French in the 17th century proved a failure in so far as the achievement of any large-scale settlement constituted the goal of this system of land tenure. In the period between the capture of Quebec by the British and the arrival of the United Empire Loyalists, imperial policy was to try to settle Acadian lands on the tenant system. This method reached the peak of its

development between 1758 and 1770 when large tracts of land were designated as townships and the proprietors undertook to bring settlers to these holdings. It was about this time that J. F. W. DesBarres acquired by purchase a rich tract in the Petitcodiac River valley. It was this same land over which extended litigation was to take place following the death of DesBarres in 1824. In any event this land tenure scheme as a whole fell far short of attaining any substantial volume of settlement.

In the 17th century and on what is now the west side of Saint John harbor, Charles la Tour built a fort that was occupied by various French and English garrisons until 1700. The fort deteriorated to a dilapidated state and remained in a ruined condition until 1758 when it was restored and named Fort Frederick by the victorious British. Among the British officers stationed at Fort Frederick was Lieut. John Marr, a sub-engineer. His sketch in colors, a handsome production, is in the Public Archives, Ottawa, and is entitled, "A Sketch of part of River St. John from Partridge Island in Latitude 45 degrees 22 N. to Opaakan (Indian Village) the length contained in this Sketch is near 80 English miles, Taken in November, 1764".

In a corner of this map, and drawn on a somewhat larger scale than the main plan, is a survey of the "Harbour of St. John and of the Environs of Fort Frederick on the North Side of the Bay of Fundy Taken in September, 1764 by John Marr, Sub-Engineer and Lieutenant".

Initial international boundary difficulties encountered by maritime areas of British North America occurred following the Treaty of Paris, 1763. Controversy developed between Americans and Canadians over the precise line separating Nova Scotia (enlarged form) and the colony of Massachusetts. Treaty commissioners had decided upon the St. Croix River, mentioned first by Champlain, as the boundary. Trouble arose over the fact that by then (1763) the name St. Croix, applied to any river in the region, was unknown. Accordingly in 1764, Governor Bernard of Massachusetts despatched John Mitchel, a New Hampshire surveyor, along with a considerable party of assistants, on a small vessel in a determined effort to settle once and for all the identity of the boundary river. The party reached Passamaquoddy Bay on May 26. The entire survey operation required slightly over a month to complete.

John Mitchel's original field book (including a diary of survey) is now in the Maine Historical Society Library at Portland. Mitchel's map of Passamaquoddy is drawn from the actual survey findings and represents an immense advance on predecessor maps, which were not much better than very rough sketches. In turn, Mitchel's production was surpassed by the very accurate and elaborate map based on the complete surveys of Thomas Wright in 1772. Wright's map was the true forerunner of all later maps of the region, at least until 1848 when new British Admiralty surveys were undertaken in the general area.

But the Mitchel map is significant for a number of reasons. It is the earliest known description of the Passamaquoddy area and it is the origin of the conviction later developed by American authorities that the Magaguadavic River was, in fact, the St. Croix. This belief exercised a profound influence on subsequent international boundary commissions operating in that part of the continent. Appearing before the first of these commissions, Mitchel and his assistant, Israel Jones, testified that they had explored the St. Croix to its source. This was a most doubtful claim. Although he was an able surveyor Mitchel, as his diary entries reveal, was illiterate.

"Thursday, May 31, 1764: A pleasant morning this Day. Mr. Jones and my Self and five of our men Imployed Sorveying on the West Side of passamaquoddy Bay and Began at Angle 16:

"Sunday, June 3: Captain flatcher Thought it most Expedient to go to St. Croix (this is the first known use of that name for the Magaguadavic) next day by reason of the Indians who for sum days past Bin Drunk were got Sober . . ."

In 1761 a party of New Englanders from Rhode Island landed at the head of the Bay of Fundy. They settled near modern-day Sackville and thus constituted what may be regarded as the first permanent community of English-speaking people in what is now New Brunswick. While these pioneers were occupied in erecting dwellings, an exploration party, headed by a young surveyor named Israel Perley, made its way through marsh and forest to the mouth of the St. John River. Perley returned to the Governor of Massachusetts with a good report on the latter area. As a result, in the summer of 1762, a group of 20 settlers from Massachusetts made the journey to the mouth of the St. John and occupied a small clearing at the head of the harbor.[26] The long story of the effective settlement of New Brunswick had commenced.

At the time of the great exodus from New York about 3,000 Loyalists set sail for Saint John in the first contingent bound for Canada. Casual shiploads of Loyalists that followed combined to augment the population of the two towns, Carleton and Parrtown, at the mouth of the St. John River. These settlements, in fact, were the beginnings of modern Saint John. In all, about 35,000 Loyalists left confiscated homes and farms to emigrate to British North America. About 14,000 of these war refugees arrived in what is now New Brunswick but which, at that time, was still part of Nova Scotia.

Governor John Parr, in supervising from Halifax the distribution of Loyalist settlers on available lands, ordered that disbanded veterans proceed to certain designated areas in the valley of the St. John northwards from Sunbury. At the outset this movement represented a token occupation only. Most of these soldier settlers drifted back to the two towns at the big river's mouth. By the spring of 1784 the choicest river valley land from Woodstock to the Bay of Fundy was largely occupied. Loyalists overflowed into the valleys of the Miramichi and Petitcodiac. Some of the early surveyors whose efforts contributed in a fundamental way to the success of this occupation included Jacob Allen, Isaac Heddon and Israel Perley. In a letter written in 1785 by Peter Huggeford, a New York physician, he mentions that he arrived as a Loyalist settler at the mouth of the St. John in July, 1783, "whilst the town plot was surveying and before any buildings were erected". In the files of the University of New Brunswick library map collection there is a very old plan of Parrtown made by Deputy Surveyor Paul Bedell. It depicts public squares, private lots, fortifications and public landings.

These new settlers on the west coast of the Bay of Fundy were openly resentful of Nova Scotian administration of their affairs. They were unhappy over Governor Parr's dictatorial direction of their destinies. From 1760 to 1784 all land titles and orders for land surveys emanated from Halifax. Political separation from Nova Scotia became a fervently desired goal. For their part British authorities perceived in such a course of action a means of retaining John Parr in office while rewarding the Fundy Bay Loyalists with public positions within a brand new provincial civil service structure. Thus in June, 1784, political partition was officially proclaimed and New Brunswick (a name honoring the then reigning British house) came into being.[27] Colonel Thomas Carleton, brother of Sir Guy, was named first governor of the new province. Jonathan Odell became Provincial Secretary and George Sproule, the first Surveyor General. The latter office was among the very few provincial positions named expressly in the establishing Order in Council dated June 18. The salary was set at £150 per year.

During the period 1784 to 1825 surveying in New Brunswick was largely performed by either active or disbanded army engineers appointed by the Governor and called

Deputy Land Surveyors. The records and maps left by these men, documents now in the vaults of the Crown Lands Office in Fredericton, reveal that these men were good surveyors. Their returns provided the basis for the earliest maps of the province.

George Sproule, destined to occupy the highly onerous and responsible post of first Surveyor General of New Brunswick for more than three decades (1784-1817), came from New Hampshire in 1785. There is no evidence to indicate that in earlier days he was the Ensign Sproule who assisted Capt. Holland in his Cape Breton Island and other maritime surveys. In his early years in New Brunswick, Sproule was greatly handicapped in as much as he had no proper accommodation for maintaining office records. But he did have the assistance of at least 24 Deputy Surveyors during these formative years. In the George Sproule Letter Books much of his correspondence is preserved. These records are in the possession of the New Brunswick Public Archives in Fredericton.

The first (registered) grant of land in what is now known as New Brunswick was issued on May 28, 1760; the second issued on September 17, 1763. Following these two initial allotments, grants were made with increasing frequency. Here is a typical property description of those early times: "Andrew Ferguson, Esq., a tract of land situate, lying and being beyond Saint Anne's Point on the south-west side of St. John's River on lands commonly known by the name of O. Park, one quarter of a mile extending on said river and containing 500 acres together with an Island or Islands commonly called Sandon Island and containing 100 acres more or less". Vague, elusive descriptions of this type did little to ease the heavy pressures experienced by the newly-appointed Surveyor General and his deputies.

On January 14, 1785, Jonathan Odell issued a proclamation of the regulations to be observed "for the orderly and expeditious settlement of the Province of New Brunswick by the several persons petitioning for Farms, etc. . . ." Regulation Number Three provided that whenever a sufficient number of farms are surveyed and are ready to be drawn for, public notice would be given to any equal number to attend at a day and place to be appointed, when and where a draft [a drawing] of the several lots would be made under the inspection of a Deputy Surveyor . . ." Regulation Number Six provided that all Deputy Surveyors "are to make returns to the [Provincial] Secretary of their several surveys". Regulation Number Nine: "The Deputy Surveyor, as soon as may be after such draft will show each proprietor or his agent the bounds and marks of the lot so drawn by him, which will be considered as a delivery of possession".

At the outset the province was divided into eight chartered counties, namely, St. John, Westmorland, York, Charlotte, Kings, Queens, Northumberland and Sunbury. In 1785 a circular was distributed by Surveyor General Sproule titled: "Additional Instructions to be rigidly observed by Deputy Surveyors in New Brunswick."[28] It warned: "You must be particularly careful that the Instrument you use in all surveys is correct and true and that you insert on the plan you return to me in four pole chains and links the front or breadth of each lot . . . and also the extent of every line you have occasion to run out . . . with its course or bearing inserted on the plan".

Names of Deputy Surveyors sworn in during 1785 and immediately succeeding years include Mather Byles, Richard Holland, John Bedell, Thomas Harper and Stephen Millidge. A Warrant of Survey addressed to Deputy Surveyor Millidge (No. 2 Westmorland) is also on record, dated June 12, 1786: "Pursuant to a Warrant of Survey from His Excellency the Governor to me directed, ordering to admeasure and lay out, at the expence of the parties, for Olive Budrou and 9 others, French Inhabitants, 200 acres of land each, in a Tract of land formerly granted to Richard Bulkley, Esq., at

Memramcook in the County of Westmorland, which said Tract has been lately escheated.... And you will make due returns of your proceedings hereon to my office with all convenient speed, with a plan annexed conformable to your general instructions". This document is signed by George Sproule in his capacity of Surveyor General. The records likewise reveal that Mr. Millidge was not formally sworn as Deputy Surveyor until July 25, 1786, more than a month after the issue of these instructions.

In 1785 a survey of the site of the present provincial capital, Fredericton, was completed by Deputy Surveyor Dugald Campbell, formerly a captain in the 42nd Highlanders and commissioned by Sir Guy Carleton to open up military roads in the Upper St. John River valley. He had come to New Brunswick in 1783 as a lieutenant along with a number of disbanded veterans of the 42nd. Originally they had received lots in St. John but in 1784 all moved to Nashwaak in York County, Campbell laid out the existing pattern of Fredericton streets, with Queen, King, Brunswick, George and Charlotte streets intersected by Smyth, Northumberland, Westmorland, York, Carleton, Regent, St. John, Church and Sunbury streets.

But this was not the first survey plan made of the locality. One township survey still on record is that of Sunbury, dated 1768, showing the site of what was then called St. Anne's Point, renamed first Osnaburg, then Fredericton, both names in honor of the second son of George III, Frederic, Bishop of Osnaburg. A certificate is attached to the survey plan, revealing that, with a view to establishing a townsite, the plan was taken to New York to show the authorities there the location of the Point. At that time the place had a population of 15 families. The certification also demonstrates that in those days the vital land settlement decisions affecting that part of British North America were being made in New York.

On January 7, 1789, Surveyor General Sproule wrote to Deputy Surveyor Israel Perley, and added the following postscript to his letter: "You will be particularly careful that the needle of your Instrument you use on this Survey together with the Instrument itself be truly accurate".[29]

It should be noted that a plan of Fredericton in two sheets, signed by Surveyor General Sproule, and dated about 1800, is also on record. "Each of the town lots represented on this plan measures in front and rear 4 poles, and in depth 10 poles, containing one Rood of Land. The streets are 4 poles wide. Scale 3 chains to the inch". There is in existence also a town plot of Fredericton as surveyed April 12, 1832, by Thomas Kelcher. The compass variation is given as 16° 34′ West. The dimensions of blocks are indicated as 10 chains by 5 chains, with streets one chain in width. The town is laid out N 45° East.

Generally the history of the first land surveys in the St. Lawrence River Basin was repeated in the early surveys of property in New Brunswick to the extent that these prepared the way for settlement along the banks of navigable waters. Each settler drew by number his prospective lot and was issued a certificate of possession, authorizing him to occupy the same. In order to meet the pressing need for completed surveys, the surveyors merely traversed the large rivers, monumenting the fronts of tracts to be occupied. The tracts of land thus laid out were of varying depths, depending upon the topography of the country and the number of settlers to be accommodated in any particular area. Some tracts were subdivided into lots of 10 chains in width and 7 miles in depth. Others were 2 or 2½ miles deep and sufficiently wide to include in each lot 200 to 500 acres. The rear or base line of such lots was located parallel to the general course of the river or the trend of the lakeshore governing the front of the lots.

It was the custom in these pioneer times for surveyors to include in their survey areas ten per cent or more in excess of the area to be actually granted. This was a device to help compensate the grantee for waste lands within his boundaries or for land expropriated for road allowances. The underlying purpose was commendable but if, when making his return to the Surveyor General, any surveyor failed to note clearly whether or not the excess was taken into consideration in fixing the recorded dimensions, he made matters exceedingly difficult for future surveyors seeking to restore boundaries and to replace property markers that had been lost or destroyed.

The next stage in the settlement process was to lay out properties at the rear of the first concession of lots. Uniformity of survey patterns, as well as of settlement procedures, was most desirable and in order to aid in achieving this purpose the range system was devised. The lots were so surveyed as to possess a uniform width fronting on a "reserved" road of one chain in width. The four corners of each range were permanently marked. Lots were posted along both sides of a road and division lines between lots were established for a distance of 5 chains. These lines, as required, were extended to the rear or base line of the range of lots. The boundaries were at right angles to the road and generally the lots were 15 chains wide and 67 chains deep, enclosing an area of 100 acres.

The Surveyor General continued to carry out his duties under back-breaking and nerve-wracking difficulties. Not the least of George Sproule's concerns was the pitifully low rate of remuneration attached to his position. The £150 annual salary meant that special sacrifices had to be made by him. Through a lack of funds the Surveyor General was compelled to withdraw his son from school in England. This situation was eased somewhat when in 1807 Governor Thomas Carleton was successful, during a trip to England early in that year, in obtaining the removal of the long-standing instruction regarding the non-collection of quit rents on New Brunswick lands. This provision of new revenue sources meant that somewhat higher salaries could be paid to civil officials. Nevertheless it was a quarter century later, after George Sproule had left office, before the annual remuneration of the Surveyor General reached £600 per year.

George Sproule performed his duties well despite grave handicaps. The results of the international boundary surveys, compiled by him in 1798 into one general map, provided the foundation for all subsequent survey maps of the regions involved. Sproule, in fact, travelled a great deal in connection with various survey assignments. In 1787, for example, at Grand Falls he met Hugh Finlay, representing the Surveyor General of Quebec, in order to discuss the establishment of a line between that province and New Brunswick. In addition there were differences of interpretation over the terms of the Treaty of Paris in relation to the "North West angle of Nova Scotia" which demanded his attention. Sproule was succeeded in 1817 by George P. Kimbell. Surveyors General in the provinces continued to be appointed for life terms by the British authorities until 1837. In that year the provinces assumed the power to appoint such officials.

One of the last acts in office by George Sproule was his letter of instructions to Deputy Surveyor Morehouse, dated July 4, 1817. In regard to the settlement of disbanded soldiers on land between Presqu' Isle and Great Falls and "on both sides of the River Saint John", the Surveyor General directed his Deputy to proceed "without loss of time" to procure assistants as Chain Bearers and Axe Men not exceeding five in all "on the lowest wages you can agree for, bearing in mind that a Ration of Provisions will be allowed to each man" and "to procure a Canoe, either by purchase or hire". Mr. Morehouse was ordered to "lay out lots of 40 rods front at right angles to their

sides, all the vacant unimproved land you may find fit for cultivation . . . not exceeding 300 lots".

What may well have been the first survey of an Indian Reserve in the province was provided for in these instructions. "On September 4, 1807, an allotment was made to Neville Bernard for himself and his Tribe of Melicete Indians on the East side of the River St. John, beginning opposite to Tobique Rock and running upstream until it comes opposite to the mouth of the Restook River, you must therefore lay it down on your plan the side lines to be ranged East and no encroachment to be made thereon . . .

"For such persons as you may find already settled and improving, and have families, you may lay out lots of 300 acres with 90 rods front, and for such single men of age as you may find settled and improving, you may lay out lots of 200 acres with 60 rods front, which surveys must be made at their own expence and placed in their true positions on the general plan of your survey.

"In the progress of your survey you must pass over any tracks [sic] of land that you may on careful examination find unfit for cultivation, the fronts of such tracts must be surveyed and measured, so as to enable you to place them on your plan and to continue a general plan of the River . . .

"The lots must be regularly numbered and marked upwards on each side of the River Saint John commencing with No. 1 on the East Side and No. 1 on the West Side. The side lines must be ranged East on the East Side and West on the West Side, and three trees marked, or three durable marks placed on each line, not less than 12 rods asunder—you must note and report the quality of each lot as near as you can estimate.

"As the expence of this Survey will be defrayed by the Government you must keep a Regular daily Journal noting down the duty or service performed each day, to be vouched for by oath if required, and return a copy thereof to me with your report.

"And you will make due return hereon with all possible speed to my office annexing the requisite plan to a scale of 40 chains to an Inch and returning this warrant".[30]

The extent to which the Surveyor General of New Brunswick entered into land allotment matters is evident also in a sample petition or memorial from Anthony Woodward, dated July 25, 1785. . . . "your Memorialist, having lost a large property in New Jersey in consequence of his loyalty, is desirous of obtaining a farm in the District of Beaver Harbour where he has resided with his family from the first of that Settlement and has pointed out to the Surveyor General a lot of vacant land in the interior part of Mascareen's grant where, being back land, it is supposed a Farmer, able and desirous of making immediate and substantial improvement, may be allowed the quantity of 200 acres . . . and your Memorialist humbly prays a grant of that quantity. . . ." This application was addressed to Governor Thomas Carleton.[31]

The functions of the Surveyor General were made clear in a letter from the Attorney General of the province to G. P. Kimbell when he was appointed in 1817 to succeed George Sproule.

"The duties of the Surveyor General of Lands, having exhibited his commission and sworn to the faithful discharge of the trust reposed in him, it is considered a primary object to appoint fit and proper persons his deputies in the several counties, taking bonds with ample security for the faithful discharge of their duty in conformity to His Majesty's Instructions. . . . As the Surveyor General is presumed to have a local knowledge of the lands in the disposal of the Crown as well as of Lands involved in Litigation, it has always been considered right and proper that all Petitions relating to

Lands should in the first instance be referred to him for his report and when he has faithfully exerted his best endeavor to ascertain the truth of the facts stated, he is to report the same for His Excellency the Commander in Chief's [Governor's] consideration and determination".[32]

All Warrants of Survey were to be executed by the Surveyor General or his Deputy and made returnable in six months and if the party to whom they were granted did not avail himself of their benefit within the time limited, the Surveyor General was then bound to report the circumstances. He was expected to keep regular books for entries in full detail of the metes and bounds of all grants of land. It is interesting to note that the Surveyor General was not obliged to interfere in any private disputes over property boundaries or landmarks but it is nevertheless presumed that for "the furtherance of Justice he will at all times be disposed to exert himself to the utmost of his abilities" and to conciliate any differences as well as to preserve inviolable original landmarks that appear to have been fixed "on principles of undeviating rectitude and justice".

Just as the special value of highways was early realized in Nova Scotia, so did the people of the new province of New Brunswick show their appreciation of the importance of surveys involved in primary road construction. In the earliest days of settlement the roads were established across the sandy, sometimes muddy seashores where the first communities were formed.[33] As the population increased roads were built along the banks or ridges to reduce exposure to damage or interruptions by tides or storms. When settlements became more numerous and extended inland, roads were laid out more systematically. Highways, in the main, were divided into two classes, grant (trunk) roads and bye roads. Both types of highways were partly repaired by the inhabitants of the area through which they passed (statute labor). In this manner every resident of the province was legally obligated to contribute his quota of time, effort or money towards the maintenance of roads passing near his home and therefore serving him and his interests. This work was always done under the supervision of a "surveyor" but, as has been already noted, such an officer was not always trained in the arts of surveying.

As Right Hon. Sir Henry Parnell perceptively pointed out in his remarkable *Treatise On Roads,* published in 1839, a book written primarily for the British but adopted and applied in Nova Scotia, "When the state of a society has arrived at a high degree of industry and wealth, so many persons and such quantities of goods are set in motion for the purpose of administering to its business and its luxuries, that it becomes of the greatest importance to construct public roads. . . ."

In regard to tracing the first line of road, Parnell, in his initial chapter, advises that the task should never be undertaken without the aid of instruments "and all local suggestions should be received with extreme caution". The author warned, "To guard against errors it is essential not to trust to the eye alone but in every case to have a survey made of the country lying between the extreme points of the intended new road. For this purpose an experienced surveyor should be employed to survey and take levels of all the various lines that . . . appear favorable. These surveys should be neatly and accurately protracted and laid down on good paper, on a scale of 65 yards to an inch for the ground plan, and of 30 feet to an inch for the vertical section".

Then comes a most prophetic reference. "The map should be correctly shaded so as to exhibit a true representation of the country, with all its undulations of high grounds and valleys, streams and brooks, houses, orchards, churches and ponds adjacent to the line of road. . . . It may be laid down as a general rule that the best line of road between any two points will be that which is shortest, the most level and the cheapest of execution. . . . It may sometimes be proper to make a road deviate from a straight line

in order to go through a town. But the expediency of such a deviation must wholly depend on the general object of the road . . .".

In 1786, chapter 32, the New Brunswick Assembly passed an Act "for laying out, repairing and amending Highways, Roads, and Streets and for appointing Commissioners and Surveyors of Highways within the several Towns or Parishes in this Province". There is in existence a Plan of the Great Road, Fredericton to Saint John (1839) "surveyed for Hon. Harry Peters. Road Supervisor: John Wilkinson, Deputy Surveyor".

A journey by stage coach, drawn by two horses, over the mail road from Halifax to Saint John, a distance of 260 miles, took 45 hours to complete in 1854, a total time that varied substantially only in certain brief periods in early spring or late autumn. In that year, by chapter 9 of the provincial statutes of New Brunswick it was provided that the Governor in Council "may cause portions of the vacant Crown Lands to be surveyed and laid off into lots not exceeding 100 acres each" and to sell or dispose thereof by private sale for the price of 3 shillings per acre or up, to industrious settlers, payable in money or by (statute) labor in opening and making such roads as would promote the improvement and settlement of the province.

Roads are useful, instruments are helpful and statutes are significant but men, and particularly leaders of men, remain the most important and most fascinating subjects of this historical study. In the newly-formed province of New Brunswick, Benjamin Marston, who contrived to avoid death by lynching at Shelburne, made an impressive re-appearance in the realm of surveys. Following the harsh treatment from Governor Parr and his dismissal from the public service of Nova Scotia, Marston left Halifax for New Brunswick on December 7, 1784. Sir John Wentworth, who continued to hold Marston in high regard, appointed him a Deputy Surveyor of the King's Woods. In addition Sir John recommended Marston to the favor of Governor Thomas Carleton. "I have fullest reliance in his discretion and shall trust much to his judgment," Sir John confided.

Marston, on his arrival in Saint John, received a cordial welcome, dining with the Governor in company with the Provincial Secretary, Jonathan Odell, several judges and military commanders. With Lieut. Lambton of the army engineers Marston, some time later, made an adventurous exploratory journey to St. Andrews. Early in 1785 he was appointed first Sheriff of Northumberland County. It is not often that one who has so narrowly escaped the noose, so soon afterwards finds himself in the office of sheriff.

From the Journal of his surveys it appears that in 1786 Marston's chainman was John M. Lesdernier. For his services in this connection Marston received 10 shillings per day; his chainman, 2 shillings sixpence. An entry in the Marston Journal of this period reads: "Left ye Indians and began at ye end of yesterday's line (along Etienne River) 531 chains to a point on ye river, there marked a pine 5½ miles and 13 chains from the forks, and here my provisions being almost expended—not more than 4 days left for the party—and one of our 2 axes broke and one of my best men having broke his snowshoes to pieces, I gave over the survey and pushed on with 2 men only". Many Canadian surveyors who followed in Marston's steps in the profession could sympathize with him in his encounters with such frustrating vicissitudes in the field.

Benjamin Marston's career did not end in Canada. He died at Bulama, Africa, on August 10, 1792, after an unsuccessful exploration expedition in that part of the Dark Continent. Although his grave is under far-off tropical skies, Marston made a memorable contribution to the development of surveys in Nova Scotia and New

Brunswick during the critical formative years in both provinces.

Another Nova Scotian, marine and land surveyor, who attained a prominent place in pioneer New Brunswick surveys was Anthony Lockwood. He wrote a memorable book, published in 1818, entitled, *"A Brief Description of Nova Scotia with Plates of The Principal Harbors including a Particular Account of the Island of Grand Manan".*[34] This volume now constitutes a treasured description of some aspects of early surveying and mapping along Canada's Atlantic coast. Lockwood served as Deputy Surveyor under the second Charles Morris. In his book, at page 74, he refers to the assistance he gave Surveyor General Morris in his strenuous but unsuccessful efforts to persuade Loyalists bound for Shelburne to settle instead along the coast of Guysborough county. On the title page of his book Lockwood is described as a "Professor of Hydrography and Assistant Surveyor General of the Provinces of Nova Scotia and Cape Breton". At page 39 the author states that he was accompanied in the latter capacity in October, 1816 by "5 axemen through lands near Sandwich Bay in search of a favorable position for laying out lands granted Captain Losack and others . . ."

In the year following publication of his book Lockwood was made Surveyor General of New Brunswick. He remained in office until 1823 when he was succeeded by Thomas Baillie. But the giant among all Surveyors General of the province was undoubtedly the first man to occupy that important post, George Sproule. Over a period of 66 years, from the establishment of the position in 1784 until the middle of the 19th century, Sproule served as Surveyor General for half of that period of time. His successors, G. P. Kimbell, George Shore, Anthony Lockwood, Thomas Baillie and John S. Saunders shared the remaining 33 years of service. Shore and Baillie each returned for brief second terms of office. Hon. J. K. Flemming, who became premier of New Brunswick (1911-1914), was the 25th and last Surveyor General in the province as the title disappeared in 1913.

Newfoundland

From the day that the sombre cliffs and grey-green hills of Newfoundland were first sighted from the *Matthew,* the life of the island has been intimately linked with the sea—with the roar of pounding surf, the whisper of ripples on the shores of countless coves, the deep awesome silences of its majestic fiords and bays. Beyond the island lay Labrador, "the only land", legends say, "that actually stood by when Life itself was born".

Five years after the initial Columbus voyage to the New World, John Cabot, a Bristol sailor of Genoese parentage, sailed from the English port on a momentous expedition. He steered northwards along the coast of Ireland and then headed due West "with the pole star at his right hand". His tiny, three-masted vessel *Matthew* of 50 tons was manned by a crew of 18. Cabot held a royal charter authorizing him to sail, at his own expense, to seek new lands in the Western Ocean, provided one-fifth of all territories thus discovered would belong to His Majesty, the King of England.

After 54 days of perilous travel, land was sighted. "Bona Vista" were Italian words that sprang easily to Cabot's lips in the circumstances. Today Cape Bonavista marks the Bristol mariner's landfall early in May, 1497. A casual entry dated August 10, 1497 "To hym that found the New Isle—£10" appears in the Privy Purse accounts of King Henry VII in acknowledgment of this major achievement in transatlantic exploration. Newfoundland tradition credits John Cabot with entering what is now St. John's

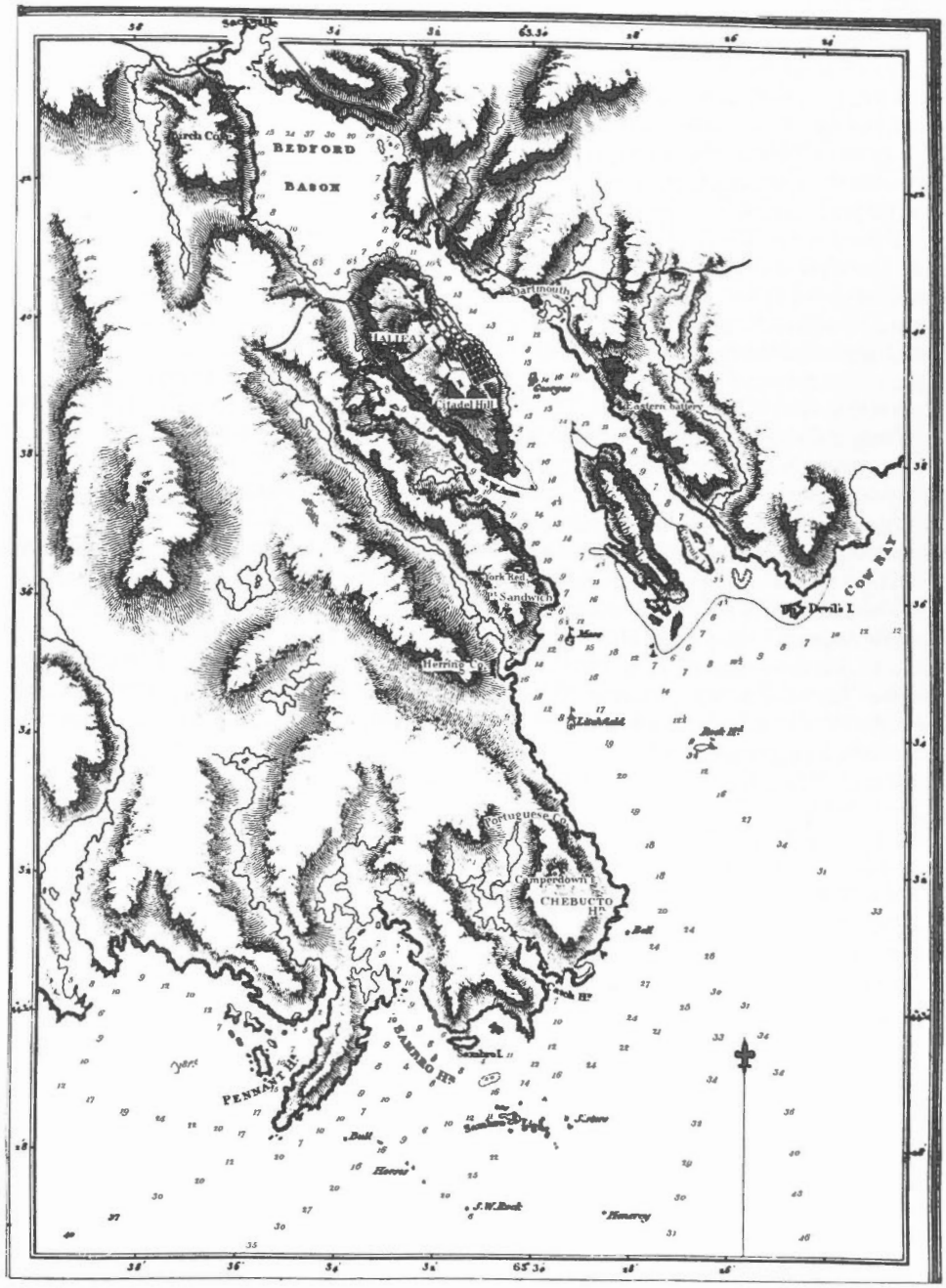

FIGURE 15. Chart of Halifax Harbor from "A Brief Description of Nova Scotia, with Plates of The Principal Harbors; Including a Particular Account of the Island of Grand Manan" by Anthony Lockwood, Professor of Hydrography, Assistant Surveyor General of the Provinces of Nova Scotia and Cape Breton (London, 1818).

harbor on the day of that saint (June 24, 1497) and naming the place in honor of the apostle. For more than 300 years after that visit, St. John's was regarded, at least by the English as a fishing station rather than as a centre of permanent settlement. Nevertheless this magnificent land-locked harbor, located half-way between Cape Bonavista and Cape Race on the extreme east side of the island, provided a natural base from which English and foreign fishing fleets conducted their operations on the banks.

From 1500 to 1750 little or no surveying or exploratory activity took place on the island itself. The aristocratic overlords of the fisheries considered that their best interests would suffer if the 'New Found Land' was settled and developed to any important extent. Laws of varying severity discouraged any large-scale or long-term occupation of the island, a state of affairs that produced a curious paradox—Newfoundland, one of the first parts of North America to be discovered by Old World navigators, became almost the last part of the New World to be systematically surveyed.

Although John Cabot is generally regarded as the "official" discoverer of Newfoundland, it is certain that venturesome fishermen from the Old World had known its waters before 1497, if not the island itself. In addition there is much evidence to indicate that during the reign of Elizabeth (1559-1603) veteran mariners from Dartmouth, Bedford and other west-country coastal towns knew some of the harbors and headlands of Newfoundland. In fact, Cape Race and Cape Francis were as familiar to 17th century sailors from Devon as their own Land's End. It may be safely assumed that, long before the visit of Sir Humphrey Gilbert, sailings to Newfoundland waters were far from unusual events.

But to stay-at-home Europeans Newfoundland, for almost a century after John Cabot's feat, remained a dark mystery. Some additional light was shed on the true nature of the island by the 1583 voyage of Sir Humphrey Gilbert, a half-brother of Sir Walter Raleigh. He sailed in three small vessels, the *Delight* (120 tons), *Golden Hind* (40 tons) and *Squirrel* (10 tons), arriving at St. John's in midsummer, 86 years after Cabot. On August 5 Sir Humphrey took formal possession of the island in the name of Queen Elizabeth, thus setting the royal seal of English ownership on Newfoundland and confirming its colonial status. Sir Humphrey perished at sea on his homeward voyage when the *Squirrel* sank in a fierce Atlantic storm. He had a clear vision, unusual for his times, of the possibilities of extensive settlements of European colonists in Newfoundland. He had written a tract on the subject and had drawn a map revealing prospects of a Northwest Passage to the Orient. He gave letters of title to English merchants concerning their fishing places in St. John's and nearby ports. At the time of the Gilbert expedition there were about fifty houses at St. John's, built by fishermen who remained each winter to cut timber, construct boats and fishing stages.

Hayes' narrative of the expedition relates that "after this, divers Englishmen made suit with Sir Humphrey to have of him by inheritance theyre accustomed stages, standings and drying places in sundry parts of that land for theyre fish as a thing they do make great accompte of. Which he granted unto them in fee farme".

Inspired, possibly, by the Gilbert expedition, Queen Elizabeth instituted a rather enlightened settlement policy in regard to Newfoundland: "Whatever room or space of foreshore a master of a vessel selected, he could retain it so long as he kept up his buildings on it and employed it for the use of the fishery".[35]

This manifestation of royal wisdom served to increase substantially the Newfoundland fishing industry. It gave enterprising men a more permanent interest in the island and multiplied the number of ship's crews who wintered there. This policy resulted in

the building of homes, wharves, fish houses and fish flakes.* The men began to cultivate small plots of land in the nature of vegetable gardens. At first these shore communities appeared around Conception Bay. But the west-country men who made this progress possible, believed they possessed an inalienable right to these shores for the sole purpose of fishing. When Queen Elizabeth died they joined in resisting renewed attempts at settlement.

Some highly restrictive laws were passed directed against colonization. Every captain of a fishing vessel was ordered to bring back to England his entire crew when his expedition had completed its mission. Deserters to the island, once caught, were severely punished. If uncaught, they faced the hardships of winter completely dependent on their own resources. Even legitimate settlers were, at one stage, forbidden to have chimneys on their homes and were not allowed to reside within six miles of the seashore. These laws were not fully repealed until 1811, when, for the first time, a year-round resident-Governor was appointed and officialdom favored, rather than frowned upon, the construction of more or less permanent buildings on the island.

For almost a century (1633-1729) St. John's and the outports were governed by "Fishing Admirals". The captain of the first fishing vessel to arrive in port for the season automatically became chief magistrate of that port until the ships departed in the autumn. This haphazard device for providing civil administration more often than not brought a veritable reign of terror in its wake. Not until the appointment of the first "official" governor, Capt. Henry Osborne, in 1729 did this lawless, brutal period end.

The 17th century, however, was not wholly devoid of efforts to introduce colonists to Newfoundland. The first planned colony on the island is credited to John Guy. In 1610 he sailed from Bristol with three ships and 41 people. He was armed with a Royal Charter from James I, a document granting him all lands between Cape St. Mary's and Cape Bonavista and all seas and islands within 10 miles of the coast. He set up his colony at Cupids, then Cuper's Cove. But roving pirates and hostile fish merchants, through their subversive agents, played havoc with John Guy's settlements, burning down homes, smashing boats, cutting nets and driving off cattle. Before long he returned, discouraged, to the relative security of England.

Richard Whitbourne, who had served, 32 years previously, with the Gilbert expedition to St. John's, was sent out from England in 1615 to establish at least some measure of law and order. Not long after his arrival he was captured by pirates and held prisoner for 10 days. Capt. Whitbourne, eventually Sir Richard, was a devout high church man and exceedingly versatile — being by turns sailor, traveller, author, judge and governor. In his famous "Discourse", a book much favored by King James (who gave the author the sole right for 21 years for printing and selling it) Sir Richard states:

"Those flies [mosquitoes?] seems to have a greate power and authority upon all loytering people that come to Newfoundland, for they have the property that when they find any such, lying lazily or sleeping in the Woods, they will presently bee more nimble to seize upon them than any Sargeant will be to arrest a man for debt; neither will they leave stinging or sucking out of the blood of such sluggards until like a beadle they bring him to his Master, where he should labour; in which time of loytering those flies will so brand such idle persons on their faces, that they be known from others as the Turks doe their slaves".**

As a leader and a colonizer Sir Richard is highly regarded in Newfoundland to this

*Platforms for dry curing.

**The book sold through seven editions from 1621 to 1623.

day. Hon. R. Bond, in saluting the memory of this outstanding pioneer, named the Avalon peninsula town after him, the first important railway junction on the island.

In 1617 Capt. John Mason, R.N., met with a goodly measure of success on a mission similar to Sir Richard's. He explored the coast of Newfoundland, made a fair map of the island and established a flourishing fish trade at Cupids. His rule lasted six years. Mason proved to be a strong, stalwart character. An Oxford classical scholar, he made the first English hydrographic chart, based upon actual surveys, of Newfoundland waters in certain limited localities. It was the first such chart to possess any degree of accuracy. He also wrote a treatise entitled: "A Brief Discourse of the Newfoundland", published in 1620. He died in 1635 and is buried in Westminster Abbey.

The modern communities of Renews and Trepassey are located on the sites of two other settlement projects of the 17th century. Sir William Vaughan, author of *The Golden Fleece* brought a small party, mainly Welsh, to the latter locality in 1616. But the venture proved to be an ill-fated one. Gradually French fishermen occupied the better shore properties facing Trepassey harbor, dislodging the Welsh who drifted nearer to St. John's. Falkland, Lord Deputy of Ireland, led a group of Irish immigrants in 1619 to the place now occupied by Renews. They, too, were elbowed out of their original holdings by the French and settled farther north. Today the Newfoundland coast from St. John's to the head of Placentia Bay is inhabited by descendants of the Irish people first introduced to the island by Lord Falkland.

In 1621 Sir George Calvert, the first Lord Baltimore, applied for a royal charter to colonize Newfoundland. In the following year he received a grant of part of the southeastern peninsula and named his picturesque domain, "Avalon". Baltimore spent £40,000 on this colony and joined it with his family in 1627. His wife and son, however, could not endure the climate and in 1629 left for Virginia, soon to be followed by Lord Baltimore and many of his colonists.

No vestige of these early colonizing attempts remain today. Even the regional names of settlements have disappeared from maps, all save Lord Baltimore's "Avalon".

Mention has been made of John Mason's map. Prowse points out that this map could not have been entirely drawn by him. Many of its features are traceable to older maps, mainly those of French origin. In his treatise Mason takes note of at least three marked advantages possessed by Newfoundland, namely, "nearness to our owne home", lively commercial intercourse and relative immunity from savages.

In summing up these various events and enterprises of the 17th century it may be said that Newfoundland was colonized not so much by aristocratic patentees as by toil-hardened settlers, some of them escaping from rigorous Stuart laws, but clinging tenaciously to the new land they had decided to make their home. From the first they carried on a rude agriculture, raising vegetables and cattle. Game and fish served to supplement their diet.

Hon. Joseph R. Smallwood, present premier of Newfoundland, in *The Book of Newfoundland* edited by him in 1937, describes in volume one, under that title, a typical outport "Brig Cove". The cove is described as about a quarter-mile in depth and its shores accommodate some 200 houses and about 1,000 people. The homes, built near the ocean, leave but a narrow strip of foreshore to contain the fishing stages, fish-rooms and fish flakes. The flat-roofed houses are small, two storeyed and built of wood and generally painted yellow, red or brown.

No effort whatever was made, so this author points out, to lay out such a settlement so that it would take on the shape and appearance of a town. Not built in ordered rows, the homes face whatever point of the compass their highly individualistic owners

might favor. The main street straggles around the curve of the cove, separating the fishing stages from private dwellings. The street, about 12 feet wide, could hardly be more stony or uneven. The only other streets in Brig Cove are narrow lanes twisting in all directions. No local authority existed to plan the community's growth or to regulate building construction.

The home-owner's garden is located "in back" from the settlement, possibly a half-mile from the coast. The land, as in the time of the first settlers, is free for the taking. True, it needed to be staked out and measured by a government surveyor. But as this latter step required the possession and transfer of hard cash, often these official formalities were not observed. The owner might just mark it off by himself and with luck, in the course of many years, manage to fence it. Each settler in Brig Cove took as much land as he desired, the earliest to arrive enjoying the best choice of available property.

Gradually all suitable agricultural land near the cove was occupied or, in any event, came to possess an owner. Though perfectly good land might be readily available "in back" yet the farther one retreated from the coast, the more difficult it became to work that land economically. After all, it was along the coast where basic livelihoods were earned. Here, then, was another important aspect of the ancient dilemma faced by many Newfoundlanders, namely, "cultivation interferes with fishing".

The initial surveys in and near St. John's were performed by garrison engineers at that point. One of these officers, Capt. Robert Pringle, R.E., left his lasting mark on the history of Newfoundland. The Naval and Military Museum, St. John's, displays Pringle's "Plan of Survey of the Hill Above the Church Within the Harbour of St. John's (including the location of an Entrenchment Battery for its Defence)". The scale of this map drawn about 1775, is 200 feet to the inch. In the same museum collection there is a Plan of Fort Townshend, St. John's, dated 1776. Capt. Pringle also began road construction in St. John's in 1773, when the entire population of the island did not exceed 8,000.

Francis Owen, Master of His Majesty's ship *Agincourt,* as a result of a survey made in October, 1798, produced a chart of St. John's harbor, complete with sailing directions for entering same. This plan, prepared on a scale of 100 fathoms to the inch, indicates in addition to water depths, the location of forts and other buldings, and access roads to the fort and gun batteries.

The struggle for supremacy in Newfoundland between the great powers of the day, France and England, lasted nearly 300 years. Control of the island fluctuated between the two nations. By the Treaty of Utrecht in 1713, full sovereignty over the island was ceded by France to England, the French retaining the right to resort to certain sections of the coast (which came to be known as the Treaty Coast) in connection with their fishing operations. The final battle of the Seven Years' War was fought on September 19, 1762, when Col. Amherst captured St. John's. This victory ended French rule on the island. The days of French supremacy are commemorated by numerous island place names, including Notre Dame Bay, Conception Bay, Placentia, Rose Blanche, Renews and Trepassey Bay.

As the 18th century came to an end, Thomas G. W. Eaststaff, draftsman and a captain of the Corps of Royal Military Surveyors, arrived in Newfoundland. His ability as a surveyor impressed the highest authorities on the island. From 1804 to 1806 he was engaged in the preparation of a comprehensive plan of St. John's. Soon after the plan's completion Capt. Eaststaff was appointed Surveyor to the Civil Government under the regime of Governor Sir Erasmus Gower. He continued in this post until 1816

when he was recommended for the permanent position of Crown Surveyor in Newfoundland.

A highly revealing exchange of letters took place in 1819 and 1820 involving Lord Bathurst, Secretary of State in London for the Colonial Department, Sir C. Hamilton, Governor of Newfoundland and Capt. Eaststaff. On October 8, 1819, Eaststaff wrote from Quebec to Lord Bathurst stating that he had been compelled "to write to his Agent in Newfoundland to sell all his property to pay . . . just and lawful debts". However (he confessed), to his dismay he had received word from Governor Hamilton that three of his lots, totalling an acre, could not be sold because, in the Governor's words, "the lots had been granted . . . to Mr. Eaststaff as connected with his situation as Surveyor of Lands, [which] by his removal from Newfoundland, is cancelled". Mr. Eaststaff protested to Lord Bathurst that this version of the transaction was incorrect and that the Governor "must have been grossly deceived by his Secretary" since the deed stated that "the grant with permission to build is given as a compensation for the road called Gower Street". Apparently Lord Bathurst was favorably impressed by Eaststaff's plea. He wrote to the Governor from Downing Street on January 8, 1820. His Lordship did not mince words. "It appears to me [the lots] have been given decidedly as compensation for the road allowance" and pointedly added, "I shall be glad to hear that you [have] permitted him to dispose of the three lots . . . without [further] delay . . .".

The survey instructions given by Governor Sir Richard G. Keats to Eaststaff on November 26, 1814 are of considerable interest:

"Whereas it is necessary to make a general survey of the lands without the Town of St. John's and to plan and register the several grants made by myself and former Governors, . . . you are hereby authorized and required to make a survey of such lands accordingly and it may be necessary to enter at proper times into any ground or enclosure occupied by individuals and to require of them a sight of the Grant or Authorities by which such lands are held by them, which lands and titles are to be registered by you according to the form No. 1 herewith delivered, and in case you should meet with any interruption or opposition in executing the aforementioned service you are to represent the same to the magistrates who are hereby authorized and required to afford you the necessary aid to enable you to effectually perform this service in the execution of which you will observe due civility and the parties are to be put to as little trouble or inconvenience as circumstances will permit of. Before you enter on this service you will take and subscribe an Oath to make a true and faithful survey and Register, according to the best of your knowledge and ability".[36]

When Eaststaff left the office of Surveyor to the Civil Government his annual salary, exclusive of fees, was £200. Some years later this salary was raised to £300 and by 1843 the remuneration had reached £500 but this was in lieu of all fees of office.

During the Eaststaff period the King's Printer, J. W. Withers, wrote in the first volume of the *Royal Gazette*, August 27, 1807, describing the social conditions in St. John's during the previous year. It was a time when the town's total population was about 6,000. The Withers report sheds light on the spirituous, if not the spiritual life of the port in those lively days. There were 33 taverns in robust operation there, places such as "Rose and Crown", "Bunch of Grapes" and "Tar for All Weathers".

"The quantity of spirits consumed in St. John's at this time", comments the Newfoundland historian, H. M. Mosdell, "was simply amazing. The imports of rum alone for an island population of about 20,000 was about 220,000 gallons or about 11 gallons

per head for everyone in Newfoundland and this besides brandy and gin, wine, beer and cider. Moreover, consumption was about 5 or 6 gallons per head. When we think that our consumption now [in the 1920s] is about one-third of a gallon of all ale, wine and spirituous liquors, we begin to realize how fully and freely those eager souls of a hundred years ago slaked their devouring thirst"![37]

The office of Surveyor General of Newfoundland existed for nearly 80 years, beginning in 1821 with the appointment of George Holbrook (1770-1832), the man who had made a marine survey of the east coast in 1813. He remained in office for 11 years and was succeeded by Joseph Noad, well known for his Noad maps of Harbour Grace.

Edmond Hanrahan, who followed Joseph Noad in the office of Surveyor General, occupied that position for five years, 1855 to 1860. Hanrahan, a member of the House of Assembly for Conception Bay for ten years and for Carbonear for an equal period, was also Chairman of the Board of Works. From 1863 until his death in April, 1875, he served as a magistrate. He was succeeded by John H. Warren, M.H.A., for Bonavista from 1855 to 1874. Warren was Surveyor General from 1861 to 1878.

Road surveys formed an important activity at this stage of the island's development. The Newfoundland authorities, in commissioning William R. Noad to draw up a plan of St. John's, indicated the limits of his surveys. The area extended from Temperance Street to Patrick Street and from the waterfront to the parade grounds. Cochrane, Gower, Prescott, Harvey (Road), Adelaide, Queen, Waldegrave and Patrick Streets were, at the time, newly opened thoroughfares. New Gower, Water and Duckworth Streets were widened and straightened somewhat about this time.[38]

The first road constructed outside the boundaries of St. John's was built in 1825, probably by the Royal Engineers. The island governor at the time, Sir Thomas J. Cochrane, had obtained a grant for the purpose from the British government. The road linked the capital to Portugal Cove over a distance of about nine miles. This development manifested a new official trend towards the encouragement of settlement.

Coastal waters afforded a relatively easy and natural means of communication between settlements but Newfoundlanders early in the 19th century became fully sensible of the basic value of suitable roads and highways. On November 16, 1835, Josiah Blackburn, Deputy Surveyor, made a report to the government of his survey of a line of road between Holyrood and Placentia:

"The Salmonier River is too great a breadth [about 90 yards] to admit of a bridge being easily erected over it, and the rush of the tide is so great that none but a bridge of the utmost stability could resist it, a Ferry therefore would be necessary here. The advanced state of the season . . . and the fatigue of myself and the five men with me, having been a month in completing the survey, and the greater time without any shelter but such as temporary tilts [lean-tos or tents] afforded us, prevented my going farther . . . Whenever the line of road ran through woods, I opened a path of not less than three feet wide and the line throughout is marked by [85] posts, [each] bearing a board of 7 inches by 2 inches with the words 'Rd. to Placn.' painted thereon".[39]

The following year there was a petition from inhabitants of Broad Cove praying that a branch road be opened from Cody's Well, on the way to Portugal Cove. The Governor, Capt. Henry Prescott, thought the matter worthy of consideration.

"The humble petition of the inhabitants of Broad Cove and places adjacent upon the southern shore of Conception Bay", so the document declared, "sheweth that petitioners reside near Broad Cove, a settlement distant about 10 miles from St. John's and that there is no direct road to their settlement from the capital, but that petitioners when bringing provisions from St. John's or taking up to town the produce of their farms, or

going thither on other necessary business, are obliged to go by way of Portugal Cove . . . Your petitioners therefore request Your Excellency recommend that some *competent surveyor* be employed to make examination into the practicability of cutting a direct path".[40] (author's italics)

It was in this same year of 1836 that general instructions were issued for the guidance of surveyors in marking out roads:

"1. To ascertain by careful examination from commanding eminences or by other judicious means, the most direct line of Road, then to keep closely to that line as may be consistent with the nature of the country.

2. Steep hills and [any] ponds must of course be avoided and rivers must be crossed where the breadth will not be inconveniently great for the construction of bridges.

3. Trees are to be marked in such a manner that the road may be distinctly traced without the possibility of mistake—when it is required to be made.

4. There must be delivered to the Secretary's Office plans of the lines of Road so marked out, being particular as possible in the bearings and distances, giving a general description of the country, the size and character of timber and pointing out such branch roads as you may think desirable.

5. You must always bear in mind that these lines are designed for high roads fit for the passage of carriages and carts of all descriptions".[41]

In Newfoundland road allowances were taken out of grants of property but compensation was given landowners thus deprived of some of their land. There is on record an undated deed of land, signed by Surveyor General George Holbrook in the reign of William IV (likely in the year 1831) as follows: "Greeting: Give and Grant to Martin Ryan of St. John's, his Heirs and Assigns, all that Piece and Parcel of Land situate and being at St. John's River near Waterford Bridge, leaving a Public Road on the North on the banks of the said River—Waste land on the East and West —500 yards back and also on the South one Hundred and Seventy Six Yards . . . described in the diagram annexed and containing 20 acres. Lot 238. Martin Ryan".[42]

All the great road improvements in the vicinity of St. John's in the 19th century began under Governor Cochrane. The roads to Topsail, Bay Bulls and Torbay as well as to Portugal Cove, although these projects had been commenced before his arrival on the island, were pushed forward to completion under his energetic direction. The pace of road construction was maintained under Governor Capt. Henry Prescott (1834-1841) and Sir John Harvey, who succeeded him.[43]

In 1836 Frederick R. Page, a surveyor, submitted to the authorities a lengthy and detailed report of a "Survey of Intended Line of Road between Cat's Cove Bridge [near the head of Conception Bay] and the Bottom Arm of Ship Harbour [on Placentia Bay] being part of a Great Western Main Line of Road extending 35 miles, to facilitate intercommunication between the western shores and the metropolis of the island".

Apparently, however, the public finances of the island could ill afford the "luxury" of road-building activities. Highway surveyors were poorly paid for their services, when they were paid at all. In connection with the making and repairing of roads of the Central District it was reported, for example, in 1836 that "In consequence . . . the [Road] Commissioners have not the means of paying Mr. Thomas Byrne [the surveyor appointed under 4 William IV, chapter 6] but a small part of his salary. That the said Mr. Byrne is still employed in superintending the levelling of snow in the streets during the winter months and has yet to receive the sum of £50". This constituted a new kind of levelling for land surveyors.[44]

The unpaid Mr. Byrne went on to higher realms of public service. A native of

Kilkenney, he became M.H.A. for Harbour Main district from 1855 to 1859. Previous to his election he had submitted, in 1840, a report to the Assembly on the "State and Condition of the Streets, Roads and Bridges of Newfoundland". At the time of his death on February 4, 1869, at the age of 70 Thomas Byrne was described as a "government surveyor".

Road surveyors, for their part, were not always punctual in submitting accounts for work accomplished. In the 1836 report already alluded to, there was mention also of sums disbursed to three surveyors "for laying out the best lines of Road from St. John's to Holyrood and Placentia, Trinity and Conception Bays:

Joseph Blackburn	£85
Joshua Green	£40
B. Sweetland	£80

N.B. The above named surveyors have not yet finished their surveys nor furnished any accounts of their disbursements . . ." On January 14, 1836, it was ordered in the message of His Excellency the Governor that the reports of Blackburn, Green and Sweetland of their road surveys be printed for the use of members of the House of Assembly. On February 23, Mr. Sweetland submitted an account to the Colonial Secretary covering the concluding part of his survey of the line of road from the capital to Trepassey.

In a report dated June 10, 1837, from the Commissioner of Roads and Bridges for the Ferryland District to the Colonial Secretary it is revealed "that unforseen circumstances retarded the appointment of a superintending surveyor until October 1, 1836, when Lieut. Robert Carter, R.N., the person appointed, was instructed to proceed forthwith to Bay Bulls and survey from thence to Cape Broyle, keeping in view the line stated to be surveyed by Mr. Sweetland the preceding year . . . and that by the time the survey was completed from Bay Bulls to La Manche Bridge, the weather set in so severe as to put a stoppage to further progress with the work until the spring . . ."

In the first six decades of 19th century Newfoundland three men stand out prominently among the trail-blazers who explored and surveyed the island during that formative period in its development. William Epps Cormack (1796-1868), John Beete Jukes (1811-1869) and Alexander Murray (1810-1884), all of them graduates of British colleges, pioneered in the introduction of scientific methods to the opening up of wilderness areas of the colony. James Patrick Howley (1847-1918) who, like Cormack, was Newfoundland-born, became assistant to Murray in 1867 and continued for many years in the distinguished tradition established by this dedicated triumvirate.

Cormack, born in St. John's of Scottish parents, was the first white man to cross Newfoundland from one coast to the other. In 1822, accompanied by a Micmac guide, he made the rugged journey on foot from Smith's Sound on Trinity Bay to the shores of St. George's Bay. Nine weeks were required to cover the distance of more than 205 miles. By this remarkable achievement Cormack, a graduate of Edinburgh University, paved the way for later and more systematic explorations of the interior.

There is little doubt that Cormack was inspired to undertake his expedition by the earlier feats of Lieut. Cartwright and Capt. John Buchan on sorties up the Exploits River. Capt. Buchan made sketches of the territory he traversed in this manner but his promising career was cut short when he met death at the hands of Indians during his second expedition. Although Cormack failed to leave maps he produced a valuable record of his field observations in a volume entitled, *Journey Across Newfoundland*, published in St. John's in 1856. Cormack became deeply interested in the origins and fate of the island's Beothuck population. He was aware of the existence of one Beothuck

Indian woman in St. John's and in 1827 made an intensive but unsuccessful search of Newfoundland for other survivors of the tribe. The woman died in 1829. Cormack remained in Newfoundland until 1836 when he departed for the Antipodes. Eventually he returned to New Westminster, B.C., where he died in 1868.[45]

By 1832, a decade after Cormack's epic journey, Newfoundland had attained a measure of representative government. Partly as a result of this constitutional development funds were provided six years later by the House of Assembly for the purpose of financing a geological survey of the island. In an address by Governor Prescott at the Assembly opening on May 17, 1838, His Excellency announced, "It gives me great pleasure to inform you that the President of the London Geological Society has, at my request, recommended a gentleman fully competent to undertake the Survey for which you made provision last year. This gentleman, a graduate of Cambridge to whose merit high testimonials have been furnished by the Geological Professor of that university, is already arrived and has entered upon his arduous task with zeal and alacrity". For John Beete Jukes that was a commendably fast start but, technically, he had beaten the legislative gun by several days.

"I cannot deny myself", the Governor continued, "the gratification of quoting the closing paragraph of the professor's letter on that occasion — 'What the survey will lead to it is impossible to judge in our present ignorance of the structure of the Island, but I cannot help anticipating great good, both economical and scientific. In the name of my brother geologists of England I offer you our best thanks for the noble example you have set to our other Colonies'."

Members of the House, realizing that through their initiative a leading geologist of his times had been attracted to the task, and intent upon receiving proper credit for their foresight and discernment, replied fittingly on May 20 to His Excellency's address: "It is particularly gratifying to the Assembly that a gentleman having the high scientific character of Mr. Jukes should be induced to undertake the Geological survey of the Island. This is a subject upon which the Assembly feels great interest — *originating as it did with them* — they are doubly solicitous it should eventuate in enhancing the physical character and developing the internal resources of the country, directly promoting the rapid and permanent advantage of its inhabitants". (author's italics) The House ratified the appointment of Jukes that same day.

Jukes, whose arrival in Newfoundland in 1838 on the clipper brig *Diana* had been a shade premature, spent the years 1839 and 1840 in exceedingly intensive exploration and mapping work in the interior of the colony. In 1839 he published his *Report on the Geology of Newfoundland,* complete with map, returning to England on H.M.S. *Spitfire* the following year. In 1842 he published *Excursions In and About Newfoundland* in two volumes. Later he surveyed in Australia and in North Wales. In 1851 he was named Director of the Irish Geological Survey, dying in Dublin on July 29, 1869.[46]

From 1830 to 1860, with the single important exception just described, no significant surveying or mapping took place in the interior of Newfoundland. In 1864, however, history was repeated and, for the second time within a quarter of a century the Assembly endeavored to place the geological survey of the island on a systematic and permanent basis.

In his address at the opening of the Assembly on January 28, 1864, the Governor, Sir Alexander Bannerman echoed his predecessor, Capt. Prescott: "Public attention has frequently been directed by many intelligent individuals to the necessity of a Geological Survey of the Colony and the importance of such a Survey has become, every day more apparent. It must be gratifying to every one who takes an interest in this Country to

learn that there are now at work Two Mines, a Lead and a Copper one, each employing 100 persons, and successfully conducted by enterprising Capitalists, in limited localities, whilst the vast unexplored territory of this Island, as well as its extensive adjunct dependency, Labrador, opens a wide field for the investigation of a Geologist, and justifies encouraging hopes that the Mineral resources of Newfoundland may yet prove most productive and afford remunerative employment to its people.

"The government lately opened a correspondence with Sir William Logan on this subject and they have reason to believe that eminent geologist will afford such information to this Legislature as may induce it to make every endeavor to promote this important object."

In its dutiful response to the opening address the House agreed that "a careful and thorough Geological Survey, carried out by competent persons, would be a measure of inestimable importance to the Colony which may one day become as remarkable for its mineral resources, as it is now for its Fisheries".[47] This sentiment reflected a growing feeling among Newfoundlanders that it would be wise to avoid becoming a one-industry colony, no matter how imposing in importance that industry might be.

Sir William Logan, first Director of the Geological Survey of Canada, proved most helpful to the Newfoundland administration in this connection and loaned to the colony his valued and highly competent second in command, Alexander Murray. In all the circumstances it was a generous gesture but the close connection between Logan and Murray was to lead, innocently enough, to considerable embarrassment to the latter. A highly suspicious House of Assembly conducted a thorough investigation in 1869 through the agency of five-man committee, including John H. Warren, the then Surveyor General. In Murray's testimony before the committee we find a summary of his professional career in Canada prior to the loan of his services to Newfoundland.

"Early in 1843 when W. E. Logan, Esquire [he was knighted in 1856] accepted the directorship of the Geological Survey of Canada", Murray testified, "I was appointed chief assistant in that organization on the recommendation of Sir Henry de la Beche, at that time Director General of the Geological Survey of Great Britain. By reference to the Preface to the *Geology of Canada, 1863* it will be seen that I 'blocked out' nearly the whole of the geology of Western Upper Canada in the first instance. I was for two seasons engaged in examining and surveying Gaspé Peninsula. In 1846 I was employed under Logan in surveys of the copper region of Lake Superior and was at work for many years on the geology of the country between Lake Huron and the Ottawa River". At this point Murray quoted an unsolicited letter of recommendation he had received from Sir R. I. Murchison, F.R.S., a most distinguished British scientist: "I have hereby great pleasure in testifying that Alexander Murray who has so long served as a Geological Surveyor in the Province of Canada, has borne a very conspicuous part in producing maps and sections of that country which have obtained approbation of men of science of all countries. The arduous labours in tracts never before surveyed and in which he was compelled to define their topography before he could define geological boundaries, can scarcely be over-rated". There was also reference made to a laudatory letter received by Murray from Archibald Geikie, F.R.S., Director, Geological Survey of Scotland, "I know of what value your work has been in bringing to light the economical value of the rocks of Canada and in unravelling those scientific problems for which the survey of Canada has obtained so world-wide a reputation".[48]

Alexander Murray continued in his evidence before the committee: "In 1864, my first year in Newfoundland, my operations were chiefly confined to the great northern peninsula . . . Previously to my arrival here, Mr. James Richardson, one of the staff

under the direction of Sir William Logan, had made a partial survey of the north-western shores and the purport of my visit to the northeast side was to join my work with his . . . I found discrepancies most conspicuous in coast charts on the coast of St. George's Bay and on Humber Arm, where errors of position were found to exist from one to two minutes of latitude and sometimes more in longitude. The whole work of combined surveys of the 1865 and 1866 seasons, including the corrected coast line was prepared on the usual scale of one inch to the mile, later reduced and submitted on the scale of 4 miles to one inch".

Born at Crieff, Perthshire, Scotland, Murray lived out his post-retirement days there. Educated at Royal Military College, Portsmouth, he served in the British Navy for ten years, 1824 to 1834. Fond of using nautical terms in his everyday conversation he became affectionately known to Newfoundlanders as "Captain" Murray. "A bright, genial, pleasant looking man", according to Dr. Robert Bell's description of him, Murray possessed a splendid physique and was uncommonly fond of early morning cold water dips. But early in the summer of 1866 he suffered a crippling accident. He severed the Achilles tendon in one leg but insisted on completing the season's field work. His resolution was admirable but the effect of his determination was to leave him lame, though not incapacitated, for the remainder of his life.

Murray's strenuous exertions on surveys during the following summer aggravated the tendon injury and finally compelled him to abandon work for the balance of the season. "In 1867", he testified at the inquiry, "in consequence of a serious accident during the previous season's explorations I was obliged to repair to England and not until August was I sufficiently recovered to resume". Additional light was shed on this mishap and its aftermath in a later passage in Murray's evidence.

"In 1866", he testified, "I made extensive survey of the Humber Valley, ascending and descending violent and dangerous rapids, carefully triangulating the country and minutely noting all particulars that came within my reach while I was at the same time a helpless cripple, having to be lifted in and out of my canoe and even to be supported by one of my two Micmac Indians while I worked my theodolite. In many cases my only means of locomotion during the autumn when I triangulated parts of Bay St. George, was on my hands and knees and thus getting suitable positions for taking observations. The same autumn I persevered, working on as best I could, in pain and suffering, from August 15 to November 22 because I was unwilling that the expense that the government had been put to in chartering a vessel for my convenience should be thrown away".

Murray made another character-revealing comment in his remarks before the legislative committee. "With respect to the shortness of my 1867 season", he stated, "I returned to St. John's at the end of September and I had one very good reason for doing so and that was I had no funds to pay further expenses, unless they came directly out of my pocket. I had been warned before going out in the field that I would be limited to £225 for all expenses, exclusive of my own salary". He went on to confess that even with the exercise of the utmost frugality he overspent that allotment by £54!

The committee was advised by Murray that in 1868 his survey activities took him to Conception, St. Mary's and Placentia bays. A survey was also made by him that year of La Manche mining locations and "a large tract of country reaching into the island's interior was connected upon a system of triangulation".

All this and much else failed to dispel misgivings of the legislators at St. John's. These doubts had stemmed from a letter from Murray to H. W. Hoyles, Newfoundland's Attorney General, soon after the appointment of the geologist. The letter was

mailed from Montreal and was dated January 3, 1865.[49]

"By letters received here from Sir William E. Logan", Murray wrote, "I have reason to apprehend that his return from England to this country is not likely to be nearly so soon as I was led to expect and it may be that, consequently, the Report of my proceedings in Newfoundland will also be delayed as it is of *the utmost importance that he should personally inspect what has been done* and approve for publication. But I will submit the following sketch of what has been ascertained for the information of the Legislature, upon which a Report will hereafter be constructed . . ." Thereupon follows a lengthy 'sketch' of Murray's findings. (author's italics)

It appears that in those formative times the Newfoundland administration was intent on keeping geological reports highly confidential. From Murray's guileless letter it seemed to the law-makers of St. John's that a solemn trust was being violated by the disclosure of information to another Canadian official. But the investigation served to clear the air. The committee reported that "it was able to supply highest testimonials to the scientific and practical capacity and eminent attainments of Mr. Murray as a Geological Surveyor, with evidence of his useful labours in other countries, especially in Canada, in connection with Sir William Logan, whose first assistant he was . . . The committee expresses satisfaction over Mr. Murray's industry and application, as of his ability and capacity . . . The committee is also quite satisfied with Mr. Murray as a Geological Surveyor, with evidence of his useful labours in other countries, of this Island and that no preferential information or advice of any kind is given to persons residing elsewhere, but that the earliest reports are presented to this Government and Legislature while we have the advantage of the subsequent scientific elaborations of Sir William Logan and his staff . . ."

Alexander Murray's own mind and conscience were clear on the issue. He told the committee plainly, "If the 'impressions' spoken of are meant to imply that either Sir William Logan or myself are capable of using information for individual personal interests, such insinuations are unworthy of indignation and need only be treated with the utmost indifference".

An interesting sidelight of the committee investigation was the testimony offered by Professor Robert Bell, Professor of Geology, Queen's University, Kingston. The questioning of the professor disclosed the inevitable and abiding political concern of all legislative bodies with the practical benefits to be derived from government-sponsored technical surveys.

"Q. Have you been engaged upon the geological survey of Canada?

A. I was engaged upon that survey for ten years, 1857 to 1867.

Q. Do you suppose that the system pursued is the best?

A. A correct geological map cannot, of course, be constructed without a correct topographical survey and where no such survey has been made, Murray's only course is to make one himself, which he is well qualified to do.

Q. How long has the Geological Survey of Canada been in existence and how long has Mr. Murray served in that department?

A. The survey went into operation in 1843. It was formed in 1842. Mr. Murray was connected with it from its origin up to the time of his present appointment, with the title of Assistant Provincial Geologist, or next in rank to its illustrious director, Sir William E. Logan.

Q. What have been the practical results and what benefits have been derived from the publication of Mr. Murray's reports and surveys in Canada?

A. Publication of these reports and surveys has been the means of giving to the world

a knowledge of the geology and geography of regions to which they refer. When such work as this is once correctly done it becomes of permanent value to the country and serves a variety of useful purposes for all time to come. In addition to aiding in the development of the mineral resources of Canada reports have contributed such general information of use to the country and observations of value to the scientific world, while the maps have also been of the greatest service from a geographical point of view. In the course of his Geological Surveys, Mr. Murray, I think, surveyed topographically more of the mines, both of Eastern and Western Canada, than any other person. These surveys have necessarily been of very great use not only in the subsequent laying out of land for agricultural and lumbering purposes, but also in the location of roads and even canals, as, for instance, his map of the French River and Lake Nipissing in connection with the Ottawa Ship Canal survey. . . . Whenever these surveys have been checked upon later, they have been found correct. . . ."

It is given to few men, under examination in a witness box, to express so perceptively and so tersely the basic purposes of surveying and mapping, or to pay such an eloquent tribute to a fellow surveyor.

Despite tragic reverses such as the disastrous fires that laid waste the island capital on three occasions over the two-year span of 1816-1817, the population, if not the prosperity, of Newfoundland continued to increase. By 1865 more than 140,000 people were living in the colony. A large measure of representative and responsible government had been achieved. The transition from pounds sterling to the dollar standard had been accomplished. With the increase in population came a steadily mounting demand for qualified surveyors and for much greater activity in land surveying.

The practice of surveying had also undergone a transformation. The profession has progressed beyond the dory compass, picket and fishing line stage. Alexander Murray, in his evidence at the 1869 inquiry, gave fleeting glimpses of some of the advances that had taken place in the field. It had become the custom among surveyors to follow river courses in two canoes. In this manner the line of the rivers could be measured, one canoe travelling ahead of the other, but always in sight. The surveyor was equipped with a Rochon micrometer telescope for measuring distances and a prismatic compass for taking bearings while afloat. One canoe carried a pole on which painted disks served as observation targets. Each river became a base for survey operations on both sides of it. The compass gradually gave way to the theodolite worked "upon a limb" and whenever possible the country was surveyed by the triangulation method, using either a theodolite or sextant. Astronomical observations were taken frequently to establish latitude and the extent of compass variation.

In commenting upon the mode of travel adopted by surveyors in Newfoundland, Murray admitted that a small coasting vessel could serve conveniently to transport a survey party from one part of the island to another but he pointed out that "accommodation of this sort necessarily involves great additional expense and in many parts coast sections are inaccurate for measuring stratographical detail". Murray was convinced that the system of sectional surveys made by following main watercourses was by far the most practical, if not the only method by which adequate knowledge of the geology or geography of Newfoundland could be acquired systematically and reliably.

In Murray's time surveying costs in Newfoundland were considerably in excess of those prevailing in Canada because of much higher costs of provisions and the substantially higher cost of labor during the fishing season. A rough estimate of a geological field party's basic expenditures was made by Murray and contained the following items and costs:

Purchase of locally made canoe	£ 5	
Purchase of a new tent	£ 5	
Hire of 4 men for 4 months	£120	
4 barrels of flour	£ 7	4s.
2 barrels of pork	£ 12	
100 pounds of bacon	£ 5	
Tea, sugar and groceries	£ 20	
Hammers, chisels, etc.	£ 5	
Contingencies	£ 50	
Assistant for 3 months	£ 30	
Total	£259	4s.

To complete a survey on the basis of any lesser expenditure would involve either having the work less efficiently done or providing extra funds out of the party chief's own pocket. This would not include such subsequent steps as the production and publication of a general map with accompanying sections and written descriptions essential in any genuine effort to do justice to the area surveyed and to make the work done fully effective.

This section has dealt mainly with land surveying on the island of Newfoundland. The story of marine surveying in Newfoundland's waters is another story, already partly told in this volume. At the midway mark in the 19th century the department of government responsible for the administration of Crown Lands in Newfoundland was styled the Surveyor General's Department. By 1856 a total of 75 grants of such lands, amounting in all to 1,000 acres, were issued for settlement purposes. In 1865 alone the number of such grants issued totalled 105. Surveys of Crown Lands for the purpose of giving title to purchasers were carried out by deputy surveyors appointed by the Surveyor General. The 20-year period, 1840 to 1860, was marked first by the passing of a bill regulating the sale of Crown Lands (1843), then by a series of amendments to the Crown Lands Act over a number of years which, in turn, led to the major consolidation of 1884. In 1873 an Act to establish homestead law in the colony was passed.

Cormack, Jukes and Murray left the indelible imprint of their resourcefulness, knowledge and dedication not only upon the record of early surveying and mapping in Newfoundland but on the life and progress of its inhabitants. Before their surveys the interior of the island was unknown and the value of its mineral, timber and agricultural resources unsuspected. At the outset Murray's annual geological reports were received with general incredulity. Then the pendulum of opinion swung in the opposite direction and a mania for mining and prospecting flared up. Copper in large quantities was successfully mined, lumbering operations were commenced and promising farmlands were disclosed around Bay St. George and in the valleys of the Humber, Exploits and Gander rivers. For the first time it dawned on the people of Newfoundland and the world that the island would not continue to be completely dependent upon its fisheries.

Following in the venturesome footsteps of these three great pioneers came James Patrick Howley of St. John's, who gave 40 active, highly useful years to the advancement of the cause that his distinguished predecessors had done so much to promote. Each of these four outstanding men realized, in the high tradition of the profession, that his contribution to the task of measuring and reporting the physical assets of the country was but one more pace forward in the continuing development of the land and of its exceptional people.

13

EARLY PROBERS OF CANADA'S SEAS AND GREAT LAKES

For more than three hundred years (1580-1880) Englishmen were active in the exploration, surveying and mapping of Canada's northern waters and the eastern approaches to them. Up until the defeat of the Spanish Armada (1588) England appeared indifferent both to the study and application of scientific principles in the construction of marine charts. The convergence of meridians, for example, was ignored. Marine cartography, in fact, was not practised in England until the 16th century, although about 1510 a fair number of crude English charts came into circulation. It was not until the latter years of the reign of Henry VIII (1509-1547) that a solid base was laid for the craft of chart construction in England. Italy, Spain, France, Portugal and the Low Countries were far ahead of England in this respect. As late as the early 17th century the Dutch House of Blaeu was the world's leading publisher of marine charts.

Henry VIII perceived the need and envisioned the possibilities for the establishment of such a craft in England. He induced the Dieppe-born Jean Rotz to come to England and, in effect, made him a royal hydrographer in 1542. Rotz quickly justified the King's faith in him by preparing, in that same year, an authoritative book on hydrography that included a set of charts incorporating the latest French discoveries in America.[1] But the principal factor in the growth of English marine cartography was the new zeal displayed for improving the nation's harbors. Yet it was not until 1657, when John Moxon published a *Book of Sea Plats* of European coasts, that England made its first substantial bid to break the Dutch monopoly in this important realm.[2]

Richard Lee, in 1533, was listed in Henry's army muster roll as a surveyor entitled to four soldier-assistants. He was a pioneer in the task of charting England's

coasts. By 1540 Lee had acquired the imposing but somewhat unofficial title of Surveyor of the King's Works at Calais. John Rogers and Richard Popinjay succeeded Lee in the post of Royal Surveyor, as the post came to be known. Instruments in use in marine surveying in those times included cross-staff for angle measurements, wooden quadrant, astrolabe and compass. But none of the early English charts contained information on soundings. Occasionally a manuscript note indicated a general depth likely to be found over an extensive area. Occasionally, also, submerged reefs were shown.

The active interest of Henry VIII bore good fruit. By the middle of Elizabeth's reign (1559-1603) London was developing into an important centre for marine chart production and for the repair of survey and drafting instruments. In 1599 Edward Wright dealt with problems of chart making in his book *Certain Errors in Navigation.* He deplored the plain charts of the day because of their failure to provide sailing course or line of constant bearing, especially in polar or sub-polar latitudes. He compiled and printed a table of meridional parts for every minute of latitude and published a chart of the Northeast Atlantic on the Mercator plan of projection.[3]

In the light of these developments the venturesome probing of Canada's northern waters by English mariners progressed over the 16th, 17th, 18th and 19th centuries. In part this out-reaching was a natural response of a young, dynamic and expanding nation to the challenge of the beckoning unknown, of new territories waiting to be claimed, settled and organized. During this extended period the commercial motive constituted the principal driving force in the promotion of polar exploration. The motive was two-sided. On the one hand it was a search for the Northwest Passage by sea, so that European trade with the Orient could be expedited and stimulated; on the other there was the hope of exploiting the extensive whale and seal resources of the northern waters.

Magellan's significant feat in rounding Cape Horn in 1520 revolutionized the thinking of European geographers of his day. His success confirmed the validity of the round world theory, also that North America was in all likelihood a continent separate from Asia, and that the land mass of the Americas had to be circumvented in some way in order to reach the Orient by water from Europe on any westward course. Sir Humphrey Gilbert in 1576 expressed the general belief of his times concerning such a route:

"I am of the opinion that America by the Northwest will be found favourable to this our enterprise, and am rather imboldened to believe the same, for that I find it not only confirmed by Plato, Aristode and other Phylosophers: but also by all the best modern Geographers . . .[4]

Before the end of the 16th century the search for the Northwest Passage was under way. To Europeans, intent on westward voyaging, North America was not so much a goal as an impediment. The initial discovery voyage of Sir Martin Frobisher (1535-1594), more than a half century after Magellan's signal achievement, stirred deep excitement. He considered that traversing the Passage was "the only thing in the world that was left undone whereby a notable mind might be made famous and fortunate".

On June 7, 1576, the Yorkshire-born Frobisher (he was knighted in 1588) sailed with a fleet of three vessels, the *Gabriel* (25 tons), the *Michael* (20 tons) and a 10-ton pinnace. The latter was lost en route and the *Michael* was abandoned. On the *Gabriel* Frobisher sighted the Labrador coast on July 28 and then sailed into what is now known as Frobisher Bay. Understandably, in view of the elongated lines of the bay, he believed that he had actually entered the Northwest Passage.

A manuscript map of the North Atlantic area, including parts of Baffin Island and Labrador, was completed by June, 1576, by W. Bourough for the use of Frobisher on his first voyage, probably, as Miller Christy puts it "not as a guide for Frobisher when upon his voyage, but as a semi-blank chart upon which he might plot out the lands discovered or visited . . ."

Two subsequent voyages made by Frobisher, one in the summer of 1577 and the other a year later, were made mainly to carry back to England what he thought was gold-bearing ore but which turned out to be iron pyrites. On the second voyage he landed on Hall Island, on the highest point of which Frobisher "made a cross of stone, sounded a trumpet and said certain prayers . . . honoured the place by the name of Mount Warwick".[5]

In 1578 Frobisher, having been made Admiral of a fleet of 15 ships, landed in the south of Greenland after finding the mouth of Frobisher Bay ice-choked. He named this part of Greenland "West England". Returning later to Frobisher Bay he sailed part way up the strait later explored by Henry Hudson and now known by his name.[6] As an outcome of these voyages England made her first original contribution to the cartography of the New World. The world map and map of Frobisher's Straits were the first to show, with reasonable accuracy, the eastern approaches to Canadian Arctic waters. As T. E. Layng has pointed out, these maps, which appeared in George Best's *A True Discourse* (1578), were probably drawn by James Beare, principal surveyor to the expedition.[7]

John Davis (1550-1605), who followed Frobisher's discovery trail, was born at Sandridge, England: "Here was born that excellent pilot and skilful navigator and fortunate discoverer of unknown countries — John Davis". On January 24, 1583, Dr. John Dee, Adrian Gilbert and John Davis waited upon Mr. Secretary Walsingham (later Sir Francis) "and made Mr. Secretary privy of the Northwest Passage and all charts and rutters* were agreed upon in generall."[8]

As a result of this momentous visit Letters Patent from the Queen were issued to Davis granting "a right to search passages by the North, Northeast and Northwest, to China". Accordingly Davis sailed in command of two vessels *Sunneshine* and *Mooneshine* in 1585. The expenses of this voyage were defrayed by "divers worshipful merchants of London and of the West Country". At this time Davis was not only a sailor but, in a sense, a surveyor. In addition to his invention of the Davis (wooden) quadrant, there is the record of his accomplishments when his vessels, on that first outward voyage, were delayed by bad weather near the Scilly Isles. He visited by boat some of the islands of the group and "did plotte out and describe the situation of all the Islands, rockes and harboroughs, to the exact use of Navigation, with lynes and scale thereunto convenient". On July 20 he sighted the east coast of Greenland, sailed across what is now Davis Strait, proceeding as far north as latitude 66 degrees 40 minutes, along Baffin Island and naming such places as Mount Raleigh, Cape Walsingham and Gilbert Sound. Davis returned to Dartmouth on September 30, 1585.

The second Davis voyage extended from May 7 to October 6, 1586. He sailed from Dartmouth with the *Mermaiyde* (120 tons), *Sunneshine* (60 tons), *Mooneshine* (35 tons) and *North Starre,* a 'pynace' of 10 tons. This latter craft was used for penetrating bays and sounds. His third and final voyage, May 19 to September 15, 1587, was also from Dartmouth with the *Elizabeth* and *Sunneshine,* also the *Ellen,* a pinnace. He sailed along the west coast of Greenland to latitude 72 degrees 12 minutes to Cum-

*Portolan sailing directions were known to the French as *Routier* and this word became corrupted by usage into the English term *Rutter.*

berland Sound and gave the cape at the entrance to Ungava Bay and Hudson Strait the name of Chidley, honoring "the Worshipfull Mr. John Chidley of Chidley, in the countie of Devon". Chidley had promoted and commanded an expedition to the South Seas by way of the Strait of Magellan.

Davis returned to Dartmouth "giving thanks to God for our safe arrival". He endeavored to reconcile his discoveries with those of Frobisher and, if he could, with the venerable, misleading but still esteemed Zeno map. Unfortunately the large-scale map prepared by Davis has been lost. We possess today only the results as delineated by Davis himself on the Molyneux globe and in the New Map of the World, prepared under the supervision of Mr. Wright. On this "new map" the Davis discoveries are shown as precisely as on the globe.

Parsons and Morris have summed up the transaction in this way: "The compilation of the 1600 chart would seem to fall in this order: Wright transferred the facts and details from Molineaux's globe to his own chart, and Davis and Hakluyt assisted in recording the latest discoveries. This was the first world chart to be published in England, and the passage in *Twelfth Night* . . . 'He does smile his face into more lines than is in the new map with the augmentation of the Indies' . . . is now generally believed to be a reference to this map . . ."[9]

The lengthy and rather grandiose title of the "New Map" is quaint and revealing: "Thou has here, gentle reader, a true hydrographical description of so much of the world as has been hitherto discovered and is come to our knowledge, which we have in such sort performed, y^{t} all places herein set down have the same position and distances that they have on the globe, being therein placed in the same longitudes and latitudes which they have in this chart which, by the ordinary sea chart, can in no wise be performed".

The restless, roving spirit of Davis turned next to somewhat warmer seas. He discovered the Falkland Islands in 1592, thirteen years before his death at the hands of Japanese pirates near Singapore. Davis was the author of a book on navigation, published in 1594, titled, *The Seaman's Secrets*. He also wrote *The World's Hydrographical Description*, published in 1595.[10]

Though John Davis was unsuccessful in the main quest of his life he managed to add immensely to the knowledge of Canadian Arctic waters. One of the most able of Elizabethan sea captains, Davis was outstanding among early explorers of Canada's north.

The story of Henry Hudson is well known. His heroism and navigational skill linked with a questing mind and spirit are commemorated in the name of the immense Canadian bay in which he met tragic death. As commander of the 55-ton ship *Discovery* he came upon the strait that also bears his name, while on his voyage of 1610. Searching patiently for the passage that had eluded Frobisher and Davis, he penetrated as far south as James Bay. After wintering on the shores of Hudson Bay he began to encounter disaffection among his crew. Most of his men mutinied in the spring of 1611. Henry Hudson, his son John and seven loyal crewmen were cast adrift in an open boat to meet certain death from cold, hunger and exhaustion.

In 1612 Sir Thomas Button, commanding the *Resolution* and Hudson's old ship, *Discovery,* followed Henry Hudson's track to Southampton Island, thence westerly to the mainland coast of the bay at 60 degrees 40 minutes. Button, the first white man to set foot on the soil of what is now Manitoba, wintered at the mouth of a large river that he named the Nelson, after a sailing master of his acquaintance. In 1613 he sailed again to Southampton Island and named one of its large embayments, Bay of God's

Mercy. On his homeward voyage, just five years after the founding of Quebec, he discovered a small group of islands near Cape Chidley. Somehow missed by Henry Hudson, the group now bears the name of the man who so soon after the ill-fated venture of father and son, followed in their course.

Robert Bylot, mate of Hudson's *Discovery* and the mariner who returned that ship to England, made a voyage in the vessel in 1616 with a pilot named William Baffin. In a number of ways this voyage was the most notable of the ventures into the Arctic during the 16th and 17th centuries. Baffin, on this trip, completely delineated the shores of Baffin Bay and reached Northumberland Island, the most northerly point reached by any explorer until the 19th century when John Ross retraced Baffin's course of some 200 years earlier.

Baffin mapped various sounds and islands on the famous 1616 voyage. He deposited his chart with the historian Samuel Purchas, along with his ship's log. The map, however, was regarded by Purchas as expendable because of its awkward size and cost. In any event, the map was lost. Baffin and Bylot were the first explorers to land on any of the Queen Elizabeth Islands as these are known today. The event took place on either Devon, Coburg or Ellesmere Island in July, 1616. One of the largest islands in the world, Baffin Island, preserves the name and fame of this courageous English navigator and mapper. Two centuries later John Ross was much impressed by the accuracy of Baffin's observed latitudes. At the time of his discoveries, however, Europeans generally disbelieved Baffin's description of the vast bay named after him. He remained discredited until the Ross vindication of 1818.

It would be well at this juncture to consider the grave difficulties attending the writing of ship's logs on any of the tiny Elizabethan ocean-going vessels equipped with such primitive and confined accommodations as to allow little human comfort. In such a log would be set down purely factual information of courses, events and distances travelled as well as weather reports. But occasionally there would also be references to the commander's philosophy of life and exploration together with unabashed ventures into poetry and fantasy.

The distinguished Danish marine pioneer, Jens Munk during 1619 and 1620, Luke Foxe aboard his 70-ton pinnace, *Charles* in 1631 and Thomas James in 1631 and 1632 on the *Henrietta Maria,* all probed Hudson Bay in the 17th century hoping to find that this vast opening into the heart of the continent was the true passage to the Pacific. Their efforts were in vain. Capt. Foxe, as he proceeded along the western shore of the bay, sent out landing parties from time to time. He gave signs, in his diary, of being a natural-born surveyor. For example, this entry for August 3rd:

". . . the land lowe, but now and then a Sandie knowle or downe would appeare, much like the coast of Holland and Flanders: wee made way S.W. and by W. 10 leag., and divers times see dry shelves betweene us and the shoare. The Latit. was 60 d. 22m."[11]

In the 18th century examination of the Hudson Bay shoreline was continued by Knight, Scroggs, Middleton and others. But, in general, by 1650 the possibility that any one of the three main water entrances into the North American continent, (Hudson Bay, the St. Lawrence or Hudson rivers), could be a Northwest Passage to the Orient, had been effectively demolished. The first entranceway to be probed, the St. Lawrence Gulf and River had been found by Cartier to be but the drainage system of a group of very large inland lakes, rather than a transcontinental breach. Hudson Bay had proved to be unfruitful as a short cut to China but it required another century of investigation to demonstrate to the world that none of the principal rivers flowing into the bay led to the Pacific. Baffin Bay, far to the north, also appeared to be an ice-bound

dead end. Champlain had proved that the Great Lakes of the interior were bodies of "sweet water" rather than part of any western ocean. He was satisfied also that at least one thousand miles of land separated those lakes from the Pacific. In fact, as geographical knowledge of North America kept increasing during the 17th century, the location of the western ocean kept fading, farther and farther away. The wide straits or water passages severing the continent, as shown on many maps of North America in the 16th century, were the result of lively imaginations rather than of any search for solid facts.

In 1745 the British government provided by legislation for a cash award for special achievement in Arctic search and research. The sum of £20,000 was offered in that year "to such person or persons, subjects of His Majesty, as shall discover a Northwest Passage through Hudson's Straits to the western and southern oceans of America". In the meantime knowledge of the theory and practice of surveying and mapping was growing apace in Europe. But it was not until the last decade of the 18th century that England matched its progress in land surveying, including the establishment of its notable Ordnance Survey in 1791 by the founding of the Hydrographic Office of the Admiralty on August 12, 1795.

During the period of the Napoleonic wars interest in the Canadian Arctic waned. But in the post-war period two polar-minded men of considerable national stature in England gave much-needed leadership, namely, Sir John Barrow, Secretary of the Admiralty and the aging man of vision, Sir Joseph Banks, president of the Royal Society. The good works of both are fittingly perpetuated in the names of prominent geographical features of our Arctic region. The legislative inducement of 1745 was repeated in 1818 with the addition of £5,000 for the attainment by any explorer of latitude 89 degrees North. Under the authority of the Commissioners of Longitude a scale of prize awards was created for the crossing of various parallels of high latitude. It was this system of official awards that sparked the liveliest and most productive half-century of Arctic discovery.

Lieut. William Edward Parry (1790-1855), knighted in 1829, conducted the first of several of his expeditions in 1819—extending into 1820—with the 375-ton *Hecla* and 180-ton *Griper*. He laid formal claim to the award made available for crossing the meridian of 110 degrees west of Greenwich in latitude 74 degrees 44 minutes 20 seconds North. He stated that September 6, 1819, was the date of such crossing. The ultimate westing reached by the Parry vessels that season was 112 degrees 51 minutes West. On August 16 of the following year Parry, commanding the *Hecla* and the 377-ton *Fury*, reached the meridian 113 degrees 48 minutes West. Unable, however, to cross the considerable Beaufort Sea to Point Barrow, Alaska, Parry returned to the Thames in mid-November, 1820. Rev. George Fisher was both chaplain and astronomer on this journey. Parry had proved that Lancaster Sound was not an inlet, as John Ross had mistakenly surmised in 1818, but the beginning of what could be a true Northwest Passage.

Parry had achieved an oustanding triumph of northern navigation and survey. He had discovered and named Devon, Cornwallis, Bathurst, Byam Martin and Melville Islands. His own name was later applied, about 1835, to this whole group. He had sailed westward across the top of the continent, over more than 30 degrees of longitude, and carried out surveys calculated to create a geodetic network upon which all later discoveries in the Arctic could be based. He had mapped the north, south and east coasts of Melville Island, the south coasts of Devon, Cornwallis and Bathurst Islands as well as the north and east coasts of Somerset Island.

On deposit with the British Admiralty, London, are the results of considerable surveying and mapping accomplished in the Arctic, by-products of official expeditions of those early days. There is, for example, a chart showing the track and discoveries of the Parry expedition of 1819, on that part of the voyage extending from Cape Farewell (at the southern tip of Greenland) to Lancaster Sound; this chart was drawn by Lieut. F. W. Beechey. There is a faint pencil note on the chart stating that it included "the track of H.M. Ship *Hecla*". There are also some unfinished 1819 field sheets indicating Beechey's work on the west coast of Baffin Bay.

In 1820 the name of John Bushnan, R.N., midshipman and assistant surveyor begins to appear in connection with the work of the Parry expedition. There are in the same collection 1820 survey bearings on the west coasts of Baffin Bay and Davis Strait taken by him. Also dated that year is a chart of the Parry discoveries with a pencil note against a representation of part of the south coast of Melville Island: "This coast line not inserted, in hopes of obtaining more accurate angles. W. E. Parry, August 1, 1820". Also there are roughs of survey observations made by Lieut. Beechey. Evidently he performed the survey work of that Parry voyage. In his pencilled notes in the rough of Barrow Strait and Baffin Bay we find the entry: "This coast was surveyed on our passage home. The data for laying it down will be found in my rough surveying book. I had not time to lay it down myself".[12]

On his second expedition (1821-23) Parry reached Foxe Basin. A chart dated 1821 shows the north coast of Hudson Strait and the track of his two vessels, the *Hecla* and *Fury*. This chart was drawn under Parry's "immediate inspection" by John Bushnan. Other charts include Davis Strait (3 sheets), Foxe Channel, Repulse Bay, Lyon Inlet and North Southampton Island. For the third Parry voyage (1824-25) to Prince Regent Inlet, there is a chart of the inlet as re-surveyed at that time, also of Port Bowen as re-surveyed in 1825 on a triangulation scheme.

Parry, who became Admiralty Hydrographer (1825-29), recommended that "ships endeavoring to reach the Pacific by this route should keep, if possible, on the coast of America and the lower in latitude that coast may be found, the more favourable will it prove for that purpose".[13] This observation by Parry set the pattern of marine exploration in the Canadian Arctic for the next quarter-century. Parry was to the Arctic waters of Canada what Cook was to the Pacific, a bold yet sagacious navigator, scientifically trained, and highly esteemed by the men he commanded.

John Ross (1770-1856) was knighted in 1834 in recognition of his Arctic work. He made three separate expeditions. He was appointed in 1818 by the British Admiralty to command a search for the Northwest Passage. His second-in-command in 1818 was Lieut. W. E. Parry, R.N. On that initial voyage Ross missed exceptional opportunities to gain lasting fame when he concluded, without sufficient examination, that Jones, Smith and Lancaster Sounds were inlets, not salt-water corridors from Baffin Bay to the Arctic Ocean. Parry, a year later, reaped the real benefits of the 1818 expedition.

The second John Ross expedition was undertaken in the 150-ton paddle-wheel steamer *Victory** which sailed on May 23, 1829, returning to England in 1833. This voyage was more notable for the information gathered in scientific fields than for geographical discovery. It served to enlarge considerably the area of knowledge on terrestrial magnetism and weather data. An extensive list of latitudes and longitudes was also compiled. Much of the charting of Boothia Peninsula and of King William Island was accomplished on this expedition.

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*The *Victory* was the first steam vessel used by the Admiralty in Canadian Arctic explorations.

On June 2, 1831, James Clark Ross, a nephew of John Ross and a midshipman on this expedition, journeyed on foot 100 miles from the base at Victory Harbor to Cape Adelaide Regina on Boothia Peninsula. There he fixed the geographical point marking the then location of the north magnetic pole at 70 degrees 5 minutes North latitude and meridian 96 degrees 46 minutes West.[14] He took possession of the pole for Great Britain and King William IV and he is probably the only scientist who has stood so near the centre of the magnetic pole zone. The magnetic pole is an area, some 16 miles in diameter, rather than a precise point. Its location is constantly fluctuating and, in addition, the pole has been moving in a rather wobbly but generally northerly direction since its discovery in 1831. From Boothia Peninsula, for instance, this pole has moved about five miles a year to Prince of Wales Island and then, according to a field redetermination party in mid-1962, it is reported to have moved to just off Peddie Bay, Bathurst Island. It was estimated that by 1965 the north magnetic pole would be either just offshore or slightly inland on Bathurst Island. Following the return of John Ross in 1833 the British Admiralty published its *Chart of the North Polar Sea,* by J. Wyld.

The third and final voyage by Sir John Ross was made when he was 73 years old. He sailed in 1850 on the 120-ton schooner *Felix* and his 12-ton yacht *Mary* to participate in the search for the lost Franklin expedition. However, as this venture took Ross only as far as Lancaster Sound it was not especially productive in terms of geographical discovery. Sir John seemed fated to attract controversy and he took part in numerous correspondence battles, both public and private. But Ross was eminently successful in guarding well the health and welfare of his crews at a time when scurvy was a constant menace. He lost very few men.

In 1848 Sir James Clark Ross was appointed to be in charge of one of three expeditions despatched by the British government to search for the missing Sir John Franklin. It was an unsuccessful foray but two men who later gained wide recognition in polar exploration, Sir R. J. le M. M'Clure and Sir F. L. M'Clintock, were introduced to the rigors of the Arctic on this voyage.[15]

By the time of the third Franklin expedition (1845) the story of the hunt for the all-important "passage" had been one of frustrating failure, despite valiant attempts by way of Melville Sound, Prince Regent Inlet, Fury and Hecla Strait and by Bering Strait. The general outline of the north and south coasts along Lancaster Sound and Barrow Strait were fairly well known, as was the mainland Arctic coast of Canada.

Sir John Franklin had made sorties into Canada's Arctic in 1819 to 1822, accompanied by two surveyors — Robert Hood and George Back (the latter being knighted in 1839). On Franklin's second overland expedition, 1825 to 1827, Back and E. N. Kendall were surveyors.

An extract from a Franklin report for Thursday, December 22, 1825, describes surveying activity, likely in the vicinity of Great Bear Lake:

"The sun rose this morning at 10 hr. 24 minutes, thirteen minutes earlier than its appearance was expected from calculation, owing to the great refraction. Mr. Kendall and I measured its meridional altitude from the lake with two instruments, the one bringing its upper limb to the top of the land 4 miles distant, the elevation of which had been ascertained to be 8 minutes, and the other, to its base, the depression of which was 2 minutes. The mean of both these observations, corrected for refraction by the tables in the Nautical Almanack, gave a result of 65° 11′ 56″ North, which latitude exactly corresponds with the best observations made in the previous autumn . . . At 8 hr. 30 minutes, p.m., a halo was observed, whose radius measured 28° 40′ from the moon; and at an equal altitude with the latter body there were two paraselenae which

as well as the moon were intersected by a luminous circle, having the zenith for its centre, and a diameter of 94° 15′. The length of our shortest day did not exceed 5 hours, but the long nights were enlivened by the most brilliant moonlight and we had frequent and very fine appearances of the Aurora Borealis . . . on all these occasions the disturbed motions of the magnetic needle were very remarkable, and a most careful series of observations convinced the party that they had a close connection with the direction of the beams of light of which the aurora was composed. My observations also led me to conclude that the deviations of the needle were, in a certain degree, connected with the changes in the weather. Previous to a gale or snowstorm deviations were always considerable but during a gale the needle almost invariably remained stationary".[16]

On Wednesday, May 24, 1826, Franklin describes an ordeal familiar to most explorers of Canadian territory:

"On the 24th the musquitoes appeared, feeble at first but, after a few days, they became vigorous and tormenting . . ." and, again on June 28, "When we landed to sup the musquitoes beset us so furiously that we hastily despatched the men and re-embarked . . . They continued, however, to pursue us and deprived us of all rest".

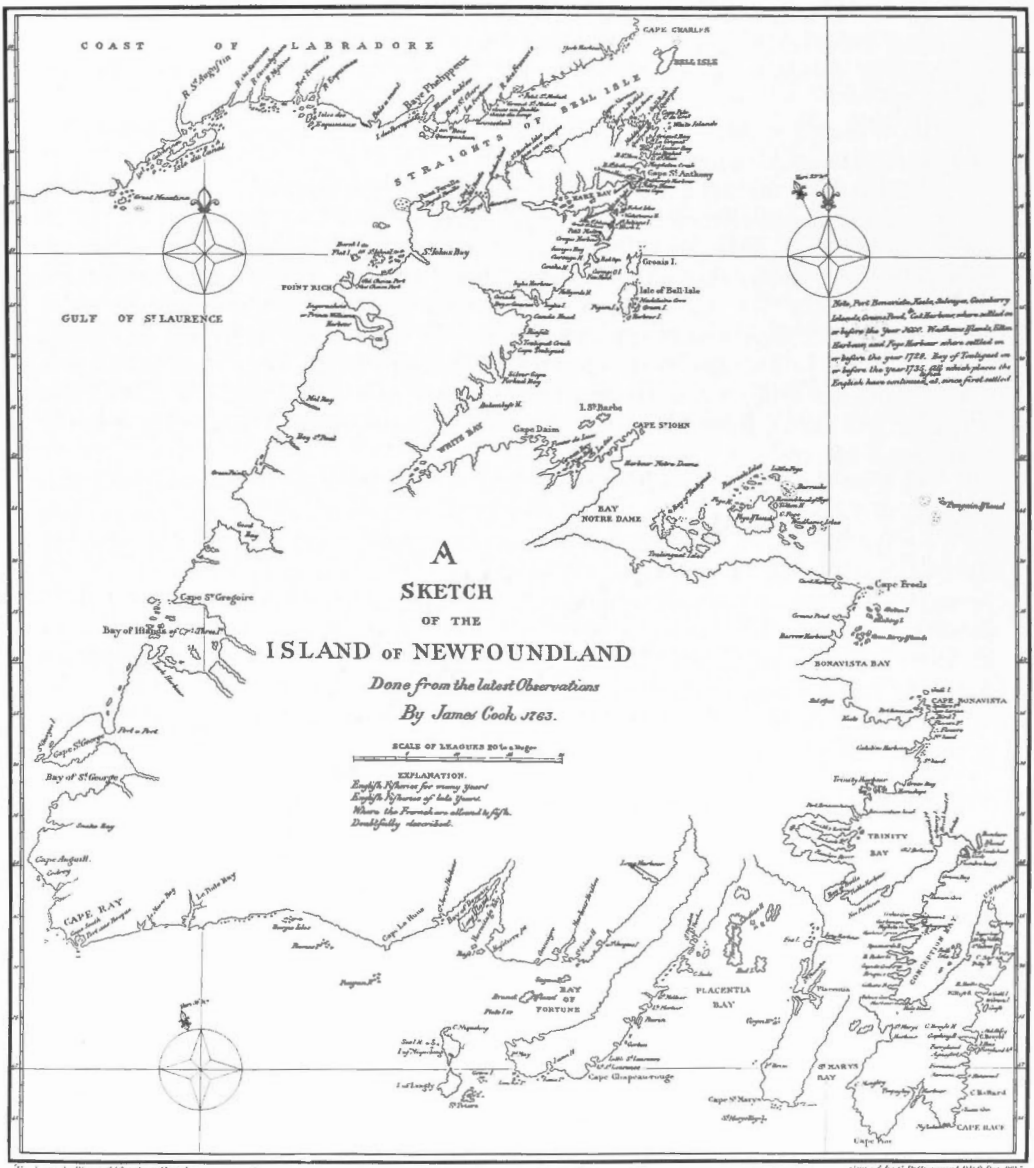
In 1845, with two vessels, the 370-ton *Erebus* and the 340-ton *Terror,* Sir John sailed on explicit instructions from the Admiralty concerning the course he should follow in order to find and to navigate the Northwest Passage. This venture ended in tragedy but, indirectly, the mysterious disappearance of Franklin and his 129 officers and men provided a powerful impetus to polar explorations at a time when it might have lapsed entirely.

The principal search extended over more than a decade. The M'Clintock expedition, financed by Lady Franklin, uncovered sufficient evidence from 1857 to 1859, especially on King William Island, to dispel, along with other findings, much of the dark mystery surrounding the fate of Franklin and his men. The scope and persistence of the numerous expeditions sailing into dangerous and largely unknown waters, has had no parallel in the maritime history of the world. During the decade of search (1849-59) 33 ships wintered in the Canadian Arctic. Hundreds of crewmen and many officers were involved in all these projects and the total cost to the British government amounted to millions of pounds sterling. In addition, very considerable amounts of money were contributed by other nations for the purposes of the search.

One of the charts in the British Admiralty collection showing the Northwest Passage, as travelled in part by H.M. Ship *Investigator* (M'Clure), indicates the coast explored in search of Franklin by (Sir) James Clark Ross, 1848-49; John Richardson, 1848-49; Commander R. J. le M. M'Clure, 1850-54; Capt. Horatio T. Austin, 1850-51; Mr. William Penny, 1850-51; Mr. John Rae, 1851; Mr. William Kennedy, 1852; Capt. (Sir) E. A. Inglefield, 1852-54; (Sir) Edward Belcher, 1852-54. The chart was drawn by W. H. Fawekner.[17] The names that appear on it read as an honor roll of many of those who, as commanders, braved many perils of storm and deep to probe Canada's northern waters in order to solve a double riddle and to make the Arctic safer for future navigation. The end of the Franklin search, as Andrew Taylor has pointed out, was the end of an era of exploration in the Canadian Archipelago. Men were now turning their thoughts from the Northwest Passage to a new goal, the North Pole.[18]

Captain James Cook

When James Cook was appointed naval engineer to Governor Palliser of Newfoundland, early in 1764, he had already gained considerable experience in marine surveying and charting. After Louisbourg he had been carefully coached in these activities by Holland, DesBarres and others. As Master of the *Pembroke* and, subsequently, of the *Northumberland* he had accomplished useful work in the St. Lawrence River and



MAP 26. The original is in the Archives of the Admiralty in London, England. Reproduced from a copy in the Public Archives of Canada.

Gulf in 1759 and 1760; in and near Halifax in 1761 and in the Placentia Bay area in 1762. But most of these duties and undertakings had been linked, more or less directly, with military projects. In 1763 he entered a period of what was essentially peacetime employment. In that year he charted the coasts of St. Pierre and Miquelon. His work along Newfoundland and Labrador coasts from 1764 to 1767 has been traced (see Chapter XI). Cook was 39 years of age when he returned in April, 1767, to Newfoundland waters for the last time.

By now, the stars in their courses appeared to be helping to shape Cook's future. Edmund Halley the eminent Astronomer Royal of England, had predicted that a transit of Venus would take place in June, 1769 and that the event could best be observed from a point in the South Seas. Measurements taken at the time of the transit would provide a means of calculating more accurately the distance between earth and sun. Apart from astronomical considerations there was a pressing need to ascertain whether or not a continent existed in the southern hemisphere. If any such new land was found, there would be the opportunity to claim it for Great Britain.

Alexander Dalrymple, the distinguished hydrographer, possessed the seafaring and scientific qualifications essential to lead the expedition to the South Seas. But he was not a naval officer. This lack of status, in the view of the British Admiralty of that day, was regarded as fatal to Dalrymple's prospects of ship command. James Cook, by this time, had built up an imposing reputation as a hydrographic surveyor, chart maker, navigator, planner and administrator. Both the Admiralty and the Royal Society had been favorably impressed by his special abilities at a moment in the world's history when sea-going scientists were rare creatures and in lively demand. It is not too surprising, therefore, that James Cook was selected to take charge of the expedition and of the ship *Endeavor*.

Cook's initial venture (1768-71) was the forerunner of two other momentous voyages of discovery under his command, adventures that would extend, in all, over eleven years until his tragic death in Hawaii early in 1779. After a ten-year interval Cook was fated to work once again along Canadian coasts. It can be said that he commenced and ended his active surveying and charting career in Canada's Atlantic and Pacific waters respectively. It can also be said that he was the only 'hydrographer' who, until quite recent times, practised his profession on all three of Canada's ocean coasts. Known only to a comparatively small group of scientists and naval authorities until his appointment to the *Endeavor* in 1768, this one-time map draftsman rapidly became renowned throughout the world as a finder of new lands and a moulder of the destinies of generations to come. Nearly a century was to elapse, however, before the occupation of Australia and New Zealand and the settlement of British Columbia were to crown the persevering and pioneering exertions of Capt. Cook. Not the least remarkable aspect of his towering achievements was the fact that he crowded so much constructive accomplishment into a lifetime barely exceeding fifty years.

Cook's men were well-trained, subjected to strict discipline and were, on the whole, happy to follow his sensible precepts and inspiring example. At the age of 14, the third son of John Jasper Vancouver and his wife Bridget, was apprenticed to James Cook in 1771, following the explorer's return from his first triumphal voyage to the South Pacific. We may assume that, if the practice of those times was observed in this case, George Vancouver was selected by Cook himself. But the circumstances of the initial meeting remain unknown.

On his initial voyage to the Pacific Cook carried no chronometer but he and his astronomer, Green, had made frequent calculations of lunar distances with the aid of

tables just published by Astronomer Royal Nevil Maskelyne. On his second voyage Cook took along astronomers William Wales and William Bayley. His vessels, the *Resolution* and *Adventure,* carried three experimental but rather unsatisfactory chronometers made by Arnold as well as a very reliable instrument made by Kendall from a design by John Harrison. In his Narrative of the first voyage Cook comments that "the commander, first lieutenant and astronomer on board each of the ships, kept, each of them, keys of the boxes which contained the watches and were always to be present at the winding them up and comparing the one with the other. . .".

Before he could become eligible for a commission, young Vancouver was required to serve six years at sea. During Cook's second voyage, which commenced on April 9, 1772, George Vancouver had daily forenoon sessions with his schoolmaster, William Wales, the astronomer, who taught him trigonometry, navigation and the sea sciences. Wales, in fact, was one of the leading astronomers of his era and contributed greatly to the establishment of longitude by mariners. The Norfolk-born student developed swiftly under this unique tutelage. In later years Capt. Vancouver expressed his gratitude by naming a headland on Observatory Inlet, British Columbia, in remembrance of his teacher, Point Wales. . . . "after my much-esteemed friend Mr. Wales of Christ's Hospital; to whose kind instruction, in the early part of my life, I am indebted for the information which enabled me to traverse and delineate these lonely regions".[19]

Prior to the Pacific Ocean ventures by James Cook great unanswered questions of geography and science occupied the minds of men. Did a southern continent actually exist? Would it be possible to find a Pacific entrance to the Northwest Passage? Could scurvy and other diseases be controlled effectively during long voyages? How could meridians of longitude be located with sufficient accuracy to ensure success of such voyages? In the final splendid decade of his life Cook provided satisfactory answers to all of these questions. By reason of the lessons learned by Cook in locating meridians, lessons based on the inventions of clockmakers and the calculations of astronomers, the science of surveying and the art of cartography were substantially advanced.

Cook made wise use of anti-scorbutics and insisted upon his crews combatting scurvy and other deficiency diseases by drinking spruce beer, fruit juices or by eating sauerkraut preparations as well as keeping their quarters aboard scrupulously clean. In addition he obtained fresh provisions for his ships wherever possible. His success in controlling such devastating illnesses may well have been his greatest contribution to the welfare of mankind. It is reported that on one very prolonged voyage an English commander, before Cook's experiments, lost 626 out of 961 men on three ships of his fleet!

The main objective of Cook's third and final voyage (1776-79) was to search for the Northwest Passage. The £20,000 reward posted by Parliament in 1745 for success in this quest, still stood. In July, 1776, Capt. Cook (he had been promoted to Post Captain in the interval between his second and third voyages) left Plymouth in command of the *Resolution* and *Discovery,* sailing independently towards the Cape of Good Hope. On his way out of Plymouth harbor he observed, with sadness, British troop ships carrying Hessian soldiers to military campaigns in North America, the continent to which he himself was now headed, intent upon an entirely peaceful and constructive mission.

It was after February 2, 1778, when he left Hawaii, that Capt. Cook entered upon the last great marine survey of his illustrious career, namely, the examination of the Pacific Coast of North America above latitude 45 degrees North. He endured the onslaught of fierce storms and during March was twice swept away from the coast. In

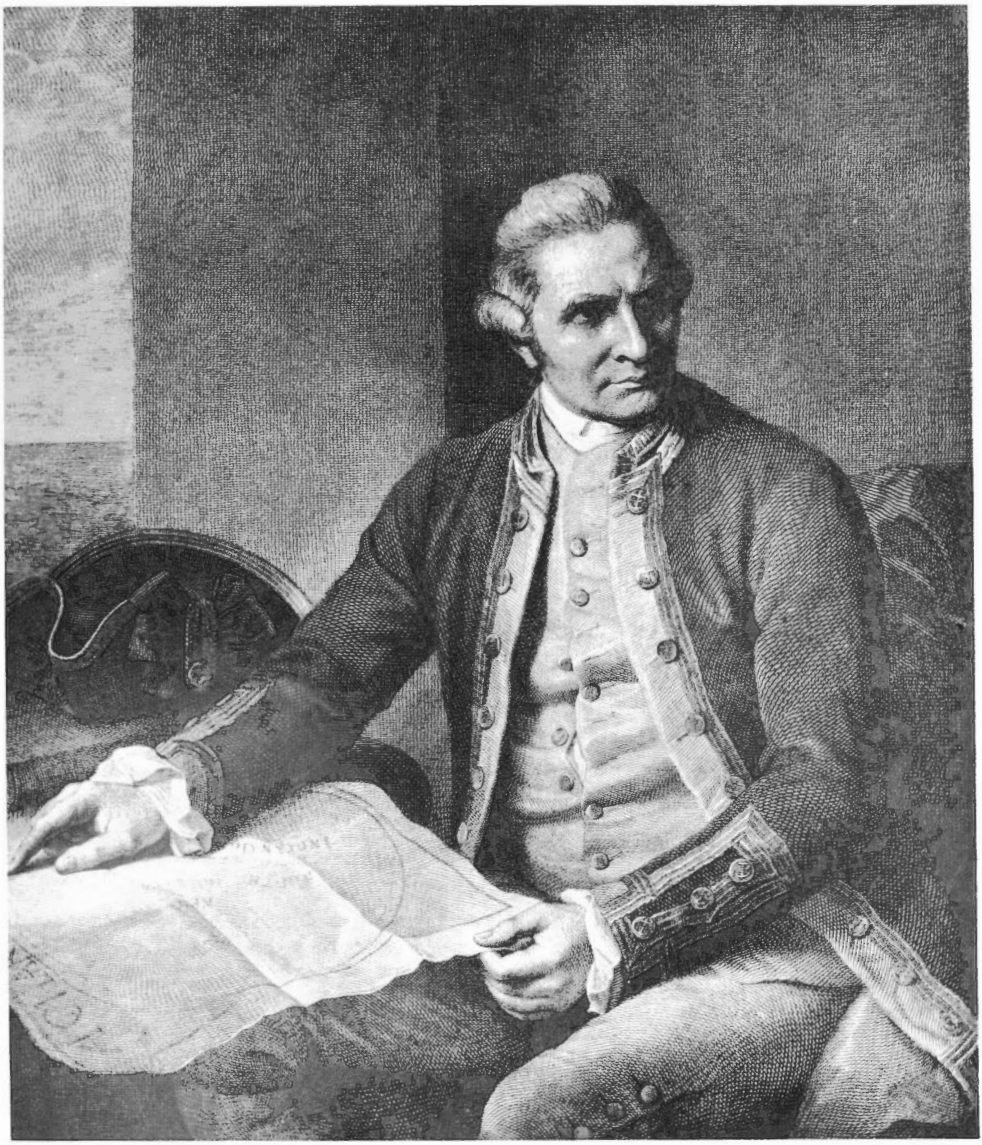


FIGURE 16. Captain James Cook, R.N.

these gales he missed the opening of Juan de Fuca Strait: "It is in this very latitude (of Cape Flattery) where we now were that geographers have placed the pretended Strait of Juan de Fuca. But we saw nothing like it; nor is there the least probability that ever any such thing existed"![20]

At the end of March, 1778, Cook made landfall at Nootka Sound on an island to become known by the name of one of his midshipmen, George Vancouver. In his Narrative is the following entry for April 26: "The inlet I honored with the name of

King George's Sound but its name with the natives is Nootka . . . the Clemate is . . . infinitely milder than on the East coast of America under the same parallel of latitude . . .". On that same day Cook sailed towards Alaska and touched at no other Canadian point. But his visit served to establish Britain's claim to this part of North America and it supplied deep-sea mariners with navigational information they required. Further north he investigated the imposing water entrance now known as Cook's Inlet, Alaska. His Narrative for June 1, 1778: "At 2 o'clock in the Morning the Master returned and reported that he had found the Inlet or rather, river, contracted to the breadth of one league by low land on each side, through which it took a northerly direction . . . all hopes of a Passage was now given up . . . If the discovery of this River should prove of use, either to the present or future ages, the time spent in exploring it ought to be the less regretted, but to us who had a much greater object in View, it was an essential loss; the season was advancing apace, we knew not how far we might have to proceed to the South and we were now convinced that the Continent extended farther to the west than from the modern Charts we had reason to expect and made a passage into Baffin or Hudson bays far less probable, or at least made it of greater extent. But if I had not examined this place it would have been concluded, nay, asserted that it communicated with the Sea to the North, or with one of these bays to the East. In the afternoon I sent Mr. King again with two armed boats, with orders to . . . display the flag, take possession of the Country and River in his Majesty's name".

It is a matter of some interest to Canadians that Capt. William "Breadfruit" Bligh (1754-1817) was Master of the *Resolution* during the 1778 survey season when Capt. Cook visited Canada's Pacific Coast.* A manuscript chart showing Cook's discoveries between Latitudes 42 degrees North and 61 degrees 45 minutes North, drawn by William Bligh, is preserved in the records of the Hydrographic Department, British Admiralty.[21] The lack of mention of Bligh's name in the official Narrative of the third voyage is puzzling, in the light of existing evidence of his substantial contribution to its success in the realm of surveys and chart construction. It is now believed that rough and ready Bligh (with his undoubted talent for making enemies) and class-conscious King disliked each other to the point of bitter hostility. It would appear that King, in his writings, deliberately and grossly neglected Bligh's important part. On his own copy of the Narrative of the third voyage of Capt. Cook, Bligh's marginal notes, in tenor and substance, support this belief. For example Bligh states bluntly: "most of the maps and charts in this publication are from the original drawings of Lieut. Henry Roberts, so it is stated—he did no more than copy the original ones from Capt. Cook, who, besides myself, was the only person who surveyed and laid the coast down, in the *Resolution*. Every Plan and Chart from the time of Cook's death, are exact copies of my works".[22]

Eight years after Capt. Cook's untimely death, Capt. Bligh was sent to the Pacific in command of the *Bounty* for the purpose of transporting and transplanting the breadfruit plant from South Sea islands to the West Indies. It was during the course of this mission that the well-publicized mutiny took place, following which Bligh and some companions made their historic journey to Timor in an open boat, a triumph of navigation and human endurance.

Some 25 years before Cook sailed into the North Pacific, the Russian explorers, Bering and Cherekov, had examined the Alaskan coast as far south as the Queen Charlotte Islands But their survey had not been exhaustive. Cook, for his part,

*Bligh Island, entrance to Nootka Sound, is named for the famous captain.

FIGURE 17. Captain Cook on Vancouver Island. Nootka Sound was the base for Captain Cook's search for the North West Passage with the *Resolution* and *Discovery*, 1778.

continued northward through Bering Sea and Strait. He proceeded along Alaska's Arctic coast as far as Icy Cape where, despite repeated efforts, his forward progress was blocked by pack ice. At this most northerly point of all his voyaging (70 degrees 29 minutes North) Cook was almost as near to the North Pole as he had been to the South Pole on his second voyage of discovery. On his return to wintering quarters in the south, Cook passed along the Pacific Coast of Siberia. He reached Kealakekua Bay in the Hawaiian Islands on January 17, 1779. In a brief encounter with natives on the shore of the bay on the morning of February 14, James Cook was killed and his body savagely dismembered.

In the melancholy aftermath of this disaster the *Resolution*, accompanied by the *Discovery*, ventured north again on a further gallant but unsuccessful effort to find the elusive passage by searching Russian and Alaskan waters. The vessels arrived back in England on October 4, 1780, more than 50 months after leaving Plymouth. Only one man out of 118 had been lost in more than 1,500 days of hazardous missions.

Throughout the whole of a vast domain washed by the waters of the Pacific Ocean, millions of English-speaking people living today owe their economic opportunities and advantages, in great measure, to the exertions and sagacity of this remarkable and celebrated man. Had he returned safely to England, Cook would almost certainly have received a baronetcy from a grateful monarch acting on behalf of a nation proud to salute his memory. As Christopher Lloyd has pointed out so perceptively, "the character of Capt. Cook is summed up in the names of his ships, *Resolution*, *Endeavor*, *Adventure* and *Discovery*".

James Cook bequeathed to mankind a precious legacy of outline maps of the entire

Pacific basin, maps that were unprecedented, at the time of their issue, in scope and general value.[23] He left another legacy of inestimable worth. Cook's third voyage took place during the period when England was heavily engaged in hostilities and when her first great empire was staggering under the grievous loss of her 13 American colonies. The Declaration of Independence was signed at Philadelphia just a few days before Cook embarked on his final venture. During that same period of convulsion and loss in the Atlantic area Cook was at work laying lasting foundations of a significant extension of empire in the Pacific.

Cook deserves immortality in the gallery of benefactors of humanity because of the high quality and immense number of pioneer surveys and charts supervised by him. More than a decade was to pass before his one-time apprentice seaman and midshipman, George Vancouver, would resume in Canada's Pacific waters the impressive hydrographic survey commenced so dauntlessly by Capt. Cook.

Captain George Vancouver

Immediately following the violent episode at Kealakekua Bay Lieut. King and Midshipman Vancouver (promoted to a lieutenancy on October 19, 1780) were sent to locate the remains of Capt. Cook. The few recovered parts of his body were buried ceremoniously at sea. This gruesome experience failed to alter young Vancouver's determination to fit himself for the task of carrying on important marine survey work, if ever the opportunity offered. During the decade following his return to England on the *Resolution,* Lieut. Vancouver served on naval vessels in the Caribbean area. Even with his undoubted talents, ambitions and experience employment was not continuous for him. For instance, there was the worrisome 18-month period extending from 1783 into the following year when he was on the inactive list at half-pay. But all the while world events and forces were constructing a prominent stage on which the restless young naval officer would soon play a formidable and memorable role.

Nootka Sound, not by any means a place name well known to Canadians of the 20th century, was much in the international limelight in the closing years of the 19th. Spanish and English spheres of influence were persistently overlapping along the Pacific shores of North America. The pressures resulting from the increasing competition of these giant rivals were concentrated at Nootka Sound in 1789 when the Spaniard, Martinez, seized English ships harboring there, as well as other property. The whole European scene was darkened by the grim threat of war. Armed conflict, in fact, was only averted by an agreement to sign the Nootka Sound Convention at Madrid in 1790. By the terms of this 8-article treaty Spain promised restoration of buildings and land seized, and also granted reparations. Opportunity to trade with the natives of the region was guaranteed to the nationals of both countries. For the first time since the age of Columbus, Spain had formally conceded that another nation possessed rights in the Pacific area. In order to receive, in a formal ceremony, Spain's offer of restitution England decided to send a representative naval officer to Nootka Sound. George Vancouver was the officer chosen for this mission, mainly on the recommendation of Sir Alan Gardiner, under whom he had served during his years in the Caribbean. Lieut. Vancouver was placed in command of an expedition which, apart from its diplomatic character, was to be a voyage of discovery in the North Pacific. His instructions were to sail "... Principally with a View to Ascertaining the Existence of Any Navigable Communication Between the North Pacific and North Atlantic Oceans". It was to be a probe not only for a Northwest Passage but for a British Passage. Vancouver com-

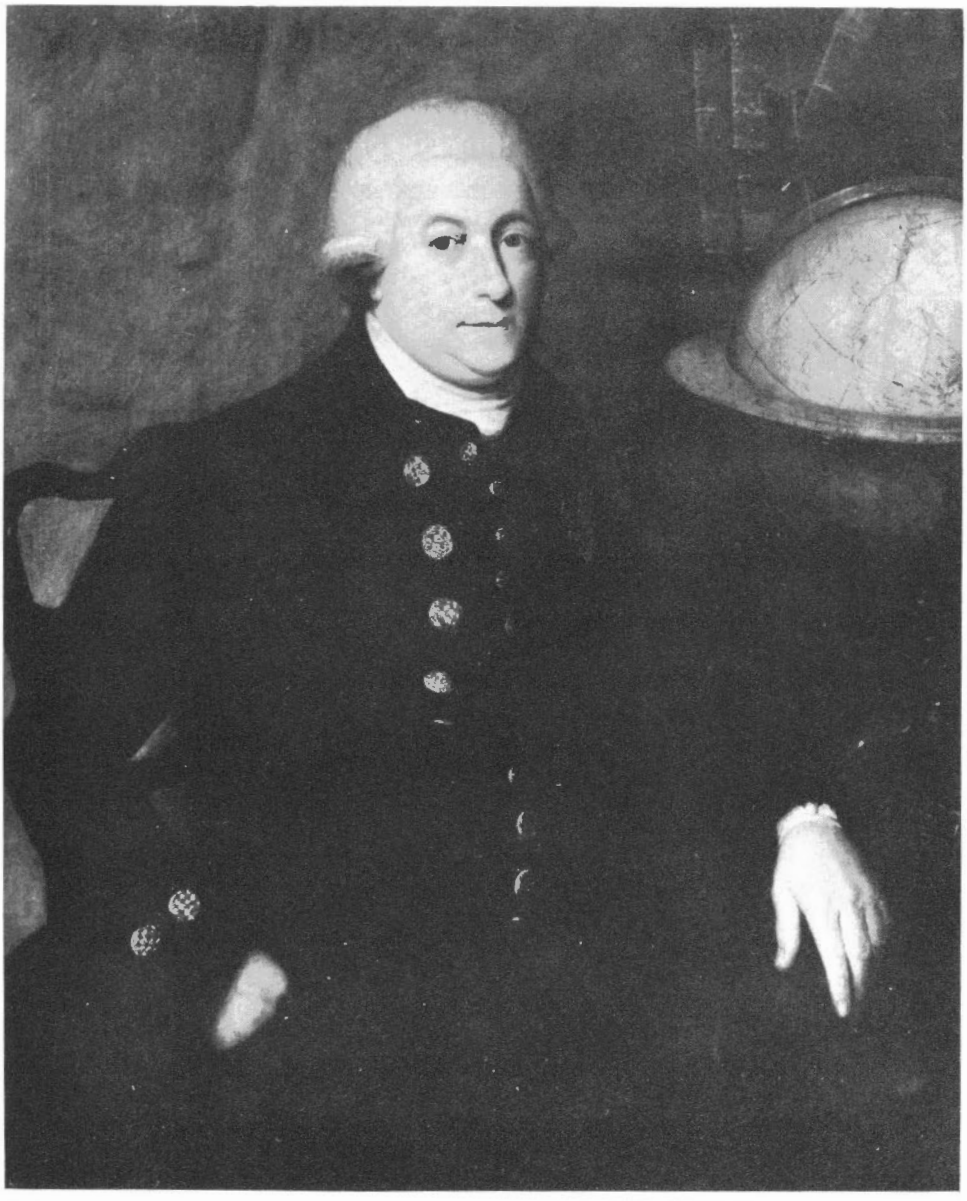


FIGURE 18. Captain George Vancouver, R.N.

manded the *Discovery* (not the same vessel used by Cook) and an armed tender, the 130-ton *Chatham*. He placed Lieut. William Broughton in charge of the latter.

Vancouver was expected to examine the Pacific Coast of North America from Latitude 30 degrees North to Latitude 60 degrees North (in the vicinity of what is now Cook Inlet). "The survey should be so conducted", his orders ran, "as not only to ascertain the general line of the sea coast but also the direction and extent of all such

considerable inlets whether made by arms of the sea, or by the mouths of large rivers. . . ."[24]

The two vessels sailed from Falmouth on April 1, 1791. They did not return until nearly 5 years later. At the outset Vancouver was not enthusiastic over having an astronomer aboard and sailed without one. But he speedily changed his mind and sent a message to home authorities asking that a scientist be sent to the Pacific on the next supply ship, equipped with astronomical instruments. Apparently the latter reached Canadian shores but not the former. Mr. Gooch, the astronomer, along with several crewmen, met death at the hands of natives on a South Pacific island. An astronomical clock, three timekeepers and other equipment sent by the Board of Longitude with the astronomer, were set up as a small observatory on the shores of Nootka Sound in 1792.

These instruments represented assets in addition to twelve sextants placed on the vessels leaving England and described in Vancouver's Narrative as having been made "by such eminent [London] instrument makers as Ramsden, Dolland, Troughton, Adams and Gilbert" though he adds, "the greater number were made by Ramsden". He proceeds to comment on their performance, "They all agreed exceedingly well together and their mean result showed the longitude to be 16 degrees 21 minutes 32 seconds, the chronometer made the longitude to be 16 degrees 31 minutes 15 seconds West, and as there could be no doubt of the latter being nearer the truth, the result of the lunar observations by the several sextants, appeared to be 9 minutes 43 seconds too far to the eastward. On the other side of the Moon, my lunar observations were 15 minutes to the west of the true, or nearly the true longitude, as was proved on our making the Madeiras. This evinces the accuracy with which these observations, in general, are capable of being made with good instruments by a careful observer".[25]

Before Vancouver sailed from England on this voyage there was available to him John H. Moore's book, *The Practical Navigator,* published in 1784. Among Moore's instructions in regard to the surveying procedure of a ship in a position to observe a seacoast, were these rules, "take with the Azimuth Compass, the Bearings, in Degrees, of such Points of the Coast as form the most material Projections or Hollows; write down these Bearings and make a rough Sketch of the Coasts . . . then let the Ship run in a direct line, which must be carefully measured by the Log or otherwise, for 1, 2 or 3 miles. . .". Four men were required to participate in this survey operation. One took compass bearings — a sextant could also be used for measuring angles between headlands — and this observer made adjustments for magnetic variations. A second man made calculations of the speed of the ship and recorded the information. A third man supervised leadline soundings and a fourth plotted the position of the ship as well as fixing the positions of headlands in relation to the track of the ship. Three weeks before their North American landfall Vancouver and his officers took 85 separate sets of lunar observations to establish an accurate starting point for the survey.

Before proceeding to the North Pacific, Vancouver carried out his plan to explore and survey the southwest coast of Australia, then mainly a blank on the map of the world. By January, 1792, his ships had sailed from Tahiti to Hawaii. Here Vancouver's health was obviously deteriorating. But little more than a year after his departure from Falmouth, the *Discovery,* on April 18, 1792, sighted the coast of New Albion, the name Sir Francis Drake had bestowed on what is now the Pacific Northwest region of the United States. This was at a point some 110 miles north of San Francisco Bay. Here began the ambitious, methodical and historic hydrographic survey for which Vancouver became so justly famous. For the most part he paid little attention to large river deltas. His chief concern was to find, if possible, a Pacific entrance to the Northwest Passage.

Hopefully he entered that important gap in the coastline that had escaped Capt. Cook's attention three years previously — Juan de Fuca Strait — and its southward extension, now known as Puget Sound. But his aspirations were cooled somewhat when he realized that the waters of this imposing entranceway were, in fact, landlocked.

By the end of May he completed his survey of the Sound, (named after Lieut. Peter Puget, then of the *Discovery,* later to become commander of the *Chatham*). Vancouver gave this region of the mainland the name of New Georgia, a title that failed to endure. But other names Vancouver gave to geographical features have lasted, names such as Mount Rainier, Mount Baker and Mount Hood, all of them immortalizing his contemporaries in the British Navy.

FIGURE 19. Captain Vancouver surveying English Bay near Burrard Inlet, site of the City of Vancouver, B.C.

Between the latitudes of 48 degrees 23 minutes and 52 degrees 19 minutes Vancouver spent three and a half months in the most careful survey work. Late in June, 1792, while operating in Burrard Inlet (named after Sir Harry Burrard of the Navy) and among islands of the Strait of Georgia, he was surprised to find that he was not alone in these measuring activities in this part of the world. In his Narrative Vancouver writes of events of June 22, 1792: "As we were rowing on Friday morning for Point Grey (named after Capt. George Grey of the Navy) purposing there to land and breakfast, we discovered two vessels at anchor . . . a brig and a schooner wearing the colours of Spanish vessels of war . . . They had sailed from Acapulco on the 8th of March in order to prosecute discoveries on this coast . . . I cannot avoid acknowledging that, on this occasion I experienced no small degree of mortification in finding the external shores of the gulph had been visited, and already examined a few miles beyond where my researches during the excursion had extended, making the land I had been in doubt about, an island".[26]

The Spanish ships found near Point Grey, the *Sitel* and the *Mexicana,* were under commanders Galiano and Valdes respectively. Vancouver, acting in accord with his instructions, urged that the Spanish and English expeditions join forces and continue the survey project together. This experiment in collaboration was launched in good faith but soon foundered on the differing national temperaments involved. The initial cordiality soon evaporated and the joint venture was abandoned.

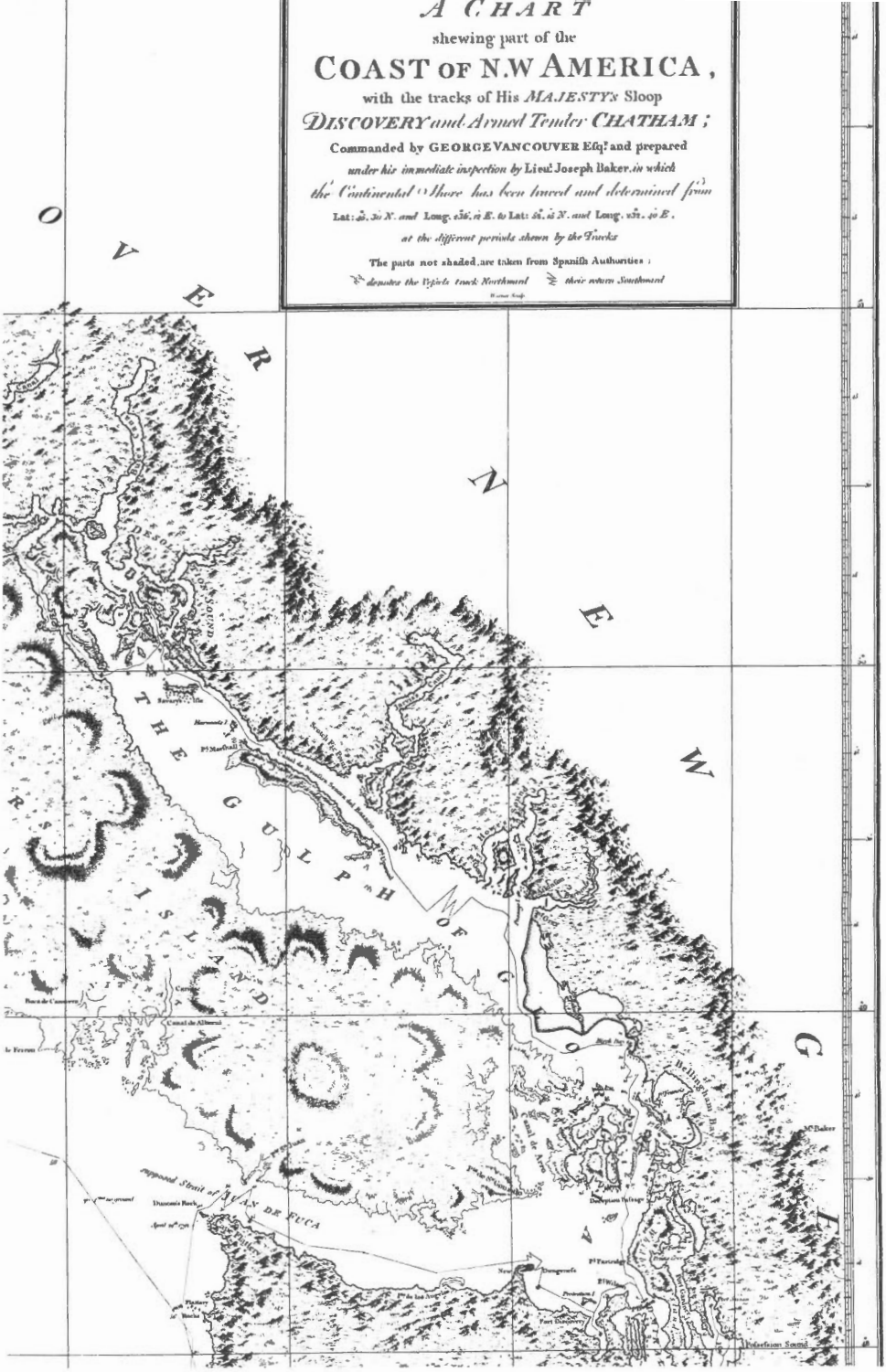
As it was Vancouver's main purpose to uncover a Northwest Passage, if such existed, he reasoned that if he should follow the continental shoreline northwards, examining carefully every possibility, he could hardly miss locating the goal of his endeavors. This seemed wise in the circumstances but the procedure consumed three summer seasons of intensive survey activity.

By the end of May, 1793, Vancouver had reached latitude 52 degrees North. Leaving the *Discovery* anchored in Restoration Bay in Burke Channel, he penetrated by small boat the various arms of the sea to a point on Dean Channel not far from the present-day community of Ocean Falls. That was in early June. In this vicinity his surveying took him very near a rocky point in a cove near Elcho Harbor. This was the farthest westerly point reached by Alexander Mackenzie a few weeks later as he concluded his search for tidewater. It was on the rock face of this point that Mackenzie wrote with vermilion mixed in melted grease his famous, if not durable, inscription.[27] Thus, by a strange historical coincidence, only a few weeks separated visits to the same British Columbia locality by the two leading explorer-surveyors associated with the development of Canada's west coast—one from the sea and one from the land. Vancouver was unaware of Mackenzie's approach overland but on reaching tidewater Mackenzie had hints from the natives that one "Macubah", a white man had recently been seen in his "large canoe". Mackenzie, 10 years in advance of the celebrated Lewis-Clark explorations of the American Northwest, had descended the Bella Coola River, reaching the North Bentinck Arm. This arm of the Pacific, nearly 70 years later, was to become the scene of a survey of importance by Lieut. H. Spencer Palmer of the Royal Engineers, seeking to find a short practical route to the Cariboo district.

Had Vancouver and Mackenzie met, the latter, merely by recounting his own travel experiences, could have solved the Northwest Passage problem faced by Vancouver. As matters turned out Vancouver, on concluding his meticulous search a year later, wrote that his survey "removed every doubt, set aside every opinion of a Northwest Passage . . . within the limits of our researches . . .".[28] Oddly enough, at this Dean Channel stage in the history of exploration in Canada, Charles Vancouver, elder brother of the distinguished marine surveyor, was busy in London pressing for British government support of an overland journey by himself, similar to that accomplished by Alexander Mackenzie.[29]

A combination of intensive survey work, adverse winds and subsequent periods of dead calm, delayed the arrival of the *Discovery* at Nootka Sound until late August, 1792. The *Chatham* reached the Sound in the forenoon of August 28. About 4 o'clock in the afternoon of that same day the appearance of the *Discovery* was greeted by the Spaniards with an echoing 13-gun salute, a gesture to which the British responded in kind. The most cordial courtesies were exchanged but subsequent negotiations for the transfer of Spanish sovereignty proved inconclusive. Broughton was sent to England for new instructions. It was not, however, until March 23, 1795, that British and Spanish commissioners finally met at Nootka Sound and in a brief ceremony British buildings were formally restored and the Union Jack unfurled over the territory.

Vancouver's descriptions of his personal relations with Spaniards on our west



MAP 27. From a survey made in 1792. Courtesy of the Public Archives of Canada.

coast as well as his respectful acknowledgment of their earlier presence as explorers in these waters serve to emphasize the extent of the influence actively exercised by men of Europe's Iberian Peninsula upon Canada's more precise development on world maps. The parts played by early Vikings and by the French in this regard have been well understood. The German and Dutch geographers and map publishers as well as skillful Italian cartographers also made valuable contributions to this process of evolution. But Canadians have not always realized the exceptional importance of the pioneering role performed by Portuguese and Spanish navigators in delineating our Atlantic and Pacific coastlines during the earliest recorded periods of our history. Nevertheless persistent reminders, in the form of picturesque place names, do exist to stir our recollections and our appreciation. Facing the Atlantic and recalling the zeal and craftsmanship of the mariners and mappers of Portugal are to be found such names as Labrador, Portuguese Cove and Cape Race (Rase). On Pacific shores we have names such as Quadra, Juan de Fuca and San Miguel to bear enduring testimony to the initiative, courage and skill displayed by the explorers and chart makers of 18th century Spain.

Vancouver's surveys in the two following seasons, 1793 and 1794 included the Queen Charlotte Islands and the main coastline as far north as Cook's River, later to be named Cook Inlet. Having concluded the entire survey to his own satisfaction Vancouver turned south from Point Conclusion on August 22, 1794, and began his long homeward voyage around the Horn. The *Discovery* and *Chatham* arrived in the Thames on October 20, 1795, although Vancouver regarded the main voyage as completed when the vessels entered the Shannon estuary on September 13. His expedition had consumed 4 years, 8 months and 29 days. The voyage represented one of the most notable, if not the longest marine survey made in the world up to that time. The *Discovery* had logged 65,000 miles, about 10,000 miles more than Cook's most extended single journey. To this mileage ought to be added the 10,000 miles or more covered by the survey party rowboats. During all these danger-ridden years the *Discovery* had lost only 5 men, the *Chatham* none at all!

Vancouver began to organize his journals following his return but his chronic ailment grew worse and, failing rapidly, he died early in May, 1798 at the age of 41. His brother John, assisted by Capt. Puget, completed the editorial work required for the publication of Vancouver's Narrative, which appeared in 1798. The span of Vancouver's 41 years (1757-1798) included the period of the Seven Years' War (1756-1763), a war that cost France the realm of Canada and established British rule in this country and in India. This era also witnessed the beginnings of the industrial revolution in England, of agricultural reforms and social stirrings destined to transform Britain into a parliamentary democracy and a society with a lively interest in every branch of science.

Capt. George Vancouver, conscientious and methodical, with a passion for accuracy, was the natural choice for the exacting task of surveying a rugged coast of exceptional beauty. Despite its undoubted scenic attractions Canada's west coast, with its deep fiords and complex channels, provided a formidable challenge to explorers or marine surveyors. The magnitude and reliability of the surveys and charts completed by Vancouver's expedition has continued, over the years since these occurred, to excite universal admiration. He and his men, in three summer seasons, surveyed and chartered first, the region of Puget Sound and next, the region between latitudes 52 degrees and 56 degrees North, then finally, the region from Cook Inlet southwards to Chatham's Strait. Vancouver accomplished his main purpose, to show that no transcontinental strait existed between those latitudes. In his secondary objective he succeeded also in

producing a detailed basic hydrographic survey of the region. His verdict on the significance of his achievement was a shade premature. . . . "the geography of the earth [is] now placed beyond the influence of conjecture". But the results of his survey were of such precision and so dependable that much of the work he did still remains in use. His was an immense achievement, one that is shared not only with the anonymous but indispensable crewmen but with the competent, loyal and industrious officers of his command, men such as Broughton, Puget, Mudge, Baker, Hanson, Whidbey and Johnstone. Their accomplishments and the permanent fame of the survey expedition are best perpetuated in the name of the pulsing, vital city that is Canada's principal Pacific gateway and in name of the island domain whose principal port is the queen-like capital of British Columbia.

Colonel Joseph F. W. DesBarres

The surveying and charting career of Joseph F. W. DesBarres had concluded by the time of his appointment as Governor of Cape Breton in 1784. At that time he was 63 years of age and such recognition would have been regarded by most men as a comfortable crown to a busy, productive career. But for Col. DesBarres it served only to mark the beginning of a brand new career that would extend over the forty remaining years of his life! His stay in Cape Breton proved a stormy one and within two years of his arrival there he was abruptly recalled by royal command. But somehow he managed to restore himself in the eyes of London authorities, returning to the New World as Governor of Prince Edward Island in 1805, remaining in that post until 1813. Col. DesBarres then took up residence in Halifax where he occupied himself in land settlement and land development projects until his death in 1824.

In the light of his long and distinctive service it would seem that DesBarres' promotions in military rank came uncommonly slowly and in a niggardly spirit. It required 35 years for him to reach a full colonelcy in 1798 from the rank of lieutenant. Making all possible allowances for his quarrelsome and abrasive temperament, DesBarres met with continual opposition, amounting at times to vindictiveness. Not only in the matter of promotions did DesBarres receive tardy justice. When his employer, the Board of Trade and Plantations was disbanded in the midst of his work on *The Atlantic Neptune,* his pay was stopped. The Admiralty allowed him to carry on for several years without remuneration. His personal financial resources exhausted, DesBarres in desperation submitted a bill to the British government for re-imbursement amounting to £21,072 18s. 2d. In time he received upwards of two-thirds of this total but the balance of £8,801 16s 4d, to which he felt he was entitled, was never paid.

It was not until he reached the age of 71 that DesBarres became convinced he had definitely identified his chief opponent in life. Although in his letter of October 15, 1792, addressed to Lord Sydney, his language was uncharacteristically guarded and tactful, the spirit of reproach gleams unmistakably through his careful phrases. Long years of agonizing experiences had at last convinced DesBarres that the man after whom he had named the most important community on Cape Breton Island was, in fact, his life-long personal enemy. If DesBarres was correct in his conclusion then the motive of Lord Sydney's hatred of him remains obscure. DesBarres wrote in sorrow rather than in anger, "None will ever pretend to deny that your Lordship has injured me most fatally in my Reputation, in my Rank, in my Fortune, in the happiness of my mind, and in every point and relation that is dear to man; for though it was your Duty to receive every complaint against me, it was also your Duty to have given

me Justice. . . ."[30] Lord Sydney, at that time a retired Cabinet minister, replied on November 3, 1792, in distant, measured and dignified tones, absolving himself from anything but the highest of motives.

Col. DesBarres may have had a deserved reputation for irascibility but he could be intensely sensitive to the requirements of gallantry. In a letter dated December 17, 1806, written from Government House in Charlottetown to the Rt. Hon. W. Windham in London, he advised, "Mrs. Holland, widow of an old Brother Officer, who has rendered many good services to his King and Country, has this moment brought me the enclosed memorial, [author's note: likely an appeal for a government pension], which in compliance to her request I humbly by leave transmit herewith. It is not improbable but that His Royal Highness the Duke of Kent who, I find, interests himself in his situation, will take an opportunity of waiting on you in his behalf".[31]

The Halifax newspaper, *The Acadian Recorder,* paid a glowing editorial tribute to DesBarres on November 6, 1824, following his death in that city:

"Colonel J. F. W. DesBarres was an amiable and valuable warrior . . . His scientific labours on our coasts and his reputation as one of the heroes of 1759 under Wolfe at Quebec . . . gave him a claim on the gratitude and reverence of all Nova Scotians. The Chart which he prepared from his own survey of this province will give his memory claims of gratitude upon the nautical world and could only have been performed by a man of surprising perseverance. . . ."

The teacher of marine surveying, sketching and navigation to such as Capt. James Cook and Admiralty Hydrographer Capt. Thomas Hurd; compiler of *The Atlantic Neptune,* soldier, hydrographer, artist, man of action, of affairs and a governor of His Majesty's territories, Joseph Frederick Wallet DesBarres was a man of outstanding achievements and distinguished service.

The Great Lakes Surveys

The peace that followed the Napoleonic Wars in Europe and the War of 1812 in America made possible a renewal of British government interest and activity in survey voyages into Canada's Arctic, along its major rivers and in its Great Lakes. Commercial advantages motivated Arctic explorations but in Canada's border waters in the south, large and small, diplomacy and defence inspired the original scientific probings of the surveyor and chart maker.

Although systematic marine surveys of the Great Lakes and their connecting waters were not initiated until 1815, there is good reason to believe that limited, isolated surveys of a hydrographic nature, did occur almost a half-century earlier. In the year of the Treaty of Paris and the creation of the province of Quebec, and when Governor Murray received from the British Crown the first set of instructions for surveying land in the new province, there were official measuring missions carried out between Lake Erie and Lake Huron. In the *Journal of Pontiac's Conspiracy* and John Rutherford's *Narrative of a Captivity,* there is this entry for May 7, 1763:

"Mr. Robertson, a ship captain [and a] colonel of militia . . . acting under orders of the Commandant [of Detroit] had gone with 10 soldiers and a Pawnee servant *to sound the channels* to see if there was enough water for a vessel to pass in case of need".[32] (author's italics) Exploring and charting these waters was a natural consequence of the introduction of sailing vessels on the Upper Lakes. As early as the summer of 1761 Sir William Johnson found the schooner *Huron* already launched and Lieut. Charles Robertson[33] engaged in sounding the Niagara River near the

eastern outlet of Lake Erie. On May 2, 1763, Robertson took a party of 11 in a large bateau to explore and sound the St. Clair River, curious to find if communication with Mackinac was possible. In addition to soldiers and sailors the group included Sir Robert Davers, his Indian slave boy and young John Rutherford. Near the entrance to Lake Huron the party was ambushed by Indians and all were killed or taken prisoner. One of the two made captive was John Rutherford, author of the recorded account of the incident and aftermath.

Before the close of the 18th century there was another development of hydrographic importance on the "sweet water" lakes. In 1788 Lord Dorchester sent Capt. Gother Mann on a tour of the region in order to gather information valuable in case of open hostilities with the United States. Capt. Mann had come to Quebec about 1785 and by the time his active service career had ended he was commander of the Corps of Royal Engineers. Mann's 1788 survey extended to Sault Ste. Marie but Lake Huron absorbed much of his time. His observations on Lake Huron substantially increased information then available concerning the nature of its shores and waters. The entire coastline of Georgian Bay was examined by him and many inlets and river mouths charted for the first time.[34]

"A great solitude, little known or frequented except by some Indians" was Mann's description of the Georgian Bay region of that time. More than a quarter-century was to pass before systematic surveys were initiated on the Canadian Great Lakes. In 1815, when peace had been restored in America, Sir Edward W. C. R. Owen was appointed commodore and commander-in-chief of British naval forces on the lakes. He, in turn, appointed his younger brother, Capt. William Fitzwilliam Owen, to the post of chief hydrographer in the area. Both in their early forties and both experienced naval officers, these men accomplished an astonishing volume of surveying, considering the times in which they operated. Naval actions on the lakes in the War of 1812-14, as well as the safety of navigation generally, had served to emphasize the need for accurate surveys of these border waters. Upwards of 40 British war vessels were on the lakes at war's end and for these ships alone increased charting was essential for their safe navigation.

Significant marine survey developments followed the end of hostilities in the 1812-14 War in America. The British Admiralty, as we have observed already, turned its attention to a fairly intensive examination of Canada's northern seas. The *Rosamond,* a British war vessel, suddenly released at Spithead from the prospect of active service in American waters, received orders to proceed to Hudson Bay. In his published narrative of that history-making voyage, Lieut. Edward Chappell, one of the ship's officers, describes hydrographic surveys conducted by that vessel in the Bay in August, 1814. The entire voyage from Spithead and return extended from mid-May to November 17 of that year. A frontispiece map in Chappell's book is titled: "Map of the Great Nelson River from Great Lake Winnipeg to Gull Lake" and is drawn by William Hillier, Master. It shows portages, falls and rapids in the Nelson River, according to information supplied to the draftsman.

Lieut. Chappell complains occasionally of the Admiralty charts of the Bay entrances: ". . . nothing can be more incorrect than the Chart supplied by the Admiralty for the guidance of a man-of-war in Hudson's Straits; it absolutely bears no resemblance to the channel . . ." The inadequacies in mapping was due, in Lieut. Chappell's view, to the reluctance of officers of the Hudson's Bay Company to divulge to any outsiders, navigational information in their possession relating to the Bay or its entranceways.

The book also contains tables of soundings taken by the *Rosamond* south of York Factory as well as statements on compass variations observed en route to Hudson Bay. There is, in addition, a table of thermometrical observations taken with a spirit thermometer (Fahrenheit).[35] The *Rosamond* was so seriously damaged as a result of sea ice on this voyage that, upon its return, it was decommissioned and sold out of His Majesty's service.

In the season of 1815 several survey parties were sent out on the lakes and at the end of the year Sir Edward was able to supply the British Admiralty with more than 50 charts related to navigable waters all the way from Galop's Island to St. Mary's River. Thus a good foundation was laid for work that continued for years to come. In 1815 Capt. William F. Owen was occupied on various surveys from the St. Lawrence to Georgian Bay. His chief assistants were Lieut. Alexander Thomas Emeric Vidal and Mr. John Harris, Master, R.N. The schooner gunboat *Huron* was used during the closing weeks of this survey season and special attention given to the eastern shores of Lake Huron and Georgian Bay.

Lieut. (later Capt.) Vidal came to Halifax naval station on the *Niobe*. He was employed there and on the Great Lakes from February to November, 1815, principally in the surveying service. His brother, Emeric Essex Vidal, R.N., was a gifted sketcher and his 1815 water color representations of Kingston Harbor and Sackett's Harbor are still in existence.* H.M.S. *Vidal,* (named after Capt. A. T. E. Vidal) was the British survey vessel employed in the famous "Rockall" expedition of 1955 in the waters north of the British Isles.[36] After receiving his commission on August 25, 1818, Lieut. A. T. E. Vidal went with Capt. William F. Owen on surveys for the Admiralty in African waters and other places until 1846.

It had been the intention of the Admiralty to establish headquarters for the Great Lakes service at Quebec, nearer salt water, but as most of Sir Edward Owen's time was spent at or near Kingston, this place became the base of his surveying operations. Capt. William F. Owen, after whom Owen Sound came to be named, served as commander of the Kingston dockyard. Following his relatively brief period as Chief Admiralty Hydrographer on the lakes and in 1817 (after he had departed from Canada) there was produced under his direction a very good chart of Kingston harbor and its approaches.[37] In the 1840s he returned to Canada to conduct surveys in the Bay of Fundy.**

During his first season of surveying on the lakes Capt. Owen resolved to go to Quebec to enlist the services of an assistant, if he could find anyone suitable. At Quebec he met a 20-year old midshipman aboard the *Wanderer* and made a momentous decision. The studious habits of young Henry Wolsey Bayfield (1795-1885) impressed Owen as did the exceptional neatness of the lad's notebooks. Bayfield, for his part, was less than enthusiastic over the prospect of leaving his ship and his promising naval career for the vagaries, hardships and low pay of hydrographic survey work. But somehow Capt. Owen prevailed upon him to make the transfer, possibly on the strength of promises of rapid promotion. Bayfield, who had been in the navy from the age of 11, could hardly have foreseen at this stage his eventual rise to the rank of full Admiral, in recognition of over 40 years of sterling marine survey work. As it was, he became Lieut. Bayfield soon after accepting Owen's offer and at a time when the double-front system of land surveys was being introduced in Upper Canada. Bayfield had been in

*Library, Royal Military College, Kingston.

**There is evidence to indicate that Captain Owen visited Canada in the late 1830s.

America about a year before he was approached by Owen. He was officially posted to the lakes survey in September, 1816.

In addition to John Harris, R.N. (1782-1850) and Lieut. Vidal, others active in these early Admiralty surveys of the Great Lakes were Lieut. A. B. Becher, R.N. and Lieut. George Cranfield, R.E. All these men, along with Lieut. Bayfield, wintered in 1816-17 at Kingston. They were accommodated in the Harris home and worked in the Hydrographic Office in a building overlooking the harbor. In a letter to Mrs. John Harris dated May 5, 1829, Bayfield described this Kingston sojourn "with all its labors, the happiest of my life".

Bayfield remained with Capt. Owen, as his assistant, until Owen left Canada in 1817. On June 17, 1817, Bayfield was appointed an Admiralty surveyor. For the next nine years he extended his marine surveys over the whole of the Canadian Great Lakes. For two years he was on Lake Erie, four years on Lake Huron and Georgian Bay, and three on Lake Superior and the North Channel. During surveys on the latter lake he used the schooner *Recovery*. Wintry weather failed to hinder him. Often he would chop holes in thick ice in order to determine depths.

Capt. J. G. Boulton, who succeeded Bayfield in this lake survey work, was an enthusiastic admirer of his predecessor: "The Admiralty Survey Service has produced good men from Captain Cook onwards but I doubt whether the British Navy has ever possessed a more gifted and zealous surveyor than Bayfield. He had a marvellous combination of natural talent and tremendous physical energy . . ."[38] And again, "While making a survey of the Georgian Bay and North Channel of Lake Huron from 1883 to 1893, under orders of the Dominion government, I had a good opportunity of witnessing the marvellous quantity and excellence of Bayfield's work. He had neither the time nor the means to find all the outlying rocks and shoals nor was it necessary, 90 years ago, in that locality where his open boats were probably the largest craft sailing thereon".

In 1825 Bayfield left the Great Lakes area, never to return there for surveying operations. He went to England where he worked at the Admiralty completing charts based on his explorations of the previous decade and in preparing them for the engraver. In 1827 he was back in Canada surveying in the St. Lawrence River and Gulf. His appointment to this task was formally confirmed in the autumn of 1827 and the area of his operations was extended to include Anticosti, the Magdalen Islands, Prince Edward Island, Sable Island, Cape Breton and the coast of Nova Scotia as far as Halifax. All this took place at a time when Col. John By of the Royal Engineers was superintending the commencement of work of the Rideau Canal at Ottawa. Capt. John Franklin (August 16, 1827) ceremoniously laid the first stone in the construction of the canal at its Bytown terminus, as he paused briefly on returning to England from the first of three historic Arctic journeys.

Bayfield made Quebec his winter headquarters until 1841 when he transferred to Charlottetown, as the survey work had by then reached the eastern areas of the Gulf. During these years of hard toil and hazards Bayfield had the valuable assistance of such able naval officers as Lieut. John Orlebar (made Commander, 1845) who eventually succeeded Bayfield; Lieut. George A. Bedford (later made a Vice-Admiral); Lieut. P. E. Collins, drowned off the Magdalens in 1835; Midshipman A. F. J. Bowen, R.N., who returned to England, and Dr. William Kelly, M.D. It was the sudden death of Collins that brought Orlebar to Bayfield's aid in the emergency.

Bayfield would measure small bases a quarter-mile long, every 20 or 30 miles, using a chain or well-stretched lead-line. The coast between would be triangulated by

the land features, if possible. Ultimate scales of charts would be determined from distances calculated between stations. Bayfield himself took nearly all the observations required for fixing latitude, using a sextant. For longitude, he made Quebec Citadel his secondary meridian, determining its longitude west of Greenwich by moon occullations and eclipses of Jupiter's satellites.

Meridians of longitude east and west of Quebec were determined by chronometers. Every opportunity was taken by Bayfield and his assistants to observe by theodolite the astronomical bearings of stations on prominent headlands. . . . Sextant observations for defining longitude were usually taken by day, those for latitude at night, both actions being dependent upon clear skies. A large part of Bayfield's time was occupied in these calculations, or in soundings with the aid of a Massey sounding machine, with the plotting of stations on various large-scale plans of harbors and smaller scale coast sheets, also in supervising the 'detached' parties on shoreline detail.

Winters were occupied in completing the plotting of remaining details on rough sheets and plans and the construction of more comprehensive small-scale charts on Mercator's projection. The astronomically determined stations were laid down by Bayfield himself. Between these stations the coast details and soundings were squared in from the roughs. Fair copies were laid down of the whole and in the spring transmitted to the Admiralty Hydrographer for publication. Sailing directions were also drawn up to accompany the charts.

In mid-September, 1832, while in Gaspé, Bayfield reported that he had "measured a base of about 1¼ miles and observed at night the immersion of Jupiter's first and third satellites for longitude". Bayfield had something to say also about one of the perpetual afflictions suffered by surveyors in Canada. In late August of that same season, while in Labrador, he comments: "I never saw the moschettoes and black flies thicker; their bites covered us with blood while observing, and we could not open our mouths without swallowing them. The torment of them was beyond description—men, painting and working at the rigging, smeared themselves with paint, oil and tar in vain . . .".[39]

In the May 19, 1828 issue of the *Quebec Gazette* the following news item appeared: "The hired schooner *Gulnare,* 140 tons, built for Capt. Bayfield, R.N., as a surveying vessel, was launched yesterday from Mr. Taylor's shipyard. She is a fine vessel, owned by Mr. Stevenson, merchant . . .". This was the first of three survey vessels named *Gulnare* to be used during Bayfield's period of service. The first *Gulnare* was condemned as unseaworthy in December, 1843, after 15 years of hard service. The second *Gulnare* was launched at Charlottetown on May 18, 1844. The third *Gulnare* (212 tons) built at Quebec, arrived at Charlottetown for the commencement of the survey season in April, 1852.

In 1833 the first *Gulnare* had the honor of being towed in the St. Lawrence by *The Royal William* which made the historic Atlantic crossing that summer. Bayfield worked along the north shore to the Strait of Belle Isle that season—"Cook's plan of Chateau Bay, Labrador, is excellent" he comments. During the summer Bayfield experienced difficulties because of drunkenness and insubordination among the crew. In 1836 the Admiralty advised that, as an economy measure, Bayfield and his officers in the surveying service had been placed on half-pay in common with those on shore . . ."

In October, 1842, Capt. Bayfield found another Admiralty survey ship, the *Columbia,* active in his general field of operations. Her commander was an old friend, Capt. W. F. Owen. At Charlottetown the officers of the *Gulnare* and *Columbia* joined in consultations for the purpose of linking Owen's proposed survey of the Bay of

Fundy with stations already established by Capt. Bayfield. The two commanders and their crews also cooperated in 1843 in a series of experiments, using rockets to denote times and positions, in the fixing of meridians of longitude. On July 29, when the *Gulnare* was in Halifax harbor, rockets exploded that night by the *Columbia* in Bedford Basin were observed at a distance of 25 miles. Assisting Owen at this time was Peter Frederick Shortland who succeeded as commander of the *Columbia* and who became eventually a Vice-Admiral in the Royal Navy.

Capt. Bayfield had competent assistants in his survey work but he continued to feel the need of clerical help. "The want of a clerk or other person", he wrote on December 8, 1843, "to assist me in writing is severely felt, which may be imagined when I state that I wrote 14 pages of foolscap today".[40] In those days he was in the habit of signing most of his letters "Henry W. Bayfield, R.N., Surveying the Gulf of St. Lawrence".

At Pictou in August, 1846, Bayfield found orders awaiting his arrival there "to proceed to Canada and put himself at the disposal of the Governor General for an examination of the channels of Lake St. Peter, with a view to the excavation of a channel". Bayfield's fiscal worries were not confined to low rates of pay. On February 23, 1847, he received a letter from the Admiralty Hydrographer, Admiral Beaufort, "limiting the annual expenditure of this service to £2,400 sterling, exclusive of pay and allowances of yourself and officers".

On June 12, 1849, Bayfield made a significant comment on the accuracy of earlier charts of the Gulf region: "I have not in the least exaggerated", he stated in a letter to the Admiralty Hydrographer, "the defects of the old charts of the Gulf, Cape Breton and Nova Scotia. There are none of them that can with any degree of safety be trusted by the seaman, excepting those of Cook and Lane. At least none have come under my observation that are not a reproach to this age of improved hydrography. When I consider the still greater importance that exists respecting the coasts of many other countries, I cannot but think that the select committee might at least have touched more lightly a Department so evidently useful to the world . . .".[41]

By 1850 Bayfield's health was beginning to fail. With great reluctance he placed Capt. Alexander McLeod in charge of the *Gulnare* that season. He wrote, "It is not without pain that I shall see the *Gulnare* sail without me. But when I remember that it is the first time for 24 years, all feeling of discontent is removed. Crew trouble again . . .". When he passed the sixty-year mark Capt. Bayfield's health had become much more precarious. In promoting him to the rank of Rear-Admiral on October 21, 1856, possibly the Admiralty had evidently discovered a way to persuade the old sea dog to curb his ambitions. In any event this promotion automatically required him to give up active survey work. Seven years later he was elevated to the status of Vice-Admiral and on October 18, 1867, the year of Confederation, Henry Wolsey Bayfield was appointed full Admiral with a Greenwich Hospital pension of £150 per annum in addition to his normal pension. He was succeeded in the surveys by Commander John Orlebar.

Of Bayfield, Capt. Boulton recalls: "His distinguished appearance and kindly countenance won him respectful recognition wherever he went. But for several years he has been an invalid and unable to leave his room . . . The admiral was a man of high religious principle, kind to the poor and disposed to aid every good work. His noble Christian example did much to exert beneficial influence on the higher circles of our city life. Few have rendered more practical benefit to the commerce of the nation and to the navy itself by his careful coast surveys and excellent charts . . .".[42]

The Lieutenant Governor of Prince Edward Island, Sir Henry V. Huntly, paid tribute to the eminent hydrographer in his address at the opening of the provincial legislature on March 4, 1845:

"Now that the dangers upon the coasts of this Island and the numerous obstructions at the entrance of the different harbours have been so elaborately laid down by Captain Bayfield and officers of the Royal Navy serving under him, I trust that you will make

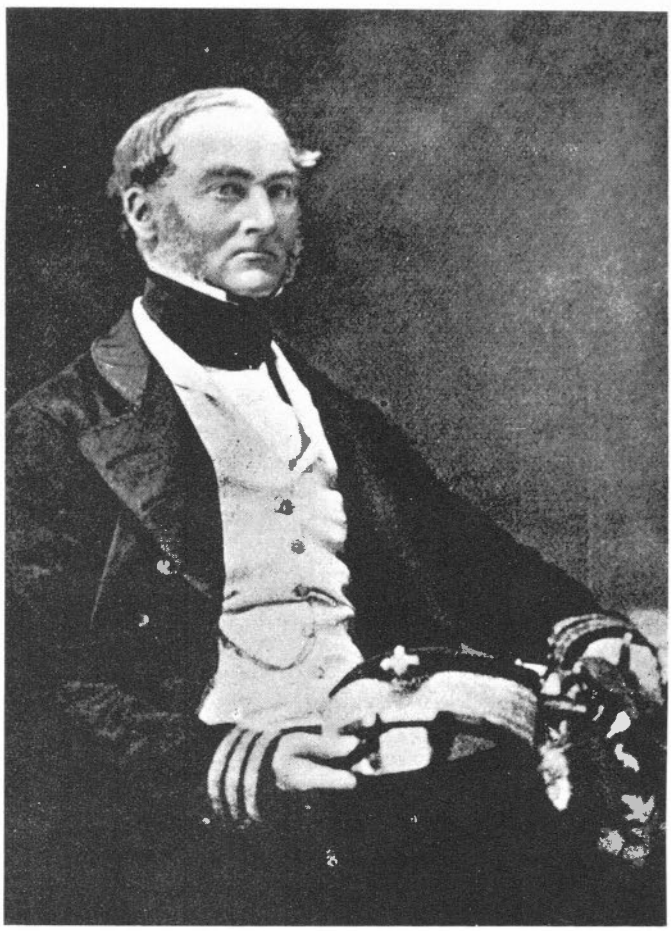


FIGURE 20
Admiral H. W. Bayfield, R.N., F.A.S.

provision for the erection and financial support of the lighthouse already proposed to be placed at Point Prim".

More than 56 Bayfield charts were produced during his active career, at least 16 of them relating to the Great Lakes. His manuscript map of Lake Superior is particularly impressive in its scope and detail. Bayfield River, near Goderich, Wolsey Lake and Bayfield Sound, all in western Ontario, help to commemorate the admiral's work and perpetuate his name. Today, on a plaque placed in the central square of Charlottetown, where the idea of Confederation received its first great impetus, there

is this inscription:

"Commemorating the distinguished services to navigation and science of Admiral Henry Wolsey Bayfield (1795-1885) whose work superseded the pioneer surveys of Admiral Durell, Captain Holland and Lieut. Desbarres. Between 1827 and 1856 after his work on the Great Lakes he conducted a thorough survey of the Gulf and River St. Lawrence, the coasts of Anticosti, Magdalen Islands, Prince Edward Island, Cape Breton, Sable Island and parts of Nova Scotia and Labrador".

14

THE EARLY PENETRATION OF CANADA'S WESTERN INTERIOR

As the 17th century dawned in North America the vast bulk of the continent remained unrevealed to the white man. Was its hinterland a relatively narrow belt lying just beyond the known horizon, or did the land mass extend for thousands of miles? Was that land divided by a strait leading from the eastern seaboard to the Pacific and thus to the Orient? These and other related questions continued to perplex the geographers of Europe.

Champlain and subsequent missionary explorers found that the Great Lakes were, in fact, large closed bodies of 'sweet water' and not inland seas. But it was not until the Hudson's Bay Company was formed in 1670 and when their men, as well as rival French fur traders, began to penetrate to the broad western plains, that the Canadian West began to emerge from obscurity and to take shape as a distinct geographical entity. The unfolding of the western interior, the demonstration of the absence of any transcontinental water passage, the existence of the Rocky Mountains barrier as well as the reaching of tidewater from the East, all resulted from a restless, driving search for the Western Ocean.

Two centuries of ceaseless quest and of gruelling physical hardship were to pass before white men were able to establish the general location, by parallels of latitude and meridians of longitude, of parts of the three ocean coasts of Canada. The pioneers who achieved this were the forerunners of a more or less steady tide of Europeans, sweeping into the west in remorseless waves. With them came the white man's way of living and attitudes towards life and its meaning. By the time of the United Empire Loyalist influx, the Red Indian way of life was doomed. It was but a matter of time before fur traders and explorer-mappers, pushing boldly westward, would give way to rugged frontiersmen and they, in turn, would yield place to the scientific explorer-surveyors.

Behind them came the advance guard of settlement accompanied by the first land surveyors and trained mappers.

The lively 17th century struggle between French and English for sovereignty and trading rights in the Hudson Bay regions, finally won by the English, was succeeded by an intensive rivalry between the English-inspired and English-led Hudson's Bay Company and the Canadian-inspired and Canadian-led North West Company. The earliest exploratory journey and mapping activity in the Canadian West, as far as the Rockies, were the consequence of the commercial competition engendered by the giant fur-trading companies.

Contrary to an impression all too general outside Canada even today, the territory within the borders of what are now Manitoba, Saskatchewan and Alberta is not entirely prairie land. Because it consists, rather, of plains, lake country, parkland and foothills, the term 'western interior' favored by John Warkentin, is being employed in this work in the interests of more precise description.[1] The first recorded visit of a white man to the western interior of Canada was made by Henry Kelsey. In 1684 he arrived at York Factory as a Hudson's Bay Company employee. On June 12, 1690, he left York Factory and travelled to what is now south central Alberta, returning to the Bay in the summer of 1692. Kelsey's aim was not to survey or to map, but to try to persuade the Plains Indians to trade with the English at Hudson Bay, rather than with the French.[2] Kelsey was the first of a distinguished company of western discoverers whose explorations were closely associated with the expansion of fur-trading activities in that region.

It was all very well for Kelsey to concentrate upon exploration, and to be content with his oral or written descriptions, but it soon became apparent to the fur companies that in order to carry on trade properly and profitably, it would be necessary for them to obtain reliable maps indicating clearly the routes and mileages as well as the location of trading posts and the exact distances between them.

The major regions of the interior of Canada, north of the 49th parallel, were explored through two main entranceways; Hudson Bay and its main tributaries on the one hand, and the St. Lawrence River and Great Lakes on the other. In 1715 the Hudson's Bay Company sent William Stewart from York Factory westwards with a party of Indians. The aim of this venture was to establish good relations with natives in the territory between Hudson Bay and Great Slave Lake. After a year's absence Stewart returned and described his journey to the Governor of York Factory who inscribed in the post journal that Stewart had travelled "N. NWt about 400 miles, then they went N. Wt to Cross the Baren Desarts and when they had cross'd them, they went W N Wt and came into a very Plentiful Country for Beasts".[3] By this feat Stewart became the first European to cross the Barrens.

In 1733 Joseph Robson, a stonemason and surveyor, arrived at Churchill to help in the construction of the fort there. The Hudson's Bay Company brought him back again to the Bay in 1744 and supplied him with surveying instruments. He mapped only parts of the coastline, never venturing inland. His maps and plans of H.B.C. forts are both detailed and accurate. Robson returned to England in 1748, a bitter critic of the company. A book that he published in 1752, describing the regions in which he had made surveys, contained severe attacks on his former employers.[4]

By 1774 the Hudson's Bay Company had taken initial steps to promote the preparation of maps of territories in which it was active. In keeping with the usual trend of North American developments, British interest in cartography lagged behind that of the French. Ten years previously the La Vérendryes had relayed maps of the western interior of Canada to their principals in the east. But it should be pointed out that the

American Revolution considerably impeded and delayed plans of the H.B.C. to investigate and map the interior of British North America.

During the period of Robson's visits to the Bay, the son of the Governor of the district in Quebec of which Three Rivers was the capital, was exploring, with his sons and nephew, the western interior by way of the Great Lakes entranceway. Pierre Gaultier de Varennes, Sieur de la Vérendrye (1685-1749) impressed the name of his family imperishably upon the pages of early western Canadian history.

In the early summer of 1731, after resigning his charge of a trading post on Lake Nipigon, the senior La Vérendrye took with him a curious map drawn by the Indian, Ochagach.[5] In 1729, while in his forties, père La Vérendrye, then a fur trader in the Lake Superior area, asked authorities in New France to sanction a search by him for the Western Sea. Two years later, by his appointment as Commandant of Western Posts, he was authorized to organize expeditions of exploration, provided he financed his own supplies and crew's wages! His eldest son, Jean Baptiste (1713-36) and his nephew, La Jemeraye, were killed on Massacre Island, Lake of the Woods in 1736 by Indians but not before the former had founded Fort Maurepas on the Red River. The white man stood poised on the threshold of the West.

In 1736 the senior La Vérendrye reached the junction of the Assiniboine and Red Rivers and built Fort Rouge there. In the years following the building of Fort Maurepas and Fort Rouge, La Vérendrye and his three remaining sons built a chain of forts and trading posts along the Assiniboine and Saskatchewan River valleys. Pierre Gaultier, the second son, (1714-55), writing in 1737 to the Marquis de Beauharnois, stated:

"I got the most experienced chiefs of the two tribes (Cree and Assiniboine) to make a map of the country, which I have the honour, Monsieur, to send you . . . You will see by this map, Monsieur, the heights of land . . ."[6]

On this very early map of the western interior the relative locations of natural features, such as lakes and rivers, were established by young La Vérendrye. He also drew attention to a basic factor in western Canadian geography, the distribution between woodland and true prairie.

In September, 1738, the senior La Vérendrye set out from Fort Rouge, following the Assiniboine River across what is now Southern Manitoba to Poplar Point, just south of Lake Manitoba. From there he struck southwards toward the Missouri River country. Some of his descriptions foreshadow the style of expression characterizing surveyors' reports of the future in Canada:

"On the 21st (October) we continued our journey as far as the first mountain (Pembina Mountain) distant from our fort 26 leagues, the general direction being south one point west, from the first mountain to the second (Turtle Mountain) is west one point south, 24 leagues; and from the point of the second mountain to go in a straight line to the Mandan you have to keep s.w. one point west."[7]

As La Vérendrye was then in his mid-fifties he found some of the exertions involved in these travels strenuous tests of his physical stamina:

"From the first mountain the whole route lay in prairie country, but with a succession of hills and valleys, which it is fatiguing to climb up and down several times a day. There are some magnificent plains of 3 or 4 leagues in extent."

His health, in fact, was waning and he was compelled to return to Quebec where he died a few years later, in 1749. But his principal work was done, namely, the establishing of French competition for the Hudson's Bay Company in the western interior and the selection of the Saskatchewan River as the most promising route to

the Western Ocean.

La Vérendrye's contribution to western cartography is small but noteworthy. His most significant map, dated 1740, is now in the Marine Department Library in Paris. His manuscript maps, rough sketches only, were sent to Quebec government officials and, in turn, forwarded to Paris where these provided data useful in the compilation there of maps of North America.

The third son, François, Chevalier de la Vérendrye (1715-94) and the youngest, Louis Joseph (1717-61) followed the trail-blazing example of their illustrious father. It was François who is credited with the discovery of the Saskatchewan River in 1749 which he ascended with his brother to the junction of the north and south branches that year. No western flowing rivers were found by the La Vérendrye family or others exploring the interior, and the main hope for finding any such streams at that time rested on the route of the Saskatchewan.

Stimulated by the French penetration of the West, the Hudson's Bay Company in 1754 ordered Anthony Henday to travel inland with a party of Indians to try to induce natives to bring their furs to the Bay. If Henday (or Hendry) was not the first European to sight the Canadian Rockies, he was among the very first to do so. He had joined the Hudson's Bay Company in 1750 and, as Henry Kelsey had done 64 years earlier, he travelled alone into strange, Indian-occupied territory. In the autumn of 1754 Henday caught his first glimpse of the Rocky Mountains. He arrived back at York Fort on June 20, 1755.[8]

By the last half of the 18th century the Hudson's Bay Company's policy of exploration had become truly aggressive. In that period the Company produced such discoverer-surveyors and mappers as Samuel Hearne, Peter Fidler, Philip Turnor and David Thompson. Samuel Hearne (1745-92) entered the employ of the company at 21 years of age. Three years later he was chosen to travel with a group of Indians northwest along the Churchill River in search of copper ore, rumors of deposits of which had been circulating for some time in the Bay area. Two Indians, for example, appeared in 1768 at Fort Churchill carrying samples of free copper and "a rude sketch, drawn with charcoal on a deer's skin, of a map of the country to the northward of Churchill".[9]

It was on the strength of these copper samples and the deer-skin map that Hearne's employers decided to send him on a journey to chart the route to the copper mine. "In consequence . . . the Committee resolved to send an intelligent person by land to observe the latitudes and longitudes of the river's mouth, to make a chart of the country he might walk through . . . By the ship that went to Churchill in the summer of 1769, the Company sent out some astronomical instruments, very portable and fit for such observations as they required me to make."

Hearne made three separate probes before he achieved success. His 1769 attempt failed to reach beyond what is now northern Manitoba. In the following year he did cross into the Barrens. On the third journey, lasting from December 7, 1770 to June 30, 1772, and guided by the very competent Matonabbie, he reached the Arctic mouth of the Coppermine River.

Hearne was not a superior type of surveyor or mapper. The inaccurate map accompanying his Journal shows the routes he followed as well as the rivers and lakes he discovered. However, the fact that he produced a map at all is a solid achievement. The country he explored was not visited again by white men until at least 50 years later when Franklin reached the Coppermine by way of Great Slave Lake.

"The track [sic] of land", states Hearne in his description of the Barrens in his

FIGURE 21
Samuel Hearne.

Journal, "inhabited by the Northern Indians is very extensive, reaching from the 59th to 68th degree of North latitude; and from east to west is upward of 500 miles wide".[10] Summing up, Hearne declares dogmatically, "Though my discoveries are not likely to prove of any . . . advantage to the nation at large, or indeed to the Hudson's Bay Company, it had put a final end to all disputes concerning a northwest passage through Hudson Bay".

It is interesting to consider the types of survey instruments on which Hearne relied. On his second venture into the North his Hadley's quadrant, which had proved 'very portable' had been damaged in an accident in August, 1770. But this was not an unmitigated disaster. The loss, though serious, had the result of demonstrating the unreliability of his Indian guide. Hearne's party reached 60 degrees North latitude when "they were entirely lost". Without the quadrant it was impossible to observe for latitude and thus the party was forced to return to its Fort Churchill base. In the preface to his Journal Hearne comments, "My broken Quadrant was a Hadley's with a bubble attached to it for a horizon and made by Daniel Scatlie of Wapping".

On his third journey Hearne was equipped with an old, cumbersome Elton's quadrant. It proved to be a heavy burden on the trail. One version of the official instructions issued to Hearne included the admonition, "If Your Observing Instrument should happen to Break or be useless as was the Case before, Don't let that hinder you from proceeding in order to see if Ye River will be worthy of any further Notice or Not".[11]

This order was unreasonable from the discovery aspect, as there would be little purpose in claiming sovereignty of any land undescribed in terms of latitude or longtitude. In any event Hearne could only estimate his longitude on the basis of the length and direction of his daily journeys. For that matter his latitudes were none too accurately calculated either. On his third journey he was in error by 2 degrees of latitude on the most important of his observations. On July 1, 1771, Hearne placed the Arctic Coast of Canada, at the mouth of the Coppermine River, some 200 miles north of its true location.

His mapping techniques also left something to be desired although his cartographic efforts ought to be assessed in the light of 18th century standards and not by those of the 20th century. But for more than a century, until J. B. Tyrrell's journeys in the Barrens, Hearne's book and map constituted the only available source of information on this important area of Canada's northland.[12]

One of the most outstanding, if also the most unstable, of the 18th century explorer-mappers of Canada's western interior was Peter Pond (1740-1807). Born at Milford, Connecticut, he came to the Canadian West in 1775 to trade in furs. Aggressive, a born explorer, unquestionably courageous and possessing marked all-round ability. Pond's career in the wilderness was a brief, yet stormy one. Pond's violent temper soon created trouble of the first magnitude. When a trader named Wadin was killed in an encounter with Pond and his employees in 1782, Pond and one of his clerks were brought to Montreal to stand trial for murder. However, the authorities decided that a Quebec court was without legal jurisdiction in any of these remote territories and the two men were released from custody in that same year.[13]

About this time a new fur trading corporation, the XY Company, came into active competition with the North West Company, to which Pond belonged. John Ross, a prominent fur trader in the Northwest, was the XY representative at Athabasca and a keen rival of Pond. In a scuffle one night during the winter of 1786-87, involving Pond and his associates at Lac La Ronge, Ross was knifed in the thigh and bled to death. Partly because the North West Company did not want the XY people to press court charges as a result of this deplorable incident, a merger of the two companies took place, in 1787, in the form of an enlarged North West Company.

In the fields of exploration and cartography Pond had a creative vision of the long-range significance of his discoveries. He foresaw with clarity the system of continental communications that would develop from his findings. He possessed other splendid pioneering qualities as well. After Pond joined the North West Company in 1785 he was sent out to organize the company's activities in the Athabasca department. At Athabasca he soon developed a vegetable garden to supplement his transported food supply and thus brought into existence the most northerly agricultural project in the New World at that time.[14]

Between 1784 and 1790 inclusive Pond drew a number of maps of Western Canada portraying his travel routes. His cartography was the first fairly complete representation of the western interior, especially in showing the pattern of rivers. In later maps he made the mistake, however, of showing the Mackenzie River flowing into the North Pacific, rather than into the Arctic Ocean. Pond was the first white man to report the existence of what later became known as the Methy Portage, located northwest of Peter Pond Lake

(near the present Alberta-Saskatchewan border) by which route the Clearwater River was reached. Alexander Mackenzie wrote of this feature: ". . . is the ridge that divides the waters which discharge themselves into Hudson Bay, from those that flow into the Northern Ocean, and is in latitude 56.20 and longitude 109.15 West". The waters of the Clearwater flowed into the Peace River which, in turn, entered Lake Athabasca. Pond realized the strategic value of this portage and his own plans and geographical concepts made possible Alexander Mackenzie's celebrated journey to the Pacific Ocean about a decade later.

But Peter Pond, in addition to the misplacement of the Mackenzie River's mouth, drew other erroneous conclusions concerning that great watercourse. "From out of the Great Slave Lake", he recounted, "runs a very large River, which runs almost South West, and has the largest Falls on it in the known world, it is at least 2 miles wide where the Falls are, and an amazing Body of Water. This River leaves the Lake on Latitude 64 and Longitude 135 and the Falls are in Longitude 141".[15] This would place Great Slave Lake in present-day Yukon Territory.

In 1790 Pond sold his share in the North West Company to Simon MacGillivray for £800, and retired to live in Boston. In 1785 and in 1790 he had drawn maps of interior Canada. The earlier of these two maps was known to Turnor when that Hudson's Bay Company official was engaged with Peter Fidler in a mission to survey Lake Athabasca in 1791. It is reported that the United States boundary commissioners, at the turn of the century, resorted to Pond's unique knowledge of Canadian geography to support their case for a boundary line along the St. Lawrence River and through the middle of the Great Lakes to the Lake of the Woods. Pond died in Milford in 1807.

The year before Pond retired to Boston, Peter Fidler (1769-1822) born in Derby, England, arrived as a Hudson's Bay Company employee at York Fort. The following summer Fidler was chosen by Philip Turnor to accompany him on the journey to Lake Athabasca. Both Fidler and David Thompson had been trained in surveying by Turnor. Both were well qualified for this exploratory task but Thompson had met with a serious accident a few days before Christmas, 1788. About a mile from Manchester House on the Saskatchewan River, Thompson, while hauling a sledload of firewood, slipped and fell down a river bank, breaking his leg. For many months he was on crutches. Even in February, 1790, "his leg [was] still bad".

From the time that Fidler wintered among the Chipewyan Indians on Slave Lake, he enjoyed the reputation of being an enterprising, perceptive and resourceful traveller. He wrote an excellent passage on the origin of the Kettle Portage potholes. Before reaching the great rapids Fidler crossed Kettle Portage (June 21, 1792) and observes, " . . . several very round holes of a cylindrical form, from 1 to 5 feet in diameter, perfectly smooth and round, a stone within loose—that served to make the excavation by the falling waters and strong current moving the stone, and by its friction causing those kind of stone kettles, above-mentioned, these having been formed when these places have been the bottom of a river, now the rocks are above the surface 4 to 5 feet".[16]

In 1800 Fidler led a party up the South Branch of the Saskatchewan. In 1802 he moved north to Lake Athabasca and in that same year sent a map to A. Arrowsmith in London to aid in the delineation of North America. There is reason to believe that Alexander Dalrymple was aware of Fidler's mapping work and ability. In 1796, four years after Turnor's retirement, Fidler was made chief surveyor and map maker of the Hudson's Bay Company, carrying on in these capacities until the union with the North West Company in 1821.

When Lord Selkirk established his colony on the Red River, Peter Fidler was em-

ployed in 1813 to make the first formal property surveys of Canada's western interior.[17] The two rivers, Red and Assiniboine, as they approached their junction, formed natural base lines for the division of land. Governor Miles Macdonell, first governor of the colony, was familiar with the river-lot system in Lower Canada and regarded it as a model or pattern for the initial Red River survey. But the lots were made one-third wider for greater convenience.

On July 17, 1813, Macdonell wrote to Lord Selkirk: ". . . I have since laid out lots of 100 acres, of 4 acres front on the river, according to the annexed rough sketch . . . The farms of Lower Canada are on 3 acres front, and the first settlers in Upper Canada had only the same, but they found it afterwards too narrow, which induced me to add one acre additional to the breadth of our lots here. This [is] sufficient for any . . . farmer".[18]

Lord Selkirk advocated a more compact type of settlement but this was never established, the river-lot system prevailing. Thus more than a thousand miles from the St. Lawrence Basin, history repeated itself. Talon and Colbert had suffered a similar reverse in New France of the 17th century. By 1870 river lots extended for more than 40 miles along the Red, and along the Assiniboine as far as Portage la Prairie. Most of the lots were laid out with a 12-chain river frontage but there were later variations all the way from 1 chain to a half-mile in width.[19]

In 1814 Fidler laid out a total of 36 lots along the Red and was recommended for appointment as permanent surveyor of the colony at £100 a year and office accommodation. The recommendation was contained in a letter written that year by Miles Macdonell to Lord Selkirk in which he stated, "We require to have a permanent surveyor who will keep a regular office and Mr. Fidler might answer the purpose. His Indian family is some objection to him. He is far from being a well-polished man and is not well liked by the people but I think him a well meaning man. I set off tomorrow for York. Mr. Fidler takes charge of matters here until my return". When Point Douglas, a peninsula formed by a bend in the Red River about a mile north of its junction with the Assiniboine, was subdivided into lots in 1817, it was Peter Fidler who made the survey. This step was taken to prepare for the settlement of some 100 disbanded soldiers after the war with the United States, probably the first soldier settlement project in Canada's West.

Fidler, who served for a time on the Council of Assiniboia, purchased five cows and an additional bull from the North West trading post at Fort la Souris, in order to augment the colony's tiny herd of cattle. The bull proved too vicious for handling and had to be slaughtered. During the 1813-14 winter a bull named Adam fell through river ice and vanished. But Adam had left a healthy son and heir before making his abrupt departure. Today Manitoba's cattle population (Dominion Bureau of Statistics 1963 figures) is more than 1,065,000, valued at more than $150,000,000.

In the Public Archives of Canada, Map Division, there is a large map drawn by Fidler and published 5 years after his death. This is an excellent cartographic representation of the western and north-western areas of Canada, as comprehended in his time.[20]

Peter Fidler is the author of one of the strangest wills ever to be drawn in Canada. Dated August 16, 1821, at Norway House (when Fidler was 51) the will provides that all his journals and maps be left to the Hudson's Bay Company; his library of 500 books and survey instruments to the governor of the Red River Colony.[21] After making provision for his Indian wife and 10 surviving children (14 children had been born to them) he disposed of his estate residue in the clause: "All my money . . . to be placed in the

public funds and the interest annually due added to the capital and continue until August 16, 1969 (the 200th anniversary of his birth) when the whole amount . . . [shall be] placed at the disposal of the next male child heir in direct descent from my son, Peter Fidler". The fact that no Fidler money has ever been uncovered does not detract from the remarkable nature of this curious bequest.

At Meadow Lake, Saskatchewan, there is a National Historic Sites plaque inscribed: "Peter Fidler, Meteorologist and Surveyor. Served the Hudson's Bay Company actively for 34 years, trading on the North and South Saskatchewan and the Churchill rivers, built the fur posts Chipewyan 1791, Bolsover 1799, Greenwich 1799, Chesterfield 1800, Nottingham 1802. Made the first boundary survey of Assiniboia and surveyed Kildonan. His extensive Journal fully reflects the life of the land. Born at Bolsover, England, 16th August, 1769. Died at Norway House in 1822".

Fidler's successor as surveyor to the colony was a Scotsman, William Kempt, also appointed Sheriff. In 1822 he was instructed by the colony's governor to resurvey the lots laid out by Fidler and then to lay out lots* on Image Plain, some 10 miles north of Point Douglas. Kempt later returned to Scotland to continue the practice of land surveying there.

The next surveys of record were made by George Taylor in the years 1836 to 1838 inclusive. His work covered all previous surveys and was known as the *Old Settlement Belt Survey*. Taylor was surveyor to the colony from 1836 to 1844. He surveyed at least 1,542 lots along the Red and Assiniboine rivers. This basic Taylor cadastral plan became the foundation of all Hudson's Bay Company land grants in the Red River Settlement.

In June, 1855, the Council of Assiniboia appointed William Inkster as public surveyor at a salary of £25 a year with authority to charge as much as 7s.6d. a day for every day he was employed in his official capacity. In May, 1856, the Council appointed a second public surveyor. This was Roger Goulet (1834-1902), born in the Settlement in 1834. During the Red River troubles of 14 years later he was imprisoned by Louis Riel for refusing to cooperate and to accept a surveyor's office under him. In 1860 Herbert L. Sabine was engaged as a surveyor on terms similar to the arrangements made with Goulet. His area for surveying was the north side of the Assiniboine River.

Born in Stornoway, Scotland, Alexander Mackenzie (1764-1820) was brought by his parents to New York. During the troubled years leading up to the American Revolution young Mackenzie was sent to Detroit to learn the fur trade. His abilities, inquisitive mind and enterprising spirit soon thrust him into prominence and when John Ross died, as a result of an altercation with Peter Pond, Mackenzie was sent to replace him. Mackenzie and Pond were on fairly amicable terms during the winter of 1787-88 at Fort Chipewyan. Pond enlightened the ambitious Scot on conditions and the lay of the land farther north, matters on which Pond possessed first-hand knowledge. The concept of a large westward-flowing river emptying into the Pacific still governed the minds of men in that age and Pond was no exception. It did not seem to occur to anyone that such a river would need to take its rise on the western slopes of the intervening Rockies. Thus Pond had convinced himself that the important river he had observed leaving Great Slave Lake and flowing westerly, reached Cook's 'River' in Alaska, which had been discovered in the same latitude as Great Slave Lake and news of which had been circulating in North America since Cook's third voyage. Pond chose to disregard information given him by Indians that the great river finally turned northward. Mackenzie was misled by

*8 lots of 32 acres each.

FIGURE 22. Alexander Mackenzie.

Pond's theory in this respect but undoubtedly he owed much to the latter's experience and practical advice in planning and executing a major journey of exploration.

An odd aspect of Mackenzie's character was his cold contempt of Pond to whom he owed so much for the ultimate success of his explorations. On the credit side of his personal ledger Mackenzie maintained excellent relations with his crewmen and with the Indians he met. The fact that none of his men was killed and none deserted him on these prolonged, arduous and hazardous ventures into the unknown, is in itself eloquent of Mackenzie's ability to win people to his viewpoint and to communicate his enthusiasms.

At 9 o'clock on the morning of June 3, 1789, Mackenzie set out from Fort Chipewyan well equipped for a bid to find the Western Sea. This was the dream that contin-

ued to cast a spell over adventurous Europeans. It was difficult in those days to grasp the possibility that a continent that was so narrow at Panama, could be so vastly wide farther north. The discovery of any navigable water passage from the continental interior to the western coast would mean enormously increased profits to fur traders because of the provision of cheaper marine transport for their goods.

So well equipped was Mackenzie on that June day in 1789 that he had with him roubles for trading with the Russians. Accompanying him were 12 men and women, including four French-Canadians (two of whom had brought their wives), a German, an important Indian called English Chief, followed in a second canoe by his two wives, and by two of his tribesmen in a third canoe. The Indians were to perform as hunters and interpreters. Mackenzie pushed all of them to the very limits of their physical endurance. They started out each morning at sunrise, making camp in the late afternoons. Cold weather, heavy rains and clouds of tiresome flies failed to discourage him. The Indians, however, complained bitterly. Among themselves they must have frequently questioned Mackenzie's sanity.

Mackenzie himself experienced profound disappointment when he found the river, which now bears his name, turning northward and being flanked to the west by a continuous mountain barrier, a northern extension of the Rockies. When the sun did not set at midnight Mackenzie realized that he was within the Arctic Circle. On the night of July 12 the party, in a state of near panic, had to move quickly to prevent their baggage from being submerged in rising water. This was the first convincing clue Mackenzie had that he was now at tidewater. This clue was confirmed when he took observations for latitude and for compass variation on July 13th.

Mackenzie and his party returned safely to Fort Chipewyan on September 12, after travelling more than 3,000 miles in 102 days. The explorer was undaunted by his failure to reach the shores of the Pacific but he had effectively demolished Peter Pond's theory that the big river emptied into Cook's 'River'. However, nowhere along his extensive route had Mackenzie been able to establish his position in terms of longitude and he planned to improve his knowledge and capacity in this field in the near future.

Mackenzie left Lake Athabasca in the spring of 1791, bound for London, England. "I resolved", he said, "to improve my knowledge of surveying and navigation [in order] to return to find a passage through those western mountains". On his way east he met Philip Turnor who was en route to make surveys for the Hudson's Bay Company at Fort Chipewyan, and, in particular, to establish its longitude. The position of Hudson Bay, in terms of longitude, had been determined and Turnor's purpose was to find the exact mileage between the Bay and Fort Chipewyan. When he finally determined the fort's longitude the true distance of the post from the Pacific Ocean was realized for the first time.

Alexander Mackenzie spent the winter of 1791-92 in London, learning sufficient astronomy to fix longitudes and to purchase required instruments, a compass, sextant, chronometer and telescope, as well as the most recent astronomical tables. He sailed from London on May 9, 1792, and set out from Fort Chipewyan on his celebrated journey to the Pacific on October 10, 1792, returning in the autumn of 1793. Despite his training Mackenzie usually underestimated distances on his trip. His compass bearings seem uncorrected for magnetic variation (which is about 23 degrees east in the latitudes of his route and in his times). In addition to other troubles he had the misfortune to damage his 'Farenheit' thermometer early on his westward journey. The instrument was rendered useless and Mackenzie's diary from that point on suffered from a lack of reliable meteorological information. He and his party followed a generally southwesterly

direction, ascending the Peace River to Finlay Forks. There he wisely chose the less inviting Parsnip River, rather than the Finlay River. Had he used the latter, it is not likely that he could have reached the coast.

On May 11, 1793, Mackenzie notes in his Journal, "Took meridian altitude which gave 55.56.3N lat.". Again, on May 29: "Rain so violent all day . . . that we did not venture to proceed. As we had almost expended the contents of a rum keg, and this being a day which allowed of no active employment, I amused myself with the experiment of inclosing a letter in it . . . [the keg] . . . dispatching it down the stream, to take its fate . . . consigned . . . to the mercy of the current".

Soon he passed over the Continental Divide into a strange entirely new world of high mountains and dangerous rivers.[22] He descended the peril-filled Fraser (which he thought was the Columbia) from near present-day Prince George, leaving the river in the vicinity of Williams Lake and striking westward to the Bella Coola River and eventually tidewater at North Bentinck Arm, one of the inlets of the ocean penetrating deeply into the North Pacific Coast. The ten men of the party had only 20 pounds of pemmican, 15 pounds of rice, 6 pounds of flour and a little ammunition left. June 25: "I now had a meridional altitude, which gave 60.23 natural horizon [the angle being more than the sextant could measure with the artificial horizon] . . . and the eye five feet above the level of the water gave 52.47.51 North latitude. During our stay . . . we had been most cruelly tortured by flies, particularly the sand fly, which I am disposed to consider as the most tormenting insect of its size in nature".[23]

It was absolutely essential that Mackenzie establish his position geographically if his discoveries were to hold any real meaning for the outside world. He needed a long stretch of open water in order to provide a natural horizon, and a clear sky at the right time for making observations of the sun and of Jupiter's satellites. It was not easy in this region to obtain the exact combination of favorable factors. Members of his party were disgusted when he showed dissatisfaction with Bella Coola village on North Bentinck Arm as a tidewater destination of the long, hard journey overland. Against all protests he ventured along the Arm in a light craft, taking occasional pot shots at elusive sea otters. He rounded Points Menzies and Edward, reaching Dean Channel and a rock formation near Elcho Harbor, not far from present-day Ocean Falls.

July 22: "My instruments being exposed they (the Indians) examined them with much apparent admiration and astonishment. My altitude, by an artificial horizon, gave 52.21.33; that by the natural horizon was 52.20.48 N. lat.". Mackenzie took a number of sightings and after observing the eclipses of the first and third satellites of Jupiter, produced an average of these observations and fixed his longitude at 128.2 West of Greenwich.[24] This reading was about 42 minutes of arc short of accuracy, or about 30 miles in error. In fixing latitudes for his inland positions Mackenzie achieved much greater accuracy, being generally a little more than a mile in error. These considerations become of some importance when one reads in Mackenzie's Journal (page 441): "I had now determined my situation, which is the most fortunate circumstance of my long, painful and perilous journey, as a few cloudy days would have prevented me from ascertaining the final longitude of it." Then he set down the now-famous words: "I now mixed with some vermilion in melted grease, and inscribed in large characters on the South-East face of the rock on which we had slept last night, this brief memorial: 'Alexander Mackenzie, from Canada, by land, the twenty-second of July, one thousand seven hundred and ninety-three'."[25]

Mackenzie's recorded observations have produced much controversy among surveyors and geographers concerning the exact place on which the inscription, long ago

erased by the elements, was made. Capt. R. P. Bishop, B.C.L.S., has made a special study of this feature of the Mackenzie epic.[26] He points out: "this [type] of observation (observing eclipses of Jupiter's satellites), the simplest of the absolute methods and one in common use even for scientific purposes a few years before Mackenzie's time, cannot be depended upon to give very accurate results, as the eclipses are not instantaneous and the exact time . . . of the disappearance and re-appearance of the satellites is difficult to determine".

Raper's *Navigation* states that the observation is only to be considered complete where both disappearance and re-appearance of the same satellite are observed on the same evening under the same circumstances. Mackenzie had a telescope which was probably not up to the standard deemed necessary by Raper . . . "In comparing results of Mackenzie's necessarily crude method with those obtained by skilled observers carrying the best equipment England could produce, we find Vancouver's determination of longitude at Nootka differed from that of Cook by 20 minutes of arc".

The coast hills were hidden in fog and a strong head wind had to be bucked by Mackenzie as he entered the arm of the sea in his frail craft that July morning. But he added a key piece to the geographic jig-saw puzzle that had for so long baffled explorers of North America. By his history-making journeys Mackenzie had replaced myth, dream and rumor by solid facts. He had explored the entire length of one of North America's largest and longest rivers (and certainly Canada's greatest) and learned that it did not discharge into the Pacific as had been almost universally thought. He was the first European to reach the Pacific by land from the east and he learned much about the rugged and extensive terrain existing all the way from the northwestern interior to the Pacific coast. His return trip to base was a very rapid one, consuming only 33 days. If only Canada's earliest fur traders and explorers had realized soon enough that the Fraser was not navigable for much of its upper reaches and that *it* was *not* the Columbia, the main Canadian effort to explore and settle might have been directed farther south and thus established British possession of the Oregon Country before the Americans reached it.[27]

Mackenzie's achievements had other interesting and historically important results. It is said that Lord Selkirk read Mackenzie's *Voyages* and its contents inspired in him the idea of colonizing the Red River valley. There is no doubt that Mackenzie himself sparked Lord Selkirk's interest in the Hudson's Bay Company. Above all, Mackenzie's superb example led to the expansion and ultimate settlement of vast portions of Canada's north and west. And he settled for all time the question whether or not there existed a natural, navigable water passage across the middle of North America.

In 1801 Mackenzie's *Voyages* was published and in 1802 he was knighted. From 1804 to 1808 he sat in the Assembly of Lower Canada as member for Huntingdon in the Eastern Townships. He left Canada in 1808, never to return.

Philip Turnor (1751-1800) is not credited with any significant geographical discoveries but has some claim to fame as the first scientific observer to work actively in the western interior of Canada. He prepared many maps of the country between James Bay and Great Slave Lake but his greatest contribution to Canada's development was in training David Thompson and Peter Fidler in the sciences of surveying, mapping and the making of field notes. Turnor was first brought to Canada in 1778 by the Hudson's Bay Company as a trained surveyor. He returned to England nine years later. His final visit to Canada was for a period of three years, commencing in 1789.

In his early years in this country Turnor worked mainly in the proximity of Hudson and James Bays. In 1790-92 he journeyed from York Fort to Cumberland House, then to Lake Athabasca and back to Hudson Bay. The map he prepared of the land

traversed is the first map of Canada's western interior to give reliable indications of the nature of its topography. His journal was finally published in 1934.

By 1763 the Canadian West known best to geographers included the large lakes in what is now the province of Manitoba, the west coast of Hudson Bay and the Assiniboine River valley as well as the prairies extending between the Assiniboine and the Missouri. There was knowledge also of a chain of high mountains somewhere beyond the Saskatchewan River forks. There was an awareness, too, of extensive prairie grasslands to the south and west of the forks. But no coherent map or description of the western interior had been produced up to the late 18th century. This serious lack of cartographic representation of Canada's West was to be remedied in the closing years of that century and during the opening years of the 19th century by a man who later became widely regarded as the greatest land geographer of his day in British America and the maker of the first comprehensive map of the Canadian West. This latter achievement may, in the long future, represent David Thompson's chief claim to enduring fame.

Born in London on April 30, 1770, David Thompson (1770-1857) was the son of David and Ann Ap-Thomas, a surname that was changed when the Welsh couple moved to London. Young David was left a foundling and was enrolled at 7 years of age in Grey Coat School, near Westminster Abbey. He remained a pupil there for seven years (1777-1784). There he was taught from such books as Atkinson's *Art of Navigation,* Newton's *An Idea of Geography,* and Barlow's *A Survey of the Tide.* Towards the end of 1783 the Hudson's Bay Company, then more than 100 years old, applied to the school to ascertain "if the Charity could furnish them with four boys against the month of May next, for their settlement in America". Apparently David Thompson was the only lad then available for the purpose. He had early shown a talent for drawing and a special interest in geography. The 14-year-old David arrived at Fort Churchill aboard the Hudson's Bay Company ship *Prince Rupert* in early September, 1784. This was the year of the Loyalist influx in the settled parts of Canada, and very shortly after the flight from Shelburne of the unappreciated surveyor, Benjamin Marston.

One of the first tasks assigned to the newly-arrived clerk was the copying by longhand of the account of the journey of Samuel Hearne to the Coppermine River. At the time Hearne was Governor at Churchill. Following upon the leg fracture Thompson sustained just before Christmas, 1788, in an accident already recounted, he was carried to Cumberland House to be treated by the Resident Surgeon. In the following year Thompson lost the sight of his right eye. But it was at Cumberland House that he met the company's official surveyor, Philip Turnor, and under his tutelage studied astronomy, geography and practical surveying during the winter of 1789-90. In addition he was carefully taught the survey uses of the telescope, chronometer, compass and thermometer. He learned to employ a sextant (10-inch radius) made by Dolland of London as well as the *Nautical Almanak* and the artificial (mercury) horizon. He was taught how to sight on the sun and stars and how to establish latitudes and longitudes of positions and places. About this time Thompson began also to use a notebook, to keep records regularly and to keep track of his meteorological observations. These were made several times daily, the direction and force of the winds were recorded as well as general remarks of prevailing climatic conditions. Thompson's later notes exhibited an insatiable curiosity concerning North American wildlife. Throughout his *Narrative* are to be found many descriptions in detail of the appearance and habits of birds and animals. In addition there were parts of vocabularies of various Indian languages that he learned to speak in the wilderness.

Young Thompson gained in this way dependable grounding in the theory and prac-

tice of surveying. It was during this apprenticeship period that he took a series of astronomical observations, six of them for meridian altitudes of the sun, in order to establish latitudes of the locality, and 35 lunar observations for longitude readings. He estimated that Cumberland House was 53 degrees, 56 minutes, 44 seconds north latitude and 102 degrees, 13 minutes west longitude. This calculation is nearly identical with the position of the place as shown on modern maps. With the coming of summer Thompson was sufficiently recovered from the effects of his accident to make the trip to York Factory. During this 750-mile journey along the canoe route he made a map of what he traversed. The map was sent to the London directors of the company on the next ship leaving York.

One of the probes made by the Hudson's Bay Company into the interior from Churchill involved a youngster, George Charles, who was expected to seek out a practical canoe route to the Athabasca country from the Bay. Charles, like Thompson, was a Grey Coat School apprentice. He had been sent out to the Bay in response to Alexander Dalrymple's pressure for the appointment of surveyors. But his training had been perfunctory and his heart was neither in the tasks of exploration nor in the practice of surveying. Thompson reports: "When he landed at Churchill, age 15, I saw him and inquired how he came to undertake the business, he told me he had been about one year in the mathematics school, had three times with a quadrant brought down the sun to a chalk line on the wall—was declared fully competent and sent out to go on discovery. Of course, nothing came of it".[28] For the remainder of his American career, Charles became more of a trader and less a surveyor.

So keen was Thompson's interest in surveying that instead of asking the company stores for clothing to which he was entitled, he requested a brass sextant. At a later time, writing to a friend, Thompson referred to his sextant as a constant and loved companion. Surveying was to him his chief pleasure and life work. Joseph Colen, Resident Chief at York, stated, "Thompson, a deserving young man and in morals and behaviour worthy of imitation . . . for I have never heard him use an indecent expression, or smoke a pipe . . . the most correct observer I have seen in this country".[29]

Thompson spent the year 1791 at York Factory. He had reached the age of 21 and his seven-year apprenticeship had been completed. In a new 3-year contract which he signed with the company it was stipulated that he was employed as a "Surveyor and Trader". But the appellation did not quite fit. Thompson, by nature, was a scientist, not a salesman. In 1792 he ventured into the muskrat country west of the Nelson River, between the Saskatchewan and Churchill Rivers. In 1796 he travelled with two young Chipewyan Indians to search out a canoe route, Churchill to Athabasca. The party made their own canoe, then set off on June 10 equipped with a fishing net, a gun, ammunition, flints and some powder. They reached the eastern end of Lake Athabasca on July 2. On his return trip Thompson survived exceptional perils and privations. On one occasion his canoe overturned in rapids and he was nearly drowned. Thompson, as a result, was left in the wilderness with only his gun, an axe, pewter basin and a small tent. Possessing but a shirt and thin vest he travelled naked from the waist down. A torn foot was bound up in a piece of tent cloth. But his precious sextant and papers, secure in a cork-lined box, were later recovered from the water. It was during such experiences that Thompson developed unusual skills as a hunter.

At the end of the harsh winter of 1796-97 Joseph Colen advised Thompson that "however extensive the countries yet unknown, I cannot sanction any further surveys".[30] Thompson, in 1794, must have signed a second three-year contract with the company because when Colen's uncooperative attitude towards his surveying activities proved too

much for Thompson to endure, he decided to leave the Hudson's Bay Company and enlist with the rival North West Company. At the time Thompson was being paid £60 a year supplemented by a bonus for 'inland service'. His main grievance appears to have pertained not to rates of remuneration nor to working conditions but simply to the fact that he could see no real future with the H.B.C. for the travelling and surveying he felt compelled to do. Accordingly, on May 21, 1797, Thompson left Bedford House and walked 75 miles to Fraser House, the nearest North West Company post, located at the outlet of Reindeer Lake.[31]

At this critical stage in his career David Thompson made some cogent remarks on the mapping work of Peter Pond. "At Lake Superior he procured a compass, took the courses of the whole route to his wintering place . . . sketching off the lake shores as best he could. In the winters . . . he constructed a map of the route followed by the canoes. Its features were tolerably correct; but by taking the League of the Canoe Men for three geographical miles [I found they averaged only two miles] he increased his longitude so much as to place the Athabasca Lake at its west end near the Pacific Ocean".[32] This palpable error resulted in the company bringing Philip Turnor back from England to ascertain the precise position of Fort Chipewyan. Following the completion of this project the Hudson's Bay Company remained relatively dormant for some years in the field of exploratory surveys.

When the high officers of the North West Company learned of Thompson's defection to their firm he was cordially welcomed. His special abilities and sterling character were well known to them. He was engaged at once as a "Surveyor and Map Maker" and, in particular, to (1) Determine the exact position of the 49th parallel of latitude; the new boundary between the western part of British North America and the United States under the 1792 treaty; (2) To ascertain the positions by latitude and longitude of the North West Company trading posts in relation to that boundary; (3) To visit the villages of the Mandan Indians on the Missouri river to promote trade; (4) To search for fossil bones of large animals.

Not long after he entered the services of the North West Company, and after he had completed the surveying of the south shore of Lake Superior, Thompson encountered Alexander Mackenzie in a surprise meeting at Sault Ste. Marie. Mackenzie paid his fellow Nor'Wester a resounding tribute. "Thompson", he told his travelling companions, "has accomplished more in ten months than the company had expected would be done in two years". In those ten months he had surveyed more than 4,000 miles of practically unmapped territory and this during the most difficult seasons of the year. Truly, a remarkable record of work!

Eight years after joining the North West Company Thompson married Charlotte Small, an Indian woman, on June 10, 1799, at Isle-à-la-Crosse. The Manitoba surveyor-historian H. E. Beresford has pointed out some natural consequences of this act. "David Thompson, as did so many Hudson's Bay Company employees of the time, married an Indian girl. She, along with several of her relatives, accompanied the explorer on his travels. They took little provisions with them as it was expected that while David Thompson carried on his mapping and surveying activities, the rest of the party would hunt and fish . . . There were many complaints of the long hours and great hardships, so that Thompson, in his exploring zeal, sacrificed not only himself, but all his wife's relatives"![33] A man of this calibre obviously deserved recognition, if not achievement, and on July 10, 1804, Thompson was made a partner in the North West Company, at the age of 34.

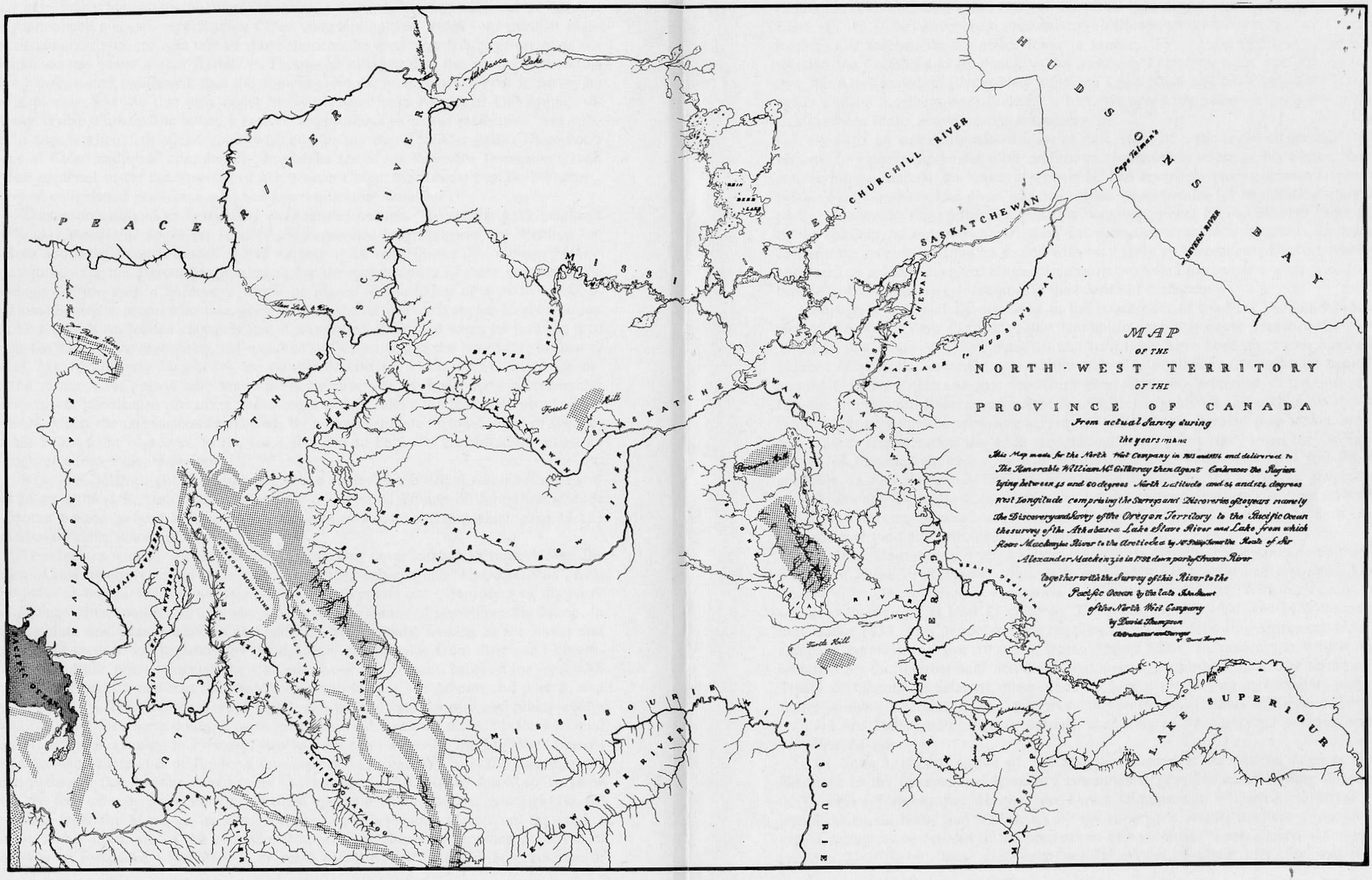
In twenty years David Thompson had come a long way in the New World. When

he left the Hudson's Bay Company he was bitter in his condemnation of Colen, writing to the latter to state that he suspected Colen to be the one responsible for cutting off his supplies of books from England as well as of letters of approbation from London, and even of robbing him of his *Nautical Almanak*, so essential to any surveyor of his day. He pronounced a severe verdict upon Colen complaining that "from your peculiar manner of conduct, you are also one of those unfortunate men who will have many an acquaintance but never a real friend".[34] Thompson charged that the company directors were lethargic and indifferent, that the company did the least possible work in surveying and exploring, and did that only under heavy pressure from Alexander Dalrymple, Admiralty Hydrographer. The letter, a gesture as gratuitous as it was ineffective, was written in anger rather than out of good judgment. In any event, in later years, Thompson's views of Colen mellowed considerably. In chapter ten of his *Narrative* Thompson stated, "I had explored under the sanction of Mr. Joseph Colen, the Resident at York Factory, the most enlightened gentleman who had [ever] filled that situation".[35]

Thompson's difficulties in the field were serious enough. "To ascertain the height of the Rocky Mountains above the level of the ocean had long occupied my attention but without any satisfaction to myself. I had written to the late Honourable William McGillivray to buy for me a mountain barometer for the measurement of these mountains; he procured for me such a barometer which he placed in the hands of a partner, Mr. J. McDonald, with a promise to take great care of it and deliver it to me in good order. But he tossed it on loaded canoes where it was rolled about and when he brought it to me at the foot of the mountains, the case was full of water and the barometer broken to pieces. Mr. McGillivray bought for me another barometer, which unfortunately was delivered to the same person who made the same promises, with the same performance. Seeing it was hopeless to procure a barometer I had to follow the best methods of measurement which the circumstances allowed. By a close estimate of the descent of the Columbia River from its source to the sea I found it to be 5,900 feet in 1,348 miles, an average of 4 feet, 5 inches per mile. . . ."[36]

Base lines were carefully measured and the angles of the height taken with the sextant in an artifical horizon of quicksilver. By this method Thompson found the altitude of Mount Nelson to be 7,223 feet above the level of Kootenay Lake which gave 13,123 feet above Pacific tidewater.[37]

The Indians among whom Thompson travelled never ceased to marvel over the antics of this strangely acting white man, whom they came to call "Koo-Koo-Sint", man who looks at the stars.[38] In his *Narrative* Thompson points out, "Canadians of my party and Indians often inquired of me why I observed the Sun, and sometimes the Moon, in the day time and passed whole nights with my instruments, looking at the moon and stars. I told them it was to determine the distance and direction from the place I observed . . . to other places; neither the Canadians nor the Indians believed me; for both argue that if what I said was the truth, I ought to look to the ground and over it, and not to the stars. Their opinions were that I was looking into futurity and seeing everybody and what they were doing; how to raise the wind, but they did not believe I could calm it. One fine evening in February two Indians came to trade; the Moon rose bright and clear, with the planet of Jupiter a few degrees on its east side; and the Canadians as usual predicted that Indians would come to trade in the direction of this Star. To show them the folly of such predictions I told them the same bright star, the next night, would be as far from the Moon on its west side; this, of course, took place from the moon's motion in her orbit; and is the common occurrence of almost every month, and yet all parties were persuaded I had done it by some occult power to falsify the prediction of



MAP 28. David Thompson's map of the North West Territory of the Province of Canada, 1792-1812. Reproduction in this form by courtesy of the Champlain Society, Toronto.

the Canadians".[39]

Thompson crowned a series of years spent mainly in the mountain areas of the West by travelling in 1808-09 to establish trading posts in what is now southern British Columbia, Idaho, Montana and Oregon. He discovered the Mayie Trail and Pend Oreille Lake. In 1810 he discovered (Athabasca) Yellowhead Pass through the Canadian Rockies and reached the Columbia River in January, 1811. Later that same year he descended the Columbia to its Pacific outlet, reaching Fort Astoria on July 15. He found that the Astor expedition from New York via Cape Horn had preceded him by several weeks and its members were building a fort. He spent the following winter in what is now northern Idaho and Washington territory.

By 1813 he was ready with a mass of data, most of it the result of personal observations, to embark upon the most ambitious cartographic effort of his career, that of constructing a map of the western regions he had travelled. His assignments from the North West Company had given him unexcelled opportunities for exploration unhindered by commercial responsibilities. For this mapping project he was allotted three years by the company, during which period he was permitted to share in its profits. In order to concentrate on map drafting he settled with his family at Terrebonne, Quebec, where he registered as a land surveyor. He required only two years to complete what was, for his time, a truly superlative achievement in the science of cartography.

Though it was proudly displayed in the boardroom of the Fort William headquarters of the North West Company, this Thompson map was never issued to the public. The fact that it was not distributed in any form may have been due to an inadequate number of potential subscribers or to the lack of a publisher with sufficient capital to handle it. It is possible also that the North West Company preferred, at the time, to retain the information the map portrayed for their own guidance rather than divulge it to business rivals. Thus the crowning accomplishment of this talented map maker brought him neither remuneration nor wide recognition. Forty years later, when the Geological Survey of Canada required a map of Western Canada, Thompson's was still the best available. In fact, as late as 1915, many maps published by the Canadian government, by railways and other agencies, were based on the cartographic work performed by David Thompson one hundred years earlier. Today the original map may be seen in the map room of the Public Archives in Toronto.

In 1815 Thompson moved to Glengarry county, Ontario, having purchased the Williamstown house of Reverend John Bethune (1751-1815), who had organized Upper Canada's first Presbyterian congregation in that village in 1787. With his family, consisting at the time of at least 13 children, Thompson and his wife lived in Williamstown until about 1835. This period was the happiest of his life, following retirement from fur company employment. For 10 years, from 1816 to 1826, Thompson was British representative on the international boundary commission established under the terms of the Treaty of Ghent. An atlas of maps made by him while serving as boundary commissioner is also to be seen in the map room of the Public Archives of Ontario. In these archives are Thompson's original journals, consisting of 38 numbered volumes and an unnumbered one.

Dr. John J. Bigsby, author of *The Shoe and Canoe,* at the time he acted as British Secretary to the international boundary commission, provides an interesting impression of Thompson's appearance. He first met David Thompson in William McGillivray's imposing Montreal home and was struck by the surveyor's simple, unaffected manner and innate dignity as he relaxed in the pretentious surroundings. "I was placed at the table", recounts Dr. Bigsby, "near a singular-looking person of about fifty. He was plainly

FIGURE 23. Students of David Thompson Secondary School, Vancouver, B.C., at work in a classroom on their Thompson mural.

dressed, quiet and observant. His figure was short and compact, and his black hair was worn long all round and cut square as if by one stroke of the shears, just above the eyebrows. His complexion was of the gardener's ruddy-brown, while the expression of his deeply-furrowed features was friendly and intelligent. But his cut-short nose gave him an odd look. His speech betrayed the Welshman. He greatly resembled Curran, the Welsh orator. . . ."

Following the termination of his work on the boundary Thompson began to experience severe economic reverses. He had readily advanced substantial sums to assist his children and undoubtedly his generosity resulted in a heavy drain on his financial resources. In addition he never refused to meet requests for money from veterans of the fur trade who approached him for help. Finally he felt compelled to move from Wil-

liamstown to Longueuil, on the south bank of the St. Lawrence across from the island of Montreal, in the hope of obtaining gainful employment. In this quest he was only moderately successful. Between 1833 and 1840, at a stage in life when most men would be preparing to retire, Thompson was surveying in the Muskoka district as well as the Lakes St. Francis and St. Peter (including the provincial line). In addition he was active in surveying parts of the Eastern Townships of Quebec and the canoe route from Lake Huron to the Ottawa River. In a report on his examination of the latter route, Thompson notes on November 11, 1837:

"Near noon we arrived at Mr. Alex McNaughton's establishment of two log houses and a sawmill in charge of Alexander McDonald, about five miles below the channel of the Calumet Falls . . . [December 6-7]. . . . Continued opening a line and taking the levels along the brook; but the thickets of willows and elders now became frequent, very tedious to open a line through, and we had to keep in the rising ground for a distance of 52 chains, 42 links, being 10 stations; the land good and for this distance with two slight undulations, may be said to be level, showing only a depression of two inches".[40]

From 1840 to 1842 Thompson executed surveys for the city of Montreal. In 1842 he accelerated his writing work on his *Narrative*. Meanwhile he carried on a lively correspondence with government officials and with editors concerning the Canada-United States boundary line. But he and his wife faced conditions of dire poverty. The sight of his remaining sound eye failed rapidly; he was forced to sell his most cherished instruments and to pawn his coat in order to obtain food. In the end Thompson and his wife became utterly dependent upon their children living in the Montreal area.

During these troubled years Thompson worked on plans to make his great map available to the public. For this purpose he prepared a prospectus addressed to those most likely to subscribe for it. "To be published in English by David Thompson", declared the document, "a new and correct map of the countries of North America situated between the parallels of 45 degrees and 60 degrees North latitude and extending in longitude from the east side of Lake Superior and Hudson's Bay, quite across the Continent to the Pacific Ocean, and from his own local knowledge, being the result of 22 years employment in discovering and laying down the several rivers, lakes, hills and mountains on this extensive tract. . . . The whole founded on astronomical observations, the author being an astronomer by profession. . . . The map will be engraved in a neat, chaste manner, combining elegance with economy, on the scale of three inches to one degree of Longitude. . . . He also offers to the scientific public, and of the same size as the General Map, a Chart to contain only the grand features of this part of the Continent . . . the position and extent of Coal Mines, of the various Beds of different kinds of Stone and Rock; of the great meadows and Forests. . . .".

Nothing, however, came of these almost pathetic ventures into the realms of publicity. David Thompson, the scientist, never succeeded as a salesman. Had his efforts in this direction been well received it is quite possible that the resulting financial returns would have made for the Thompsons all the difference between prosperity and penury.

Dr. Alex E. MacDonald, well-known map collector of Toronto, has in his possession a rare book, published in Montreal by Armour and Ramsay in 1850 and titled, *Anatomy, Physiology and Pathology of the Eye*. At page 357 of this volume as one of the cases of eye trouble listed by the author Henry Howard is that of "David Thompson, Surveyor and astronomer, led to my surgery by his daughter on February 24, 1848. Claimed to have been blind in right eye since February, 1789. Claims he woke up one morning so blind he could not tell daylight". All indications of his condition point to the onset of glaucoma, following an eye hemorrhage. Thus at the age of 78 darkness closed

down on this remarkable man. He was totally blind for the last ten years of his life.

On this continent of North America no other man, by his own unaided labor, left such a legacy of combined discovery, surveying and mapping as did David Thompson. The Public Archives of Canada, Map Division, has catalogued more than thirty of his maps dated from 1817 on, including atlases of his international boundary maps. With his Celtic imagination and idealism, Thompson combined a fine practicality and accuracy instilled by English training. Tempering the vision and daring of the explorer was the cool calculation of a mathematical scientist. His outstanding characteristic was his ability to form, early in his career, a lofty concept of what could be accomplished and then to follow persistently in a long-term pattern of contributory activity in order to fulfil that purpose. It was this determination to work methodically and untiringly over many years, within a self-imposed discipline, that distinguished David Thompson from his contemporaries.

For many of his revisions of the map of North America, Aaron Arrowsmith was greatly indebted to Thompson. During the years Thompson was employed by the Hudson's Bay Company his maps and reports were made available to English cartographers. Although Arrowsmith acknowledged his obligation to the company he gave no credit line to their brilliant young surveyor. The same conduct applied to information sent to Arrowsmith by the North West Company for geographical data obtained and compiled for them by Thompson.

Sir George Simpson in his Journal of 1824-25 stated: "The different establishments and points where observations have been taken are placed according to the latitudes and longitudes given us on Mr. David Thompson's chart and the relative situation in regard to distances where Observations have not been taken are given and regulated according to the length of time occupied in going from one place to another either by land or by water. This draft will be forwarded to the Honourable Committee, who may perhaps allow Arrowsmith to correct his map thereby, which in its present state is very erroneous".

On foot or by canoe Thompson covered more than 50,000 miles during his explorations and surveys. He was the first white man to travel the full length of that 'mystery river' of the Pacific Northwest, the Columbia. He built the first trading post on that great river in August, 1807, then known as Kootenai House. In midwinter, 1810-11, with ten companions he discovered and negotiated the Athabasca, now the Yellowhead Pass through the Rockies. This pass became a regular transportation route across the mountains and was adopted by one of the national railway systems as its main gateway route to the Pacific Ocean. Canada and the world owes to this distinguished man the first reasonably accurate map of the Canadian West, embodying results of his surveys from 1792 to 1812. He surveyed the Canada-United States boundary line from Maine to the Northwest Angle of the Lake of the Woods and prepared the appropriate maps. He was the first white man to canoe around the shoreline of Lake Superior for the purposes of survey and the first white man to fix the true source of the Mississippi and Missouri rivers.

In Montreal the death, on February 10, 1857, of David Thompson passed unnoticed by the press and public. His life had ended, as it had commenced, in poverty. His reputation in geographical matters might have been largely lost but for the laudable and zealous salvage work of J. B. Tyrrell of the Geological Survey of Canada. As an assistant to Dr. G. M. Dawson in geological surveys in the Canadian West Tyrrell was strongly attracted to the quality of Thompson's exploratory surveys and pioneer mapping. He was highly successful in rescuing Thompson's name and achievements from oblivion. As one of the editors of Thompson's journals, he assisted in bringing about their publication

by the Champlain Society in 1916.

In British Columbia a major river bears Thompson's name as does a lake in the Rainy River district of Ontario. Historic plaques commemorating his deeds have been erected at various points across Canada, including Kootenai House on the Columbia, Williamstown, Montreal and in Jasper National Park. In Vancouver, students at the David Thompson secondary school obtained colored mosaic tiles from Italy and constructed an impressive mural in the school dedicated to "David Thompson, 1770-1857, Fur Trader, Map Maker, Explorer".[41] On May 23, 1927, a memorial service was held in Montreal's Mount Royal Cemetery. A monument was unveiled at Thompson's grave by Sir Frederick Williams-Taylor. "Without exact surveys and accurate maps", Sir Frederick stated, "it would have been impossible to open and allot our western plains for the homes of our present and future millions, or to develop that vast land with roads and railways. Remembering this, we begin to realize the heavy debt of gratitude our country owes to David Thompson. He worked not merely for his employers but for the increase of knowledge, not so much for his own time as for the future".

During the decade prior to Confederation two important exploratory and survey expeditions were despatched to Canada's Northwest. Both expeditions were government supported and instructed. The scientist-explorers who were carefully selected for these projects proved to be the advance guard of a small army of land surveyors, empowered to prepare millions of acres for occupation by property-hungry people from all over the world. The Palliser Expedition (1857-60) was financed by the British government; the Hind-Dawson Expeditions (1857-58) by the government of the Province of Canada. The reports of both investigations added immensely to knowledge of that portion of Canada west of the Great Lakes. Part of their purpose was to discover how much of the territory they examined was fit for cultivation. The comments that resulted served to stir considerable public interest in the settlement of the western interior.

Capt. John Palliser (1834-1907) was an energetic, wealthy, well-connected and observant Irishman with a strong bent for wilderness life and adventure. By persistence in his representations and with the help of some highly-placed supporters in London he prevailed upon the British government to organize and finance an expedition under his leadership to Western Canada. ". . . in addition to maintaining a regular series of instrumental observations, of regularly recording the physical features of the country . . . noting its . . . capability for agriculture . . . for practicable passes through the Rockies . . . and the quantity and quality of its timber and any indications of coal or other minerals".[42]

Four European experts were recruited to aid Palliser: Eugene Bourgeau, botany collector; Dr. James Hector, geologist-naturalist-medical man; John W. Sullivan, astronomical observer and Lieut. Thomas Blakiston, magnetic surveyor.

On arrival of some of the expedition members in New York Palliser discovered that one of his barometers had been broken in transit. The New York Observatory loaned one of its instruments to the party while their damaged one was being repaired. The itinerary of the expedition covered three main regions; Lake Superior to Red River; Red River to the Rockies; and thirdly, the Rockies area. The intention was to map all regions, to examine transportation routes, appraise settlement possibilities, make botanical, zoological, geological, meteorological and magnetic survey records. At one stage of their investigations the Palliser party linked up its westering explorations with the eastering international boundary survey by a British party under Col. Hawkins of the Royal Engineers. In October, 1859, the Palliser group encountered in the Rockies area Lieut. Henry Palmer, one of the ablest surveyor-explorers of the Royal Engineer detachment

then in British Columbia.

Early in 1860 the Palliser group members were welcomed to the new mainland colony of British Columbia by Col. R. C. Moody, Capt. R. M. Parsons and other officers of the Corps of Royal Engineers. It required a considerable amount of time to prepare the report of the expedition. It was finally published in 1863 but the main map of the territory traversed was not published until 1865. John Arrowsmith started to draw a new map, checking Palliser's findings against all earlier information received on the regions. This procedure consumed so much time that the Colonial Office became impatient and turned over the mapping job to cartographer Edward Stanford.

Dr. James Hector (Sir James Hector in 1887), a most versatile member of the Pallister expedition, made geological observations, sketches and records that formed the foundation of later and more detailed surveys of the Canadian West. A small-scale map, 100 miles to an inch, summarized Hector's findings over three field seasons.[43] Some of his concepts, arising out of his Canadian investigations, proved both durable and influential. His use of the term 'fertile belt' stimulated, in itself, the interest of prospective settlers. His description of three main steppes of the western interior provided a theme basic to all future geographical writings on the region. But the finding that was to become most prominently and firmly associated with the Palliser report was that relating to the so-called Palliser Triangle. Hector stated: "The British portion of the arid country (extending north from the United States) is a triangular region, its apex reaching to the 52nd parallel while its base, applied along the 49th, extends between Longitude 100 degrees and 114 degrees West. It contains, however, many varieties of land, and some limited areas that are really even good; but, on the whole, it must be described as deficient in wood, water and grass".[44]

Sir John Palliser (he was knighted in 1877) did not return to Canada, dying in his home in Ireland in August of 1887. In addition to the famous Triangle, his name is perpetuated in Canada by such mountain features as a lake, river and pass, by a station on the Canadian Pacific Rockies and by the world renowned hostelry in Calgary.

In 1857 the government of the Province of Canada decided to send an expedition to examine the country between Lake Superior and the Red River in order to determine the best route over British territory between these two bodies of water and "to the great tracts of cultivable land beyond the Red River Settlements". The 1857 expedition was divided into three parties, one led by Professor Henry Youle Hind (1823-1908), chemist and geologist, University of Trinity College, Toronto; another by Simon James Dawson (1820-1902), engineer and surveyor; and the third by W. H. Napier, engineer. The Scottish-born Dawson had applied to the Canadian government in 1857 to explore the country between Lake Superior and the Saskatchewan River.[45]

Dawson was instructed to secure information on the topography and routes from Lake Superior to Red River. Hind was guided on his geological observations by a memorandum from Sir William Logan, first director of the Canadian Geological Survey. The expedition arrived at Fort William on July 31, 1857, and reached Fort Garry on the Red River on September 5. The Legislative Assembly of Canada decided to resume the investigation, directing that explorations be continued to the Saskatchewan River in the 1858 field season.

Professor Hind, for his part, reported that his explorations were made "with reference to the construction of a map as complete as possible of the region explored, on a scale of 2 miles to the inch". He mentions that the map of Selkirk Settlement . . . "is reduced from an authorized instrumental survey [made] by the Hudson's Bay Company surveyor, Mr. Taylor". Also that ". . . the data upon which [unvisited parts of the coun-

try] are laid down is derived from the large mss. map of the North West . . . by the late excellent but neglected geographer, David Thompson . . ."

"The labours of this remarkable man", states Hind in his report, are only now beginning to be appreciated. His map of the (International) Boundary Line between Lake Superior and Lake of the Woods is an admirable piece of work. We recognized every portage as we came to it . . . although Thompson's survey was made in 1826".

W. Fleming is listed in the official reports as assistant surveyor and draftsman of the expeditions and Lindsay Russell (later Surveyor General of Canada) as a chainman.[46] Another Fleming (later to become Sir Sandford) in this same year, 1857, came into prominence as chief engineer of the Ontario, Simcoe and Huron (later Northern) Railway, an early step up the ladder in a notable railway building career.

In his report published in 1859 in Toronto by John Lovell, Dawson indicated that the surveys extended over 4½ degrees of latitude and about 13 degrees of longitude. Detailed maps, on a scale of approximately 6 miles to the inch, accompanied these reports, including a general map of "a portion of British North America" showing what was believed to be the most easily accessible route through Canada and British Columbia, also sketches showing surveys made by L. A. Russell between Thunder Bay and Dog Lake. Dawson referred also to his 1858 Blue Book report and map of the 90 miles of country between Lake of the Woods and the Red River.

His report was one of the first to point out the possibilities of settlement on a substantial scale in the Canadian West. Like Hector, he interpreted the country westward from Red River as consisting of three main topographical divisions.[47] Dawson's report also marked the beginning of an auspicious career in surveying, construction work and public affairs.

Hind wrote what is considered by some experts to be the best geographical account of what is now Southern Manitoba as it appeared before the advent of railways. Some of his descriptions of the prairies border on the poetic: "The Red River Plain must be seen, too, by moonlight, when the summits of the low-green grass waves are topped with silver, and the stars in the west disappear suddenly as they touch the earth". Hind also observes prophetically, "It is a physical reality of the highest importance to the interests of British North America that this continuous belt (the western interior) can be settled and cultivated from a few miles west of the Lake of the Woods to the passes of the Rocky Mountains, and any line of communication, whether by waggon road or railroad, passing through it, will eventually enjoy the great advantage of being fed by an agricultural population from one extremity to the other".[48]

At about the time of the Mackenzie-Papineau troubles in Canada, an able, ambitious young artillery lieutenant began to study practical astronomy at Chatham, England. John Henry Lefroy (1817-1890), son of Reverend J. H. G. Lefroy, developed aptitudes along scientific lines that marked him as being well in advance of his times. Problems of terrestrial magnetism were engaging the attention of geographers the world over. In the spring of 1839 the British government decided to establish in various parts of the Empire, a series of magnetic stations. In 1840 Lieut. Lefroy was sent to St. Helena to take magnetic observations. He remained there until 1842 when he was transferred to Canada to set up an observatory. On the advice of Admiral Bayfield, then engaged in St. Lawrence Gulf surveys, the observatory site was chosen at Toronto. At this time plans were already formed to carry out magnetic surveys in the Lake Athabasca-Great Slave Lake region. The observer was to be Lieut. Lefroy.

On May 1, 1843 Lefroy set out on a momentous journey, accompanied by Bombardier William Henry of the Royal Artillery. Lefroy, in 1877, was knighted and Henry

attained the rank of colonel before his retirement. In *canots de maître,* manned by voyageurs and Indians, numbering fifty in all, the party ascended the Ottawa River, sped across Lake Nipissing to Lake Huron by way of the French River, that well-travelled watercourse, which had echoed for so long to the dip of fur-traders' paddles. In a letter to a cousin, dated May 6, 1843, Lefroy vividly describes various aspects of the expedition; "Imagine a table rock", he writes from Chat Falls on the Ottawa, "shewing its grey face between patches of moss and grass, with young fir and juniper growing out of the crevices, three large birch bark canoes, the prettiest vessels that float, lie bottom upwards with keel to the wind, the open side to the fires, and under them and before are standing or lying some fifty voyageurs and Indians talking French patois, with more oaths than you would like to hear, and the light plays on the tents behind, and their red shirts and caps . . . in true Rembrandt effects". And again, "About an hour before daylight tents are struck, canoes loaded and off we start. Breakfast at seven or eight, tea boiled in a kettle expeditiously, dinner about one p.m. Camp about an hour before sunset. Canoes large, each carrying 14 paddles, 4 passengers and luggage. . . . Instruments suffer somewhat from rust. Am writing in a cramped position in the canoe, taking notes all subject to splashing".

Lieut. Lefroy makes some interesting comments on the mode of travel; "I think the circumstances of all the paddlers facing the direction in which they go, instead of turning the back to it, as in rowing, gives a peculiar effect of intentness, intelligent will, to the movement. Then they strike up old French songs, more particularly in approaching a fort, many of them very pretty [tunes], almost all curious. Their pronounciation is so extraordinary . . .". And again, a familiar note is struck, "From the Lake of the Woods to Winnipeg the musquitoes began to be very bad . . . one can neither eat nor sleep for them. . . . A large fly called the bulldog gives a more painful bite but it is followed by no irritation and they are stupid brutes, easily kept off. A bulldog draws blood by a fair bite instantly; a musquitoe is a considerable time boring before he gets blood, and a long time gorging himself. Have repeatedly seen them draw blood through my trousers which are thin cloth . . .". But there were moments of undiluted bliss also; ". . . the pleasure of lying down under a pure starry sky, a bright moon gleaming through the trees, and all around the wilderness of a forest of nature . . .".

On June 28 the party landed at Lower Fort Garry, to be greeted by Sir George Simpson, Governor of Rupert's Land. Then, by way of The Pas and Cumberland House, Lefroy and Henry crossed the Methy Portage to the Clearwater River, arriving at Fort Chipewyan on September 23. Already a frosty nip in the night air heralded the approach of winter. Writing at Lake Athabasca on December 13, 1843, Lefroy reports, "Arrived here September 23, cold weather already commenced . . . one-storied buildings with cheerless parchment windows. I found no building useful as an observatory. So necessary to build one, which we did in three weeks. I completed a set of instruments of the Absolute Intensity with six bars, and commenced a series of hourly observations on October 16. The observatory is kept habitable by a fire which ensures a more uniform temperature. It is only when there is much wind that we cannot keep it uniform, our parchment frames let in too much cold air. . . . We live on whitefish chiefly, varied with dried or fresh moose meat or buffalo. They grow potatoes here, and we have cows. Flour is the scarcest article and bread is unknown . . . a good many partridges about. . .".

On March 5, 1844, their instruments were repacked and transported by dog team to Fort Simpson, reached on March 26. Hourly observations were carried out there also. The party returned to Edmonton on August 19 and to Toronto on November 18. After

reporting to army authorities at Montreal, Lefroy returned to Toronto on December 5 to take charge of the new Toronto observatory.

During the 18 months of his survey activities in the northern wilderness Lefroy travelled nearly 6,000 miles, setting up his instruments in scores of localities under most exacting physical conditions. Lefroy's measurements remained for many years the authority for the approximate position of the North Magnetic Pole. One of his tutors wrote of Lefroy's Canadian work, "it is probably the most remarkable contribution to our knowledge of magnetic disturbance we [thus far] possess". Not until 66 years later were the results of Lefroy's labors published in a book titled, *Diary of A Magnetic Survey of a Portion of the Dominion of Canada Chiefly in the North Western Territories Executed in the Years 1842-44.* It is interesting to recall that 13 years after the completion of these surveys Lieut.-Col. Lefroy, as he had become, recommended the appointment of Lieut. Thomas Blakiston of the Royal Artillery to the Palliser expedition as magnetic surveyor.[49]

In a letter to his mother from Montreal on April 25, 1843, Lefroy gives us a brief glimpse of some of the strains to which surveyors of those days as well as their instruments were often subjected: "The villainous state of the road between Kingston and Williamsburg literally shook to pieces a nine-inch Dip Circle by Gambey (a 27-pound instrument then used in magnetic surveys) and the loose parts were lying about in the box. But no damage was done, the most serious part was that one of the agates got jolted out of position and I had no level to adjust it again. I was obliged to do so by hand and test with the needle. Also parts of the theodolite were shaken out. The Barometers I carried on my shoulders, a little mercury had escaped from one of them but I hope not enough to impair its value".

In the early part of 1853, before he left Canada for England, Lefroy founded the Canadian Institute (now the Royal Canadian Institute) and became its first president. He ended his active military career in 1870 as Major-General J. H. Lefroy.

15

UPPER CANADA SURVEYS

"We first survey the plot, then draw the model;"
King Henry IV, (2), Act I, Sc. 3.

Major-General Sir Frederick Haldimand, named Governor General late in 1777, was quick to foresee that the services of a capable Surveyor General would be in lively demand in Canada during his vice-regal term. Accordingly His Excellency wrote to Major Samuel Holland, then attached to the army staff of Sir Henry Clinton at New York, requesting his return to Quebec. Haldimand was eager to obtain the man who was mainly responsible for the initial scientific large-scale land surveys in British North America and in New England. But the urgently-sought transfer was not completed until 1779.

During the first year or so following his return to Canada, Holland devoted much time to re-organizing the office and work-load of the Surveyor General. His duties, as time passed, proved to be varied, highly responsible and exceedingly onerous. In addition Holland served, as did Deputy Surveyor General John Collins, on the Executive Council of Quebec. In 1781 he surveyed Ordnance lands at Montreal and in 1782 he reported on the Township of Bulstrode.

Holland's resumption of duties as Surveyor General coincided with the beginning of a three-decade period of peace between Canada and the United States. It proved to be a period of considerable development and relative prosperity for both countries. The remote territory that was to become known, under the Constitutional Act of 1791, as Upper Canada, remained for the most part an unexplored wilderness, guarded by a few widely scattered military posts. But violent events in other parts of the continent determined the destiny of this upper country with inhabitants totalling, exclusive of Indians, some 2,000 people. The same eruptive events and the resulting exodus from the States of United Empire Loyalists, set the pattern for Holland's surveying plans and mapping activities for more than a score of years to come.

The year 1783 was one of heavy responsibilities and bright opportunities for Holland and his staff. The Treaty of Versailles formally ended hostilities in America. In England, Royal Society President Sir Joseph Banks invited Major-General William Roy of the Royal Engineers to make a survey from London to Dover. This move came as the result of the first proposal ever made for an international cooperative mapping venture. In October, 1783, the French Ambassador presented to Charles James Fox, one of His Majesty's Secretaries of State, a memoir written by the French Astronomer, Cassini. This document pointed out the advantages that would be derived from precise measurement of the distances between Greenwich and Paris observatories in terms of latitude and longitude. It was this same year that witnessed the largest influx into Canada of Loyalists seeking lands on which to settle. It was the year, also, that saw the founding of Parrtown, nucleus of the future city of Saint John.

Out of a deep consideration for colonists loyal to the British Crown who had been dispossessed of their American holdings, the British government decided to grant free lands for all Loyalists who might apply for them, as well as for disbanded soldiers willing to settle in British North America. Governor General Haldimand on August 7, 1783, received royal instructions that lands were to be granted to any commissioned officer-applicant, to be surveyed on a basis of 1,000-acre lots for field officers, with lesser acreages for captains and subalterns. These acreages were later considerably increased. To civilian Loyalists free patents were granted to a maximum of 200 acres each, upon subscribing to an oath of allegience and complying with certain minor regulations, including payment of nominal fees.

The Surveyor General was faced with an imposing tangle of distracting problems. It was the Shelburne conundrum again, but in different circumstances. Thousands of newcomers wanted to get located on new land without delay. As it was impossible to completely survey farm lots in advance of the settlers, how was the situation to be met? Without some clearing away of thick bush, surveyors could not establish required lines of sight. There was a complete absence of detailed maps of the new country and, in fact, it was not for another 15 years that a fairly accurate map of the kind was made available. Above all, there was an acute shortage of qualified surveyors. Holland solved the more immediate problem by ordering that initial surveys be confined to the laying out and posting of frontages or base lines of townships bordering rivers and lakes, then blocking out (on paper only) townships to be constructed on the frontages so drawn. This blocking-out process included indications of concessions or ranges, as well as lots and road allowances. The properties were then distributed by ballot to the settlers. In brief, then, the plan involved the laying out of waterfront parcels for immediate occupation and then working inland with surveys as the need arose. The township was closed off by the surveyors when it was considered large enough.[1]

On May 26, 1783, Haldimand sent a letter of instructions to Holland, conveying what is probably the first order concerning a British survey to be made in what is now the province of Ontario.[2]

"You are directed", stated Haldimand, "to set off immediately for Montreal and proceed to Cataraqui [Kingston] where you will minutely examine into the situation . . .". Holland was also instructed to send his assistants from there to the Niagara country on a similar errand. The Surveyor General arrived at his Cataraqui destination late at night on June 10. His report to Haldimand of June 26 indicated that among the developments of June 11 was a survey of the harbor made by his assistant with "Captain LaForce to take the soundings". He added that "Lieut. [William] Tinling [has] joined me . . ." and mentioned that Captain LaForce, with Lieutenants [Louis] Kotté or Cotté and

[James] Peachey, proceeded later to conduct an exploratory survey along the north shore of Lake Ontario all the way to Niagara.[3]

Encouraged by the information provided to him by these preliminary surveys Haldimand set the official stage for launching the pioneer land surveys of the upper country.[4] In a message dated September 7, 1783, conveyed by John Collins to Major Ross, commander of Fort Oswego, the Governor General advised that ". . . Mr. Collins . . . with proper assistance I have sent to Cataraqui in order to survey and mark out the settlement at that place for the refugee Loyalists". His Excellency added, "I enclose for your information a copy of my instructions to Mr. Collins, by which you will perceive that it is my intention to have the lands distributed in townships containing lots of 120 acres . . . Captain LaForce, Captain [Justus] Sherwood[5] and others skilled . . . in principles of colonization accompany Mr. Collins".

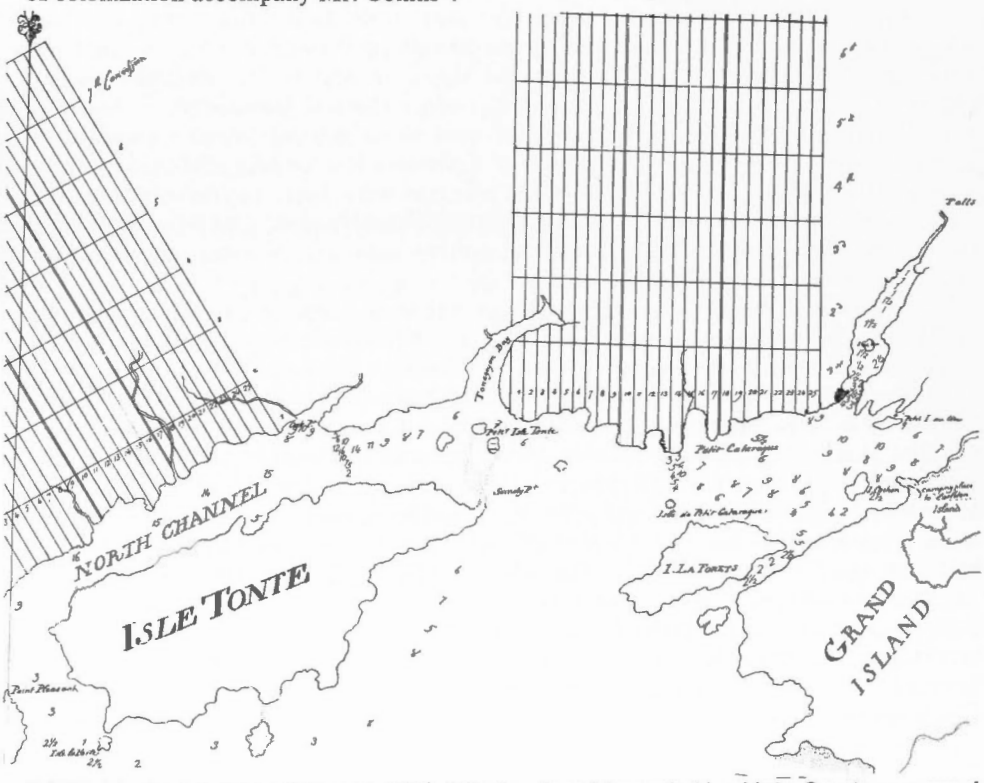


FIGURE 24. No. 1 Township, Cataraqui, 1784. Part of a plan of the north side of Lake Ontario as surveyed by Deputy Surveyors Kotté and Peachey under the direction of Surveyor General Samuel Holland.

Haldimand's basic concept of a scheme of settlement and plan of survey for Upper Canada was undoubtedly influenced by the Royal Instructions of 1763 addressed to Governor General Murray, especially paragraphs 45 and 46 dealing with townships. Very likely he had in mind also the fact that the Loyalists from New York and New England had become accustomed to town government related to a rural area of 30 or 40 square miles, tributary to a relatively small urban nucleus. Thus wrote Haldimand, "The Method of laying out Townships of Six Miles Square I consider as the best to be followed as the People to be settled there are most used to it, and will best answer the Proportion of

Land I propose to grant to each family . . .". Thus the township became the unit of settlement along the Upper St. Lawrence River, just as the seigniory had been the unit of settlement in French Canada.

The initial pattern of survey in what is now Ontario came to be known as the *single-front system* and was in vogue from 1783 to 1818. A single-front township was one, as we have seen, in which it was customary to survey the township boundaries and the fronts of concessions and to establish lot corners on such front lines. The size of the lots and townships varied somewhat and no absolute standard seems to have been followed. In addition there were a few townships surveyed in a manner incapable of any regular classification. Sandwich township on the Detroit River, for example, was laid out to accommodate French settlers.

Because of its key significance in the story of Canadian surveying, the text of the letter of instructions dated September 11, 1783, sent by Haldimand to Collins is reproduced here in its entirety:

"Headquarters, Quebec,
11th September, 1783.

John Collins, Esq.:

Sir: It being my intention to establish settlements for the provision of part of the distressed Loyalists resorting to this Province at and in the neighborhood of Cataraqui, upon Lake Ontario, you are hereby directed to proceed to that place without loss of time for the purpose of surveying and laying out the several lands in townships and lots agreeably to the following instructions:

1. You will make an exact survey of the neck intended for the town plot, describing and expressing the nature of the ground and soil, and if Point Frederick is not commanded from Point Henry, on both which places sufficient spaces for fortifications must be reserved.

2. At the west side of Cataraqui Harbour the ground near the fort and within the lines (as marked in the plan A, B, C) must remain to the Crown, for the use of the garrison, and as a place of resort for the Indians, where some of the most noted might be allowed to build, reserving sufficient spaces round the slips (where vessels were formerly constructed) unincumbered with buildings.

3. Though a common, containing about 400 acres, must be reserved for the use of the town, leases may be given for a term of years, not exceeding 30 years, to settle there as the people for the present will be glad to be as near the town as possible, and the common will be cleared by the time the town will be in want of it.

4. The method of laying out townships of six miles square I consider as the best to be followed, as the people to be settled there are most used to it, and will best answer the proportion of lands I propose to grant to each family, viz: 120 acres, of which six are to be in front, which will make 19 chains in front and 63 chains 25 links in depth, so that every township will have 25 lots in front and 4 chains 75 links will remain for roads, with 7 concessions in depth. Fifty-eight links will remain for a road, by which distribution each township will contain 175 lots of 120 acres.

For your assistance in the execution of this business you will be joined at Montreal by Captain Sherwood and Lieut. Cotté and also by Mr. Grass, captain of one of the companies of militia intended for that settlement, and these gentlemen will be attended by axemen, etc. proper for that occasion.

You will begin your survey by a township on each side of the bay, and transmit it to me, together with your remarks, reporting to me in the like manner from time to time the progress you shall make.

As it is not improbable that in exploring these lands some of the persons employed may make choice of particular situations, and make preparations accordingly, to prevent which you are to signify to them that my intentions are to distribute the lots impartially by drawing for them, and that all timber cut down this fall, or any log houses they may choose to make and reside in until the settlements shall be regularly granted, will not be considered as any right of such persons, but entered as a temporary beginning, and should any of them prefer remaining there this winter to returning to Sorel, may have lots of four acres marked out for them in common, which they will enjoy for 30 years, as before mentioned, by which means whatever work is done will forward the clearing of the common and be for the public good. The officers commanding at Carleton Island, Cataraqui, or any post you shall have occasion to call at, are hereby directed to afford you every assistance in their power, whether in provisions or otherwise, for the speedy and effectual execution of these instructions.

Wishing you success, etc.

(Sd.) F. Haldimand."[6]

Collins arrived at Cataraqui on October 1, 1783, after experiencing "excessive bad weather" almost every day since leaving Quebec. Major Ross advised Collins to postpone activities until the lands for the proposed new townships were "purchased from the savages". Collins filled in the intervening period by surveying properties fronting on the lake. It was later in the month of October that the historic Crawford Purchase was negotiated. William Redford Crawford of the Royal Regiment of New York, acting for the Crown, purchased for settlement purposes from the Mississauga Indians at Carleton Island land that now comprises the counties of Frontenac, Prince Edward, Lennox and Addington, Hastings, Glengarry, Stormont, Dundas, and Leeds.

Adverse weather resulted in a water-logged Cataraqui countryside and by early November Collins and his men had completed the outline survey of only one township, the plan of which he forwarded to Haldimand at once along with a plan of Point Henry by Lieut. Kotté[7]. Sherwood and Collins began work on November 4 on the second township, located a few miles from the first. The land between was stony and unfit for cultivation. Collins declined to lay out any township on the east side of the Cataraqui River, but Lieut. John F. Holland laid out a townsite, as distinct from a township, on the west side of the river. This surveyor was the eldest son of Samuel Holland and had studied surveying under his father, who often named him in his reports. John Frederick Holland was Acting Engineer at Cataraqui in 1783-84. Later on Collins mentioned to Haldimand that he had employed "Mr. Tuffe and Mr. Henry Holland with each a good party when drawing the lines of the 2nd and 3rd concessions of the first township".

In all, Deputy Surveyor General Collins and his aides surveyed four townships before the end of 1783. At first the early townships were known by number bestowed as surveys of each, in turn, were completed. Later these first four townships came to have the names, respectively, of Kingston, Ernestown, Fredericksburg and Adolphustown, following the practice then adopted of christening early townships after the sons and daughters of King George III. On August 12, 1784, Collins reported that he had completed the survey of Township No. 5 (Marysburgh).

Collins had been clothed with authority to administer oaths and he reported that in regard to Marysburgh all British and German disbanded troops had drawn their lots, each man had taken the oath of allegiance, signed the books, received his certificate of title and settled on his land. Concerning the townships laid out during the previous autumn Collins commented: "The poor people have set themselves down . . . in dif-

ferent parts of the townships, not knowing where to find their lots, except those on the front; nor can it be expected [otherwise] until the several lines between the different concessions be drawn and boundaries fixed.... I should have set out on that business this day, but find myself too weak, having just got quit of a fever...."

In the late summer of 1784 the Surveyor General made a trip to Cataraqui and in a letter (August 21) to his friend General Tryon, Samuel Holland refers to the fatigue of himself and his deputies in surveying "where insects are in such multitudes". He mentions that Lieut. Henry Holland, his second son, had been helping Collins with surveys on the Bay of Quinte. Henry was apparently with the 70th Foot Regiment at the time, on loan for survey work on a half-pay basis. Henry was drowned at sea in 1798.

In the main the distribution and settlement of land proceeded satisfactorily. One officer of the Royal New Yorkers, Capt. James McDonell, became disgruntled over the lot assigned to him and insulted Samuel Holland. Haldimand, who heard of the incident, promptly ordered McDonell to be sent down the river and to forfeit his lot. McDonell, his anger cooled, apologized to Holland and was reinstated.

Settlers continued to stream into the upper country and by July, 1784, at least 187 settlers were on the land in Kingston township. There is some uncertainty over the time of the first application of "Kingston" to Cataraqui but Collins in 1788 definitely assigned the name "Kingston" to the new townsite. Collins on May 15, 1788, submitted his account for expenses for surveys in the area and drew up an outline of survey work yet to be completed in the general area.[8]

Holland and Collins, on the whole, worked in harmony but did not always see eye to eye. For instance, a dispute arose over Township No. 4 (Adolphustown). Collins had informed Haldimand he would not survey it until he had discovered to whom the land belonged. Holland and Collins took opposite views on this method of procedure and finally the question was referred to Haldimand for determination. The outcome was that the township was divided and the east strip was attached to Township No. 3 and became known as Fredericksburgh Additional.

The first Canadian ordinance bearing upon survey activities other than those in French Canada was proclaimed in 1785 (25 George III, ch. 3). In brief this statute provided for the establishment of a meridian in the presence of the Surveyor General or of his Deputy; the testing of survey instruments before use; examinations of a surveyor before his appointment as such; the obligation of a qualifying surveyor to take the oath of allegiance; the provision that surveys made prior to 1780 be not disturbed; all surveyors to keep field notes and upon the death of any surveyor, his notes to be filed in court and made available to the public. By a second edict later that year, surveyors were debarred from acting as notaries and notaries as surveyors. The 1785 law constituted, in effect, a legal foundation upon which the edifice of all following Canadian enactments on surveying was built.

As the science of surveying and registration of land titles are, in practice, such closely interwoven activities, it should be noted that the first Land Registry Act, applicable to what is now Ontario, was passed in 1795.* It provided for the registration of documents of title, not original deeds, by means of alphabetical indices, based on the names of property owners. The effectiveness of this system depended upon adequate maintenance of records. But such careful maintenance could not be relied upon consistently. In 1865 the registry system in Upper Canada was altered by the introduction of the "abstract index" under which information on the owner's name was not essential to a search of title.

*First Parliament, Upper Canada, 35 George III, ch. 5. August 10, 1795.

In the spring of 1784, at a time when David Thompson was entering his period of apprenticeship with the Hudson's Bay Company, Loyalists and disbanded troops were leaving their winter quarters at Sorel to set off up the St. Lawrence in boats. By midsummer more than 4,000 had settled in two groups; the first in 8 townships westwards from New Longueuil Seigniory; the second in 5 townships from Cataraqui to the Bay of Quinte. The greater part of Capt. Michael Grass' party settled in Kingston Township. At this time there were about 46 families at or near Niagara and about 700 acres were cleared there. Still farther west, opposite Detroit, there was an undetermined number of settlers. These localities in the west increased in population until by 1787 what is now southern Ontario contained more than 17,000 people. Land made available for settlement through purchases from Indians had extended, by 1792, along the entire northern shore of Lake Ontario, the Niagara Peninsula and most of what is now eastern Ontario. The loyalist Six Nations of Iroquois had accepted, by 1785, in compensation for terri-

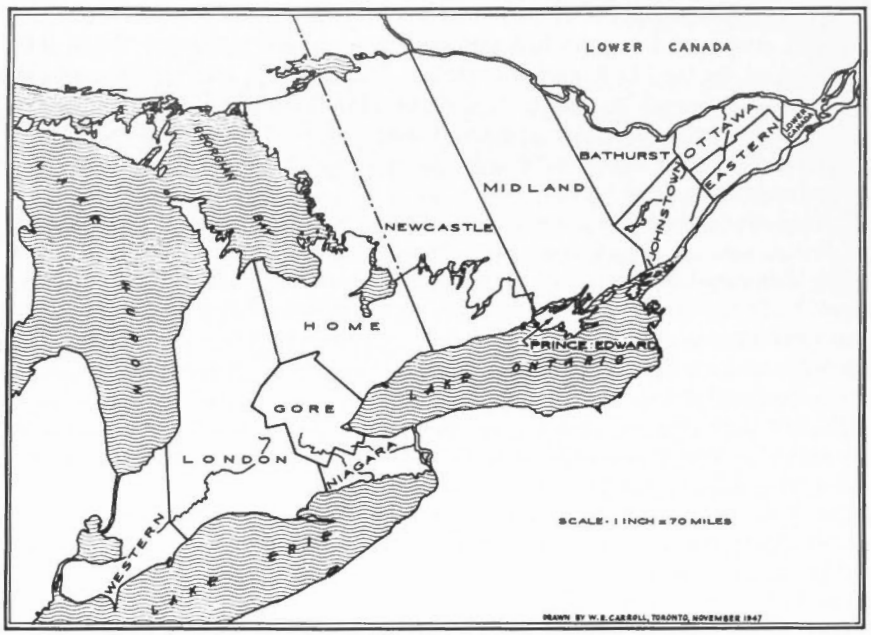


FIGURE 25. Map of Upper Canada showing Districts, 1836.

tories in northern New York State lost to them, a tract of land drained by the Grand River. Theoretically this land could not be alienated by them but in practice several large blocks were sold by Indians to incoming settlers and land promoters.

The population in what is now eastern Ontario was divided among four original settlement areas or districts named Luneburg, Mecklenburg, Nassau and Hesse, after branches of the Hanoverian dynasty. Deputy surveyors, appointed by the Surveyor General, were attached to each district. Nine townships were formed in the Luneburg District, twelve in Mecklenburg.[9] Townships in the two western districts seem to have been known only by their numbers. The names of these four original districts were changed in 1792 to Eastern, Midland, Home and Western district respectively.*

*The renaming was accomplished by an Act (32 George III, ch. 8) passed at the opening session of the first parliament of Upper Canada in 1792.

In order to expedite the entire settlement process, land boards were established early in 1789 in each district. These boards directed surveyors as to what surveys ought to be performed, though not on detailed methods to be followed. The boards were also empowered to receive applications from settlers for land. When granted the board issued a certificate to the petitioner addressed to the Surveyor General, requesting assignment within two days to the certificate holder of a single lot of 200 acres, improvements on same land to be made within one year. These boards served their emergency purpose and on November 6, 1794, were abolished. From that time on, surveys were made under the direct instructions from the Surveyor General or from his Deputy.

In a report to Lord Dorchester, dated December 19, 1787, Collins stated: ". . . I conferred with Sir John Johnson respecting boundarys to be fixed between the Mohawk Settlement and that of the loyalists and called twice on Captain John [Indian] chief of that Village, to inform him of the mode of Settlements we have agreed upon, *he being absent I acquainted his wife* and accordingly proceeded to fix the boundarys leaving a tract of 12 miles fronting on the Bay of Quinty by 15 miles in depth. . . . This extensive tract it appears is by no means satisfactory to Captain John who I am informed from good authority *he spoke in very threatening terms* . . . I have amicably settled all disputes occasioned by erroneous surveys made in several parts of the lower settlements which in short time would have been the ruin of many worthy familys . . .". (author's italics) In the end the Indian tract matter was also settled to the satisfaction of those directly concerned. In connection with these 1787 surveys Collins mentions the names of surveyors Kotté, Aitkin, McDonell, Chewitt and McCarthy.

In 1787, the year that the Corps of Engineers of the British Army became the Royal Engineers, a new survey system appeared in the Niagara Peninsula. Actually this system was confined to 13 townships in that area. Surveyor Allan McDonell is credited by some with the authorship of the new mode that had the surveyor running all the side lines, travelling back and forth in the manner of a shuttle, from front to rear of a township. This method, known as the *front-and-rear system,* involved an impressive total mileage in survey lines and was not calculated to win favor among authorities lacking ample public funds. This system did not spread to other parts of the upper country and was discontinued in the Niagara Peninsula in 1813.

Meanwhile Collins and his assistants had been fully occupied along the Upper St. Lawrence River area. In June, 1785, Collins had reported to the Governor transmitting a plan of the Second Township of Cornwall "which is the only one below Cataraqui that has been regularly surveyed, all the others having nothing more than the front line run with a single picket set up at each side of the lot. . . ." On June 18 Collins instructed Patrick McNiff to run front lines of the 2nd, 3rd and 4th concessions in the townships of Lancaster, Osnabruck, Williamsburg and Matilda, leaving an allowance of forty feet for the width of a proposed road between each concession and setting up posts carefully "to serve as a government to the inhabitants to divide their lands". By the end of 1785 McNiff reported that all people were on their lands in the five lower townships. He recommended that all applicants for land help pay the expense of required surveys by finding chainmen or axemen and that the whole of the township population assist in cutting roads. In February, 1792, McNiff's recommendation concerning the distribution of the cost of the surveys was officially adopted.

In 1791 the Constitutional Act was passed and the old, extensive province of Quebec was divided into Upper and Lower Canada. Col. John Graves Simcoe (1752-1806), son of the captain of the *Pembroke* at Louisbourg, was appointed Lieutenant Governor of Upper Canada. Following his arrival in the New World in 1771 this youthful one-time

ensign of the 35th Regiment of the Line, had risen to command the Queen's Rangers. By 1791 he was a member of parliament at Westminster for Cornwall riding. Simcoe arrived with his wife and two children at Quebec in November, 1791, and wintered there. He had numerous opportunities there to develop close relationships with Samuel Holland who, 34 years previously, had come to know his father at Louisbourg. Simcoe could not fail to notice, however, the deterioration in Holland's bodily health. "Poor Holland," he wrote to a friend privately, "that good and faithful servant of the Crown is worn out in body, though in full possession of his intellect. His deputy Collins [now] possesses neither strength nor intellect".[10]

Before leaving Quebec Simcoe asked Surveyor General Holland to provide him with names of the duly qualified deputy surveyors then available in Upper Canada. The list, when furnished, contained the names of William Chewitt, Patrick McNiff, Alexander Aitkin, William Fortune, Hugh McDonell, Theod. DePencier, John Stegman, Joseph Bouchette and Augustus Jones. But there are curious omissions. The list makes no mention, for instance, of Philip R. Frey, prominent in the surveys of the Niagara district, nor of James McDonell nor of Kotté. By letter from the office of the Surveyor General, Quebec, dated July 20, 1790, the land board of Nassau District had been directed to employ Philip Frey (appointed a deputy surveyor by Holland on January 19, 1785) as surveyor in charge of a party of ten men for the marking out of front lines of the townships from the eastern boundary of Nassau to what is now Toronto, and to "carry the sidelines of each township one mile well-marked."

The Constitutional Act provided that *lands equal in value to the Seventh part* of grants made since the beginning of British rule and, subsequently, of all future grants,

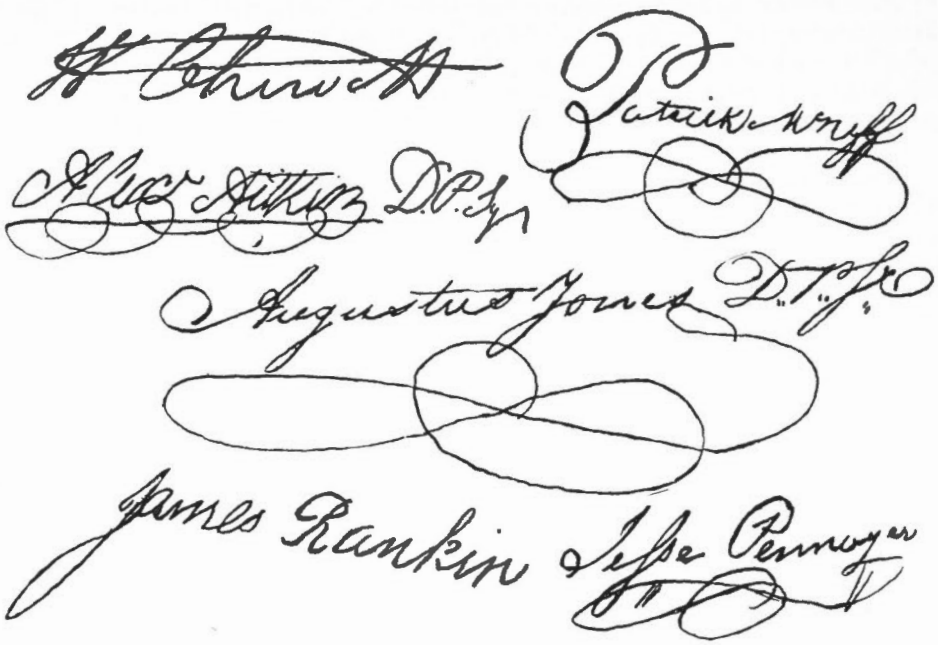


FIGURE 26. Signatures of some early Upper Canada surveyors.

should be reserved in both Upper and Lower Canada for the use of the Protestant clergy. These came to be known as Clergy Reserves. These were sold or otherwise secularized by 1854. On Colonial Office instructions another seventh was reserved for the Crown. The sketch on page 273 shows how townships were surveyed in order to provide for these Clergy and Crown Reserves.

Man-made conditions under which surveyors worked in those early times in the upper country appear, to modern eyes, unduly harsh. In order to place Deputy Surveyors of Upper Canada on the same rates of pay as those in Lower Canada, Simcoe in 1792 ruled that one-quarter of a dollar a day be allowed "to find your own ration". For a 'coasting survey' any number of men could be employed, not exceeding 10; for an 'inland survey' not more than 12. The allowance for axemen was 1/6 of a [Halifax] shilling a day and for chainbearers, 2½ [Halifax] shillings a day. For the daily quarter-dollar allotment the Deputy Surveyor was obliged to deliver to each person employed on his party, 1½ pounds of flour, 12 ounces of pork and ½ pint of pease [peas]. "If you are furnished with a Battoe, axes, tomahawks, camp kettles, oilcloths, Tents, Bags for the King's Stores, you will be allowed only 10 pence rations for your party".[11]

In these same instructions it was provided by paragraph 18 that the party chief ". . . will in general protract all your surveys on a scale of 20 chains to an inch, and you will transmit to the Surveyor General's office, with every survey . . . a written report explanatory of your survey with a copy of your field notes. . .".

With the setting apart of Upper Canada as a separate province, Major Holland's official connection with that part of Canada virtually ceased. He continued, however, as Surveyor General of Lower Canada. In any event it is improbable that he visited any western point after 1784. On June 21, 1792, Simcoe wrote to Henry Dundas, the first Viscount Melville, Secretary of State (in the British Cabinet) for War and the Colonies. ". . . [the office] of Surveyor General requires great Professional abilities and equal integrity. It was on the conviction of the important Qualities necessary for this office that I did not venture to recommend to you any of the numerous persons who applied to me . . . for this Employment and I greatly fear through the incompetence of persons who Major Holland, that able servant of the Crown, has been formerly obliged to employ in Upper Canada, I shall have considerable difficulty, if I may judge from the documents before me, in the preventing of the most mischievous litigations".

In the light of this communication it is mystifying to find that the following month David William Smith, captain of the garrison regiment at Niagara, untrained (as far as is known) in land surveying, was named Acting Surveyor General of Upper Canada. This appointment is even more puzzling in as much as William Chewitt had both the desire and technical qualifications for the position. On Simcoe's arrival in Quebec, Holland had recommended Chewitt to him as one eminently suited to take charge of land surveys in the upper country. At the time Chewitt had understood that the recommendation had been accepted but on attending a Governor's levee at Niagara months later, Simcoe told him that he had appointed Smith as Acting Surveyor General but that he would name Chewitt, Deputy Surveyor General. Smith, an upright, painstaking official who was universally respected, did not receive his commission until May, 1800. This rejection of Chewitt, for reasons never made known, was not the only reverse experienced by Chewitt in his hopes for advancement.

Despite failing health Holland made a gallant offer of his personal services to Simcoe in a letter from Quebec, dated October 4, 1792:

"Sir: A retrospect of the surveys . . . made . . . point out their being altogether local and confined to a small tract of that valuable country now under your Excellency's gov-

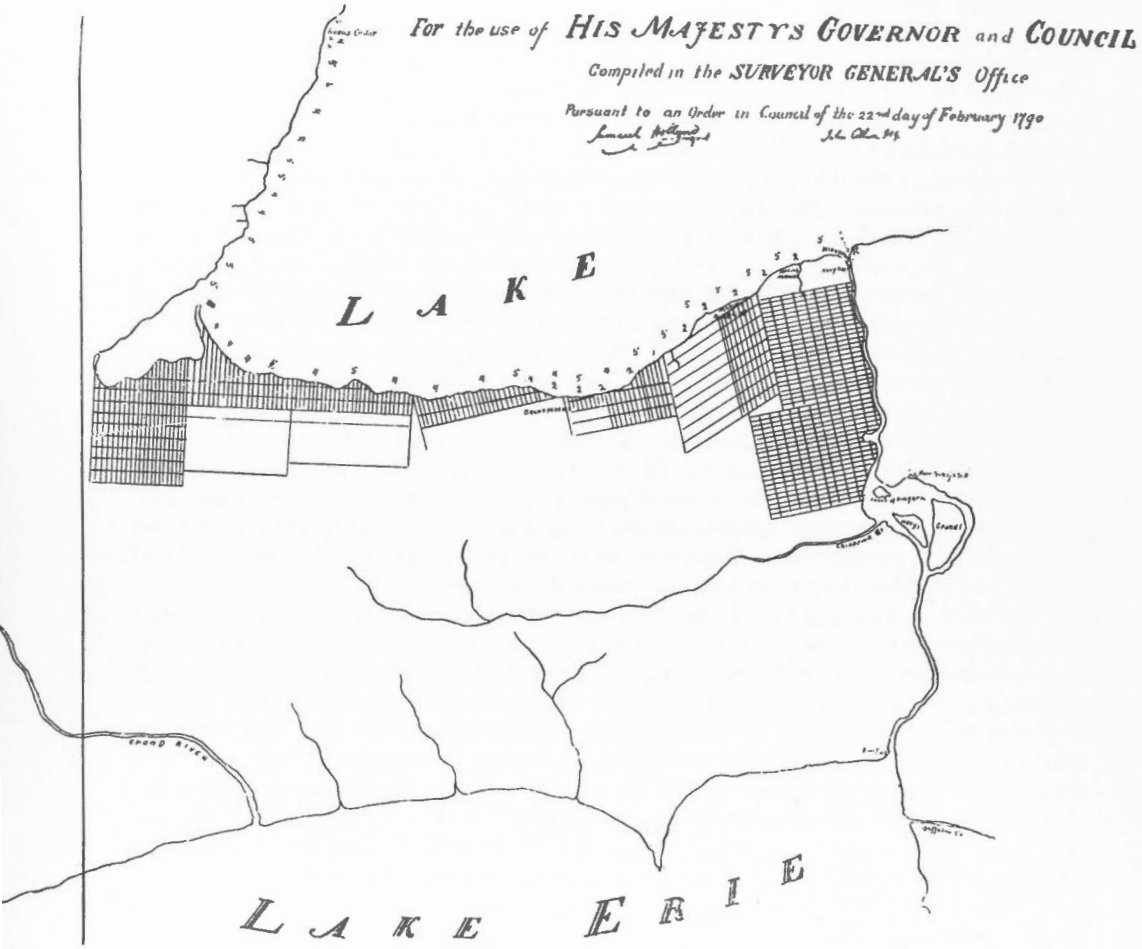


FIGURE 27. Plan of the District of Nassau, Section One, signed by Samuel Holland and John Collins c. 1790.

ernment . . . [and are] still far from being accurately delineated on any plan or map . . . owing to want of a general survey being made and latitudes and longitude taken to ascertain the true position of the most principal places situated on the several Upper Lakes . . . I am ready with a tried and approved set of astronomical instruments to take an active part in the operation myself . . .". Holland proceeded to point out the need to determine the true length of Lake Superior and to ascertain more accurately the distance from its most westerly extension to Capt. Cook's "line of coast, discovered in the Western Ocean". There is no record of any official acceptance of Holland's bid to perform these formidable tasks "with every possible care, exactitude and dispatch".

Following the death of John Collins in 1795, Holland failed more rapidly. The toll of sustained physical and mental exertions over so many years began to show. On December 28, 1801, at the age of 73, he died at Holland House with his wife Marie and family gathered at his bedside. An issue of the *Quebec Gazette* early in January, 1802, described the final ceremonial salutes to this great Canadian. "On Saturday last was

interred the remains of the late Major Samuel Holland, Surveyor General, with military honours due his rank and length of service . . . His remains . . . were escorted by a detachment of troops (200 men) and a Band commanded by Major de Salaberry, accompanied by the most reputable Gentlemen of the City, Civil and Military, thence to the [family] cemetery in the suburbs, where three volleys were fired by the troops". Burial was in the plot at Holland Farm under the famous Holland Tree, beside the remains of Samuel Junior.

The tragic death of Samuel Lester Holland, his fourth son, at the age of 19, shadowed the father's declining years. As a result of a bitter feud between the lad (a lieutenant in his father's old unit, the 60th Regiment) and Capt. Shoedde, a duel was arranged at Point St. Charles, then on the outskirts of Montreal. Hearing of the insulting behavior of Capt. Shoedde towards the Holland family, the father sent Samuel a brace of engraved duelling pistols which he claimed had been given to him by a famous commander. "Sam-

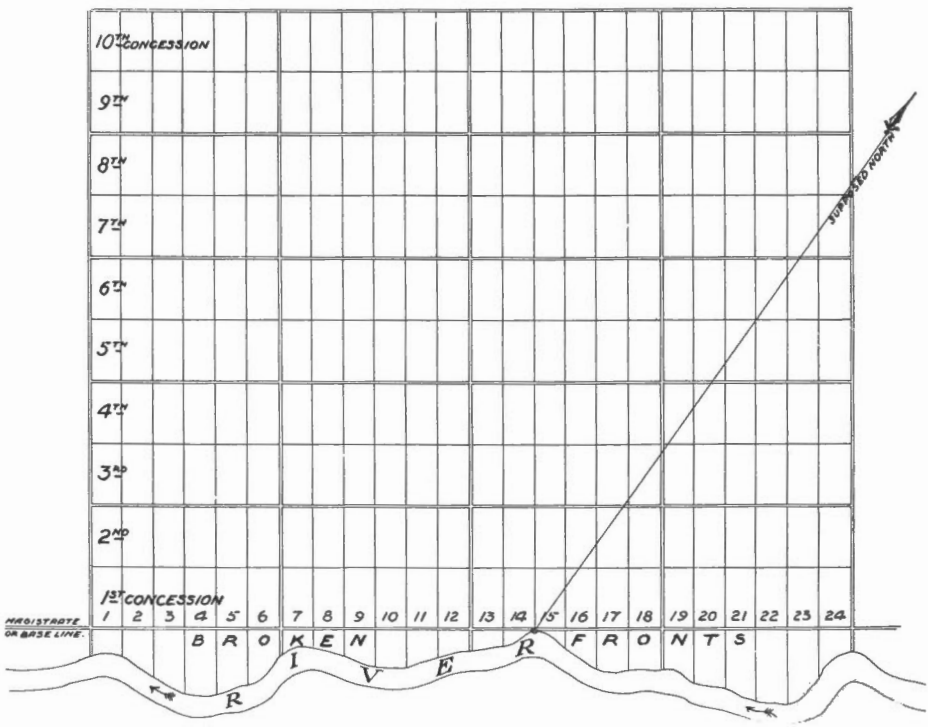


FIGURE 28. Specimen sketch for guidance of surveyors as supplied from office of the Acting Surveyor General D. W. Smith c. 1792.

uel, my boy", wrote the Surveyor General, "here are the weapons which my beloved friend, General Wolfe, presented to me on the day of his death. Use them to keep the old family without stain".* Vindication was not to come, however. Samuel Junior fell mortally wounded. His death was a grievous shock to the whole Holland family.

Holland's actions and correspondence reveal him as ambitious, tactful, industrious and highly competent. Always respectful to his superiors in rank, he was ever alert to opportunities for advancement. Holland reached a post of key importance in a rapidly changing New World. In spite of unexcelled speculative opportunities for making easy money, there is no evidence that Holland became wealthy. In days before journeys by train, motor car or plane and when watercourses offered the best highways of communication, Holland's travel mileage during his active surveying career reached an astonishing total. He was chiefly responsible for many of the pioneer land surveys in Lower Canada, Upper Canada, the St. Lawrence Gulf Islands, Prince Edward Island, parts of New Brunswick and of Nova Scotia (Cape Breton) as well as of New England and of lands even farther south. His surveys extended over more than three decades, including the most important formative surveys during the nation's transition from French to British administration.

The name of Canada's first Surveyor General is remembered today in such continuing place names as Holland Avenue and Holland School in Quebec City, by a cove in Prince Edward Island, by Holland Landing near Lake Simcoe and by a river, draining appropriately enough into Cook Bay in that same lake. These names serve to remind Canadians of a notable, constructive career without parallel in the annals of our earliest scientific surveying and mapping in Canada.

In June, 1787, Deputy Surveyor Philip R. Frey commenced a systematic laying out of the Stamford settlement, the second township to be surveyed in the Nassau District. Frey undertook this project on orders from Major Campbell, the commandant at Fort Niagara. As he marked out each holding, Frey gave the owner a ticket bearing the lot number on Frey's governing plan. Frey warned all property holders not to regard these tickets as in any sense title-deeds to the land to which they referred. Scarcity of paper in the settlement posed a problem in the production of the required number of tickets. So Frey began to use playing cards as land tickets. As the backs of the cards were commonly blank, Frey would write a few words on them and add his signature. There is no indication that jokers were used. But as there were no vaults or safety deposit boxes in which to retain the precious tickets or cards, a fair number of them were lost or destroyed by mildew, fire or mice. This situation produced much anxiety among settlers and numerous property boundary problems in later years.

Frey found that previous surveying work had been poorly done in the district. The new lines that he laid down resulted in considerable consternation in some cases. Settlers found that under the new allotments buildings they had erected were on other men's properties and, in some instances, months had been occupied in back-breaking toil clearing land they had no right to occupy. In September, 1787, Frey forwarded to the Surveyor General at Quebec survey plans of townships No. 1 and 2 "the first concessions of the latter lately surveyed". Records show that Augustus and Ebenezer Jones were with survey parties working in that township (Stamford) during November and December, 1787. Augustus at the time was a chainbearer for Frey.

Two of the Deputy Surveyors included in the Holland list to Simcoe worked together for several seasons. Augustus Jones (1763-1836) and John Stegman (1754-1804)

*The duelling pistols are now in the possession of the McCord Museum, Montreal. These are inscribed "The Gift of Major General James Wolfe to Capt. Sam'l. Holland, 1759."

singly, as well as in cooperation, completed a remarkable volume of township and road surveys. Stegman, a former lieutenant in a German regiment that had fought on the British side during the American Revolutionary War, settled in Canada and was appointed a Deputy (Provincial) Surveyor on October 18, 1790. He was in active practice in Upper Canada at a time when Capt. Vancouver was engaged in his historic marine surveys along Canada's western seaboard.

Jones and Stegman, working out of York in the years 1796 to 1798, surveyed the townships of Wolford, Burford, Oxford and Blenheim. In 1800 Stegman laid out the 2nd, 3rd and 4th concessions on the east side of Yonge Street and in 1801 was directed to report to Surveyor General Smith on the condition of that highway. Stegman wrote on June 10, "I have the Honour to report . . . that the most ancient inhabitants of Yonge Street have been most neglectful . . . and I have reason to believe that some trifle with the requisition of the Government in respect of clearing the street". In that same year Stegman examined Markham township and in 1802 wrote to the Surveyor General, "I beg you will have the goodness to send me a bush sextant". While on a surveying assignment two years later, travelling on a government schooner, Stegman was drowned.

Augustus Jones, a settler of Welsh descent, came to Canada as a refugee Loyalist. He obtained a grant of 300 acres in Saltfleet township near Stoney Creek. Jones, as we have noted, began his surveying career as an assistant to Philip Frey, working along the Niagara Frontier. In 1788 Jones was appointed a Deputy Surveyor to the officer commanding the upper posts. He quickly won the confidence of Simcoe and received numerous surveying assignments from the energetic and constructively-minded governor.

From 1787 to 1799 no other surveyor in Upper Canada measured out and subdivided so large or so important an area as did Jones. In the year of his appointment he surveyed Thorold, Pelham, Saltfleet and parts of Clinton, Grimsby and Bertie townships. Collins, in his first official message to Jones, requested maps of the townships he had surveyed, with the names of settlers marked on lots, all on the scale of 40 chains to an inch. Swamps were to be shaded in on the plans and the courses of small creeks shown. Road allowances as surveyed were to be indicated also although in many instances settlers carved out their own rough trails long before surveyors arrived on the scene.[12]

The Jones' surveys were not completely faultless. Hon. Peter Russell, President of the Executive Council and Administrator of Upper Canada (1796-99), was a prominent administrator in matters of land development and related surveys. During his term of office he was on record with one pointed complaint on the quality of surveying work. As one who was responsible for much of the planning of the new town of York, Russell wrote feelingly to Surveyor General Smith:

"It is much to be lamented that Mr. Aitkin and Mr. Jones have not been more accurate in laying off the Blocks. But as the Evil is Committed, all we have to do is remedy it the best way we can . . . notice [should be] given that no person in future shall presume to lay down a house, until the Surveyor examines the Spot and declares it to be agreeable to the Regulations of Council".[13] Here we have another sign foreshadowing the advent of modern town planning in Canada.

Jones surveyed Dundas Street, the "Governor's Road", from Burlington Bay to the Thames in 1792-94 and explored the sources of the Thames River. With Stegman he surveyed Yonge Street from Lake Ontario to Holland Landing, 1794 to 1797.* In 1798 Jones surveyed the town of York. The following year marked the end of his active survey work and he enjoyed a rather lengthy period of retirement. He died at Cold Springs on November 16, 1836. Surveyor of Iroquois lands along the Grand River,

*Yonge Street survey commenced January 26, 1794. Four men of the Queen's Rangers served as chainmen and axemen.

FIGURE 29. Plaque honoring Surveyor Mahlon Burwell, erected at Port Burwell, Ontario, in 1960 by the Ontario Archaeological and Historic Sites Board.

Jones was always on good terms with Indians of the province. In 1798, in fact, he married the daughter of an Indian chief. As one of the pathfinders and pioneer measurers of a largely unsettled province he endured exceptional hardships. His accomplishments were remarkable and his career a most constructive one. His extensive diaries, field notes and correspondence, now in the keeping of the Public Archives of Ontario and of the provincial Surveys and Maps Office in Toronto, form a priceless source of information on early days in central Canada.

The protection of boundary marks has occupied the attention of law makers and law enforcement agencies since the origin of private ownership of land. In few places in the world, however, have the penalties for removing or damaging survey boundary monuments in relation to private property been so severe as those imposed in Upper Canada at the end of the 18th century. In a statute passed in 1798 (U.C. 38 George III ch. 1, sec. 4) it was provided that "if any person or persons shall knowingly and wilfully pull down, alter, deface or remove any such monument as aforesaid, he, she or they shall be adjudged guilty of felony, and shall suffer death *without benefit of clergy*". (author's italics)

By 1849 this offence had been reduced to a misdemeanor and the death sentence reduced to a period of imprisonment. In any event, as far as is known, nobody was executed in Upper Canada under this law. The phrase, "without benefit of clergy" has been much misunderstood. It does not mean that anyone under sentence of death, in such a case, is deprived of spiritual comfort. The roots of this expression are deep in English criminal law and the phrase represents a form of court pleading. In the 12th century any member of holy orders who broke the criminal law obtained exemption from punishment inflicted by lay courts by submitting proof that he was, in fact, a member of the clergy.[14] By 1350 the standard test of such status involved the ability to recite the opening words of the first verse of Psalm 51: "Have mercy upon me, O God, according to thy loving kindness. . . ." This passage of the Scriptures became known, in time, as the "neck-verse". This test was abrogated in 1705. Until the practice was finally abolished for all commoners in 1827, it had been widely exercised. Whenever it was intended that a breach of statute was to be punished with the utmost severity, the words "without benefit of clergy" were added as part of the penalty.

Soon after the passage of this highly punitive 1798 measure, a surveyor who achieved considerable distinction in his profession, began to practice in Upper Canada. His father, a zealous Loyalist named Thomas Sherwood, was reputed to be the first settler in the United Counties of Leeds and Grenville. He located on Lot No. 1 in the first concession of Elizabethtown in June, 1784. He became a magistrate and captain in the militia. As a man of some education he was often called to run sidelines of lots for other pioneer settlers. His son, Reuben Sherwood (1775-1851), conducted township surveys as early as 1799. From 1809 to 1820 he was employed on government surveys subdividing such townships as Augusta, Bastard, Bathurst, Lansdowne, Leeds, Marmora, Nelson, Pittsburgh, Sherbrooke, Nassagawega and Yonge.

In later years some of the surveyors who served their apprenticeships under Reuben Sherwood included John Stoughton Dennis, later to become Canada's first post-Confederation Surveyor General, Richard Birdsall, John McNaughton and W. Harry Kilborn. Excerpts from Sherwood's diary, an account kept during his surveys of Nelson and Nassagawega townships, afford revealing glimpses of surveying conditions at the end of the second decade of the 19th century:

"Saturday, March 13, 1819: Snowing again in the morning. I go out with the party and finish the 2nd concession line to 15 and road. Return again at 7 p.m., find Hudson arrived. An exceeding cold night; about 15 inches on the ground. Break my compass glass in coming home.

Sunday, March 14: A cold day. The boys go out and bring 3 packs of biscuits in and all get drunk. . . ."

Another Upper Canadian surveyor who came into prominence near the turn of the century was Thomas Ridout (1754-1829). An English-born Loyalist who first settled in Maryland, he was captured by Indians in 1787. This occurred at a time when savages of that region were in the habit of cruelly torturing any white prisoners. Ridout was fortunate to escape with his life. He came to York with his family in 1797 and was employed in the office of Surveyor General Smith. He became the representative of Simcoe, Durham and the east riding of York in the provincial House of Assembly, 1812 to 1816. In 1804, when Smith (who had served as Speaker of the House in 1797 and 1801) retired to England, eventually (1821) to be created a baronet, Col. William Chewitt, already once rebuffed in the realm of advancement, discovered to his chagrin that although he had been promised the Surveyor Generalship, Smith had been succeeded by Charles B. Wyatt. After the latter was suspended in 1805 on charges of con-

spiracy, Chewitt was appointed to the post jointly with Thomas Ridout. It would not appear to have been a wise arrangement but this dual occupancy continued until 1810 when Ridout was accorded the full and undivided title, holding it until 1829.

Only four others held the position of Surveyor General of Upper Canada until the post was abolished (later to be revived) in 1845 (8 Victoria ch. 11, sec. 1) when his department and office were consolidated under the Commissioner of Crown Lands. These four were: Hon. Samuel F. Hurd (1832-35); J. Macaulay (1836-38); Robert B. Sullivan (1838-40); and Thomas Parke (1841-45).

Samuel Ridout (1778- ?), son of Thomas, was employed in his father's office as chief clerk to the Surveyor General and was appointed a Deputy (Provincial) Surveyor about 1810. Twice married, Samuel owned and occupied a farm abutting on Yonge Street in the area now known as Summerhill.[15]

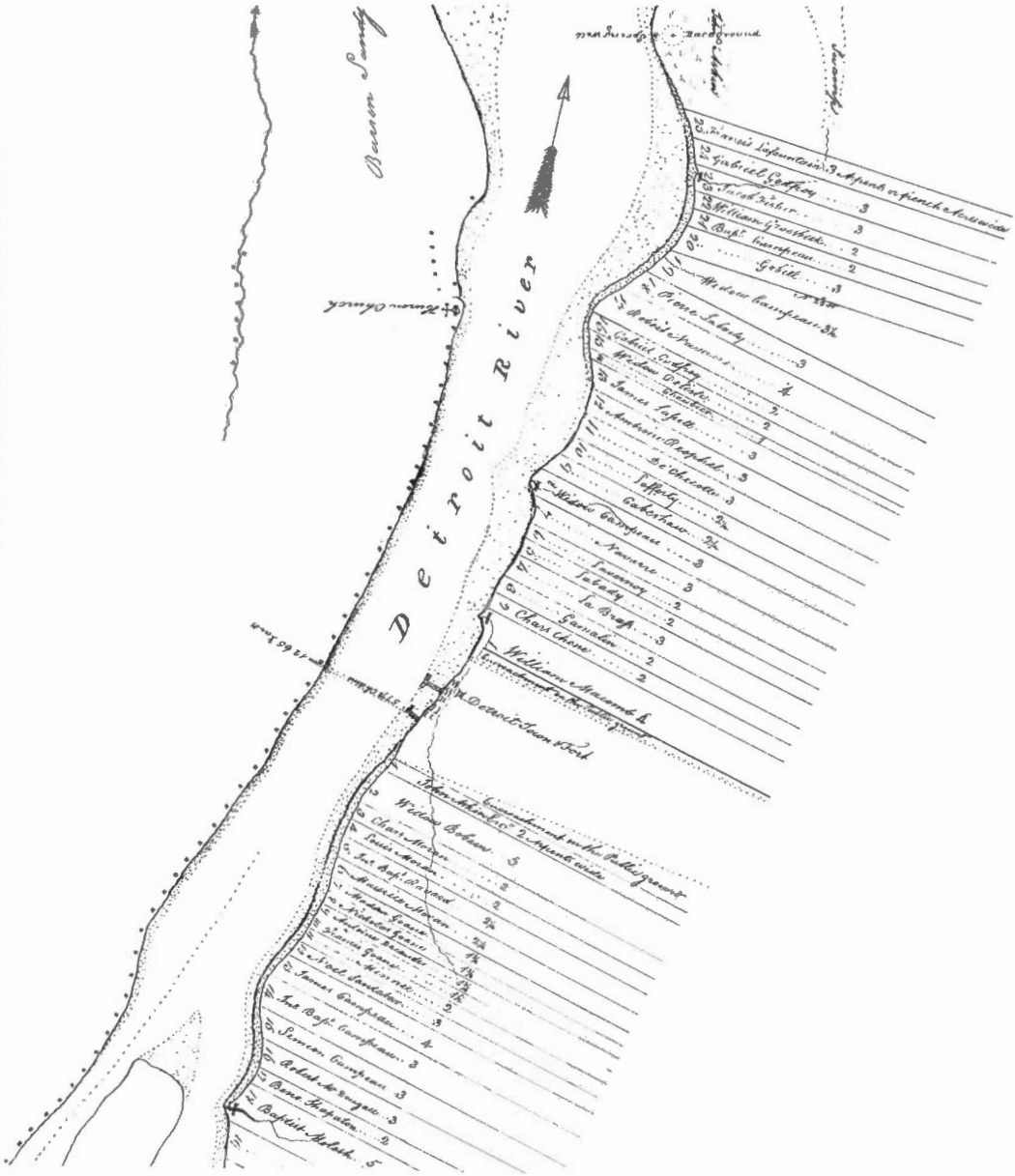
By his decision to establish counties in Upper Canada, Simcoe sought to serve a basic three-fold purpose; to promote loyalty to the Crown, to establish the framework of an effective democracy, British style, and to provide a basis for representation in the House of Assembly. He felt also that the division into counties would serve to unite and blend the several districts of the province.

Even the settlers preferred names to mere numbers, encouraging Simcoe to indulge in 1792 in an orgy of place-naming. In the eastern reaches of Upper Canada he bestowed county names from local sources or developments; Leeds, Stormont, Dundas, and Glengarry. He used English county names methodically, applying that nomenclature along the Canadian shores of Lake Ontario and Lake Erie. Thus in the Niagara Peninsula we find Lincoln county; west of the Bay of Quinte, Northumberland county, and on Lake St. Clair, Kent.

Under Simcoe also an ambitious start was made on systematic road-building in the province. Yonge Street, named after Sir George Yonge, British Secretary of State for War (1782-94), was surveyed by Jones and Stegman and built by the Queen's Rangers, from 1794 to 1796. The road extended more than 30 miles, designed to link Lake Ontario and Lake Simcoe. In addition, Dundas Street, planned by Simcoe as a trunk military highway running east-west across the province, was partly laid out by Jones and constructed by the Queen's Rangers in 1794 and 1795.[16] This highway was more popularly known as the Governor's Road and later as Dundas Street. Its route includes today's main streets of Woodstock and London. Thus the highways Simcoe caused to be surveyed have become some of the principal traffic arteries of present-day Ontario. In addition to its military aspects, Dundas Street, in Simcoe's plans, was to help build up London as a potential capital of the upper country. The Governor General had other plans, however, and Simcoe was instructed to establish York as the seat of government.

The Niagara Portage Road was surveyed and constructed also before the turn of the century. When Augustus Jones surveyed the Canadian bluffs overlooking the famous falls and river he reserved a strip one chain in width along the crest of the bank, for road-making purposes. This became a highly popular travel route and by the end of 1791 was carrying all west-side traffic.

Following Simcoe's departure from Canada in 1796 roadwork in the upper country declined and settlement progress fell off proportionately. In 1800, in fact, immigration had fallen so far behind completed surveys that Lieut.-Governor Hunter directed the whole of the lands surveyed in the province to be settled *before* any new surveys would be undertaken. During the entire period of the Loyalist influx the only substantial body of immigrants to enter Upper Canada from the British Isles was the Glengarry Fencibles, who came in 1804. At this time the population of Upper Canada was estimated at 40,000.



MAP 29. A section from Patrick McNiff's plan of the settlements at Detroit, 1796. Courtesy of The Clements Library, Ann Arbor, Michigan.

Kingston had 600 inhabitants and York, 500.[17] But within the first decade of the 19th century a combination of dynamic factors served to alter the face and future of the province. Within the following half-century both road-building and settlement received a powerful impetus.

Col. Thomas Talbot (1771-1853) was one of these formative factors. Born in Malahide County, Ireland, Talbot joined the British army as soon as he was of enlistment age and in 1790 was sent to Canada. By 1792 he had been appointed private secretary (aide) to Simcoe. When he returned to England in 1794 he resumed his military career and rose to the rank of Lieutenant Colonel. But Talbot could not rid himself of the visions stirred by his glimpse of the constructive opportunities offered by Canada and in 1802 he sold his army commission, and induced the British government to grant him a large acreage in Upper Canada. With remarkable single-mindedness combined with ruthless energy and unusual administrative talents, Col. Talbot rapidly became one of the most outstanding colonizers of British North America.

In his various settlement projects he had the valuable assistance of Lieut.-Colonel Mahlon Burwell (1783-1846) in the role of surveyor. In the earliest days of Upper Canada military men predominated in the surveying field, probably because of the scarcity of properly qualified civilians. Burwell was among the vanguard of Talbot's Loyalist settlers, arriving from New Jersey. In 1809 he located at a place now known as Port Talbot. His knowledge of practical mathematics made him highly useful and much in demand as a surveyor in the wilderness districts. He was named a Deputy (Provincial) Surveyor in 1809 and became a close associate of Talbot. He was instructed to lay out the Talbot Road (or Street), an important element in Talbot's strategy for developing his lands and settlement schemes.

Burwell had his problems. For his road survey party he tried to recruit axemen, chainmen and picketmen at the then prevailing official wage rates of 1 shilling, sixpence a day (Halifax currency). He found it very difficult to interest anyone at such rates. Finally he persuaded the government to pay his men 1 shilling a day extra. Burwell received 5 shillings a day, later increased to grants of land up to 4½ per cent of the acreage he surveyed.

Survey instruments available in those times in Upper Canada would be considered today as very primitive, a circumferentor and a chain of up to 100 links. As an indication of the peculiar problems and privations faced by pioneer surveyors it is recounted that in 1800 in surveying along Dundas Street, James Hambly (or Hanvey) was left in a state of shock when his circumferentor fell from a stump and the needle broke. He was compelled by this mishap to make a long journey on foot to Victoria village, the home of John Bostwick (1780-1849) to obtain the services of that surveyor to repair the damaged instrument. Hambly, who contracted grippe as a result of fording cold spring freshets and swollen streams, lay sick in Bostwick's quarters for several days. All the while he was tormented by visions of his idle field men, drawing wages and eating all too heartily at Ingersoll Inn. In the field the food was simple and sustaining but somewhat monotonous; salt pork, pea soup and bread supplemented by fresh fish and fowl.

The practice in the field at that time was for the surveyor to set up his circumferentor on a level stump or flat rock and take a sight along the intended township base line. Axemen cut away obstructing trees. One chainman held the first link over the stake at the starting point. The second chainman carried and opened up the remaining 99 links of the chain to a point determined as precisely correct, the surveyor then signalling the picketman to drive in a stake at that point. At the termination of every fourth lot, a span of one chain was provided for a future side-road. As he came to each creek or swamp

the surveyor recorded the feature in his field book. He entered also the quality of the soil, number of rock outcroppings and types of timber.

Col. Burwell, as government surveyor, often chose to be paid for his services in land grants rather than in cash. In this way he became the owner of thousands of acres of choice farmland in the western townships. For example, in Southwold township he obtained 600 acres near present-day London, where he settled in 1815. In the spring of 1810 he had commenced the survey of London township, laying out lots on Dundas and beginning "the Proof Line of the work", now Richmond Street in London. By June 13 he had completed the survey of the lower part of London township as far as the 6th concession. In spite of rheumatism Burwell could not forget his military background and in his diary writes of "marching my men" from one point to another. The War of 1812 interrupted these measuring activities but with the coming of peace Burwell resumed surveys in the London area. The township occupied his full attention during the autumn of 1818 and the spring of 1819. Often makeshift wigwams of bark and branches afforded shelter for the survey party at nights. In 1819 Burwell and his men were overtaken by a heavy rainstorm and "soaked to the skin. We could not get the bark off the trees". From such ordeals came occasional casualties as illnesses depleted survey party ranks. In addition Indian assistants would leave abruptly to attend tribal pow-wows. But by May 11, 1819, with the help of his brother Lewis, Mahlon Burwell completed the London township surveys.

At about this stage in the development of Upper Canada surveys a third method of measuring land was introduced, known as the *double-front system*. Under the single-front system (1783-1818) a typical lot contained 200 acres. Under the front-and-rear system in the Niagara Peninsula (1787-1813) each lot, as a rule, contained 100 acres. Under this third method, 200-acre plots were allocated to settlers and the Crown grants were made generally in one-half lots of 100 acres. In order that settlers might properly locate limits for the back 100 acres, a double-front system of corner posting was introduced. This method of laying out land prevailed from 1815 to 1829. About 100 townships in the province were surveyed in accordance with this third system.

Not long after Burwell's achievement in the London area, the survey authorities at York realized, none too soon, the need to maintain a standard or uniform size for lots and concessions. In the spring of 1829 Surveyor General Ridout submitted a report to Lieut.-Governor Sir John Colborne, recommending adoption of what has become known as the *2,400-acre block system,* in effect from 1829 to 1851. Chronologically this was the fourth system of surveying land out of a total of seven applied in what is now Ontario. Ridout's plan was approved by order-in-council on November 27, 1829, thus instituting the first of the so-called sectional systems, an adaptation of the double-front. When surveyed under the Chewitt proposal the township was divided into blocks two concessions deep and six lots wide, 12 lots of 200 acres, or a total of 2,400 acres. Later on in the 19th century the subdivision on Canada Company lands was accomplished under the 1,000-acre section plan, the fifth system, but about 50 townships were laid under the fourth or Chewitt system.

The period 1815-40 represented the peak of Col. Thomas Talbot's influence and authority.[18] Although he would not claim to be above all reproach, the hamlet that sprang up near Kettle Creek about 1817 was named St. Thomas in his honor, as was nearby Talbotville. The St. Thomas *Liberal* was not impressed by Talbot's "saintliness" and editorially observed "that Colonel Talbot rules with a more absolute sway and his power is infinitely more to be dreaded than that of the King of Great Britain".

Talbot made a personal enemy of Simon Zalotes Watson, a pioneer surveyor in

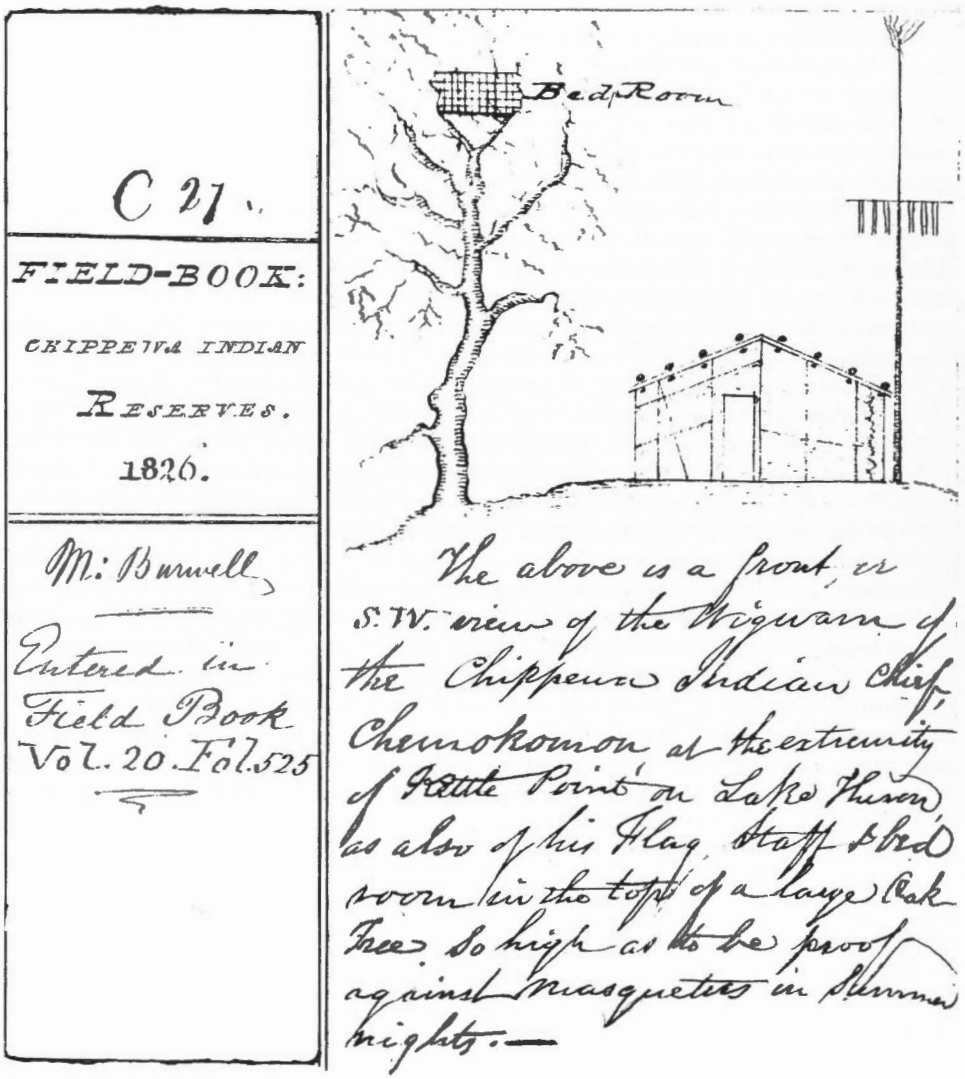


FIGURE 30. Spine of a Burwell Field-Book, 1826, and extract from a page therein.

both Lower and Upper Canada. A one-time magistrate in Montreal, the American-born Watson had been active as a land surveyor as early as 1792 in the Eastern Townships.[19] He came to Upper Canada and was made a Deputy (Provincial) Surveyor for the upper country on May 2, 1810. In June of that year Watson surveyed the first and second concessions of Westminster township in the London area. Also in that year he surveyed Commissioners' Road, named after the group appointed by the Crown in 1804 to supervise road-building in the province. The first commission included Thomas Talbot, John Bostwick and Moses Brigham. Watson also surveyed Base Line Road, now within London city.

For a time Watson was in Talbot's good graces and became associated with him in settlement projects. This was his undoing. Misunderstandings arose over the scope of Watson's authority and Talbot repudiated him. The embittered Watson joined American invaders in the War of 1812 and in July of that year General Brock wrote unofficially that enemy cavalry "was being led by one Watson, a surveyor from Montreal, a desperate character".

Pioneer surveyors of the London area, in addition to Mahlon Burwell, John Bostwick, Simon Z. Watson and James Hambly, included Sam Peters, Charles Rankin and John McDonald. A survey of a town plot at the fork of the Thames in 1826 marked the beginning of the town of London as distinct from the township.[20]

In accordance with Talbot's settlement plan, as suggested to Lieut.-Governor Maitland, an order-in-council was issued for the survey of a road to connect the settled concessions of London township with the main road. The surveyor was instructed to lay out farm lots of 100 acres on each side of the highway. Talbot was to arrange for the sale of these lots at 12½ shillings an acre.[21]

On June 29, 1826, Burwell sent to Surveyor General Ridout his newly-completed plan of London, containing 240 acres, bounded by Wellington Street on the east, and on the north by Carling and Queens Avenues, both then known as North Street. He reported that the "most eligible and beautiful scite [sic] for public buildings" was near the centre of the block composed of lots numbered 21 to 24 on the south side of Dundas Street and exending south to King Street.

Thomas Talbot died in Brant county on February 6, 1853, the same year in which the first Great Western train entered London. Talbot had turned the first sod on this historic railway-building project a few years earlier. Talbot's dynamic achievements in colonization created wide interest overseas in the agricultural possibilities of the upper country. Outstanding as Talbot was in the panorama of Canadian development, the name of Mahlon Burwell, his land surveyor in chief, will always remain closely linked with that of his principal employer. His pioneer surveying is commemorated in the name of a community he laid out in 1830, Port Burwell on Lake Erie, fittingly located in relative proximity to Port Talbot.

Other factors of special significance in providing impetus, scope and direction to immigration into Upper Canada were two highly ambitious English land companies, authorized to help develop the province. The Canada Company, incorporated June 27, 1825, and granted a Royal Charter in 1826 (6 George IV, ch. 75) played a key role in opening up midwestern Ontario. The Canadian Land and Immigration (sometimes Emigration) Company, incorporated in London, England, on April 15, 1861, served to develop the Haliburton district. An odd coincidence connected with these corporate activities is that in each case the company was directed by a gentleman of literary, rather than of promotional or administrative experience. John Galt, founder and first superintendent of The Canada Company, was a poet, biographer, historian, essayist and novelist. Hon. Thomas C. Haliburton was well-known as a Nova Scotian author and creator of "Sam Slick". The appearance of The Canada Company in the upper country was the signal for a strong revival of highway construction, especially of colonization roads in the more central and westerly parts of the province. One of the most important of these was the Huron Road, in the building of which contractor Col. Anthony Van Egmond played a major role in 1827.

The Talbot Road, already described, was surveyed first, in 1804, by the Massachusetts-born Lieut.-Colonel John Bostwick (1780-1849). He laid out some of the earliest roads of the Talbot Settlement and founded Port Stanley. Parts of the Talbot Road were

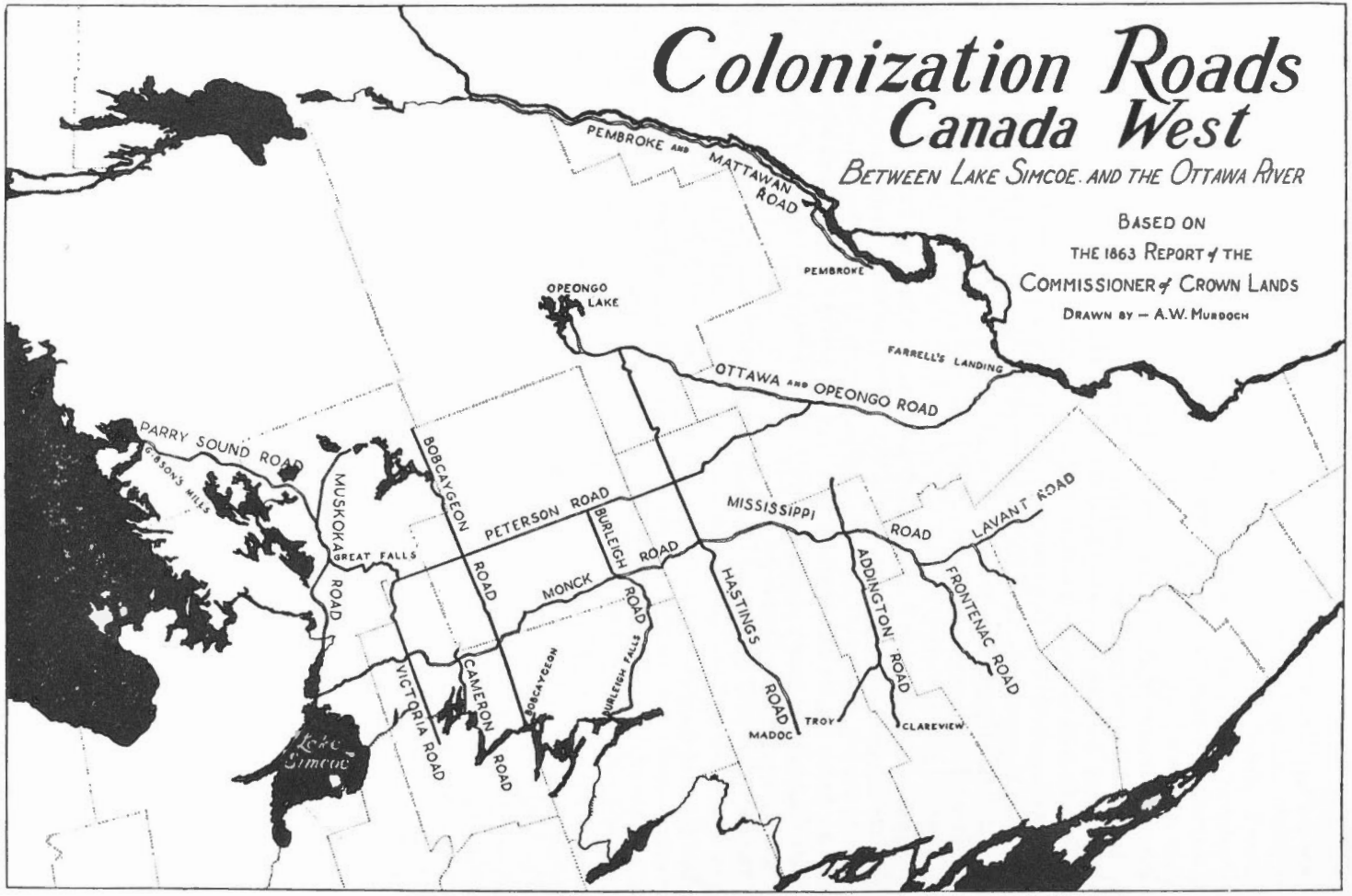


FIGURE 31. Colonization Roads, Canada West, based on the 1863 Report of the Commissioner of Crown Lands.

surveyed by Burwell in 1809. Two years later he was instructed to extend the road to Amherstburg and to survey branches of it connecting with settlements to the north. The existence of that road, completed in 1811 and improved in 1826, meant more rapid colonization of the north shore of Lake Erie. This Talbot Road was, in fact, considered the best road in Upper Canada in the 1820s and 1830s.

The 75-mile-long Garafraxa Road that eventually extended from Fergus through Arthur, Mount Forest, Durham and Chatsworth to Owen Sound, constituted another major colonization road and was surveyed from 1837 to 1839 by Irish-born Charles Rankin (1797-1886). Appointed a Deputy (Provincial Land) Surveyor in 1820 he worked initially in the southwestern part of the province. In 1833 Rankin began surveying Nottawasaga Bay area and settled on 200 acres west of the present town of Thornbury. In addition to his Garafraxa Road project Rankin surveyed Owen Sound and Southampton townsites as well as the Muskoka Road.

The Garafraxa Road, built from 1840 to 1848, and the Muskoka Road, completed in 1858, were followed by a momentous decision of government to open up for settlement the vast Ottawa-Huron country. This fact, with the advent of the Canadian Immigration and Land Company, brought about the construction of several colonization roads, including the Bobcaygeon and Peterson Roads, both completed in 1862. There were colonization roads of somewhat lesser significance constructed during this same settlement epoch, such as the Ottawa-Opeongo, the Addington, Victoria, Burleigh, Hastings and Frontenac-Madawaska Roads. It was a busy time for highway surveyors!

By 1850 there was in existence in Canada West a fairly complex system of roads of all types. In addition to colonization roads and such routes as the Niagara Portage, Yonge Street and Dundas Street arteries, there were the heavily-utilized highways in the province's midwestern sector such as that part of the through road, London to Sarnia, known as the Egremont Road (1840), Guelph Road (1819), Commissioners' Road (1804), the Base Line Road and Proof Line Road (1824). The last three arteries served the people of London and Middlesex county. By 1866 a beginning was made on a county highway system.

The million-acre section of The Canada Company's domain known as the Huron Tract had been acquired by purchase from the Six Nations Indians. For this vast region the Company contracted to pay two-thirds of its value in cash (£145,150 and 5s.) and provide the balance in the form of improvements such as roads, bridges and wharves.[22] The development of this region and the provision of improvements resulted in the employment by the government of Upper Canada (at the request of the Company) of a sizable platoon of qualified surveyors, one of the most notable being John MacDonald. But John Galt himself must have mastered at least the rudiments of land surveying. With a company associate, Dr. William Dunlop, he laid out the site of Goderich. The site of Guelph, founded in 1827, was also selected by Galt. By midsummer of that year surveys had reached the townsite of Galt. Hon. William Dickson, a Scot and former schoolmate of John Galt, named the place after the Canada Company superintendent.

A road from Guelph to Goderich was cut through the bush and communication established for the first time overland between Lake Ontario and Lake Huron. Townships along this road were named after Company directors such as Ellice, Logan, and McKillop. Galt's policy was to open up roads and render lands more readily accessible. In his autobiography Galt describes the road-making process:

"All the woodmen that could be assembled from the settlers were directed to be employed, an explorer of the line to go at their head, then two surveyors with compasses, after them a band of blazers, of men to mark trees in the line, then went the woodmen

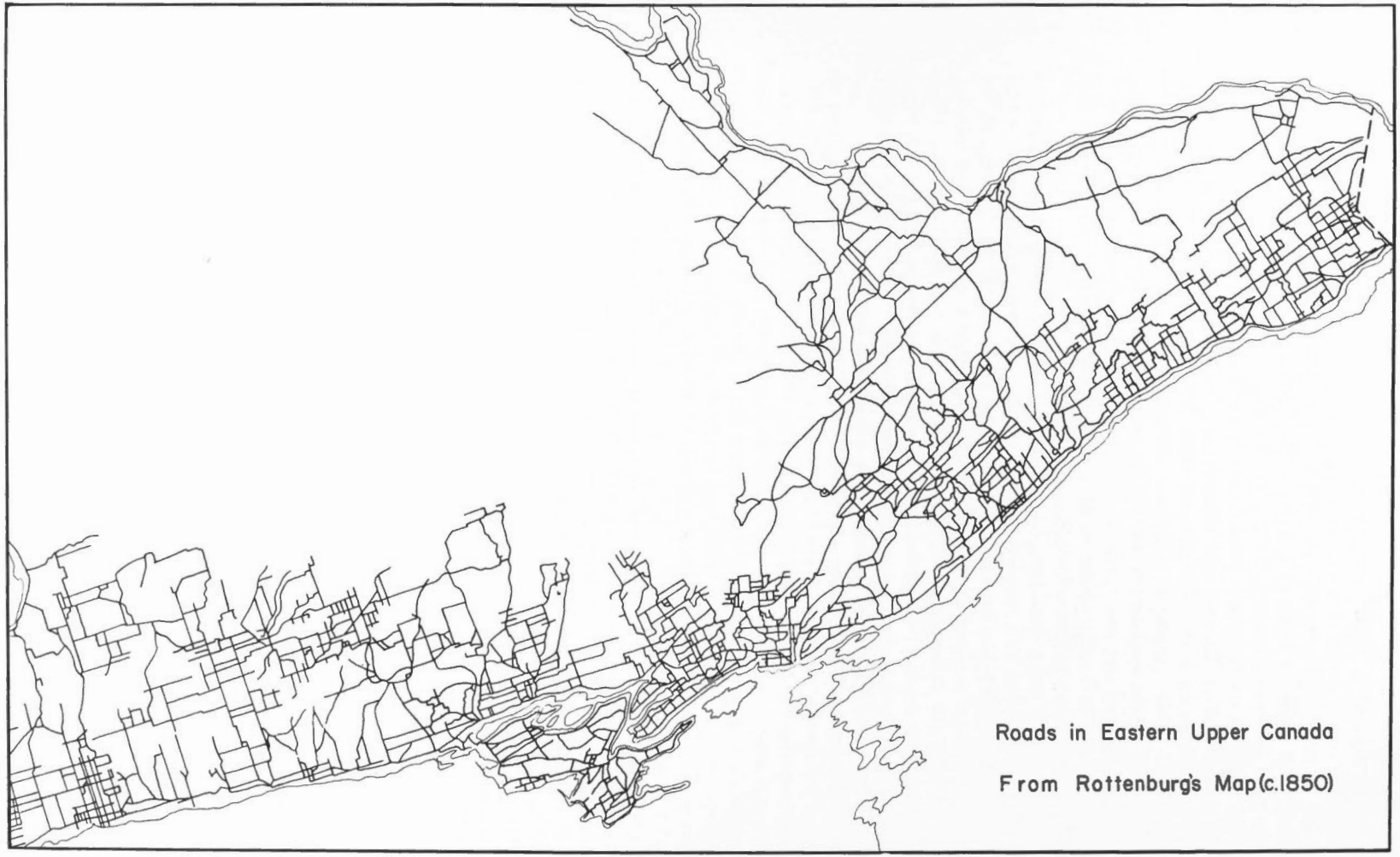


Figure. 32.

with their hatchets to fell the trees and the rear was brought up by waggons with provisions . . .".[23]

Galt, described as a very tall man (six feet, four inches) with black hair and keen eyes, may have lacked business acumen. But he had a vision of Canada's future possessed by few of his generation. Today monuments to his foresight are impressive: the cities of Guelph, Goderich, Galt and the Huron Road. He supervised the drainage of swamps, the damming of rivers, the building of bridges, clearing of forests, the endowing of hospitals and the founding of important communities. The immigrants he attracted to Canada were of the desired and needed quality; they were men, women and children whose worth was beyond mere counting. Canada, as John Galt saw it, was "the most beautiful country in the world".

Lots 20 chains by 50 chains represented the general arrangement in the Tract, fronted on both sides of concession roads and extended to a blind rear line. Side roads were provided every fifth lot and these bounded the ends of blocks a mile and a quarter square, each containing 1,000 acres. This was the fifth system of land surveying put into effect in Upper Canada, namely, the *1,000-acre section system*. It was first applied in 1835 and continued to 1906. About 1850 this system, which had proved highly popular, was adopted for Crown surveys also,[24] except that the government introduced the placing of a one-chain-wide road allowance along the banks of rivers and lakes. This practice has been continued since. Some 200 townships were surveyed under this system, representing the largest area of Upper Canada subdivided up to that period, according to one pattern. It was a system designed to apply to agricultural lands, not for hilly or rocky country, full of lakes.

Highways, overland links between communities, were keeping pace with settlement, if not preceding it. But canal projects were not neglected. The idea of joining Lakes Ontario and Erie by a canal sprang into men's minds at the outset of exploratory surveys. Col. Robert Nichol, a member for Norfolk in the House of Assembly, introduced a bill in 1816 to provide funds for a survey of possible man-made water routes between the two lakes. William H. Merritt, a mill owner, took time by the forelock in 1818. He borrowed a water level and began a survey of the height of land separating the headwaters of Twelve Mile Creek from the nearest point on the Welland River. As a result of that survey the Assembly granted £2,000 for a proper survey, including any canal prospects along the St. Lawrence River. But not until 1823 did Merritt get his actual survey. Many were opposed to the whole idea. Some, like William Chewitt, feared that proximity of the undertaking to the United States would jeopardize it. A survey by Hiram Tibbetts, a civil engineer, proved favorable and Merritt was authorized by an Act passed January 19, 1824, to incorporate the Welland Canal Company.

Early surveyors in the region often found marsh water unfit for drinking because of a plenitude of waterbugs, so the men were kept supplied with whisky, served from tin pails with tin dippers. Whisky at the time cost 25 cents a gallon. Progress on these canal surveys was, therefore, remarkable and it might be added, at times exhilarating. But in other parts of Canada superabundant supplies of whisky at such low prices aggravated troubles such as the Roman Catholic-Protestant feuds, if it did not actually cause them.

From the advent of the white man in the upper country of 19th century Canada the Trent Valley was regarded as a principal traffic route between Lake Huron (Georgian Bay) and the eastern end of Lake Ontario. English-born Richard Birdsall (1799-1851) was among the more prominent of the early land surveyors in the region, having laid out the townsite of Peterborough under Z. Burnham, in 1825, as well as parts of various townships before and after that year. Frances Stewart, a settler's wife with literary gifts,

in one of her 1823 letters to friends in England (Our Forest Home, 1902, Montreal), written in Duoro township, recounted vividly how, ". . . one very wet day I saw two men walk past my window; one had a blanket about his shoulders, a pair of snowshoes in his hands, and a small fur cap. The other was dressed in ragged sailor's clothes. I took the foremost for an Indian . . . but to my surprise . . . found this was Mr. Birdsall, a very smart young Englishman, who is surveyor of the township in this district, and his assistant; they had five other men with them as chainbearers, etc. I found that they had all been living in the woods for the months of March and April, which accounted for the ragged and weatherbeaten appearance of the whole party".

From the closing years of the 18th century reports, maps and surveys had been produced for the purpose of enabling government authorities to decide whether the Toronto Portage was a better way to Lake Simcoe than the Trent system of waterways between the Bay of Quinte and Lake Simcoe. As early as 1790 a map, dated October of that year, and signed by Holland and Collins, contained manuscript notes on portages along the Trent.[25]

In 1819, one year after the first settlement in the "back townships" had taken place (surveys of Smith township were completed in 1818) Lieut. J. P. Catty of the Royal Engineers conducted a survey in the Trent region and refers to his journey to the Bay of Quinte as "more tedious and less satisfactory than might have been expected". Other early surveyors in the area were E. C. Caddy (1815-97) Deputy (Provincial) Surveyor and artist; also F. P. Rubidge (1806-98), surveyor and poet, who was instructed in surveying by Major Samuel Wilmot. In 1835 Rubidge surveyed for the Cobourg Rail Road Company and also in several of the more northerly townships in the valley of the Trent. In particular he examined the country between Rice Lake and Lake Simcoe. The various watercourse projects in the Trent system came to be known as the Trent Canal. This chain of lakes, rivers and canals occupies a considerable part of the counties of Hastings, Durham, Northumberland, Peterborough, Haliburton and Victoria.

Not all early canal surveys in the upper country can be considered in this chapter but mention should be made of the Murray Canal near Presqu'isle in Lake Ontario. Surveys extending from those of Jones in 1792 to those of Birdsall and Walkins in 1824 favored a canal project in that vicinity. After 1794, it is said, nearly every representative of the East Riding of Northumberland swept into office on the sure promise of the Murray Canal. But following electoral victory the pledge was forgotten. The first sod, however, was turned on this project on August 31, 1882, and the canal was ultimately completed.

As early as October, 1783, a Lieut. French headed an exploratory survey party in the Rideau Lake country as far as the Ottawa River. His report, likely the first one written that foreshadowed the establishment of an artificial waterway connecting the Ottawa River and Kingston by the Rideau Lakes, preceded by ten years an investigation by John Stegman. In 1793 Stegman surveyed in an area later covered by the four townships, Osgoode, Gloucester, North Gower and Nepean. A Rideau River country legend, rooted in questionable premises, told how Stegman, just before his death by drowning, planted his last survey stakes near Dow's Great Swamp, now Dow's Lake in central Ottawa.

Not until 1809 did first signs of settlement appear in the proximity of the junction of the Rideau and Ottawa rivers, on the south bank. Ira Honeywell, Braddish Billings and Nicholas Sparks located in small clearings, facing a sea of oaks, elms, beech and hemlocks. What was eventually to become the central area of Canada's capital city was then mostly forest, beaver-meadow or swamp. Sparks' farm extended across what is now

MAP 30. A fortification survey of the Niagara Frontier from sketches by Capt. Stotherd and Lieut. Price, R.E., and Lieut. Halet, 1st Battn. Grendr. Guards, in 1862-63. Courtesy of the Public Archives of Canada.

the heart of downtown Ottawa. Across the river from the "curtain" falls marking the descent of the Rideau into the Ottawa, American-born Philemon Wright (1756-1839) provided pioneer leadership in colonization and other activities. Wright, a Massachusetts stock-breeder, became interested in purchasing four townships in the vicinity of modern Hull. These townships were Hull, Rippon, Harrington and Grandisson. In March, 1797, on coming to inspect the land involved in this deal, Wright found that only Hull township was suitable for settlement. In the following month he filed a petition at Quebec City for a warrant of survey. But not until four years later was official action taken in the matter. In 1801 Wright was engaged to make a plan of Hull township and during the year following he claims to have surveyed the entire area "placing 377 square posts in a township of 82,429 acres". In all likelihood Wright meant that he employed surveyors such as P. H. Smith.

Philemon Wright was exceedingly active in other fields as well. He constructed the first Aylmer Road and built the first steamboat to ply the Ottawa River. A quarter-century later he played a valuable role in the construction of the Rideau Canal. He represented his county in the Legislative Assembly of Lower Canada from 1830 to 1834. As settler, surveyor, colonizer, entrepreneur and man of affairs Wright accomplished much, in 40 years, to help transform a primitive place into the most important, lively and productive community on the north bank of the Ottawa, from the river's source to its mouth near Montreal.

Surveys other than those of Lieut. French and John Stegman contributed to the shaping of the destiny of the then nameless settlement on the south bank opposite Hull. From April to June, 1816, Lieut. Joshua Jebb, R.E., examined and reported on the Rideau River country. In 1824, Samuel Clowes, instructed by an Upper Canada government (Macaulay) commission to conduct a survey in the region, reported his findings. His report was forwarded to London, England, through the Governor General, in 1825. The Smyth commission, appointed by the British government, accepted Clowes' line and his calculations of levels involved. The commission recommended that a canal be built, primarily for the transport of troops and military supplies along the proposed route, relatively unexposed to U.S. aggression.

Developments followed swiftly on the tendering of this advice. Lieut.-Colonel By of the Royal Engineers was selected to take charge of the Rideau Canal project and to utilize all efficient methods to push it to a speedy conclusion. He landed at Quebec on May 30, 1826, and at the proposed canal terminus on the Ottawa, on September 21 of that year. When By arrived on the Ottawa site Philemon Wright, still a fine figure of a man at an upright six feet, had reached the age of 70. MacTaggart, Col. By's Clerk of Works, reached Bytown, as it was called in honor of the officer in charge of the canal project, in October, 1826.

Two companies of Royal Sappers and Miners, of 81 men each, arrived and camped for a time under canvas on Nepean Point. MacTaggart apparently was sufficiently trained to survey alternative routes for the 'Big Ditch'. In June and July, 1827, MacTaggart with 8 men launched his survey. Also in 1827, during July and August, Lieut. Pooley of the Royal Engineers conducted an intensive canal survey. MacTaggart and his party struggled valiantly for three days across a distance traversed today by the canal from the Chateau Laurier to Hog's Back, about 4 miles. Heavy bush and soggy footing forced MacTaggart to wait for the freeze-up. Even so, the deep snows of the winter of 1827-28 made progress very slow over what is now the Glebe area and Ottawa South. His account of this surveying experience has survived.[26]

On September 26, 1826, Lord Dalhousie, Governor in Chief of British North

America, placed in Col. By's hands "a sketch plan of several lots of land" he, the Governor, had purchased for the Crown to serve as "a site of the head of locks and for such villages and other settlements as might be needed to house construction workers". Upper Town, as it was named, was laid out first, in mid-October, 1826. Lower Town was located on Crown land also. Contemporary plans reveal that not only one-half mile of unoccupied property separated the two settlements but also the canal excavation itself.

On August 16, 1827, an occasion significant to our story took place in Bytown when Capt. John Franklin, returning from the Far North of Canada, laid the first stone of the Ottawa locks of the Rideau Canal in a brief, happy and formal ceremony.

Lord Dalhousie had personally selected, after examination on the spot, the site of the canal locks leading into the Ottawa River, and had confirmed his choice by letter dated September 26, 1826. That day might well be regarded as Ottawa's date of founding.

In the face of many hard ordeals, including lethal "swamp fever", a type of malaria that killed many workers, nearly ended By's life and compelled MacTaggart to return, ailing, to England in 1829, the 125-mile canal was finished within five years. In May, 1832, Col. By toured the full length of the newly-completed waterway. But his personal triumph was short-lived. A House of Commons committee at Westminster investigated charges that he had exceeded authorized estimates of expenditure on the project. He was exonerated but anxieties resulting from this cruel and unmerited inquiry doubtlessly helped to shorten By's life. He died in 1836 at the age of 53. Today this historic and scenic canal, although no longer used for the military purposes for which it was primarily designed, stands as a memorial to a man who directed what has been described as "the greatest work of British military engineers to be carried out in eastern North America".* No doubt the canal's initial utility and attractiveness helped to influence favorably Queen Victoria's choice in 1857 of Ottawa, formerly Bytown, as the seat of Canada's government. The settlement had won out over the rival claims of previous centres of government such as Montreal, Toronto, Quebec City and Kingston.

Twenty years after construction work began on the Rideau Canal, an Ottawa Provincial Land Surveyor, Robert Bell, headed a survey party that hewed its way toward the Muskoka River from Bytown. Montreal was then Canada's capital. Kingston had just been incorporated as a city, and Lord Elgin was newly-installed in office as Governor General. If one drew a line between Lake Simcoe across the province in the general direction of Montreal, there would be found, during the period 1820-50, four tiers of townships between that line and the water boundary to the south formed by Lake Ontario and the Upper St. Lawrence. This was a line that stood for a generation as a figurative, if not literal, barrier to economic development northward, while the mainstream of immigrants flowed into the far western parts of the province. Bell's project arose out of a change of government attitude towards more northerly settlement.

Bell was preceded in his monumental survey by Lieut. J. P. Catty, R.E., who in 1819 had made an exploratory survey from Lake Simcoe to the Ottawa River by way of the Madawaska, as well as by Lieut. Henry Briscoe, R.E., and Ensign Holland who surveyed in 1826 from Holland Landing to Fort Coulonge. In 1827 Lieut. Briscoe, Lieut. Greenwood and Lieut. Walpole completed these military examinations that were not so much designed to assess land resources as to find a practical water transport route for troops and supplies. In 1829 Alexander Sherriff, a civilian using maps drawn for him by Indians, journeyed from the Ottawa to the Muskoka River. Whereas reports of military surveyors had been unencouraging, Sheriff claimed, a trifle over-optimistically for his

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*Robert Legget in *Rideau Waterway* (p. 221); also "a masterpiece of early engineering".

time, the existence of "more than a million acres of fine, habitable land".

In any event the government of Upper Canada was beginning to show a constructive interest in the region and in 1835 this resulted in action. A survey party was launched, headed by Lieut. J. Cathew, R.N. and Lieut. F. H. Baddeley, R.E., assisted by a Mr. Hawkins, P.L.S., instructed to establish a base line running north through the centre of Muskoka and Parry Sound districts to reach Lake Nipissing. Explorations were also to be made of all large rivers flowing into Georgian Bay. The assignment was only partly completed as hardships experienced proved too severe. At one point the party nearly starved to death. Their reports disagreed with Sherriff's favorable conclusions.

But the tide of immigration continued to run strongly and pressure to open up more northerly areas in the province for settlement resulted in the active exploratory surveys of the mid-century era. One of the most important of these projects was headed by Robert Bell who later became a pioneer newspaper publisher, a railroad director and a member of parliament. He and his survey party left Bytown on August 9, 1847, and on August 25 had reached the Madawaska River. Bell started his survey line on the north bank of the river at a point determined by astronomical observations. Here his party divided, Bell surveying westward and John J. Haslett, P.L.S., travelling eastwards. Haslett had served his apprenticeship with Joseph S. Peterson, P.L.S. of Belleville, the man after whom the colonization road was to be named. On February 15, 1848, Bell completed his survey line about a half-mile beyond the junction of the north and south branches of the Muskoka River. On May 18 Bell and his party arrived back in Bytown. In 1850 Bell surveyed the route of the Ottawa-Opeongo colonization road. His line was not used as a road route, however, as the government favored the Peterson Road some 8 miles further south and running roughly parallel.

In 1849 Robert Bell became sole proprietor of a weekly publication in the Ottawa Valley known as *The Packet* and on February 22, 1851, changed its name to *The Citizen.* When Bell was elected to Parliament in 1861, representing Russell riding, he sold *The Citizen* to J. B. Taylor who published the first daily *Citizen* in 1865. During the 1850s Bell was also a director of the Bytown and Prescott Railroad, the first train of which reached Bytown on Christmas Day, 1854. In the following year Bytown became Ottawa, and the railroad was re-christened accordingly.

In 1854 John A. Snow, P.L.S., was instructed to survey the upper York River, a branch of the Madawaska, and its tributaries. This was the John Snow who, 15 years later, would prove to be a storm-centre in the serious troubles of the Red River Settlement. Yet Snow was a map maker of some talent and he drew very interesting maps in 1854 and 1855 which include the eastern parts of Haliburton county.

On November 8, 1852, William Lyon Mackenzie introduced in the Assembly a resolution asking for a survey of the Huron-Ottawa territory. There was a flurry of activity in road-building and in the surveying of the "back country" in 1857 and 1858. The Bobcaygeon Road and Peterson Road were pushed forward energetically and most of the outlines of three northern tiers of townships in Haliburton county were surveyed by Michael Deane, John Lindsay and J. W. Fitzgerald.

Early in 1859 a decision was made on the highest government level to open up the Huron-Ottawa country for settlement. This development was followed by another of major significance to the future of the area, the incorporation in 1861 in London, England, of The Canadian Land and Immigration Company. The date, April 15, coincided closely with the outbreak of the American Civil War, a conflict that was to have a considerable bearing on the fortunes of the newly-formed company. The story of this company and its settlement program, a corporate venture destined for liquidation some

28 years later, and of Alex Niven, a surveyor who was to play an important role in its affairs, is told in a subsequent chapter. It is sufficient to note here that the peopling of Haliburton region was influenced to a considerable extent by the survey and construction of at least four government-financed colonization roads, the Bobcaygeon, Peterson, Victoria and Burleigh Roads.

J. W. Fitzgerald had been one of the several trained men active in the earliest surveying of the Peterborough area. John Huston was another. Under the official seal of Sir Peregrine Maitland a document declared that Huston had been found qualified in the art of surveying land and authorized to practice on October 28, 1820. In April, 1831, we find Huston surveying the road serving Hope, Cavan and Emily townships. Most of the original surveying in Peterborough district took place in 1861. Land closest to large lakes was surveyed first. In his diary of 1860 Fitzgerald the surveyor had some highly interesting observations to make of the Anstruther Lake country:

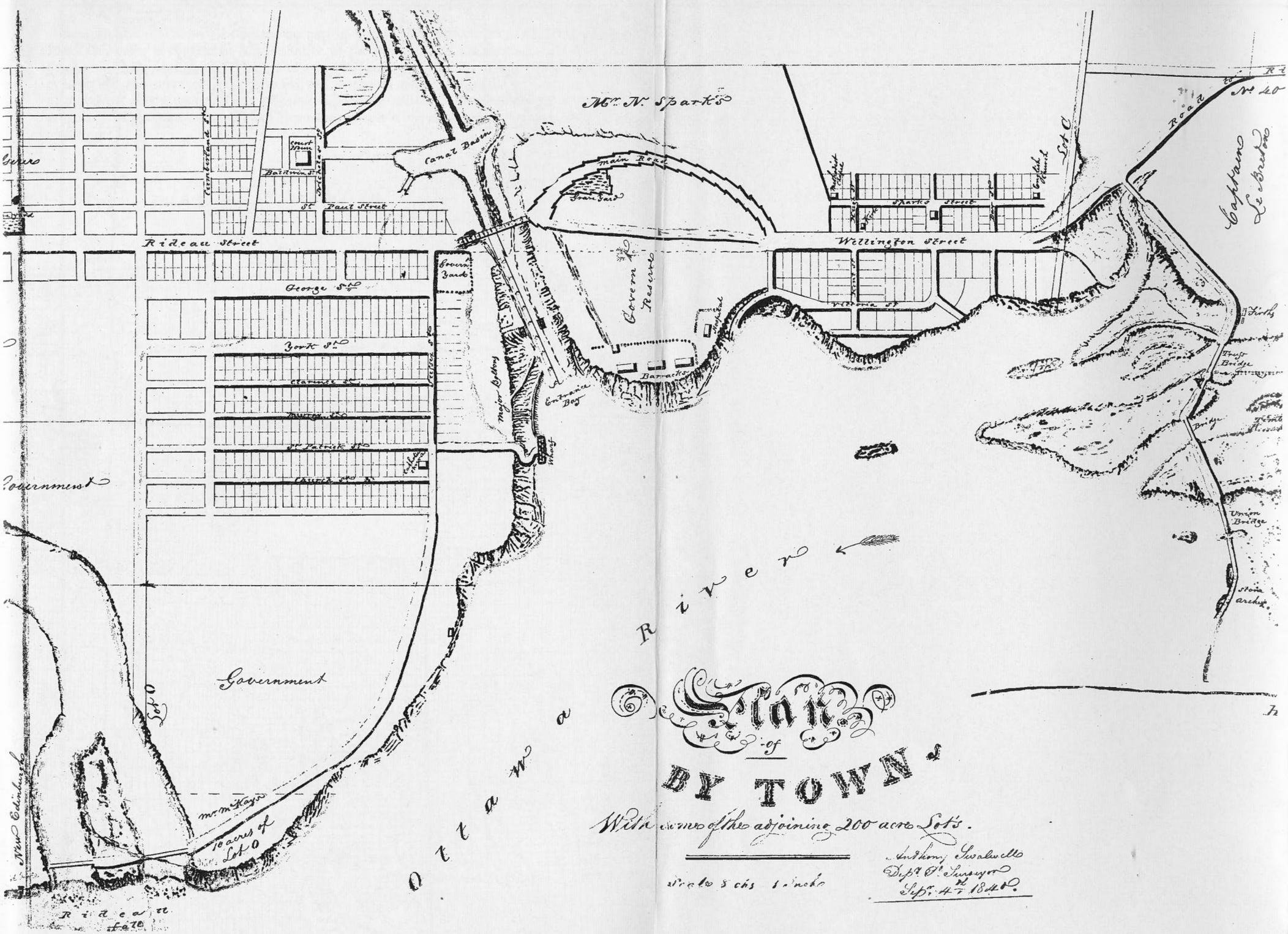
"In passing over a small creek, falling 30 feet from one lake into another, my attention was attracted to what on first sight appeared to be water flowing uphill. On closer examination I discovered swarms of suckers struggling up the current and so densely packed as to completely exclude the banks of the stream from sight. My next thought was to get some of the fish out. After many attempts and contrivances I jumped into the stream to catch them with my hands . . . In this way I and a few men threw out 500 pounds of fish . . . Suckers are capital eating towards the end of April when the water is yet cold".

The sale to the Crown of the Saugeen (Bruce) Peninsula by the Chippewa Indians in 1854 led, in the following year to an order for survey, on a rush basis, of the area involved in the transaction. It was necessary to act furiously fast in order to prepare the lands for settlement. The first lots, in fact, were put up for sale by public auction in the autumn of 1855.

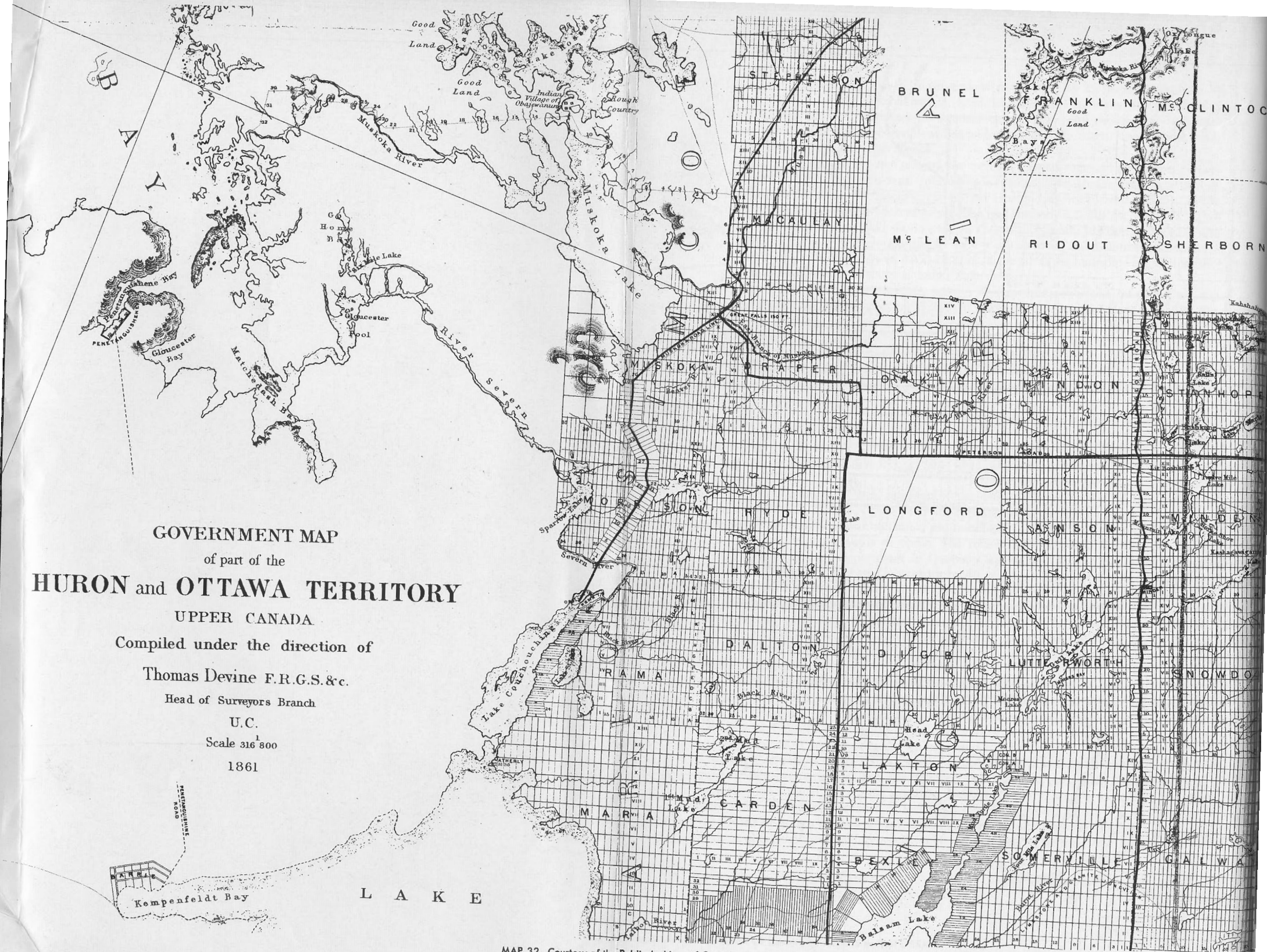
The men chosen for this emergency task were Charles Rankin, P.L.S. and John Stoughton Dennis, P.L.S. A year later in Toronto, John Stoughton Dennis, Jr., would be born. Father and son were to have a profound impact on the development of Canadian surveys generally in the years to come. The instructions issued to Rankin and Dennis came from the Indian Department in Quebec City, in March, 1855. The regular farm lots were to be made 20 chains in breadth by 50 chains in depth, of 100 acres each, with road allowances each one chain wide between each alternate concession and every fifth lot. "If your survey contains an eligible site for a town-plot, mark it on your plan, and report on its capabilities. You will keep a diary, in the form transmitted herewith, containing a detailed account of your proceedings; the number of chains surveyed each day, when you hired and when you discharged your men, and their names; the kind of weather, etc.".

Dennis, throughout these surveys, used a constant magnetic variation of 2 degrees, 34 minutes W. His instructions required him to traverse bodies of water in the townships of Albermarle, Eastnor, Lindsay, and St. Edmunds as well as the shores of Georgian Bay and of Lake Huron. In the mid-20th century surveyors who have had reason to retrace these 1855 survey lines are unimpressed by the quality of the work done. Field notes on this early project have been described as "inaccurate and unreliable". But it must be kept in mind that the 1855 surveys were carried out under the most difficult conditions and under very great pressure. And, as far as is known, no delays in settlement were experienced because of lack of preparatory surveying.

In the mid-19th century Upper Canada surveyors, although they might endure hardships in the field, managed generally to live comfortably in their city residences. The



MAP 31. Plan of Bytown (Ottawa) by Anthony Swalwell, Deputy Prov. Surveyor, 1840. Courtesy of the Public Archives of Canada.



MAP 32. Courtesy of the Public Archives of Canada.

Gibson House in Willowdale, located on part of Lot 18, first concession west of Yonge Street, Toronto, is considered representative of the times and of the profession. It was the home of David Gibson, P.L.S., and was built in the 1840s. From this edifice it is evident that the surveyor of that period was a man of means and social position. It is now preserved as a historical site of some importance and an authentic example of the progress of Canadian housebuilding from the pioneer's log cabin to the modern split-level home.

16

INTERNATIONAL BOUNDARY SURVEYS

"Come here's the map—shall we divide our right . . . ?"
Henry IV (1), Act 3, Sc. 1.

Through the ages man has devoted considerable time and effort to the task of drawing lines calculated to divide up his locality or his world in one form or another. In more modern times he has established grids of lines around the earth by means of which he may more accurately fix points on the earth's surface. Nations, like individuals, have drawn boundary lines to mark off their territories from those of other nations and by manning these borders, warn off trespassing forces. Violations of private property have culminated, all too often, in litigation and violations of national frontiers in wars. With nations, as with individuals, validly founded and physically durable boundary lines, the work of surveyors and mappers, are indispensable to harmonious relationships.

The most satisfactory and most permanent boundaries are those that, in the main, follow well-defined geographic features; are readily recognizable and where residents on both sides of the line are reasonably well reconciled to its presence. The Canada-United States boundary derives its durability not from its connection with definite geographic features but because, on the whole, Canadians and Americans are agreed over its validity.

International boundaries, in their very nature, are the result of compromises, often of the reconciliation of strongly opposing views. Canada and the United States, during the years their territories were taking shape, came close on several occasions to open warfare over boundary differences. Whenever compacts, after due deliberation, were concluded there has been a tendency on both sides to forget feelings of animosity and to live peaceably with the decision. Cooperation across borders has been increasingly cultivated by the people of North America, rather than any nursing of grudges over lands lost through treaties and other settlements.

The road to enlightened agreement was, on occasion, very rough and fraught with grievous dangers to the peace. On at least three separate occasions clouds hung low over

the international horizon as a result of stormy disagreements during which patriotic passions ran high on both sides. In some instances European monarchs were asked to arbitrate outstanding boundary line differences. The position of the Canada-United States boundary achieved at the mid-20th century is the result of nine formal treaties, those of 1783, 1794, 1814, 1842, 1846, 1871, 1908, 1910, and 1925; of five international conventions (1818, 1827, 1892, 1903 and 1906) as well as of a number of exchanges of diplomatic notes.

Canadians and Americans share one of the longest land-water boundaries in the world. Its 5,525.1 miles represent nearly one-quarter of the earth's circumference at the equator. The border between the two countries consists of a series of straight lines, courses of which vary in length from 23¼ inches in the Quebec-Maine highlands to 647 miles of the 141st meridian. The latter course is probably the longest surveyed straight-line international boundary in existence.

The Canada-United States boundary extends from the Bay of Fundy in the Atlantic across the continent to the Pacific by way of the Straits of Georgia and Juan de Fuca (3,986.8 miles) and from Dixon Entrance to Mount St. Elias, thence along the 141st meridian to the Arctic Ocean (1,538.3 miles). More than 125 years of negotiations, arbitrations and treaty-making have been required to establish this boundary to date. From 1783 onwards the work of surveyors and mappers has been essential to the conclusion of agreements worked out by statesmen. This chapter is devoted to an assessment of the value of Canadian surveys and maps to boundary-line bargaining processes and to the settlement of sometimes acrimonious disputes extending from the last part of the 18th century to the time of Confederation.

Unlike the development of borders of European nations the Canada-United States boundary, to a large extent, was drawn on paper in the first instance and then traced on the ground. The early treaty-makers depended mainly upon certain prominent physical features, upon historical usage and geographical coordinates of latitudes and longitudes.

The source of greatest friction over the boundary was ignorance of treaty-makers of the land on which border lines were being imposed. If the statesmen concerned had had the opportunity to view the lines on the ground, rather than drawn on paper, much trouble could have been averted. The framers of the 1783 treaty (Versailles) in selecting the St. Croix River as the international boundary leading inland from the Bay of Fundy, failed to realize that the name "St. Croix" had long ago become obsolete and that even experts in the geography of the region disagreed over the identity of the river to which that name once applied. Similarly on the Pacific Coast the treaty drafters provided that the international boundary should follow "the middle of the channel separating Vancouver's Island from the continent . . ." not realizing that, in fact, there were several channels answering that description.

Those responsible for the various Canada-United States boundary line treaties and conventions were undoubtedly influenced in varying degrees by the claims and disputes arising out of the earliest discoveries in and around the North American continent. There were, for example, conflicting descriptions of the territory of Acadia. In 1638 the King of France awarded the province of Nova Scotia as Acadia to La Tour. Yet 10 years later when Charnisay was made governor of Acadia that area is described not as the peninsula country but all the land from Virginia to the south shore of the St. Lawrence. This uncertainty over the precise bounds of Acadia persisted over the years. Border disputes arose all too readily over the interpretation of treaty terms in which such vagueness was repeated.

One principal ironic condition applied to all these boundary claims and counter-

claims. Britain, when opposing New France from the base of her American colonies, persisted in claims that her territories extended northward to the St. Lawrence itself. Throughout the period of the Treaty of Utrecht (1713-63) Britain considered Acadia and Nova Scotia to extend to the St. Lawrence and maps of that time clearly reflected that belief. But after the capture of Canada and the revolt of the American colonies Britain found it necessary to reverse her previous attitude in boundary arguments and to advocate a Quebec border extending as far to the south as possible.

In practically all the boundary-line surveys conducted on behalf of Canada during the 19th century the British Royal Engineers played an important part. The names of Hawkins, Pipon, Ward, Anderson and others are prominent in the reports of these highly important surveying and mapping activities. But even before the coming to Canada of the first Royal Engineers as land surveyors, certain pioneer boundary measurements had been made.

In 1738, for example, there had been a tentative exchange of letters between the Surveyor General of New York and the Governor of Nova Scotia in which the former urged the British to resist boundary violations by the French. Again, in 1766, Governor Moore of New York suggested to Governor Murray at Quebec that it would be well to locate definitely the 45th parallel. He suggested a joint meeting at the junction of the Richelieu River with the St. Lawrence. In the absence of Governor Murray in England, Lieut.-Governor Guy Carleton kept this appointment, taking with him John Collins, the Deputy Surveyor General. In the surveys that followed, each surveyor working independently of the other, it was discovered that the New York representative had placed his boundary line farther south than had Collins. It was agreed to accept the Collins line. An Order in Council of August 12, 1768, confirmed this line and ordered its extension eastward to the Connecticut River. But it was 1771 before this survey was undertaken. John Collins met Joseph Smith of New York on the shores of Lake Champlain. Before harsh winter weather stalled them the line had been surveyed for 22 miles. Bills for "sundrys" on this survey included items such as "rum and wine (£10 7s 4d); six gallons of French brandy (£2 8s); and Paid to the Cooper for Kegs and drawing off a Cask of Wine at Quebec (£1 1s 7d)". All in all, it is surprising that the line they surveyed was so straight!

In 1771-72 the Governor of Quebec, evidently unaware of the rigors of the continental winter climate, insisted on pushing ahead in March with these boundary surveys. The New York Surveyor General demurred on the grounds that his chronic gout would be aggravated "which would not only Retard the Service but would endanger my life". Accordingly Thomas Valentine (sometimes Vallentine) was chosen as a substitute for the sagacious, if painfully stricken, Surveyor General. His instructions were to run the line with care. Valentine was to "blaze the Trees on the East and west Sides as you pass along, Cuting down only such Trees as stand directly in the sight of the Compass, and at the Distance of every 3 miles lying together in large heaps of stones and cutting a few Knotches on the Trees nighest each pile of Stones".[1]

This eastward-moving survey was completed in September, 1772, and the result of these labors came to be known as the Valentine-Collins Line. When the survey parties reached the Connecticut River they were disturbed by Abenaki Indians who "were much displeased", claiming their hunting grounds were being encroached upon. The anger of the savages with Valentine and Collins took a more positive form when the Abenakis "pull'd down a Post that had been erected on the east bank of Lake Memphremagog". This incident, though a minor one, was a dire portent of a future replete with displays of Indian resistance to the white man's surveys, culminating in Canada in the Red River

troubles of 1870 and the prairie uprising of 1885.

During the 1773 survey season a substitute for Valentine had to be found as the New Yorker came down with "a Billious complaint, attended with a Choke in my Bowels . . . ". It was decided, however, that the boundary line work could not wait upon a cure for constipation any more than on the convolutions of governments. Accordingly a surveyor named Saulthier became the New York representative in running the line westward from Lake Champlain. Collins, apparently fearful that Saulthier might develop sickness on the job, offered to run the line himself the remainder of the distance for £100. Governor Tryon of New York, satisfied with Collins' integrity, agreed. Thus, by 1774, the surveyed boundary line stretched from the Connecticut River to the St. Lawrence River.

Protracted peace negotiations were held at Paris during 1782, leading to the treaty between Great Britain and the United States in the following year, and although the extent of its territory was being decided Canada itself was not directly represented in the discussion. To British leaders of that day Canada remained a sort of unresolved North American riddle. Lord Shelburne, the British prime minister at the time, was not noted for his concern over British North America and his chief negotiator at the peace conference, Richard Oswald, a weak and vacillating diplomat, appeared content to liquidate on any terms what he considered to be a disastrous imperial investment. None of the British negotiators were a match for the Philadelphia printer (Benjamin Franklin), the New York aristocrat (John Jay) or the Boston lawyer (John Adams) who represented the American case.

Franklin at the outset sought all of Canada for the new republic. Oswald thought well enough of this bold proposition to recommend it to Shelburne who at first was inclined to approve the idea. But on reflection the prime minister became convinced that Britain could not thus abandon Nova Scotia and the Halifax naval base. Accordingly the emphasis in the talks shifted to boundaries. Although the negotiators at Paris knew little about the course of the St. Croix River the Americans pressed for the international border along that watercourse. They also advocated that beyond the unmapped river the boundary line ought to proceed directly north to the St. Lawrence River. In this daring effort to sever land communications between the province of Quebec and the Maritime settlements the astute and aggressive American delegates failed.

Gradually the British attitude at the conference stiffened in regard to American demands. Article Two of the treaty, signed on September 3, 1783, reflected this change of heart. It was provided that the boundary would run from the so-called North West Angle of Nova Scotia to the highlands ". . . which divided rivers emptying into the St. Lawrence from those which fall into the Atlantic, to the Northwesternmost head of the Connecticut River, then along that river to the 45th degree of North latitude." From that point the line was to run due west until it met the St. Lawrence River (then known as the Iroquois or Cataraquy) then up the middle of that river to Lake Ontario, through the middle of the Great Lakes "northward of Isles Royale and Phelipeaux to the Long Lake . . . to the most Northwestern Point of the Lake of the Woods . . . and from thence on a due West course to the Mississippi River . . .".

The wording of the first part of Article Two of the treaty followed closely that of the Royal Proclamation of 1763 creating the province of Quebec and of the 1774 Quebec Act as well as the commission given by the Crown to Governor Wilmot of Nova Scotia in 1763. So sparse was the information available to the 1783 treaty makers that they supposed the source of the Mississippi was far enough north so that a line running due west from the North West Angle of the Lake of the Woods would intersect that river.

The 1755 Mitchell map of North America, on which the negotiators confidently relied, failed to delineate the source of the Mississippi but carried the footnote: "The head of the Mississippi is not yet known. It is supposed to arise about the 50th degree of latitude". Possibly this was an educated guess for those times but nevertheless the estimate was about 150 miles in error. David Thompson in 1798 found the head of that river to be at 47 degrees 38 minutes north latitude.

Not long after ratification by both sides of the 1783 treaty it became obvious that surveys of the boundary line on the ground would be delayed by a variety of interpretations of such points as the true location of the "St. Croix River", the whereabouts of the "North West Angle of Nova Scotia", of the "Northwesternmost head of the Connecticut River" and the nature and location of the "highlands"—all mentioned in Article Two. Actually arguments over issues such as these continued for a half-century to come. Even at the time of the Treaty of Ghent (1814) controversy was in its early stages only. When reports began to circulate concerning the unusual fertility of land near headwaters of the Connecticut River, pressures for the solution of these lingering problems began to mount. By 1820 about 50 families of Americans were settled near Indian Stream in what is now New Hampshire. Soon the boundary line question in that vicinity was to develop into a lively, not to say explosive, issue.

Thirteen years passed before the first point of controversy was settled. As there was no river known as the St. Croix during the latter part of the 18th century Nova Scotians claimed that the Cobscook or the Scoodic (sometimes spelled Schoodic) was the river intended to form the international boundary. Americans claimed that the Magaguadavic was, in fact, the boundary river. With the passing of years and the appearance of Loyalist settlements at St. Andrews and St. Stephen the matter was becoming more urgent. Finally, after considerable haggling Jay's Treaty (as it came to be known) of 1794 was signed providing for the appointment of a commission to settle the issue. David Howell was the United States commissioner and Thomas Barclay (1753-1830) of Annapolis, the British commissioner. As Barclay served on several succeeding boundary commissions it is interesting to note that he studied law under John Jay, after attending King's College, New York (now Columbia University). He served with the Loyal American Regiment during the Revolution, attaining the rank of major in 1777. In Nova Scotia, as a Loyalist immigrant, he was elected to the House of Assembly in 1785, becoming its Speaker in 1793.[2]

In 1796 at the first meeting of the commissioners in Halifax, a third commissioner, Egbert Benson of New York, was appointed. James Sullivan was United States agent and Ward Chipman, Solicitor General of New Brunswick, was British agent for the commission. These agents were instructed to have surveys made of the rivers claimed by the opposing sides to be the St. Croix. The surveys were carried out from 1796 through to the end of the 1797 season, resulting in very detailed, accurate maps. Copies of the original surveyors' journals and field notes have been preserved. The survey of the Magaguadavic commenced in October, 1796, by Isaac Hedden, a skilled surveyor employed by the New Brunswick Crown Land Office. John Peters of Maine was the United States representative. The following year, when Hedden's health was poor, Dugald Campbell was appointed in his place. Campbell and Peters, working in the greatest harmony, completed the joint survey in 1797, supplemented by work of another American surveyor, Samuel Titcomb. Maps in Campbell's field book are on the scale of 20 chains to the inch, or 4 inches to the mile, and are beautifully drawn.[3] Results of all the surveys were assembled and compiled in a general map in 1798 by Surveyor General George Sproule of New Brunswick. This map became basic to all subsequent cartography of the rivers surveyed.

Some extracts from the journal of John Peters on the Hedden-Peters surveys of 1796 are enlightening:

"Saturday, October 1: Begin our survey at a point mentioned in our instructions in company with Mr. Hedden and mark two birch trees *1796* and run 187 Rods this day".

"Sunday, October 2: Employed this morning in storing provisions at the Falls and pitching the Tent".

"Thursday, November 3: This day Snow. . . ."

"Friday, November 4: The snow remaining, could not continue the Survey, conclude to return home. . . ."

From the journal written by Dugald Campbell in 1797 we learn:

"Thursday, June 29: In the morning after a still night we observed that the surface of this considerable Lake we have called Loon Lake was generally covered with a yellow scum mixed with flies which gave the water an intolerable bad smell than which nothing could be more offensive, and yet we were obliged to drink of it, as we could not find a spring of water any where around the lake".

"Friday, August 25: having now compleated [sic] the Survey of all the upper branches of the River Magagawdavic [sic] the time arrived at last, for us to take our leave of those woods, which we certainly did without any regret, believing that it is but seldom any party on a similar occasion has undergone greater fatigue. When we undertook this survey we well knew that it would necessarily be attended with a great deal of toil and although in this respect it has far exceeded our expectations, if we are so happy as to merit the approbation of the Agents of His Britannic Majesty and the United States of America under whose instructions we acted, we shall think our pains well bestowed. . . ."

Finally, in September, 1798, following consideration of the survey reports and after listening to opposing arguments, the commission decided that the Scoodic was in fact the historical St. Croix River, described by Champlain.[4] A verifying factor was Ward Chipman's timely excavation of relics of an ancient settlement on Dochet Island in the Scoodic.

By Article Five of the Treaty of Ghent it had been provided that as the North West Angle of Nova Scotia had not been determined nor any part of the international boundary between the source of the St. Croix and the St. Lawrence surveyed or marked, two commissioners should be appointed to determine this line in accordance with the 1783 treaty, and to submit a properly certified map thereof. Once again Thomas Barclay was made British commissioner and Cornelius Van Ness the United States commissioner. Ward Chipman, aided by his son Ward, was appointed British agent and William C. Bradley, United States agent. This commission met at St. Andrews in September, 1816 and in June, 1817 in Boston decided to institute surveys. Accordingly in the seasons of 1817-18-19 a large number of surveys were carried out. In addition, Dr. J. C. Tiarks, a British astronomer, made a new determination of latitude where the old Valentine-Collins line intersected the Connecticut River. Observations made by Tiarks and F. R. Hassler, first Superintendent of the United States Coast and Geodetic Survey (formed in 1807) revealed that the original determination of the 45th parallel as made in 1766 was three-quarters of a mile too far north.[5]

The T. Barclay-J. Holmes commission was entrusted under the terms of Article Four of the Treaty of Ghent with the task of examining and, if possible, deciding finally upon the course of the boundary from the mouth of the St. Croix, through the islands of Passamaquoddy Bay, to the Bay of Fundy. Article Two of the 1783 treaty in part declared ". . . comprehending all islands within 20 leagues of any part of the shores of the United States and lying between lines to be drawn due east from the points where the

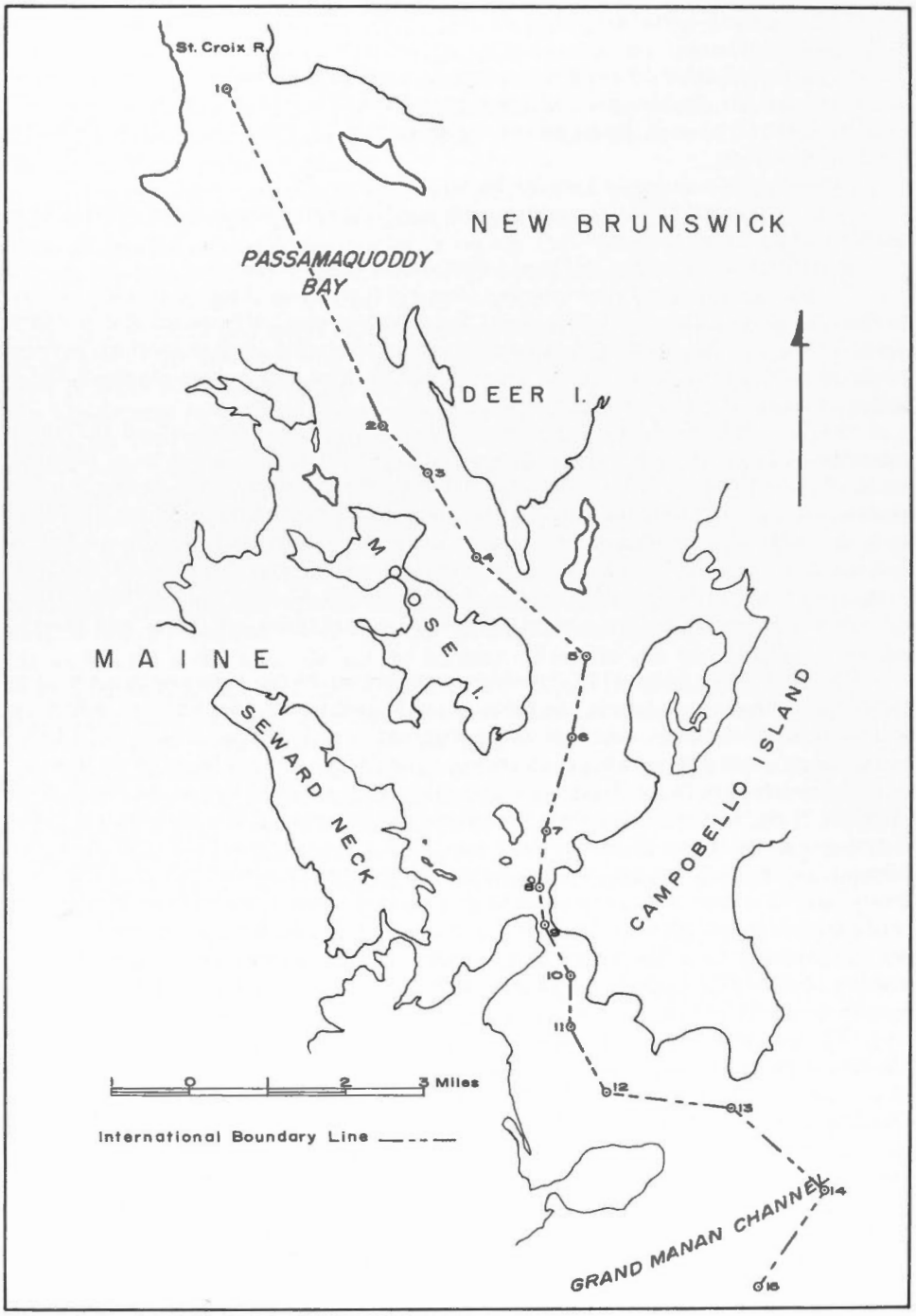


FIGURE 33. International Boundary Line in Passamaquoddy Bay, New Brunswick.

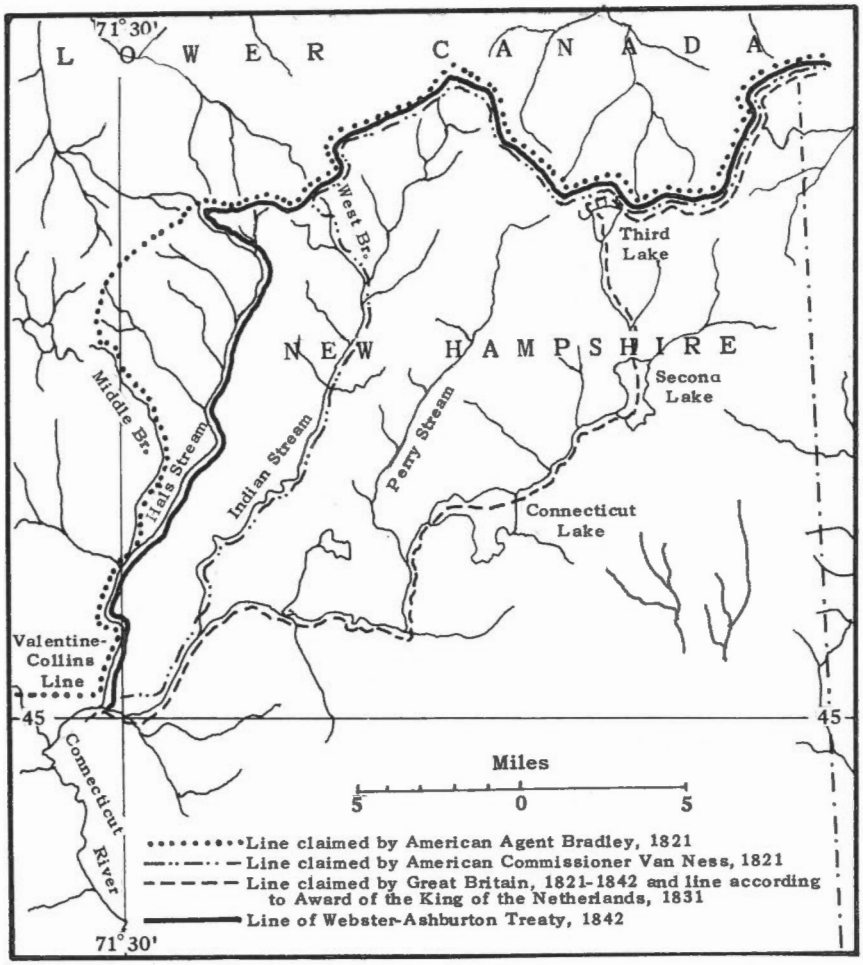


FIGURE 34. Certain proposed Lower Canada-United States boundary lines and the final (1842) treaty line, showing relationship to Indian Stream Territory, New Hampshire, and the northwesternmost head of the Connecticut River. (After Albert B. Corey, *The Crisis of 1830-42 in Canadian-American Relations*. The Ryerson Press, 1941 and courtesy of Carnegie Endowment for International Peace.)

[aforesaid] boundaries between Nova Scotia on the one part . . . East Florida on the other, shall respectively touch the Bay of Fundy . . . excepting such islands as now are, or heretofore have been, within the limits of the said Province of Nova Scotia".

On a modern map it will be observed readily that Grand Manan Island and, in fact, nearly all the islands in Passamaquoddy Bay lie south of a line drawn due east from the mouth of the St. Croix and within 20 leagues of the United States. Thus these islands would belong to the United States except for that saving final clause in Article Two.

Previous to the 1783 treaty Nova Scotia did exercise jurisdiction over some of these islands. The United States, however, claimed Moose, Dudley and Frederick islands. In any case a final decision on the distribution of the Bay islands rested on the identification of the St. Croix River. Following the meetings of 1816 and 1817 a decision was reached

on November 24, 1817, by the commissioners Barclay and Holmes that Moose, Dudley and Frederick islands belonged to the United States and all other islands in Passamaquoddy Bay, including Grand Menan (Manan) and Campobello belonged to Great Britain. No precise surveys of the boundary line in the Bay were undertaken by either nation until 1893.[6]

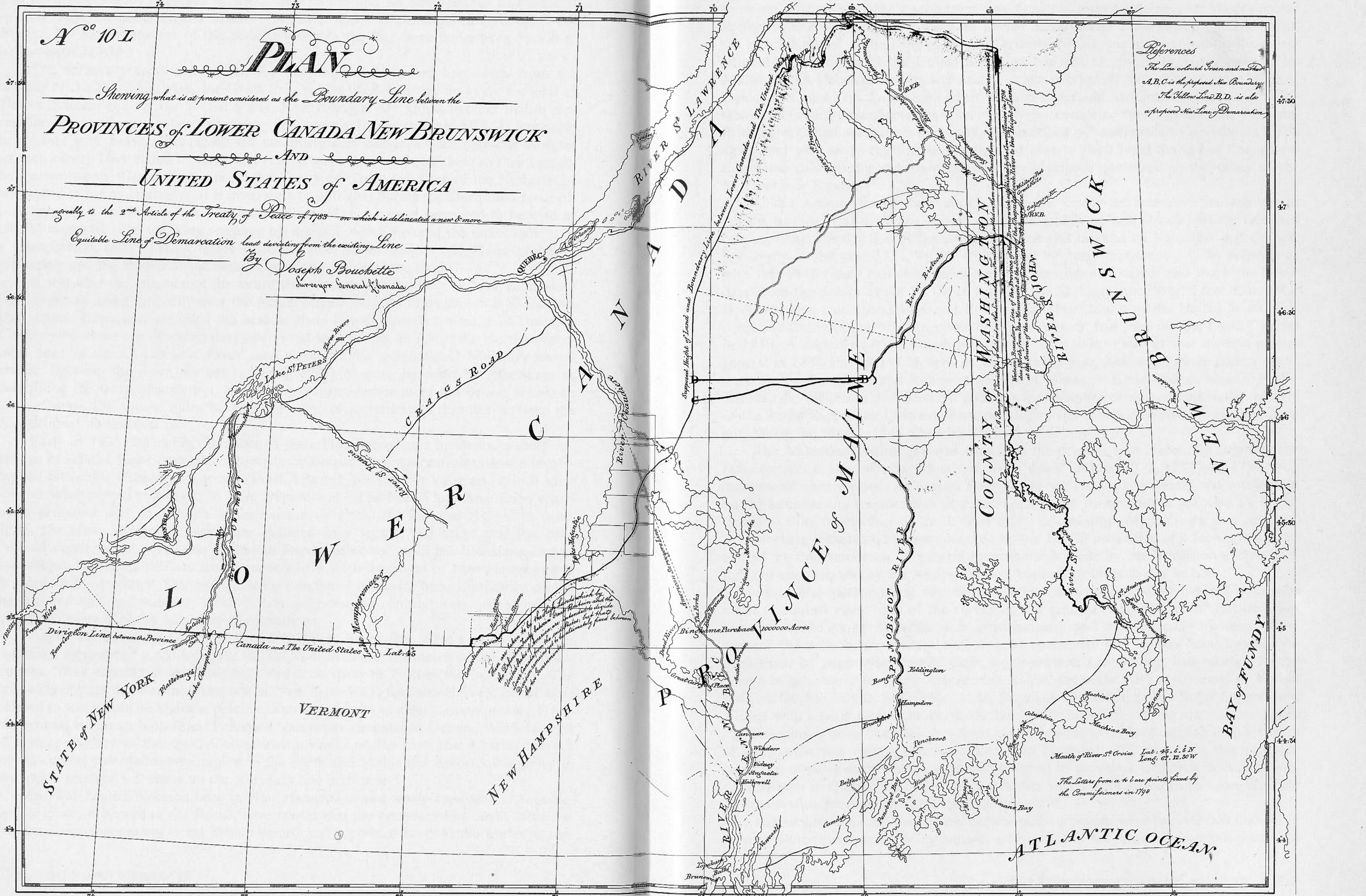
The surveyors appointed to run the international boundary line north from the sources of the St. Croix were, for Great Britain, Col. J. Bouchette, Surveyor General of Lower Canada, and for the United States, John Johnson. Mr. Odell, another British representative, acted on a related exploring line survey. In the summer of 1821 opposing arguments were heard, after which the commissioners delivered their opinions in notes to each other. They failed to agree and reports were then made by them to their respective governments. Under the terms of the Treaty of Ghent the King of the Netherlands was asked to act as arbitrator. It is interesting to note that during the arbitration proceedings only the 1755 Mitchell map and one other (Map A) were permitted to be used as official maps. In 1830 the King rendered his decision which favored the establishment of a conventional, rather than a treaty boundary line. Massachusetts and Maine protested vigorously and the United States Senate accordingly rejected the award.

It was after the rejection of the award that Canada and the State of New Hampshire both began to assert authority over the Indian Stream country in which some 50 families had settled. Canadians regarded the area as their Lower Canada township of Drayton. Controversy arose out of uncertainty over what stream was, in fact, "the Northwesternmost head of the Connecticut River" and therefore the international boundary watercourse. Between the more northerly-running Hall's Stream, regarded by Americans as best fitting the treaty description, and Indian Stream, representing the British claim, an area of some 150 square miles became the scene of jurisdictional disputes between the two national authorities.

Early in 1835, following a number of disturbing border area incidents, a sharp exchange of official views took place through diplomatic channels, correspondence involving the Governor General of Canada (Lord Aylmer), Sir Charles Vaughan, British Minister to Washington, and the U.S. State Department.[7] The British and Americans vigorously protested over the arrests of their nationals within the disputed region. In June, 1835, the New Hampshire legislature declared in a formal resolution that the state "should continue the possession of Indian Stream territory" until the boundary dispute was settled. Governor William Badger ordered the 24th Regiment of New Hampshire to proceed to the territory. During that tense summer war clouds hung ominously on the horizon but vanished suddenly when British assurances of restraint were offered pending a final disposition of the boundary line question.

Again, on February 12, 1839, men from New Brunswick, after a series of border incidents, surrounded a civilian force of 500 from Maine at the mouth of the Little Madawaska. They arrested three Americans and took them to Fredericton in custody. The following day the Lieutenant Governor of New Brunswick, Sir John Harvey, issued what seemed to the people of Maine a proclamation tantamount to a declaration of war. Troop movements began on both sides. President Van Buren despatched General Winfield Scott to restore stability in the area. A truce was arranged on the basis that New Brunswick would control the Madawaska region to the north and Maine the Aroostook country to the south, pending a decision on the boundary line in dispute.[8]

In 1841 Daniel Webster, born in New Hampshire, and newly-appointed U.S. Secretary of State, proposed to the British government that the boundary line ought to be settled by direct negotiation. Great Britain agreed and appointed Lord Ashburton as its rep-



MAP 33. From a copy in the Public Archives of Canada.

resentative. Proceedings opened in Washington, D.C. in April, 1842. By a treaty signed there on August 9, 1842, a settlement was finally achieved. Maine and Massachusetts consented although this treaty gave the United States nearly 1,000 square miles less than the rejected award of the King of the Netherlands! Maine was made a less unwilling participant by a promise of the United States government to pay all expenses incurred by Maine in the bloodless border war and to make a grant of $150,000 in place of land yielded to Canada on the St. John River. Both Webster and Ashburton were strongly criticized for unduly sacrificing the interests of the countries they represented. In some British and Canadian quarters the treaty was described as "Ashburton's Capitulation". The agreement gave seven-twelfths of the disputed area to the United States but Canada retained the strategically important ridge of the highlands commanding the valley of the St. Lawrence River.

Under Article One of the Webster-Ashburton Treaty the boundary line was to run "to the head of Hall's Stream, thence down the middle of said stream, till the line thus run intersects the old line of boundary surveyed and marked by Valentine and Collins, previously to the year 1774, as the 45th degree of north latitude. . . .". In accordance with this 1842 treaty two commissioners were appointed to survey and mark the boundary from the source of the St. Croix River to the St. Lawrence River. Lieut.-Colonel J. B. B. Estcourt was named by Great Britain and Albert Smith by the United States. Estcourt (1802-55) of the 43rd Regiment of Light Infantry, had been made a Lieut.-Colonel in 1839. A member of the British parliament for a term, Estcourt was made a major-general in 1854 and died of cholera in the following year. Assisting him on these surveys were Capts. Broughton and Robinson and Lieut. Pipon, R.E., as well as Messrs. Featherstonaugh, Wilkinson and Scott, in addition to a number of non-commissioned officers of the Royal Sappers and Miners. First meeting of the commissioners took place at Bangor, Maine, on May 1, 1843. On June 1st field work began.

The Valentine-Collins line was found by the original tree blazes. By counting the rings in trees it was calculated that the marks dated back to 1772, 1773 and 1774. Iron monuments were erected. At Rouses Point, however, a stone monument was established on the boundary in the meridian as determined by the transit instrument used by Major Graham, chief astronomer of the United States commission. Maps drawn as a result of these surveys included 62 sheets compiled by the British on a scale of 4 inches to a mile, and 61 by the Americans. A general map was also made by the British on a scale of 8 miles to one inch and by the Americans on a scale of 10 miles to one inch.[9]

At several points along the highlands boundary astronomical observations were made to control guide lines of the survey in this region. The longitude of Rouses Point was determined by the interchange of chronometers, and independently by lunar observations. Other boundary stations were directly connected with Rouses Point by observations made of gunpowder flashes. Capt. Robinson and Lieut. Pipon had taken a special course in astronomy from the Astronomer Royal, Professor Airy at Greenwich. Within sight of Quebec City in September, 1844, Sergeant McGuckin of the Royal Sappers and Miners with a party cleared timber from the top of a high hill, leaving one tall tree standing. Stripping it of its branches they fixed a small pulley to the tree top and then a charge of gunpowder was wrapped, hoisted, and then exploded. This operation was repeated every ten minutes each evening, and was designed to provide a longitude determination. Lieut. Pipon in Quebec City observed the flashes which were found to be more effective for observation purposes than the firing of rockets.[10]

Instruments used by the British commission surveyors were two 30-inch transits; a 15-inch altitude and azimuth instrument, a 12-incher of the same type besides numerous

smaller theodolites, reflecting circles, sextants, compasses, barometers and thermometers. Many of these were manufactured by the London, England, firm of Troughton and Simm.

In the meantime progress had been made in surveying the international boundary line through the Great Lakes system under Article Six of the Treaty of Ghent. Anthony Barclay had been named for Great Britain and Peter B. Porter for the United States as boundary commissioners. They met in February, 1822, in Utica, N.Y. and gave instructions under Article Seven for the surveys from Lake Superior to the North West Angle of the Lake of the Woods. This imposing task required four full seasons of surveying to complete. Most of the surviving records of this project are the work of David Thompson who was selected to be in charge of the Canadian survey party. Williamstown was then Thompson's home. Realizing the need of a light boat for such field work Thompson supervised the designing and construction of such a craft, even to the cutting of the cedar logs.

The surveyors had been instructed to ascertain the position of the Long Lake mentioned in the 1783 treaty and if they failed to find any such lake to locate the chain of waters likely intended by the treaty-makers to govern the boundary. Surveyors made the month-long boat trip by way of the Ottawa River, Lake Nipissing, French River and Georgian Bay route. Inevitable delays required travel from dawn to dusk; the customary routine involved starting just after dawn, paddling for several hours, then going ashore for breakfast. The only other interruption in the day's journeying was time off for a shore luncheon. The crew had no cook and each man's rations were weighed out to him carefully once or twice a week. Reserve food stores were kept under lock. A daily ration consisted of a pound of salt pork or beef, a pound of biscuit and a half-pint of corn or, occasionally, dried peas. On one occasion, so Thompson relates in his diary, his men stole a few pounds of biscuits and a piece of salt beef from him. These rations were supplemented to some extent by fish and game. Once in a while a little sugar or whisky was doled out. Wages of boundary survey laborers ranged from $17 to $20 a month with board. One assistant surveyor hired by Thompson was paid at the rate of £24 7s 6d a month.[11]

These treaty surveys were carried on in the seasons of 1823, 1824 and 1825. In the early summer of the latter year Thompson took ill with dysentery and his son Samuel continued to direct the field party. On August 3rd David Thompson resumed control of the survey. By late September the entire project was completed and in early October at Sault Ste. Marie the survey equipment was sold. The transaction brought little cash as the bidders possessed slim financial resources. During the busy 1825 season Dr. Tiarks, the British astronomer, proceeded to the Lake of the Woods to select the Northwesternmost Point or Angle. Apparently on the basis of previous surveys by David Thompson it had been decided that the point should be either at what is now Kenora or at the northern part of the bay now known as the Northwest Angle Inlet. The question was decided by Tiarks in favor of the latter on the principle that the northwest point was that which, if a line were drawn in the plane of a great circle—thus forming an angle of 45 degrees with the meridian—would cut no other water in the lake. He determined the relative position of the alternative points by means of their latitudes and longitudes, the former being fixed by use of a sextant, the latter by the use of several chronometer determinations. This point was located at 49 degrees 23 minutes and 55 seconds north latitude and 95 degrees 14 minutes 38 seconds west longitude. Maps and reports were submitted at New York in October, 1826. The commissioners failed to agree completely and submitted separate reports to their respective governments. The maps thus compiled were used in the Webster-Ashburton settlement of 1842 when the boundary line in that region was finally defined.

At a time when field work was getting under way on the delineation of the New England-Quebec boundary, a border crisis was fast developing on the other side of the continent. The United States had won the race for the effective settlement of the Oregon country. By May, 1844, the Democratic Party in convention adopted a declaration calling on the United States to claim ownership of all territory in the Pacific Northwest as far as 54 degrees 40 minutes north latitude. This declaration was popularly interpreted in the jingoistic party slogan "Fifty-four forty or fight". This may be the only election cry ever created to make use of a latitude description.

Many feared the outbreak of hostilities but saner thoughts prevailed. President Polk, elected at least in part on the basis of that aggressive platform assertion, deemed it his duty, nevertheless, to arrive at a peaceful solution. In June, 1846, the British Minister to the United States, Hon. Richard Pakenham, forwarded a draft treaty to the Secretary of State in Washington, D.C. This text quickly won Senate approval and the pact, now known as the Oregon Treaty, was signed on June 15, 1846. Canadians had little if any voice or influence in the shaping of these far-reaching developments.

Extensive gold finds in the interior of British Columbia and the resulting influx of American miners in large numbers emphasized the pressing need for an international boundary line located and marked on the ground and in channels in conformity with Article One of the 1846 treaty. Just ten years after the Oregon pact, on August 11, 1856, Congress provided for the appointment of United States representatives on a joint boundary commission, Archibald Campbell being the chief delegate. On June 17, 1857, the American party sailed for Victoria to meet Capt. James Charles Prevost, commander of H.M.S. *Satellite,* aboard his ship in Esquimalt harbor, and for a second meeting on the *Satellite* at Nanaimo three weeks later. Both meetings proved abortive, however, due to the delay in the arrival of Capt. George Henry Richards of the British survey steamer *Plumper.* However, when he did finally arrive on the scene Capt. Richards cooperated fully with United States Coast and Geodetic Survey in making a complete survey of all islands and channels along the proposed boundary route.

It was not until the summer of 1858 that the British commissioner for the survey of the Pacific Northwest land boundary, Col. John Summerfield Hawkins of the Royal Engineers, arrived from England. He had the assistance in the field of Capt. Robert Wolseley Haig, astronomer, and of Lieut. Samuel Anderson, R.E., secretary to the British part of the commission. Col. Hawkins appeared to be at ease whether he was interviewing or corresponding with men in the highest government circles in London and Washington, D.C. His letters to the Secretary of State for Foreign Affairs in London and to the U.S. Secretary of State as well as to the British Ambassador in Washington reveal competence as a field party leader and an exceptional ability and readiness to discuss his boundary survey problems with men at the summit of public affairs in his day.[12]

At a joint meeting attended by Hawkins and Campbell, the U.S. commissioner, it was agreed that it would be inexpedient to undertake to mark the entire boundary through dense forest by cutting tracks. Rather the decision was to ascertain points on the line by astronomical observations at convenient intervals and to mark such astronomical stations by cutting a track not less than 20 feet in width on each side of the line for a half-mile or so. The cost of the United States surveys in this region was $1,463 a mile or a total of $600,000.[13] Because excitement in the interior over the gold discoveries was growing rapidly at the time of Col. Hawkins' arrival in British Columbia there occurred large, not to say embarrassing, increases in the cost of supplies for field survey operations. These were reflected in the official record of British survey expenses.[14] Work continued over several field seasons until the line was run from tidewater to the crest of the Rockies

along the 49th parallel. The United States field work was completed in 1861 and that of the British section early in 1862. The final joint meeting of the commissioners took place in Washington, D.C., May 4 to May 7, 1869. On June 23, 1871, Sir Edward Thornton, British Minister to Washington, sent to the State Department an atlas of the newly-surveyed northwest land boundary. The maps were made by the British Ordnance Survey under the supervision of Capt. Parsons, R.E., and Sir Henry James, R.E.

Campbell's report to Washington on the U.S. surveys was lost under mysterious circumstances and never found. By coincidence the British report to London also disappeared from sight. It was not until 1898 when the distinguished Canadian astronomer and surveyor, Dr. Otto Julius Klotz, was visiting the Royal Observatory at Greenwich that he discovered, quite by accident, the missing British records in an Observatory storage room.[15]

A brief period of relative tranquillity prevailed in the border region following the treaty settlement but in 1859 a crisis developed over the ownership of San Juan Island in Georgia Strait. The treaty-makers, unaware of the actual geography of the region, had specified that the boundary should follow "the middle of the channel which separates the continent from Vancouver's Island". What they failed to realize was that several channels existed which could meet the specifications of the agreement. In 1859 when a trespassing, garden-raiding pig of English ownership on San Juan was shot and killed by an offended American neighbor, the owner of the dead animal threatened arrest of the shooter. But the American insisted on being tried in a United States court. Feelings were aroused among the island's inhabitants and the military commander of the U.S. Oregon Department ordered troops to occupy the island. British men-of-war appeared in the waters off San Juan. Once again General Winfield Scott was named trouble-shooter by Washington. With the aid of Rear-Admiral R. L. Baynes he persuaded Vancouver Island's irate Governor Douglas to agree to joint U.S.-British occupation of the island until the issue of sovereignty could be settled. Nevertheless, despite the careful surveys of 1857-58 there was no joint agreement on the water boundary line.[16]

By the Treaty of Washington, May 8, 1871, this inability to concur was recognized; note was taken of the fact that the British claimed Rosario Straits as the "middle channel" of the 1846 treaty whereas the United States claimed Canal de Haro to be the channel to which the negotiators referred. By this treaty the contending parties agreed to the arbitration and award of Emperor William I of Germany. On October 21, 1872, the Emperor decided in favor of the contention of the United States. This award rang down the final curtain on the prolonged drama that began in the "Year of the Pig" on San Juan Island.

In a protocol signed at Washington in March, 1873, by U.S. Secretary of State Hamilton Fish, Sir Edward Thornton and Rear-Admiral J. C. Prevost, the Canada-United States Pacific boundary line was finally established. The chart on which the line is defined is titled, "North America, West Coast, Strait of Juan de Fuca, and the channels between the continent and Vancouver Island showing the Boundary line between British and American Possessions, from the Admiralty surveys by Capts. H. Kellett, R.N., 1847 and G. H. Richards, R.N., 1858-62". Early in the 19th century this line was to be more accurately defined and marked.

East of the Rockies boundary surveys along the 49th parallel of latitude commenced in 1872 and required several field seasons to complete. These and other boundary surveys are described at a later stage in this history. In 1825, on February 28, a convention was signed between Great Britain and Russia setting forth the boundaries between their respective areas of operation in the Pacific Northwest of North America. When Alaska was

purchased by the United States from Russia in 1867 the description of the boundaries of Russian possessions in America were taken practically direct from the 1825 convention. The significance of this latter agreement in relation to Canadian boundaries with the United States is dealt with later in connection with the development and ultimate resolution of the Alaska boundary dispute that raged in the declining years of the 19th century and into the opening years of the 20th century.

It is sufficient to quote at this juncture the concluding words of an editorial article in the Victoria *Colonist* of April 3, 1867: "To Russia the possessions to the north of us are of no political importance, but to the United States they may prove of incalculable value in view of the great and important change that has lately taken place on the continent".[17] This was a timely and perceptive comment on the world-shaping ebb and flow of forces and events just at a time when four Canadian provinces were on the verge of Confederation.

17

LOWER CANADA SURVEYS

In the span of somewhat more than 100 years between 1759 and Confederation, surveying and mapping in Lower Canada were dominated by four highly talented and dedicated men: Samuel Holland, John Collins, Joseph Bouchette, Sr. (1774-1841) and Joseph Bouchette, Jr. (1798-1881). Holland and the senior Bouchette occupied the office of Surveyor General for a total of 74 years. Coincidentally, each of them served in that capacity for 37 years. Neither Collins nor Bouchette, Jr. rose in title above the rank of Deputy Surveyor General yet each substituted with distinction for his respective chief over extended periods of time.

In previous chapters the outstanding achievements of Holland and Collins have been reviewed. The Holland-Collins era came to an end just after the close of the 18th century. The man chosen to succeed Holland was related to him by marriage. The senior Joseph Bouchette's grandfather, Marc Bouchette (originally spelled Bouchet) had come to Canada from St. Malo, France, early in the 18th century. Marc's only son was Jean-Baptiste (1736-1804), the man who became Commodore of the Provincial Navy of Canada and who made possible Sir Guy Carleton's daring and timely penetration of American lines in 1775 in order to reach Quebec from Montreal by way of the St. Lawrence.

Jean-Baptiste, was the first husband of Thérèse Grenet who, in her second marriage, became Mme François Rolette. Her daughter, Marie Josephte, became Mrs. Samuel Holland. The eldest of Jean-Baptiste Bouchette's children, Joseph, accordingly was a half-brother of Mrs. Holland. Joseph was born in 1774 and at the age of sixteen joined the staff of his (half) uncle, the Surveyor General. It is claimed that Holland and Bouchette worked in the Eastern Townships together on land surveys, with Joseph mainly occupied in sketching. Evidence of this particular association is scanty and such joint participation must have been confined to the season of 1790. In 1791 Joseph sought to emulate his father's example by joining the Provincial Navy. By 1793 his surveying abili-

ties and training were recognized and he was commissioned to conduct a hydrographic survey of Toronto harbor, for which he received the munificent sum of £5 16s and 18d. Lieut. Bouchette described the locality:

"I still distinctly recollect the untamed aspect which the country exhibited when first I entered the beautiful basin, which thus became the scene of my early hydrographical operations. Dense and trackless forests lined the margin of the lake, reflecting inverted images in its glassy surface. The wandering savage had constructed his ephemeral habitation beneath the luxuriant foliage—and the bay and neighboring marshes were the uninvaded haunts of immense coveys of wild fowl—indeed they were so abundant as in some measure to annoy us during the night".[1]

During his service on the Great Lakes J. Bouchette Sr. refloated his father's flagship *Onondaga,* given up for lost. During the winter of 1794-95 he was employed as a draftsman making copies of a map of Upper Canada for which he was paid at the rate of 5 shillings a day. When the Provincial Navy was drastically reduced in 1796 Bouchette was let out but he soon acquired a lieutenancy in the Royal Canadian Volunteers, an army unit. In 1797 he married and in the following year Joseph was born. In 1801 he returned to the staff of the Surveyor General of Lower Canada and about this time was promoted to the rank of Lieutenant Colonel. When Holland died in December of that year, Bouchette was made acting head of the office. Soon he won the complete confidence of the authorites and in August, 1803, was named Surveyor General, an appointment formally confirmed in 1804.

Two years later Bouchette made a survey report on the seigniory of St. Maurice, a survey compiled from direct personal observations, studies by assistants and from documents and maps supplied by seigniors. In the following year he went to London, England, in connection with the better definition of the Canada-United States boundary. By August, 1807, he had returned to North America by way of New Brunswick where he commenced a study of the topography of the British Atlantic provinces. During the 1812-14 war the senior Bouchette was active in the army. In 1814 a committee of the legislature of Lower Canada recommended that he be granted £1,500 in aid of his proposed publication of a map-illustrated catalogue of information on the province. That summer, supported by £500 advance on the grant, Lieut.-Colonel Bouchette again proceeded to England. While in London he was named a special surveyor under the Ghent Treaty provisions in order to work with an American counterpart on the Canada-United States boundary line. A perfectionist, Bouchette took lessons in astronomy in order to improve his qualifications for participating in boundary line surveys. The legislature, in the meantime, had reneged on the balance of its undertaking to finance Bouchette's catalogue of the province. It was 60 years before the house finally reimbursed him but it did so without paying any interest on the long overdue sum.

By 1817 his son had become one of two deputies serving in the office of the Surveyor General during his frequent and occasionally extended absences from Quebec. On February 16, 1819, Joseph Bouchette, Jr., was commissioned a practising surveyor. Later that same year he was designated to draw a plan of Quebec and vicinity. Within eight years this grandson of the gallant commodore was to become Deputy Surveyor General of Lower Canada.

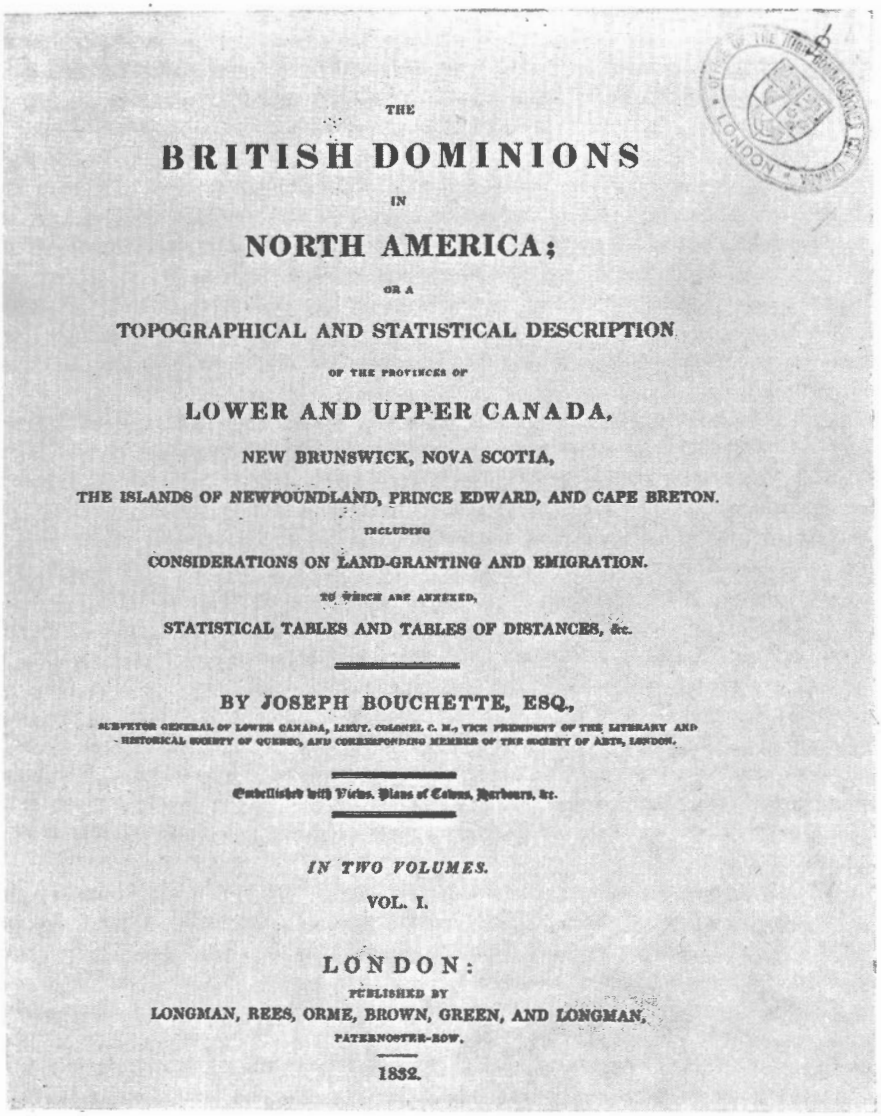
In the spring of 1817 boundary survey operations began in the field and after the erection of a monument jointly with the American surveyor, John Johnson, at the source of the St. Croix River, a line due north from there was established. During the following survey season Bouchette, with his American opposite number, proceeded to establish the international boundary along the 45th parallel when Bouchette suddenly became danger-

FIGURE 35
Joseph Bouchette.

ously ill. His place was taken by Dr. Tiarks for the remainder of that season.

In the meanwhile Bouchette's magnum opus, *A Topographical Description of the Province of Lower Canada (With Remarks upon Upper Canada)* had been published by W. Faden, London, in 1815. The volume was "embellished by several views, plans of harbours, etc.". There was a general map of British North America and parts of the United States as well as a map of Lower Canada on a scale of 2½ miles to an inch. This book was dedicated to George Augustus Frederick, Prince of Wales and Prince Regent of the United Kingdom of Great Britain and Ireland. The future George IV had taken a personal interest in Bouchette's work and received a complimentary copy from the author's own hand at Carleton Palace.

In the Preface the author emphasized the desirability of better maps of his native land: "The interior of Lower Canada being so little known beyond the limits of the province, a belief that a detailed account of it would not only be useful in shewing its present state, but by bringing it under more general notice, might possibly *assist in the development of its vast resources,* has led to the construction of a topographical map upon a large scale and to the publication of the following Book to illustrate the same more fully". (author's italics). Once again in the story of Canada's progress the note is struck recalling the close association of mapping and surveying with the proper utilization of the renewable and non-renewable natural resources of a country.



THE

BRITISH DOMINIONS

IN

NORTH AMERICA;

OR A

TOPOGRAPHICAL AND STATISTICAL DESCRIPTION

OF THE PROVINCES OF

LOWER AND UPPER CANADA,

NEW BRUNSWICK, NOVA SCOTIA,

THE ISLANDS OF NEWFOUNDLAND, PRINCE EDWARD, AND CAPE BRETON.

INCLUDING

CONSIDERATIONS ON LAND-GRANTING AND EMIGRATION.

TO WHICH ARE ANNEXED,

STATISTICAL TABLES AND TABLES OF DISTANCES, &c.

BY JOSEPH BOUCHETTE, ESQ.,

SURVEYOR GENERAL OF LOWER CANADA, LIEUT. COLONEL C. M., VICE PRESIDENT OF THE LITERARY AND HISTORICAL SOCIETY OF QUEBEC, AND CORRESPONDING MEMBER OF THE SOCIETY OF ARTS, LONDON.

Embellished with Views, Plans of Towns, Harbours, &c.

IN TWO VOLUMES.

VOL. I.

LONDON:

PUBLISHED BY

LONGMAN, REES, ORME, BROWN, GREEN, AND LONGMAN,

PATERNOSTER-ROW.

1832.

FIGURE 36. Title Page of Volume One of Joseph Bouchette's two-volume work (London, 1832).

This monumental literary effort was not the only contribution made by the Bouchettes to geographical knowledge of their country. In 1832 Longman and Green of London published in two volumes the Surveyor General's *The British Dominions in North America: Or a Topographical and Statistical Account of the Provinces of Upper and Lower Canada, New Brunswick, Nova Scotia, The Islands of Newfoundland, Prince Edward and Cape Breton with Topographical Maps of Lower Canada and a Geographical Map of the British Provinces in North America.* In the same year Wyld of London published, also by the senior Bouchette, *Topographical Dictionary of Lower Canada.* This work contained a map of Canada on a scale of 3 miles to the inch. At the same time Joseph

Bouchette, Jr. had his map of British North America published in London on a scale of 14 miles to the inch. This was issued in a larger, revised edition in New York in 1846.

The Geological Survey of Canada, according to Logan's Preface to his 1863 Report, found the large 1832 map of Canada especially helpful and Logan commented that the maps of this father and son combination "have served for laying down preliminary sketches of the geology of the older settled and better surveyed sections".

References to surveying are relatively sparse in Bouchette's 1815 work. He describes the Valentine-Collins line as being "irregular in the field, at some places inclining towards the north, and at others diverging towards the south. . . . The correctness of the position of St. Regis is unimpeachable; but it deviates widely from its true latitude at the monument on the Connecticut, which spot is nearly on the meridian of Quebec . . . Proceeding on that [confirmed] datum the boundary line proves to be at the Connecticut an encroachment upon the province of Lower Canada *exceeding three geographical miles*".* (author's italics)

In his 1832 book Bouchette refers to four meridian stones fixed in 1790 by Major Holland on the Plains of Abraham, representing the astronomical north . . . "One of them stood in the angle of a field redoubt where General Wolfe is said to have breathed his last . . . tourists for souvenirs kept breaking off pieces of this stone over thirty years".

Bouchette also pointed out that the primary object for which these meridian stones had been installed had been defeated by the extension of the suburbs of St. Louis and St. Jean, the structures of which impeded the view from one stone to another.

Bouchette drew attention as well to an aggravating situation arising out of the drawing of district boundaries in Lower Canada: "On the north side of the St. Lawrence they are identified with seignioral divisions. But on the south side they are only ideal lines, prolonged to the boundary of the province, not only cutting several townships but even farm lots, placing them in two districts". In too many instances, apparently, persons summoned to attend court hearings had travelled long distances, say to Montreal, before discovering that their attendance was, in fact, required in the district court of Three Rivers! Bouchette argued for a revision of district and county boundaries and suggested a practical remedy.[2]

Bouchette left a notable legacy of maps and plans. These included a plan (1813) of the waterway between Montreal, Kingston and Sackett's Harbour; a plan (probably 1817) of exploration of a line northward from the monument at the source of the St. Croix River . . . in conformity with the Ghent Treaty; his 1815 topographical map of Lower Canada with divisions into districts, counties, seigniories and townships and showing lands reserved for the crown and clergy; his 1815 map of Upper and Lower Canada with boundaries with the United States; his 1832 map of Montreal showing part of Upper Canada and the 1832 general map of British possessions in North America as well as an 1815 plan of "the route from Halifax to River Du Loup".

In 1822 when a Lower Canada Committee was formed to promote the idea of political union of Upper and Lower Canada the senior Bouchette was the only Canadian of French extraction to sit on this body. His sustained enthusiastic support of this cause resulted, ironically enough, in the abolition of the title of Surveyor General of Lower Canada. After union that title was dropped and never used again officially in the province. It was swallowed up in the continuing office and function of the Commissioner of Crown Lands and his department.**

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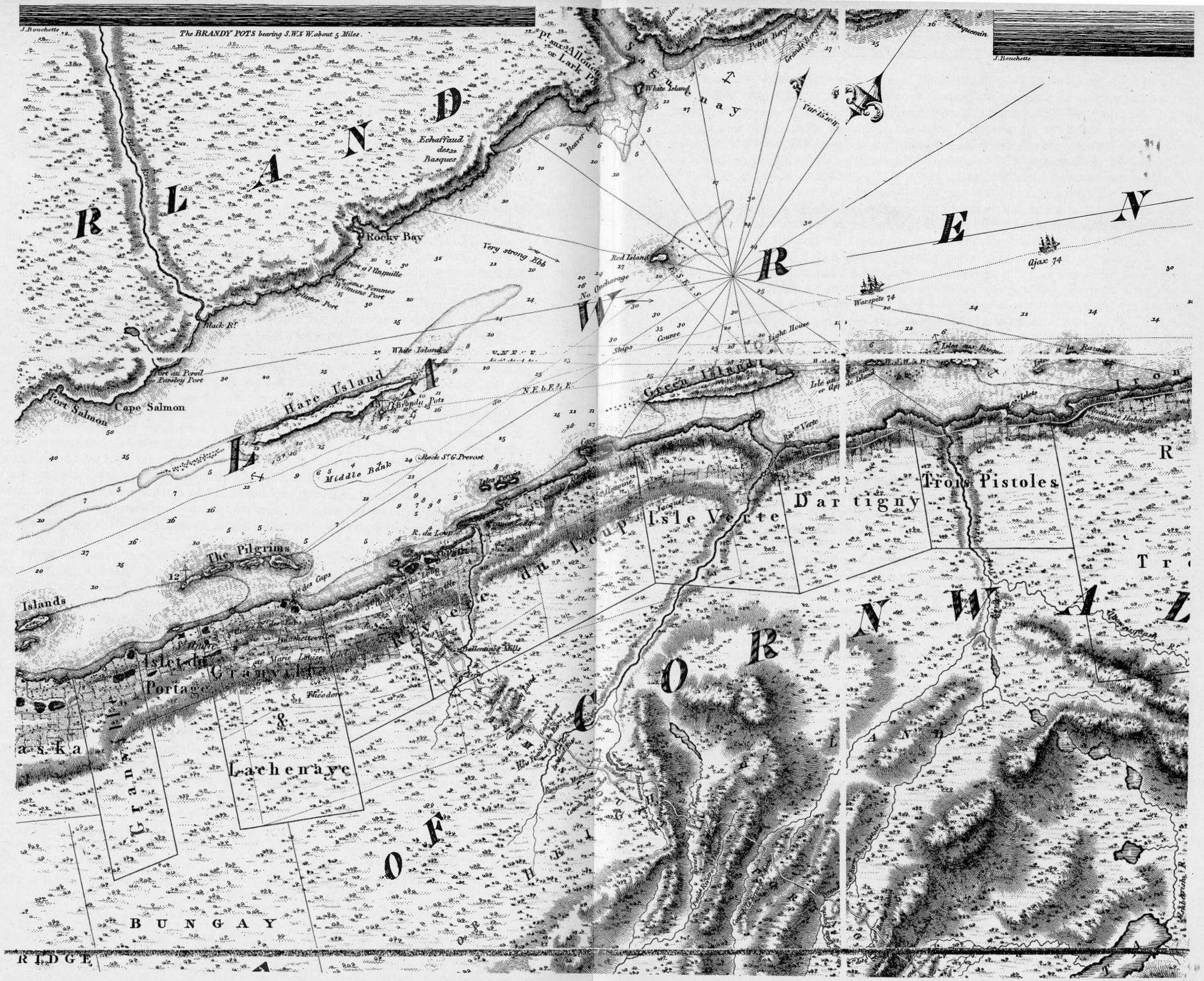
*Page 278 of Bouchette et seq.

**Formally confirmed by 8 Vic. ch. 11, sec. 1.



MAP 34. A section from Joseph Bouchette's map of Lower Canada, 1815. Courtesy of the Public Archives of Canada.

Soon after this development Joseph Bouchette died. His passing on April 9, 1841, was widely mourned. Sir George Étienne Cartier, on the floor of the Legislative Assembly, delivered an eloquent and stirring tribute: (translation) "An eminently distinguished man, Mr. Joseph Bouchette, has done everything for the topography and geography of the land. This man was truly ahead of his century in our country. He provided the Canadian people with a vast store of information which has remained the foundation of their geographical knowledge . . ."[3] A newspaper editorial tribute, in part, reminded readers that "he honestly and faithfully served not less than four sovereigns [George III, George IV, William IV and Victoria] and for his veneration and attachment to constitutional government and for perpetuation of the connection of Canada with Great Britain the late Surveyor General was most conspicuously distinguished".

Today in Quebec City a memorial plaque placed on the wall of a structure at 35 St. Louis Street commemorates his half-century of service in the military and civil service and, in particular, his 37 years as Surveyor General of his native province. Some historians maintain that the plaque would have been more correctly placed on the dwelling across the way, 34 St. Louis Street, his actual place of residence.

Two brothers of Joseph Bouchette, Jr. were on the Surveyor General's staff at Quebec. The names of Jean-François and Robert Shore Milnes Bouchette are listed as clerks in the *Quebec Almanac,* along with William Saxe and others in the 1820s and 1830s. R.S.M. Bouchette, named after a Quebec governor and close friend of his father, worked in 1823 on Canada-United States boundary maps, under the nominal direction of Thomas Barclay. In all there were 25 maps of varying sizes to be copied and Robert writes of the 6-hour work days—"we could not work after sunset when lighting was scarce and expensive". Three months of close application were required to complete the important assignment. Following the 1837 civil disturbances in Lower Canada, Robert was banished to Bermuda, apparently for taking part in the insurrection.

Joseph Bouchette, Jr. served a busy apprenticeship in his father's employ. The excellence of his 1819 plan of Quebec and vicinity led to a request to prepare a plan of the city and port of Montreal, with all harbor improvements. This plan was dated 1824. On May 12, 1827, after some ten years in his father's office young Bouchette, at 29, was named Deputy Surveyor General of Lower Canada and remained in that position after Union and well into the Confederation period despite the disappearance in the meantime of the title of Surveyor General. A Department of Crown Lands memorandum dated June 29, 1867, is signed by him as Deputy Surveyor General. This document pertained to the Ottawa River boundary line between the two Canadas. In 1878 Joseph Bouchette, Jr. retired on pension, dying on February 24, 1881, at 83 years. The regime of the two Bouchettes had extended over 75 years of active administration in the sphere of 19th century surveying and mapping in what had been Quebec, later Lower Canada, then Canada East and finally, the province of Quebec in the new Confederation.

Joseph Bouchette, Jr. had forecast in 1831 that within 50 years British North America would contain ten million persons.[4] His estimate proved to be somewhat generous. Actually in 1881 Canada possessed a total population of about 4,325,000. Nevertheless it was constructive optimism such as that of the younger Bouchette that helped Canada develop into a nation of consequence in the 20th century.

According to the *Quebec Almanac* (John Neilson) there were in Quebec province in 1797 a total of 34 listed surveyors. The list had grown steadily to 50 by 1808. By 1832 the number had reached 100 and remained at about that level for the ten following years. Land surveyors in the Montreal area formed a considerable proportion of all practising surveyors in the province from 1759 to 1867. A representative list of these men

has been compiled and is reproduced here.[5] The bracketed information indicates the period of the most fully recorded surveys of each man: Pierre Arseneau (Arsenault) (1762,63); Pierre Beaupré (1791-1820); Louis Charland (1792-1813); Pierre Dézéry (1792-1800); Jean Delisle (De Lisle) (1768-71); M. D. de Glandons (1796-1802); F. des Dev. de Glandons (1800- ?); François Enouville-Lanoix (1772- ?); François Fortin (1770-73); Joseph Filion (1773- ?); P.-P. Gagnier (1782- ?); Jn. Gaudet (1787-88); Amable Gipouloux (1776-1809); E. Guy (1798-1819); Thomas Guerin (1847); J.-B. Grenier (1770); J.-B. Perrot (1762-74); Jean Pennoyer (1788-1806); J.-B. Plamondon (1735-95); Ignace Plamondon, his son; Joseph Papineau (father of Louis-Joseph) (1773-75); and his son, François Papineau (1791-1821); William Saxe (1797-1825) and Charles Turgeon (1792-1803). Also according to the *Quebec Almanac* there were in 1797 elsewhere in Quebec province (including Upper Canada) a number of qualified active surveyors including William Fortune, Joseph Fortune, James Rankin, John Stegman, Jeremiah McCarthy, Joseph Whitman and William Waller.

Land-survey conditions during the period immediately preceding Confederation are revealed in the diaries of F. W. Blaiklock, a surveyor commissioned on February 20, 1843. On August 7, 1847, he was instructed by the Commissioner of Crown Lands to establish on the ground an exploration line of slightly more than 100 miles in length to the south shore of Lake St. John . . . ". . . through astronomical observations you will determine with the utmost degree of precision the latitude and magnetic variation . . . then follow N.15° W in a straight line until intersection is made with the shore of Lake St. John . . ."[6]

Blaiklock's track was to be marked by tree blazes, careful daily examination of his surveyor's chain in order to keep it accurate for measuring. He had two survey teams of ten men each, in addition to the surveyors and an "explorer". M. Duberger headed one party and Blaiklock the other. The qualified surveyors received 20 shillings a day, the explorer 10 shillings, and chainmen 5 shillings. All were allowed 1½ shillings a day for rations which for the most part comprised biscuits, lard, beans, peas and salt. At the risk of smothering enthusiasm it was stipulated that no one would be paid until completion of the work!

The survey began on September 16. Steady application to the task under most trying conditions was required to complete 41 gruelling miles by Christmas Day, 1847. On October 14 there had been more than a taste of approaching winter when the parties encountered a snowfall of 14 inches. Alternately mild and very cold weather taxed the health and endurance of the men. Some of them suffered frozen feet after wading in ice-cold rivulets and pools of melted snow, only to experience subsequent spells of heavy frost. At first progress was at the rate of a mile a day but even this modest pace could not be maintained. Deep ravines and rugged hills demanded effort to the point of physical exhaustion. On November 2 the teams were threatening to give up working. Somehow Blaiklock persuaded them to remain on the job. By Christmas Day, however, provisions had reached a low ebb. Nevertheless by November 12, 1848, 104¼ miles of line had been laid down and the exacting assignment concluded.

Justice would not be done to the history of surveying in Lower Canada prior to Confederation without reference to the Laurier family. At St. Lin, Quebec, on November 20, 1841, Henri Charles Wilfrid Laurier was born "of the lawful marriage of Carolus Laurier, gentleman, land surveyor — and Marie Marcelle Martinault (Martineau)". This boy became Sir Wilfrid Laurier (1841-1919), Prime Minister of Canada from 1896 to 1911. The boy's paternal grandfather, Charles, was also a land surveyor of considerable prominence. He had surveyed a great part of the ancient seigniory of

Lachenaie. Charles had a pronounced inventive turn of mind and, among other such accomplishments, in 1822 devised a "land log", an ingenious mechanism designed as an attachment to a carriage wheel. In this way it became possible to measure and to register distances traversed by the wheel. The log recorded automatically the number of revolutions of the wheel, the dials indicating leagues and fractions of leagues travelled. Charles appealed to the Quebec legislative assembly for a patent and after the politicians had consulted Surveyor General Bouchette and E. D. Wells, a Quebec watchmaker, the patent was issued in 1826.[7]

Carolus, son of Charles Laurier, was born in 1815. He was a surveyor who also maintained a farm at St. Lin. In 1834 he married an Acadian girl. In his field surveys, which extended from 1842 to 1886, Carolus made many firm friends in the predominantly Scottish-Canadian village of New Glasgow, seven miles from St. Lin. In New Glasgow Wilfrid, at the age of eleven, began attending school and for two years lived with English-speaking families. This experience proved invaluable to him in later life when he entered public affairs. The wisdom of his surveyor-farmer father was more than vindicated.

The coming of the United Empire Loyalists to central Canada and the corresponding need for increased and more rapid property surveys resulted in a marked advance in the legal status of surveying in Quebec. The authorities found it advisable to promote a solid foundation in the form of laws and regulations governing the practice of surveying. The responsibility of the surveyor to the general public was recognized in statutory safeguards against possible abuses or incompetence. Qualifications for admission to the profession were defined and a scale of fees authorized. Penalties were provided for infractions of the law. Even before the senior Bouchette joined Surveyor General Holland's staff, legislation in this field included the 1785 ordinance concerning land surveyors and the admeasurement of lands (25 Geo. III ch. 3) and the 1798 enactment (38 Geo. III ch. 3). In the Bouchette period this pioneer legislation was superseded by a series of statutes on surveying including that of 1817 (57 Geo. III ch. 26) that extended the 1798 act to provide for the establishment of meridian stones by astronomical observations in towns, parishes and seigniories.

A key enactment in this succession of laws was that of 1832 (2 William IV ch. 21) that repealed the 1785 law and provided that applicants for the title of "land surveyor" be duly examined by the Surveyor General or Deputy Surveyor General and four other competent persons, named by the Governor, "as to fitness and capacity, character and the efficiency of his instruments". If the applicant passed all tests he was authorized to practice as a public surveyor and was provided with a certificate to that effect. This 1832 measure, in several respects, may be regarded as the statutory cornerstone of modern Canadian surveying.

By section two of this 1832 act no person could practice as a land surveyor until he was 21 years of age and qualified in regular courses of geometry, trigonometry and astronomy *sufficient to enable him to draw a meridian* and provided that he must serve three successive years as an apprentice. (author's italics) Security had to be given in each instance to the Crown in the sum of £50 and an oath taken to perform survey duties "without favour, affection or partiality". Under a section of this act meridian lines were drawn and marked in or near the cities of Quebec and Montreal and the town of Three Rivers, by which lines surveyors of land were to verify their instruments at least once a year.

In 1841-42 (4-5 Vic. ch. 9) and again in 1849 (12 Vic. ch. 35) amendments to existing laws were made. In the case of the former act it was provided that anyone

guilty of hindering a surveyor in the carrying out of his duties could be punished by fine or by prison term. Between these two legislative developments the 1845 enactment (8 Vic. ch. 11) had consolidated the office and functions of the Surveyor General of Lower Canada with the Department of the Commissioner of Crown Lands under the title of the latter official.

By making improved provision for the admission of a land surveyor to practice, the 1849 measure expedited his transformation into an independent professional man. With the establishment in Upper Canada of the formal apprenticeship system, instituted in Lower Canada in 1832, training was placed on a sounder footing in the newer province. In Lower Canada surveyors were required to keep their survey records (procès verbaux) correctly, to sign and index same. On the death of a surveyor his procès verbaux became part of the public records of civil courts... In Upper Canada property plans were to be certified as correct by a land surveyor and filed in county registry offices. Surveyors in Upper Canada, under this legislation, were required to keep exact and regular journals and field notes of all their surveys and to properly file the same.

The Commissioner of Crown Lands was directed by the 1849 act to procure a standard English measure of length and a standard of the old French measure of length, these to remain in his office for the purpose of comparing therewith the standards to be kept by each qualified surveyor. A brass bar measuring a standard English yard in length, with scale graduations was obtained in 1850 from Troughton and Simms of London. Replicas of this bar, in the form of wooden yardsticks, were supplied to surveyors in Upper Canada until about 1900 when the sticks were replaced by standard steel tapes, 33 feet long. The original brass bar supplied to the Board of Examiners' office in Toronto is now in the keeping of the Association of Ontario Land Surveyors.

All sections of 12 Vic. ch. 35 (1849) inconsistent with the bill passed on August 2nd of 1851 (14-15 Vic. ch. 4) were repealed thereby. This 1851 measure provided for the establishment of separate boards of examiners of 8 members each in addition to the Commissioner of Crown Lands who was empowered to sit on both boards. These bodies passed upon applicants for admission to the practice of surveying. The board for Lower Canada was located at Quebec and that for Upper Canada at Toronto. Apparently the former one-board arrangement was unsuitable for so large a territory and resulted in great inconveniences.

In 1855 by 18 Vic. ch. 83 additional matters involved in examination procedure were covered. An examination before apprenticeship was instituted, the applicant being tested in vulgar and decimal fractions, square and cube roots in addition to geometry and trigonometry.

In 1841 another venerable office in the structure of the civil administration, first of New France, then of Lower Canada, was discontinued, that of Grand Voyer. The functions performed by this official were peculiar to the French-speaking community. The Grand Voyer was an overseer of highways but he was more than that. He not only supervised road building, he selected the route to be followed as well as those responsible for construction of the road.[8] The office of the Commissioner of Crown Lands, however, assumed increasing importance during the quarter-century immediately preceding Confederation. As a rule the commissionership was filled by a man of cabinet rank but seldom was any occupant in the office for long. When Hon. Joseph Cauchon resigned from the position in June, 1857, Sir Étienne P. Taché, although continuing to serve as Speaker of the upper house, assumed the duties of Commissioner until November of that year. He carried the extra load of duties rather than put the country to any additional expense during that period, functioning as Commissioner without pay.[9] Sir Étienne, a descendant

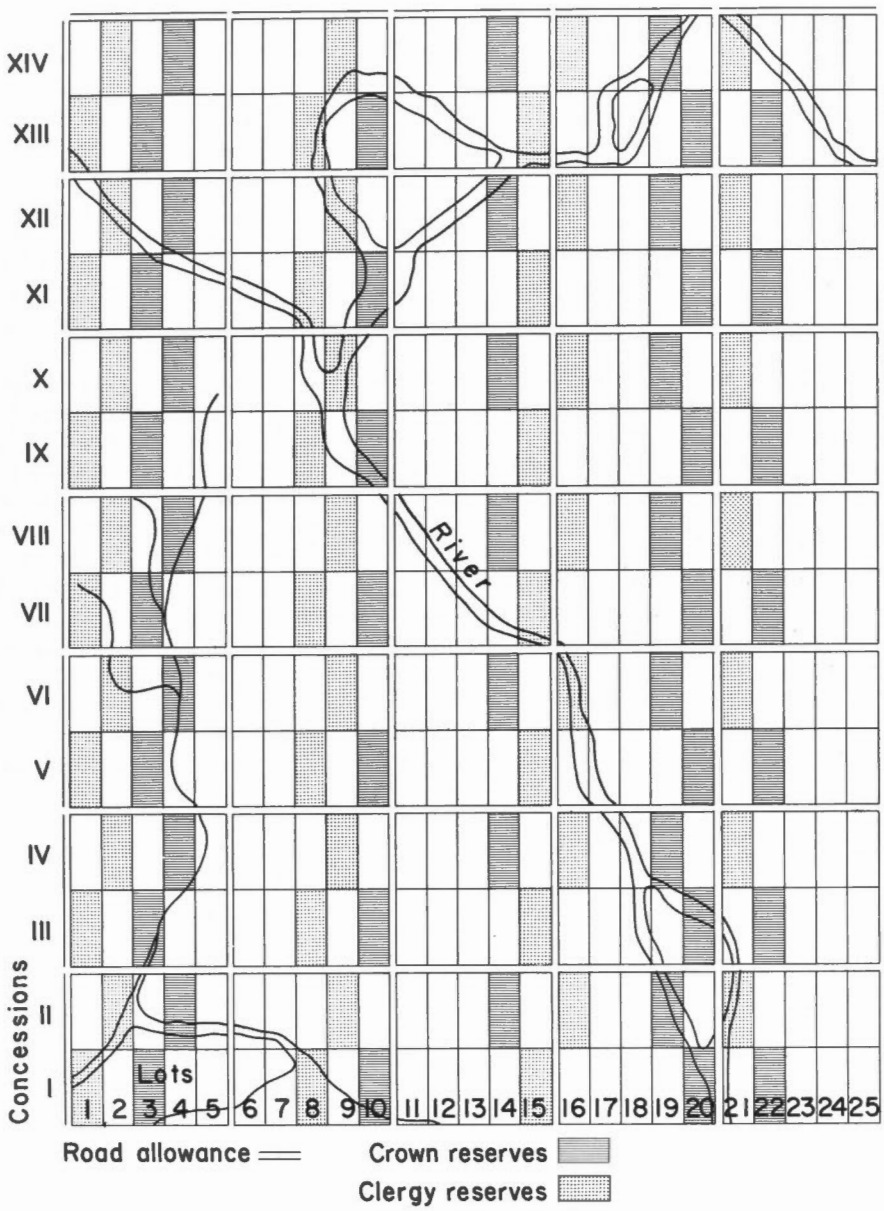


FIGURE 37. Diagram showing pattern of distribution in an average township in central Canada of Crown and Clergy Reserves in accordance with the Constitutional Act, 1791, applicable to Upper and Lower Canada (after *Historical Atlas of Canada*, ed. D. G. G. Kerr, Thomas Nelson and Sons (Canada) Ltd., 1960.)

of Louis Jolliet, presided at the Quebec Conference of 1864 and although he is regarded as a Father of Confederation, did not live to see Confederation become a reality.

About the middle of the 19th century Canadian surveyors had become deeply impressed with the need of membership in an organization of like-minded professional people. In March, 1859, an Association of Architects, Civil Engineers and Provincial

Land Surveyors of the Province of Canada was founded. W. Thomas of Toronto was its first president and George Brown of Montreal its first vice-president. The association faded but it is significant that at one of its early meetings the membership heard a paper from Mr. Hanvey of St. Thomas "On the Allowance to be Made for Curvature of the Earth in Surveying". Minutes of the meeting indicated that such curvature was a definite factor in surveying in Canada "where frequently the first line of survey is run on a true meridian, and the others parallel or rectangular to it". Experience in this form of fraternization convinced surveyors of Quebec province of the advantages of organization on a professional basis. In 1882 by an act passed on May 27 (45 Vic. ch. 16) the Corporation of Quebec Land Surveyors—Corporation des Arpenteurs-Géomètres de la Province de Québec—was founded with M. Charles Baillairgé as its first president.

In 1854 an ancient system and a long-established practice were discarded in Lower Canada. As both system and practice related directly to land tenure in Canada these developments were of interest to surveyors and mappers. Nearly 8 million acres had been granted under the seigniorial system since its first appearance on the shores of the St. Lawrence in the early 17th century. About one-quarter of all these land grants were owned by the Roman Catholic church. Some abuses had developed but nothing like the harsh tyranny experienced in the Old World. From the onset of British rule in Canada this New World version of feudal land tenure was doomed. Most of the agitation for the system's discontinuance came from outside Quebec province. Nevertheless the system was becoming in the 19th century more and more anachronistic. In 1854, after prolonged legislative inquiries the seigniorial system was formally abolished.

"Clergy Reserves", lands "equal in value to the seventh part" of all lands granted, set apart under the provisions of the 1791 Constitutional Act "for the support and maintenance of a Protestant Clergy" had become a bone of contention among the various religious denominations. In addition the reserves interrupted continuity of settlement and made difficult the extension of some roads. This long-standing source of grievances and friction was removed in 1854 when the MacNab-Morin administration passed an act of secularization formally abolishing the system.

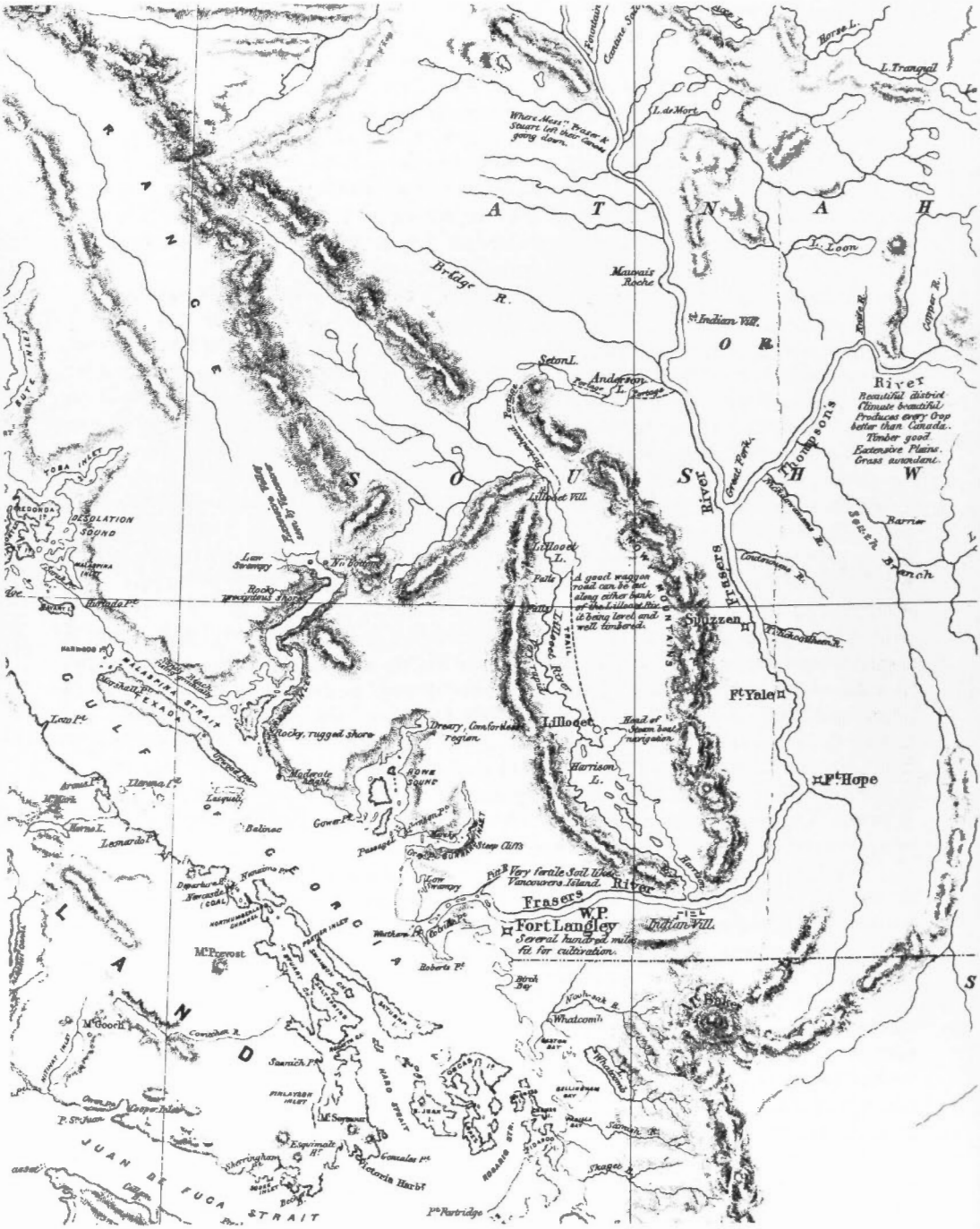
18

EARLY B. C. SURVEYS AND THE ROYAL ENGINEERS

The rugged and richly endowed region west of the Rockies in British North America was generally known among early fur traders as New Caledonia. It was a land as easy on the eye as it was hard on the feet. Unsurpassed vistas of snowy mountain peaks, gleaming alpine lakes, turbulent rivers and impressive fiords greeted the white pioneers. Augmenting the wild grandeur of the territory was the spreading, almost impenetrable, forest. One of the most eminent of the early visitors to this domain remarked in some despair after initial encounters with its jungle-like bush and timber growth, "The woods are magnificent, superb beyond description, but most vexatious to a surveyor and the first dwellers in a town".[1]

For nearly half a century after the voices of Vancouver and Mackenzie and their crews had echoed along its waterways, New Caledonia remained a relatively silent wilderness, its white occupants numbering some 50 white men employed by the Hudson's Bay Company and scattered about in a dozen or so trading posts or forts. But the combination of several apparently unrelated but powerful developments served to transform this scene in the course of the next half-century. The ceaseless search for a Northwest Passage, the commercial lure of sea-otter skins and the desire of ambitious nations to acquire new territories attracted Spanish, English, Russian and American vessels to the coast of what is now British Columbia during the 18th and 19th centuries. Alexander Mackenzie's startling success in 1793 spurred the Northwest Company to venture more boldly into regions west of the Great Divide.

During the first quarter of the 19th century the wilderness was penetrated, by use of river transport, by Thompson, Fraser, Samuel Black and John McLeod. These were the exploratory surveys, indispensable to the ultimate settlement of any new country. In the light of these achievements the Hudson's Bay Company began to increase its active interest in New Caledonia. In these expanding activities an able man of strong character



MAP 35. A section from a map of part of the British possessions to the west of the Rocky Mountains from surveys made by the Royal Engineers in the 1860's. Courtesy of the Public Archives of Canada.

was needed to provide leadership. We have seen how essential to the sound development of other parts of Canada were the contributions of capable governors such as Frontenac, Parr, Simcoe and Simpson. In its coastal frontier work the Hudson's Bay Company found a man in the same heroic mould, James Douglas (1803-77). Douglas was sent by the company to Vancouver Island in the summer of 1842, empowered to select a site for the new Hudson's Bay Company fort, intended as company headquarters west of the Rockies. With Douglas went Adolphus Lee Lewes, English-educated, half-breed son of Chief Factor John Lee Lewes.[2] In 1839 A. Lee Lewes had entered the company's employ as "Surveyor and Clerk for general service" and was assigned to what was then known as the Columbia Department. He arrived in 1840 and it was understood that when Lewes was not engaged in surveying he would serve as a general clerk. The extent of his training as a surveyor remains vague. The Governor and Committee of the company in London, England, had been content to state that Lewes had been "brought up in the land surveying business" and expressed the wish that he might also qualify in nautical surveying while in the Department. Lewes prepared plans of the new fort, formal approval for which was given on June 28, 1842. In the following year Fort Victoria was erected. Lewes retired from the company service in 1853 and died at Fort Vancouver in September, 1856.

FIGURE 38. Birth of Victoria, B.C. James Douglas viewing site for Fort Victoria and Hudson's Bay trading post, Vancouver Island, 1843.

The successor to Lewes as company surveyor was Capt. Walter Colquhoun Grant (1822-61). This Edinburgh-born officer in the Royal North British Dragoons (later Royal Scots Greys) met financial reverses and, unable to maintain his army commission, resigned and emigrated to America.[3] The 26-year-old Scot was offered the post of

Hudson's Bay Company surveyor and arrived at Victoria by way of Fort Vancouver on August 11, 1849. Sir John Pelly had given him his appointment as surveyor, the salary as well as the volume of surveys to be fixed after his arrival on Vancouver Island.[4]

Apparently the salary rate was fixed at £100 a year but Grant's training in surveying proved inadequate and he was eased out of his position, resigning in March, 1850. As early as the previous September, Douglas had advised his own superiors in London, "I fear that Captain Grant has undertaken a duty which the pressing nature of his own affairs will not allow him time to attend to, he has not been able as yet to make any surveys nor can he with prudence absent himself from his establishment, until it is in a more advanced state".[5] At this time, owing to rather restrictive land settlement policies of the Hudson's Bay Company, not more than a score of settlers resided on Vancouver Island.

Mention ought to be made, at this stage, of Capt. Henry Kellett, commanding H.M.S. *Herald* and the tender *Pandora*. In 1846 he carried out hydrographic surveys off the coast of Vancouver Island. The harbors of Victoria, Esquimalt and Sooke were examined by him during the survey season. An interesting sidelight on the progress of position-finding at sea occurs in the narrative of this expedition written by Berthold

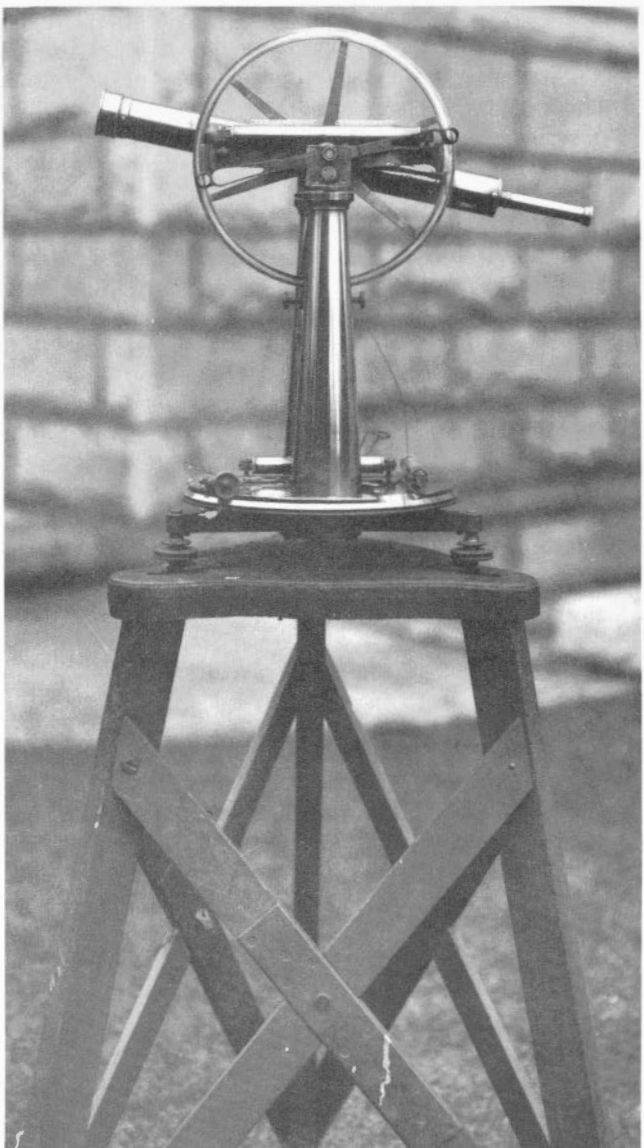


FIGURE 39
Pioneer surveying instrument used on Vancouver Island, c. 1850.

Seeman: "At daylight on [June] 24th [1846] we found ourselves off Cape Flattery rocks; and thus, after a seventy days' passage without seeing land, was our voyage concluded; yet, thanks to our admirable chronometers, we made the land within a mile, a nicety of calculation which in these days is not much to boast of, being performed by three-fourths of the vessels of England and America, as well as France and Holland; but looking back thirty or forty years, the change is immense".[6]

Douglas, in a report on a canoe expedition along the east coast of Vancouver Island in 1852, remarks that he was "struck with the extreme incorrectness of the maps of Vancouver Island". He proceeds to point out that the line of coast "is well delineated, and could be traced upon our maps as far as the promontory named Cowichin Head; but from that point all resemblance to the coast ceases. . ."[7] In view of the importance of the Nanaimo coalfields Douglas stressed the need of a survey of what he called the "Canal de Arro", a series of channels between Vancouver Island and the Gulf Islands.

Captain Grant's successor as company surveyor on Vancouver Island was Dublin-born Joseph Despard Pemberton (1821-93), an excellent draftsman and former professor of surveying, civil engineering and mathematics at the Royal Agricultural College, Cirencester, England. Appointed company surveyor by the Hudson's Bay Company on February 15, 1851, Pemberton arrived at Victoria in June of that year. This event, in effect, marked the inception of cadastral surveys of consequence on the island.

Pemberton's services were in considerable demand. This arrangement continued until 1858 when Pemberton left the service of the company. The following year he was named by royal warrant the first Surveyor General of the Crown Colony of Vancouver Island. Ten years previously the British government, considering it a wise and necessary move following the Oregon boundary settlement, had established the new colony on the island, under the auspices of the Hudson's Bay Company. The first governor of the colony, Richard Blanshard, remained little more than one year. Douglas succeeded him in 1851. Douglas, a former Nor'wester who entered the Hudson's Bay Company employ as a result of the 1821 merger, had been moved to Fort Victoria as the company's agent in the colony. In 1854 Douglas, not a man inclined to offer praise glibly, paid a substantial tribute to Pemberton and to his work. "He has given perfect satisfaction", Douglas declared, "during his residence here, and I may observe that the Compy have made a fortunate selection, and I think it will be difficult to find a person so well adapted for the situation he now so creditably fills, or who will discharge its duties with equal zeal and untiring energy".[8]

Pemberton's early years in office were marked by a lively demand for townsite surveys. In 1858 he completed the survey of Victoria and compiled an official town map. Streets were named after colonial governors, eminent navigators and their famous ships, Arctic explorers as well as after Canadian cities, lakes, rivers and other geographical features. Pemberton Point, Meadows and Portage are three features that recall the surveying achievements of this pioneer.

Pemberton's Victoria surveys involved the allotment to settlers of more or less rectangular parcels of land, with little attention given to running boundaries according to cardinal points of the compass. A highly irregular land pattern was produced with the lots varying from 12 to 840 acres, with no two lots containing the same acreage. By the end of 1858 a few thousand acres had been surveyed in the immediate vicinity of Victoria. By the end of 1860 more than 175,000 acres had been measured out.

But not all of Pemberton's surveying was performed on Vancouver Island. In August, 1858, when the mainland was being opened for settlement, Douglas despatched Pemberton on a mission to lay out new townsites at old Fort Langley, Fort Hope and

Fort Yale. His instructions were to survey as quickly as possible all open districts "so that the country may be laid out for immediate settlement and occupation".[9]

The year 1858 proved to be a turning point of key significance in the development of British Columbia. It brought swarms of newcomers to the colony, an avalanche of formative events and a multitude of administrative problems. The Crown Colony of Vancouver Island had been created in 1849, almost in a defensive frame of mind, as an entrenchment against the spread of American sovereignty. Then in the spring of 1858 the world learned of valuable placer gold finds in the Fraser River valley, as well as gold discoveries in the Cariboo districts, deep in the interior. The strange fever that grips men who have caught glimpses of an Eldorado, raced through the western and northwestern states. It was the California gold rush over again. Before the year ended more than 25,000 American gold-seekers, mostly rough and ready miners, had poured into British territory. Many of these newcomers passed through Vancouver Island's new capital. Douglas saw Victoria transformed almost overnight from a quiet, English-type village into a bustling commercial centre of increasing magnitude. The changes made by this remarkable influx on the mainland colony were even more impressive.

The invasion confronted Douglas with a cascade of harassing problems. The foundations of law and order had to be strengthened. The Governor's voluminous and urgent correspondence with authorities in London during this hectic formative period is both enlightening and eloquent in regard to the needs of the hour. Fortunately for British Columbia and for Canada the Secretary of State for the Colonies at the time was a man of stature, of imagination, ability and understanding. Sir Edward Bulwer Lytton, author of *The Last Days of Pompeii,* had succeeded to the office and was quick to perceive the gravity of the issues involved. He proceeded to take a number of wise legislative and administrative steps to meet the situation. He piloted through the Commons at Westminster a bill to establish on the mainland a new Crown Colony. The bill, as printed for first reading, employed the name "New Caledonia" but before the measure passed Parliament on August 2, 1858, Queen Victoria had bestowed upon the embryo colony the proud title of "British Columbia".

Next, Lytton approached Douglas to agree to become Governor of the mainland colony, as well as of Vancouver Island, on the condition that he sever his connections with the Hudson's Bay Company. Douglas (knighted in 1863 in recognition of his invaluable public service) was sworn in at Fort Langley on November 19, 1858, regarded by some as the official birthday of British Columbia.

In order to provide reliable land surveys as well as townsites essential to permanent settlement and to curb lawless elements, Lytton persuaded the British government to send a detachment of Royal Engineers to the aid of the hard-pressed Douglas administration. In July Lytton wrote to Douglas: "I have to inform you that Her Majesty's Government propose sending to British Columbia, by the earliest opportunity, an officer of Royal Engineers [probably a Field Officer with two or three subalterns], and a company of Sappers and Miners, made up to 150 non-commissioned officers and men".[10] Lytton kept his word. The detachment that arrived in three sections actually totalled 165. Two sections came by way of Panama overland to the Pacific; the third and largest, by way of Cape Horn travelled 15,000 miles in the space of 184 days.

The Crown Colony office of Chief Commissioner of Lands and Works was set up by British authorities and Col. Richard Clement Moody (1813-87) was selected not only to command the Royal Engineers detachment but to fill the role of Commissioner in addition to holding the dormant commission of Lieutenant Governor of the mainland colony. The military unit was not merely one of the 40 regular companies into which the Royal

FIGURE 40
Col. Richard Clement Moody, R.E.

Engineers was then divided. It was a specially picked body of men. Of the two sections that came out by way of Panama, the one headed by Capt. R. M. Parsons consisted of 20 men, mainly land surveyors; the other, headed by Capt. J. M. Grant, consisted of 12 men, mainly carpenters. The third section of some 120 sailed on the *Thames City* and was commanded by Capt. H. R. Luard. Col. Moody made the 57-day journey by way of Panama. In addition to the officers mentioned he was to receive important support from such other commissioned and non-commissioned men as Lieut. Henry Spencer Palmer, Lieut. A. R. Lempriere, Sergeant-Major George Cann, Sergeants William McColl and Richard Bridgeman, Lance-Corporal George Turner and Sapper J. B. Launders.* All of these soldiers took part in carrying out the basic surveys under the instructions of Col. Moody.

The assignment given the Royal Engineers detachment was a grim and challenging one. The new British American colonies washed by the Pacific were remote from any large centres of population in North America. Two thousand miles separated Upper

*McColl, Turner and Launders became civilian surveyors after 1863. Turner became a charter member of the B.C. Association of Provincial Land Surveyors, founded in 1891.

Canada from British Columbia with the exception of the tiny Red River settlements. To the west stretched the world's widest ocean. To the north lay a vast wilderness. The topography and geography of the Far West combined to frustrate governments, impede settlement and baffle surveyors. There were formidable difficulties involved in transporting delicate surveying instruments over hilly and heavily wooded country. "The thickets", remarked Moody in a report, "are the closest and thorniest I ever came across" and Palmer, struggling valiantly through the interior complained that he had outstripped the sufferings of St. Paul.[11]

In the face of such conditions the record of solid accomplishments made by the Royal Engineers on the West Coast commands admiration, if not a form of reverence. Men of the Royal Engineers had already taken a prominent and helpful part in other Canadian survey projects, such as those connected with the construction of the Rideau Canal and in the fixing of the Canada-United States boundary. The Moody contingent fully lived up to the high surveying and mapping traditions established by their regimental predecessors. Officers and men, during their 5-year sojourn in British Columbia, ran its first meridian line, the Coast Meridian; performed important exploratory surveys; surveyed for cadastral purposes the peninsula between Burrard Inlet and the Fraser River; laid out the townsites of the principal communities of the mainland colony; located and constructed lines of all main roads required in their time; drafted and constructed all maps resulting from their numerous surveys, then lithographed and published them; formed British Columbia's first building society; designed its first church and schoolhouse; its first municipal coat of arms and its first postage stamp issue; its first observatory and first systematic meteorological observations. They organized its first Lands and Works Department, its first printing office, publishing the British Columbia *Gazette*. Last but not least, the unit helped to maintain law and order under circumstances not always conducive to that condition.[12]

Political cross-currents and personality clashes complicated tasks already onerous. The manly effort made by Douglas to serve impartially the interests of civil government on the one hand, and of the Hudson's Bay Company on the other, placed him under heavy strains. Lytton was biased against the Company and this attitude did little to alleviate the stresses already keenly felt by Douglas. The Governor was among the few who realized that the 1858 gold rush spelled out the end of the Company's trading monopoly in the Far West. Although at the outset of Royal Engineers' activities in the colony Douglas expressed official satisfaction over Moody and his administration, in time the relationship soured and this unhappy development also added to the Governor's heavy burdens. In a moment of exasperation Douglas declared that the Royal Engineers had become to British Columbia "what the old man of the sea was to Sinbad. . ."[13]

At the root of most, but not all, of the friction that developed in this situation were the well-nigh insoluable fiscal problems confronting Douglas. Lytton made it plain that the new colony was expected to pay its own way from funds derived mainly from the sale to settlers of Crown lands. The Royal Engineers were to receive colonial pay from the Colony administration, the regular regimental pay to be forwarded from England. The cost of land surveys, in practice, dismayed Douglas. By the end of 1859 that cost had exceeded $15,000.

Actually the amounts derived from land sales fell far short of expectations. By 1870 this form of income constituted only one-fortieth of the total revenue of the colony. During the colonial period, revenues gained from the sale of surveyed land and town lots proved insignificant compared to sums produced from customs duties and

road tolls. Considerable official reluctance was shown over the payment of some of the expenses of surveys performed by the Royal Engineers. Judge Matthew Baillie Begbie, for example, lamented in a letter to Douglas in the spring of 1860 that surveyors had "marked and trenched nothing but town lots and suburban lots, in four localities of the colony — New Westminster, Douglas, Fort Hope and Fort Yale".[14] It was about this time that Douglas threatened to terminate the duties of the Royal Engineers if heavy bills such as those arising from the Fort Hope survey project continued to come in for payment. To add to his frustrations Douglas experienced constant delays and evasions in obtaining accounts of expenditure from Col. Moody's friend, Capt. Gosset, Treasurer of the Colony, who was also in charge of the commissariat of the Royal Engineers!

The reverse side of the coin presented an equally distressing picture. With expenses severely curtailed the plight of the Royal Engineers surveyor in the field became acute. Palmer, for example, travelling from Bella Coola River to the Fraser River, requested instructions from Moody as to "whether I am to stop work when the £350 is finished, or go on. I scarcely think I shall be able to do all the work that is laid down, either in the season or within the £350".[15]

Col. Moody replied to the Governor's complaints over expenditures with demands for more instruments. "It is obvious", he reported, "that without sufficient Instruments the progress of the survey of allotments in this wooded region, so thickly entangled with under-brush, must be extremely slow".[16] At this stage there were 16 Royal Engineers employed on survey duties. Of this total, five were on land registration work, taking meteorological observations, on plotting and drawing work, or on the felling of trees. Two were at Fort Hope, assisted by two civilian axemen or chainmen. The remaining 9 were in two groups, occupied in surveying suburban or rural properties near New Westminster, without civilian aid. As this small survey organization was also part of a military unit, camp duties frequently interrupted surveying work, both in regard to its accuracy and general rate of progress.

Douglas had differences with Moody on other important points. Although he consented to the Colonel's preference of New Westminster as the capital of the mainland colony, he was not happy over the transfer of the seat of government from his own choice, old Fort Langley, in February, 1859. Before Moody's arrival in the colony Douglas had, in all good faith, instructed Pemberton of Vancouver Island to survey old Fort Langley townsite and to conduct an auction sale of its lots. The subsequent abandonment of the town as the colony's capital, even after adjustments in regard to land purchases had been made, left a heritage of political grievances, Douglas bearing the brunt of these burdens.

There were disagreements also between Douglas and Moody over priorities to be accorded road surveys and construction as against property and townsite surveys. From the outset of his administration Douglas considered road construction to be one of the first objectives of government.[17] He was fully aware of the fact that gold miners in the interior were paying famine prices for provisions and that road links with the coast would alleviate much hardship and prevent civil troubles. However, Moody had his instructions direct from Downing Street to "regard with a military eye the best positions for such towns and cities, as well as for the engineering of roads and passes, or laying the foundations of any public works".[18]

Even as early as July, 1858, there was public clamor over the fact that no public rural land had been placed on the market by the government. The surveys of these lands had been postponed while the townsite of Queensborough (later New Westminster) was being laid out.

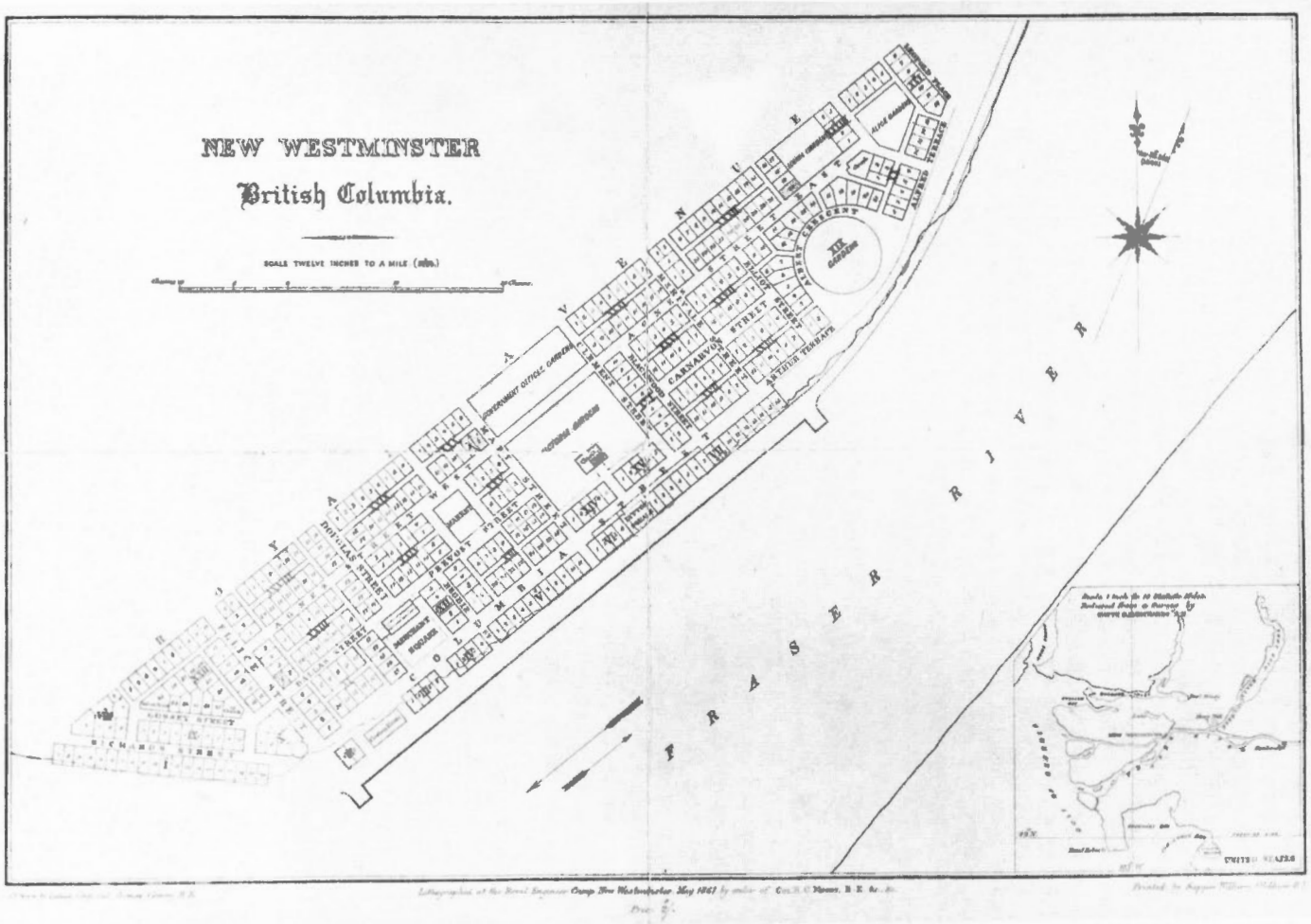
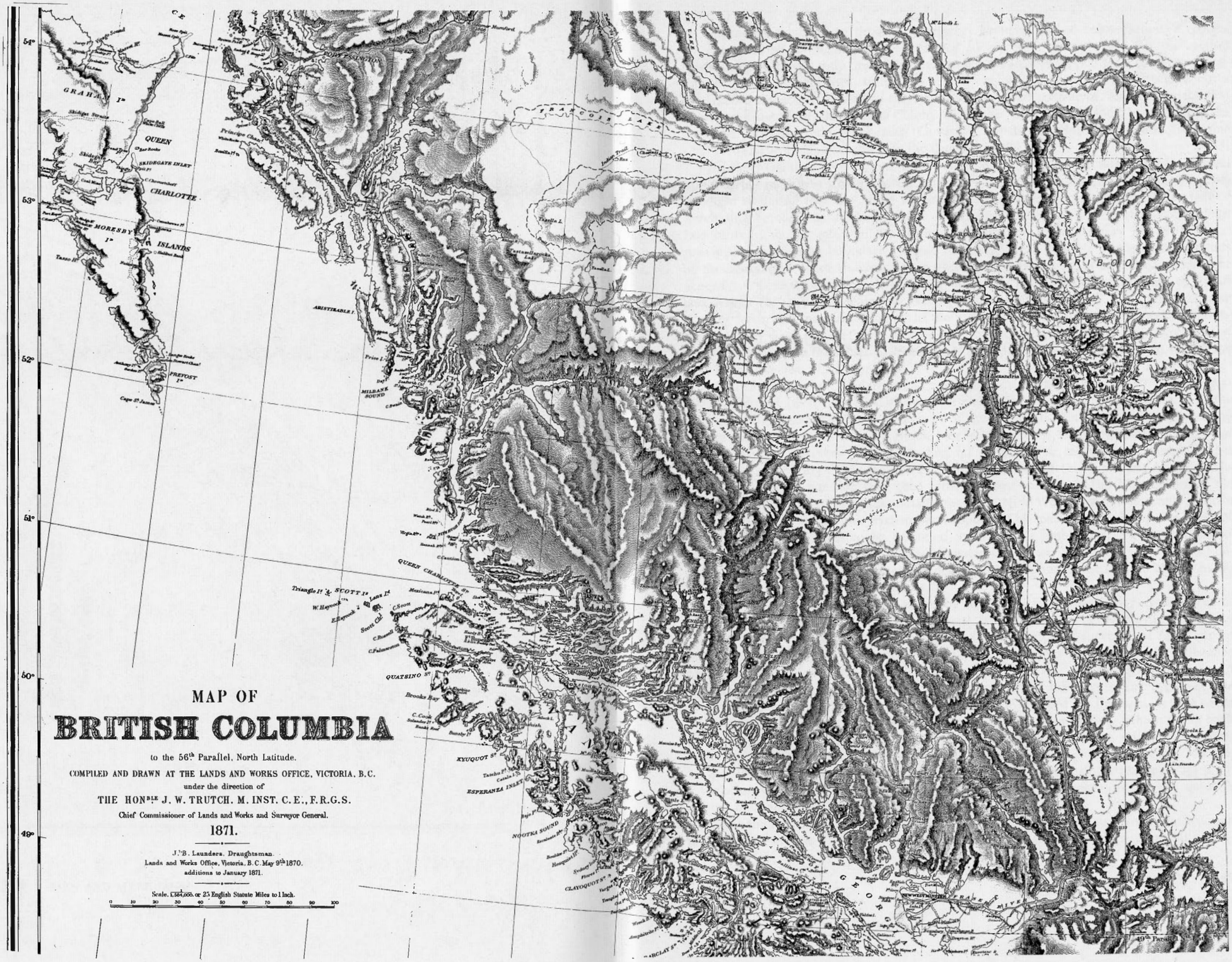


FIGURE 41. Townsite plan of New Westminster, drawn and lithographed at the Royal Engineers' camp nearby, with inset showing lower mainland area of B.C.



MAP 36. Courtesy of the Public Archives of Canada.

Because of increasing financial stringency Douglas had to refuse Moody's request that one Joseph William Trutch be added to his staff of surveyors. In this action Douglas, quite unwittingly, may have performed a valuable service for Trutch, the English-born son of a solicitor, trained as a civil engineer, who proceeded to carve out a remarkable career for himself in the colony as a civilian contractor. He became the first Surveyor General of the United Colony of British Columbia (1866-71) and then the first post-Confederation Lieutenant Governor of the province of British Columbia (1871-76) before being knighted by the Queen in 1889.

In the meantime foundations were being laid for future enactments on the subject of surveying in British Columbia. On January 4, 1860, Governor Douglas issued a proclamation declaring that any piece of land to be acquired by pre-emption (the right of purchasing before others) should be in rectangular form with the shortest side at least two-thirds of the longest side. By further proclamation dated January 19, 1861, it was provided that property boundaries should run as nearly as possible by the cardinal points of the compass. Vacant fractions up to 160 acres, enclosed by prior locations could be acquired notwithstanding any irregularity of shape. The Chief Commissioner of Lands and Works (Moody) was empowered to appoint 'Sworn Surveyors', ". . . and shall also acquire from each of them security to the value of £100 that they will well and efficiently survey such piece of land as they may be required to survey". Any purchaser of land could apply to the Chief Commissioner to appoint a Sworn Surveyor to survey the land at the expense of the applicant.

In 1859 the Royal Engineers had run the Coast Meridian line from the 49th parallel to Burrard Inlet, over a relatively level plain. The mountainous terrain north of the inlet probably discouraged any extension of the meridian. But every three miles along the established line was called a Block North. At a point 12 miles north of the point of beginning, a line was run west setting off ranges three miles wide, named Ranges West. The numbering of the 160-acre sections was from 1 to 36, starting in the northeast corner and proceeding west then returning east, similar to the U.S. system in the State of Washington. This rather small area near New Westminster is the only area in British Columbia where this system was applied. This pattern represents the third of nine land survey systems to be instituted in British Columbia over the years since its birth. The first system was that of the irregular lots in the Victoria area (1851-58) already described. The second system involved the laying out of sections 20 chains by 50 chains in districts tributary to Victoria.

Most of the survey lines laid down by the Royal Engineers were run with a compass. Not until 1879 were instruments apart from the magnetic needle used. Civilian surveyors were less careful than the engineers. For example, a surveyor of fairly recent times has reported that "on the north boundary of Township 12 I traced quite a distance on a flat through hardback and then got on a side hill. On looking back over the line, I saw the bend at every quarter section post. I suppose that the original Surveyor when he got to that point looked back, and when he saw how crooked his line was, he just wrote [in] his notes, 'Strong local attraction here', and continued on his line without going back to correct [the situation]."[19] In contrast to those conditions another surveyor of recent times reports that "in the Fraser Valley and around Victoria pioneer surveys . . . made by the Royal Engineers [using the] magnetic needle on the transit for starting lines [and] a variation which had been determined at the observatory [Sapperton . . . left me with a] high opinion of the [early] work . . .".[20]

Although military men dominated the highly active survey and road construction period, 1858-63, the Douglas and Moody projects benefitted from the contributory ef-

forts of three able and highly resourceful civilians. Each was a civil engineer and each became a practising land and highways surveyor. J. W. Trutch, already mentioned, Edgar Dewdney (1835-1916) and Walter Moberly (1832-1915) assisted the Royal Engineers in opening up new country. Two of the three, Trutch and Dewdney, later became lieutenant governors of British Columbia. Dewdney and Moberly, as new arrivals in the Pacific Northwest, were employed by Moody in 1859 on the work of laying out the townsite of Queensborough (New Westminster). In time Moberly became an author and his first book *The Rocks and Rivers of British Columbia,* published in 1885, was dedicated to Col. Moody. Moberly had come from Upper Canada to conduct an exploratory survey, at his own expense, in search of a mountain pass through the Rockies affording passage to a trans-continental railway. He worked with military labor in the construction of the Cariboo wagon road and his advice in later years guided the Canadian Pacific in the selection of its mountain route. Both Moberly and Dewdney entered public life in the province, the former being elected to represent Cariboo West in the Legislative Council and the latter, Kootenay district in the provincial Legislature. Dewdney was named Lieutenant Governor of the Northwest Territories in 1881, serving in that capacity until 1888. He was an important moderating influence during the 1885 uprising on the prairies. Before he became Lieutenant Governor of British Columbia in 1892, Dewdney was Minister of the Interior in the cabinet of Sir John A. Macdonald.

Road surveys and road construction were carried on by the Royal Engineers in 1859. Both Lieut. Palmer and Lieut. Lempriere were active in conducting preliminary surveys. A trail was cut that year from New Westminster to Burrard Inlet along a line which, two years later, was followed by the Royal Engineers in building the North Road. In the summer of 1860 Sergeant McColl led a party in locating a route for the Hope-Similkameen Trail, carrying the line over a 4,000-foot elevation with a gradient no greater than one foot in twelve. This became known as the Dewdney Trail after the man who was largely responsible for its construction. Sergeant-Major Cann and a detachment of Royal Engineers in 1860 excavated a mountain near Yale so that a roadway could be built. Similarly Sergeant Bridgeman and a party conquered Gibraltar Hill with a brilliant display of engineering techniques in 1861. In the same year Capt. Grant and 80 men started construction of the Hope-Similkameen Road and the Royal Engineers made a reconnaissance survey of the difficult terrain between Yale and Lytton. Sergeant McColl and a party selected a place for the crossing of the Fraser Canyon, finally accomplished by the erection of the Alexandra Suspension Bridge built by J. W. Trutch and completed in 1863.

Various alternative road routes were being advocated through the interior and to help decide the issue Lieut. Palmer was sent to conduct a survey from the head of North Bentinck Arm to Alexander and Williams Creek. Palmer's report and maps constitute an important contribution to the survey and cartographical literature of British Columbia. His was the first recorded effort since the exploratory survey of Alexander Mackenzie to map a route across the Chilcotin Plateau. Palmer was highly enthusiastic over the boat journey of 440 miles from Victoria to the point of beginning of his survey. He was persuaded that the trip afforded "the most wonderful inland navigation in the world . . . through an archipelago of surpassing beauty". The Arm, which was the inlet reached by Mackenzie in 1793, was about 25 miles long. He began his exploratory survey up the valley with one other officer, two sappers, a packer and 8 horses. After four months his conclusions were succinctly worded: ". . . My own impression is that . . . the [North] Bentinck Arm route is, from its high continuous elevation, and from the general absence of good soil and pasturage in the districts which it traverses, unlikely . . . to acquire

importance as an arterial highway to the established gold mines of this country".[21]

Palmer's findings made it clear that the Cariboo Road project had been wisely chosen as the best highway route from tidewater to the interior. In 1863 military engineers under Capt. Grant located the Cariboo Road from Clinton to Alexander (named after Mackenzie) and selected the route to Williams Creek. More than 63 miles of new road were built under his direction that season. They bequeathed to the new colony a well-engineered, soundly-constructed road that effectively solved Governor Douglas' problem of establishing communication with interior settlements. It may be justly said as well that the Royal Engineers left a notable heritage of survey plans and map sheets, work that laid the foundations for the future systematic mapping of British Columbia.

Restless miners had spread over a wide region. Minor gold rushes to Rock Creek in the Similkameen country, to Wild Horse Creek in the Kootenay and to the Big Bend district of the Columbia had taken place and eventually the precious metal was discovered as far north as the Stikine, Nass and Peace rivers. It was financially, if not administratively impossible to govern such an immense area under the two-colony set-up. Unification was inevitable and on November 19, 1866, the Crown Colony of Van-

FIGURE 42
Lieut. Henry Spencer Palmer, R.E.

FIGURE 43. The Cariboo Road. In 1862 surveyors of the Royal Engineers helped make possible the bridging of many formidable chasms in the Fraser River Canyon.

couver Island merged with the mainland colony to become the United Colony of British Columbia.

Among their achievements the Royal Engineers had established an observatory at their Sapperton camp outside New Westminster, fixing its position at 49 degrees, 12 minutes, 47 seconds north latitude and 122 degrees, 53 minutes, 19 seconds west longitude. The transit used in making this observation, as well as many others, is now in the British Columbia Archives. On January 23, 1863, a party of the Royal Engineers under Lance-Corporal George Turner was ordered by Moody "... to lay out claims or survey lands (160 acres each), narrow side to shore front" on the present site of Vancouver, constituting the first property surveys, on lots 184 to 187 inclusive in that city. The party also made a complete traverse of the shoreline from Hastings townsite around the peninsula now known as Stanley Park into English Bay and up False Creek.

In April, 1863, the Municipal Council of the City of New Westminster passed a resolution: "That in consequence of the judicious selection of the townsite of New Westminster for the capital of British Columbia by Colonel Moody, R.E., this Council considers it desirable that a space of not less than 20 acres should be reserved in the suburbs not being surveyed, to be called Moody Square in commemoration of the founder of the city". Port Moody and several natural features of the coast province have been named in honor of this dedicated and enterprising soldier who, by his leadership and with his men, made an enduring contribution to the upbuilding of British Columbia. Stanley Park, in a real sense, is a memorial also to Col. Moody who set aside as a military reserve 354 acres of that peninsula on the south side of the First Narrows at the entrance to Vancouver Harbor. In addition to their sterling work on pioneer

roads to the interior the Royal Engineers laid out townsites of New Westminster, Lytton, Lillooet, Clinton, Quesnel, Richfield, Hope, Yale and Douglas as well as making a beginning on cadastral surveys within what was to become the townsite of Vancouver.

On July 8, 1863, an order from London for the recall of the Royal Engineers was announced on regimental parade. A large number of men, on being given the option to do so, remained in British Columbia. Each qualified man received a free grant of 150 acres. A few men were retained in such local government posts as printers and customs officers. Others found work as civilian surveyors, architects, carpenters, masons and in a variety of other occupations. Married men were permitted to occupy the houses in which they had been living. The valuable library donated by Sir Edward Bullwer Lytton to the unit was handed on for the use of those men who took their discharge and remained to take up new lives in the young colony.

At a complimentary dinner tendered at the Colonial Hotel, New Westminster, November 5, 1863, the Colonel responded to the toast to the commander and officers of the Royal Engineers detachment. He replied with military brevity, "It was an experiment, gentlemen, a novelty, mingling thus military and civilian duties. How far it has met what was sought for by the Government, is not for me to say. I ever, as was natural, and as was my duty, kept the military part foremost in my mind, and it is with feelings of extreme satisfaction I can reflect on that part of our service in British Columbia. You have been witnesses throughout of our discipline, and at the same time how we, — soldiers — have borne ourselves in our social relations with you. Some anxiety was felt on the probable result of this part of the experiment. I had no fear. I had full confidence from the beginning in the class of men I had the honour to command. I knew what they were; I knew well how they would act, and in this I have not been mistaken. . . . For myself, my functions as Chief Commissioner of Lands and Works will cease when I embark for England, but from that moment I can be, and I shall be, more truly a British Columbian than ever".[22]

This gallant leader departed in the steamer *Enterprise* never to return to Canadian shores as he hoped that he could. One hour later H.M.S. *Cameleon* with Dr. Seddall, Lieut. Palmer and bride as well as 15 sappers, sailed past the Pioneer Wharf that served the town. As the vessel sailed one hundred of His Majesty's sailors gave three rousing cheers. This demonstration brought a similar response from the large crowd on shore while the Royal Engineers' brass band played popular songs of farewell. There was a flurry of unseemly political scuffling over the appointment of a successor to the commissionership. Douglas wished to appoint Capt. Luard. But for some obscure reason this plan collapsed. In 1864 J. W. Trutch was appointed the first Surveyor General of the mainland colony and in 1866 became the first Surveyor General of the United Colony of British Columbia.

19

THE GEOLOGICAL SURVEY OF CANADA: THE FIRST QUARTER-CENTURY

"And time, that takes survey of all the world, must have a stop."
King Henry IV (1), Act 5, Sc. 4.

By the beginning of the 1840s Canadians stood at the portal of an era of political resurgence and economic growth. The French-speaking community of Lower Canada had acquired a fair measure of stability. Other provinces of British North America were developing distinctive characteristics. Population had reached 1.4 million. Following abortive uprisings in Upper and Lower Canada in 1837, Lord Durham proposed legislative union as a promising solution of political difficulties and, as a result, the new united Province of Canada was established by the Act of Union (3-4 Vic. ch. 35). Kingston became the capital of the combined colonies.

Land surveys, road-building and canal construction had grown apace in this large central region of British North America. There was increased talk of railway-building on an ambitious scale. A ferment of thought and activity permeated a variety of economic and public-spirited pursuits. In Canada West, as Upper Canada became officially known after union, District Councils were authorized to construct new roads and to maintain existing highways. In 1841 (4-5 Vic. ch. 9) penalties were imposed upon anyone who interfered with the work of land surveyors. Licensed surveyors were authorized to administer oaths. In Canada East (Lower Canada) the union of provinces brought about the disappearance of the title of Surveyor General in that jurisdiction.

The year 1842, in particular, was characterized by wise planning, sensible action and vision. Queen's University, founded the previous year, began holding classes in 1842. Admiral Bayfield moved the headquarters of his Canadian hydrographic surveys to

Charlottetown. The Webster-Ashburton treaty had settled long-standing boundary differences and dispelled the clouds of international hostility. It was the year of the birth of the composer (Calixa Lavallée) of "O Canada"; the year when J. S. Dennis Sr., was admitted to the practice of land surveying in Canada West; when J. G. Boulton, destined to become a noted Great Lakes hydrographer, was born in England; the year of the (Robert) Baldwin-(Louis) Lafontaine ministry, the first to face the newly-constituted provincial parliament and it was the year of the appointment of William E. Logan (1798-1875) as Provincial Geologist, a man of singular merit who was to become the first Director of the Geological Survey of Canada.

It is not within the purview of this history to trace the whole of the growth of the Geological Survey of Canada over the years since its establishment. That development is of such monumental character and on such a massive scale as to demand a definitive history of its own. This history is concerned, however, with Canadian geological surveying to the extent that our earliest professional geologists found it necessary to undertake topographical mapping of their own. The story of the beginnings of the Geological Survey in this country is largely that of one man. Not that Logan was without capable assistants. Yet he remained the guiding and moving spirit of the organization and by far its most prodigious worker and most generous benefactor. Alexander Murray, later to be awarded the C.M.G., was Assistant Provincial Geologist from the first. Almost from the outset Logan had the devoted help of James Richardson, a Beauharnois farmer and of James Lowe, a Grenville township farmer, enthusiasts who became trained in the work as it proceeded. Other staff members included a chemist, De Rottermond, and a provincial land surveyor, J. De Cew. These two men served for relatively brief periods. T. Sperry Hunt (1826-1892) was recruited early in 1847 as a chemist and mineralogist. Later on Robert Bell, a young civil engineer, joined the Survey. He first came in contact with the organization at the age of 15 as a helper in the Richardson field party in the Gaspé. Robert Barlow and his son Scott were also active as topographers and draftsmen.

In the Province of Canada the need for a geological survey organization was being acutely felt. A scattering of unrelated but scholarly papers had been written in Canada on aspects of local geology and some significant collections of minerals had been made. But no systematic or comprehensive geological studies had been undertaken. Almost nothing was known of the various rock formations of Canada and their distribution. In January, 1832, a Dr. Rae petitioned the parliament of Upper Canada for financial assistance to conduct a geological survey. His request, although supported by Lieut.-Governor Sir John Colborne, was rejected by the committee of supply. In December of the same year a petition was submitted by the York Library and Philosophical Society for a government grant to provide for an investigation of the geology, mineralogy and natural history of the province. In 1836, on a motion made by W. L. Mackenzie, a committee was named by the house to report upon a plan for a geological survey. A report was printed but no other action taken. Other moves, all abortive, were made, including an effort by R. G. Dunlop, a member of the house, to obtain a grant of wild lands to help defray the cost of a geological survey.

Under the new Governor General, Lord Sydenham, progress was made in the matter. In the first (united) parliament of 1841 the Natural History Society of Montreal and the Literary and Historical Society of Quebec petitioned for fiscal aid in order that a geological survey could be carried out. Hon. S. B. Harrison moved that £1,500 sterling be included in the estimates for such a purpose. This motion carried. The ill-fated Sydenham, whose death followed a fall from his horse in September, 1841, was succeeded by Sir Charles Bagot. It became Bagot's responsibility to name a provincial geologist. Bagot

consulted with Lord Stanley, then Secretary of State for the Colonies, and as a consequence Canadian-born William Logan was appointed in the spring of 1842 to make a geological survey of the Province of Canada.

The selection of Logan was far from being a shot in the dark. William Edmond Logan was born in Montreal of Scottish parents on April 20, 1798, the year in which the death penalty was applied in Upper Canada for tampering with or destroying property boundary markers. William Logan, the father, was a well-to-do merchant. He sent this third child of a family of nine to Edinburgh High School in Scotland. That was in 1814, when Napoleon was exiled to Elba and when hostilities between Canada and the United States came to an end. From 1815 to 1827 Logan worked in a large London counting house. During this period, while on holidays, he climbed Ben Nevis (4,406 feet), the highest mountain in the British Isles. "Never did I endure such dreadful fatigue as I experienced in ascending and descending this great mountain". At 29 years of age he could not have foreseen that, in time, Canada's highest mountain (Mount Logan, 19,850 feet) would be named in his honor as a result of his contributions as a geological surveyor to the advancement of his native land.

Surprisingly enough, it was not until he was 35 years of age that Logan first revealed his keen interest in matters geological. By this time he had been in South Wales for two years, near Swansea, where he was employed at the Forest Copper Works. "The study of ores of copper", he wrote in a letter to his brother James in Montreal in June, 1833, "has gradually led me to that of mineralogy and geology and of specimens in both departments. I have become a bit of a collector. Now if you could assist me to a few of Canadian origin I should be obliged".

Logan, at this time, purchased at his own expense a theodolite, compass and other

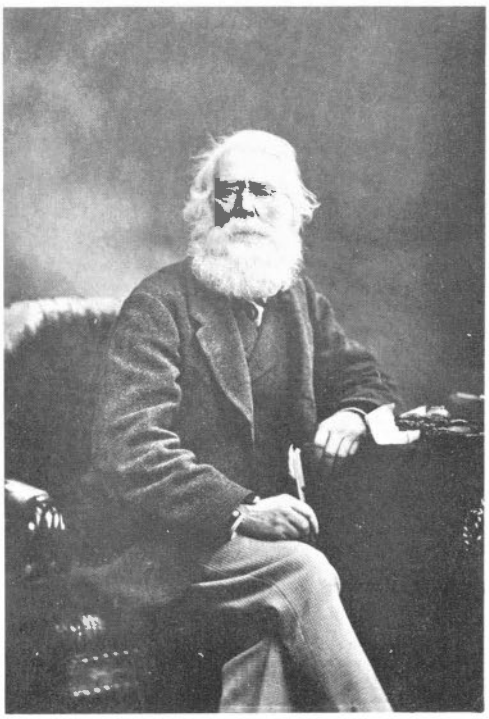


FIGURE 44
Sir William E. Logan.

surveying instruments to enable him to produce a geological map of the Welsh district in which he worked. It was this splendidly executed map that (Sir) Henry De la Beche used for the purposes of the British Ordnance Survey of which he was the director. Logan's fondness for geology increased daily and soon his work attracted attention in high places. In 1837 he was made a Fellow of the Geological Society. In 1837 he wrote to James "If I ever return to Canada, I'll geologize there".

Logan was in Canada during the winter of 1840-41 and, after examining a landslide near Montreal, wrote a learned paper for the Geological Society in London. The paper revealed Logan to be a careful, accurate observer who possessed a marked ability to express his conclusions in clear, concise prose. Before he returned to England, Logan visited Windsor, Nova Scotia, where he examined gypsum deposits with Judge Thomas C. Haliburton whom Logan considered "not deep in the mysteries of stratification". It was on this 1841 visit, during an examination of the Pictou coalfields, that Logan met the 23-year-old Dr. William Dawson, a geologist from Edinburgh University who was just beginning field research in Nova Scotia. Friendship between Logan and Dawson grew, as did their professional cooperation. It was a relationship from which Canada was to derive very substantial scientific benefits.

When Lord Stanley, through his Under-Secretary, G. W. Hope, M.P., received strong recommendations in support of Logan from De la Beche, the matter was as good as settled. "... I consider W. E. Logan perfectly equal for the task... His sections [profiles] are all levelled and measured carefully with proper instruments and his map executed with a precision only as yet employed except in his case, on the Ordnance Geological Survey... I would further observe that Mr. Logan is highly qualified as a miner and metallurgist to point out the applications of geology to the useful purposes of life, *an object of the highest importance in a country like Canada,* the mineral wealth of which is now so little known". (author's italics) (Sir) Roderick I. Murchison, President of the Geological Society of London, England, was equally laudatory.

Logan's name was conveyed to Bagot and in August, 1842, following his preliminary appointment as provincial geologist, Logan arrived at Kingston, the seat of government. An Order in Council passed by the Committee of the Executive Council on April 18, 1843, formally confirmed Logan's appointment and its text is enlightening on the conditions of his employment and the confidence reposed in him. The question of an assistant for Logan arose early in the discussion with officials in Kingston. Alexander Murray, also recommended by De la Beche, was chosen for the post.

FIGURE 45
Alexander Murray.

With the adoption of the Harrison motion and with the appointments of Logan and Murray, there came into being the senior scientific organization of the federal public service of Canada. In fact, looking back now over its unbroken record of constructive activities, the Geological Survey of this country was one of the earliest of its kind to appear anywhere in the world. The birth of the Survey is commonly regarded as the year in which Logan was named its head (1842), rather than the year in which public funds were first appropriated for its purposes (1841) or the first season of its field operations (1843).

The functions of the Survey were set forth in the early legislation concerning it. Following the initiating motion in the 1841 session, an act dated March 17, 1845 (8 Vic. ch. 16) authorized the employment of competent persons to make an accurate and complete geological survey of the Province and to furnish a full and scientific description of its rocks, soils and minerals, accompanied by maps, diagrams and drawings along with a collection of specimens. By an act dated May 16, 1856 (19-20 Vic. ch. 13) publication of maps was authorized along with the installation of permanent bench marks to fix accurately latitudes and longitudes and relative levels of various points of reference. The provision of museum facilities was also envisioned.

For a prolonged period the Survey, although geological in essence, was the only government or other organization in Canada assembling information on Canada's natural resources. Later, as government departments expanded, other special branches were created to function in the various resource fields.[1] One of the principal obstacles to any effective geological survey of Canada in the mid-19th century was the lack of adequate topographical maps.[2] More than that, large areas of the country remained wholly unex-

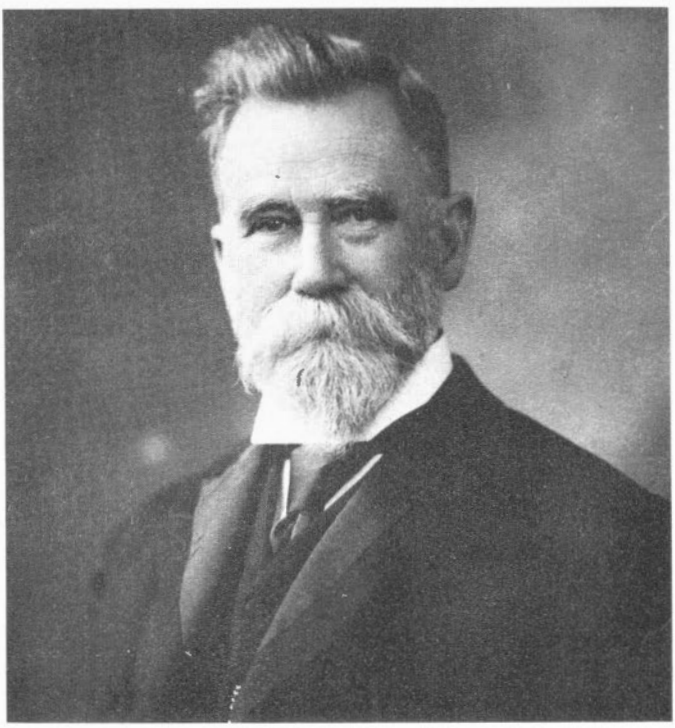
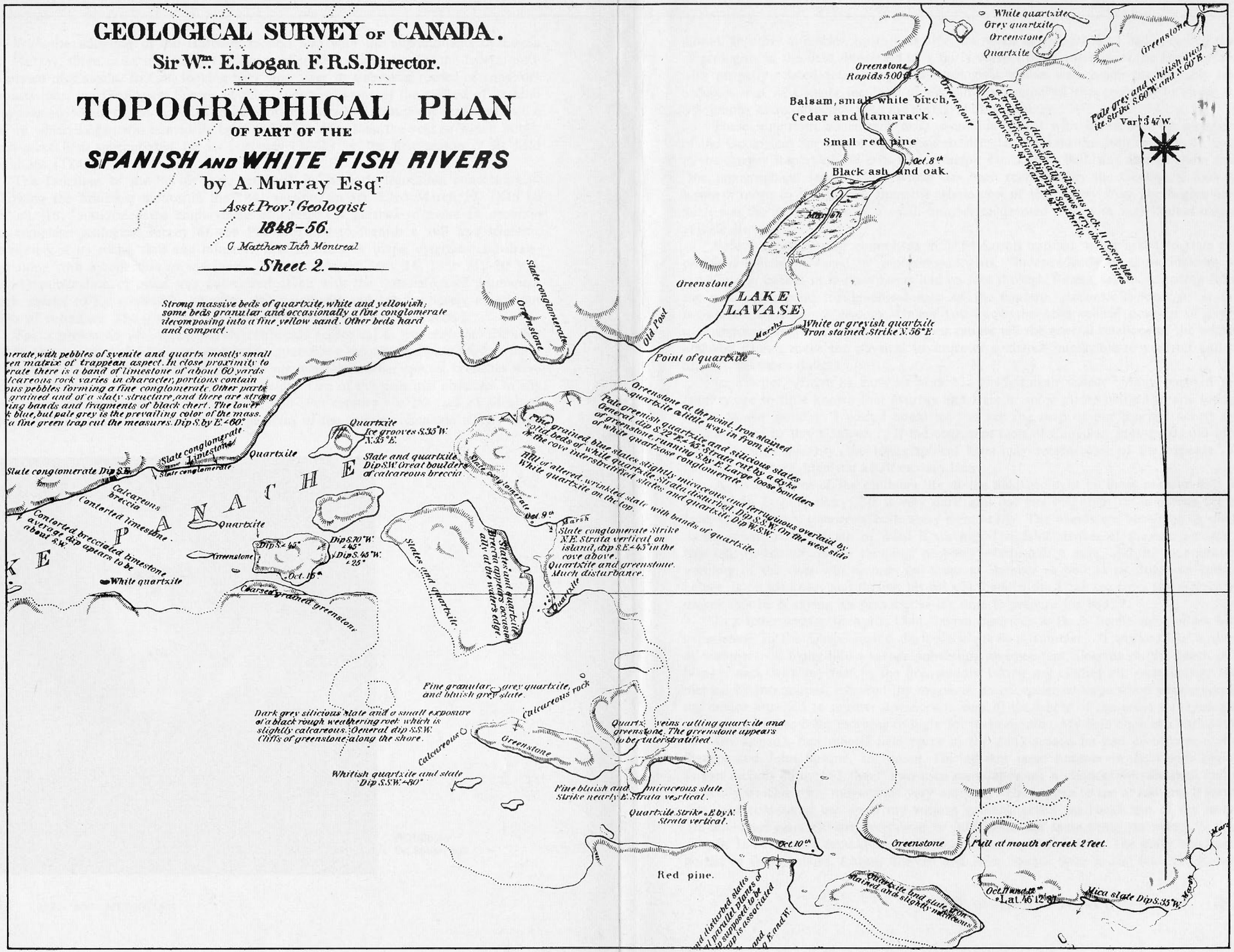


FIGURE 46
Dr. Robert Bell.



MAP 37. Example of a combined topographical and geological survey carried out by the Geological Survey of Canada. Courtesy, Geological Survey of Canada.

plored. In other countries, up to that time, the work of topographers had preceded that of geologists in the field. Possessed of a fairly correct representation of the land surface with properly related reference points, geological studies were made considerably less arduous. But in Canada the lack of such maps compelled the geologist to study its topography as an introduction to the portrayal of its geology.

These important concurrent tasks were performed with distinction by members of the Geological Survey for more than six decades and into the 20th century. In fact, in the Survey Report of 1902 its then director, Dr. Robert Bell, was able to claim that "the topographical service alone which has been rendered [by the Geological Survey] is worth more to the country than the whole cost of the Survey from the beginning". Such was the achievement of a small number of devoted men with very limited means at their disposal.

Before a government committee in 1854 Logan testified, when asked to state the principal difficulties faced by pioneer geologists, "Independently of those incident to travelling in canoes in shallow rivers and on foot through forests, are those arising from the want of a good topographical map of the country. *Accurate topography is the foundation of accurate geology.* Unless you know the geographical position of every rock exposure that comes before you, you cannot tell the general relations of the whole, and you cannot make the physical structure of a district intelligible to yourself and to others". (author's italics)

In a letter written as early as May 12, 1845, Logan stated, "Many parts of the country are so little known that Murray and I are in some places obliged to add topography to our geology. I wish I could let you see the map of our journey across the St. Lawrence to Bay Chaleur... If the economic facts of Canadian geology should turn out a negative quantity, the topographical facts may return some of the expense..." Dr. Bell was more dogmatic a half-century later.

A vivid picture of the outdoors life of the field geologist in those pioneer days is revealed in Logan's diary: "It is very dark and our fire heightens or brightens up its face. Our pork for tomorrow boils away right busily. The woods are becoming as silent as the grave, not a breath of wind is stirring. The faint strokes of the axe against a tree tell us that others are camping, probably within half a mile, and the monotonous gurgling of the river will perhaps tell them to slumber as well as us. John, an Indian helper, is on his knees and though his back is towards me I can see from the crosses he makes that he is saying his prayers. So it's time to prepare for bed".[3]

In a letter written in April, 1844, Logan describes to De la Beche some of his field experiences in the Gaspé region during the previous summer: "I worked like a slave all summer . . . living like a savage, inhabiting an open tent, sleeping on the beach in a blanket sack with my feet to the fire, seldom taking my clothes off, occasionally tormented by mosquitoes. I dialled [by means of an odometer or large wheel with a counting device attached to register distances traversed] the whole of the coast surveyed and counted my paces from morning to night for three months. My field-book is a curiosity".

On Logan's first official field party in the 1843 season he had as helpers a Mr. Stevens and John Basque, an Indian. During that same summer in the Gaspé region Logan records (July 18) that "Two men came after me a considerable distance today, evidently watching my movements very narrowly. They spoke to me at last and it seems they had considered me, from my various gambols about the rocks, out of my mind. Three clam-diggers did me the favour to inform me the same thing yesterday . . .".

In 1844 Logan's expedition to the Gaspé was more elaborate. The party was transported in three canoes. Logan, Stevens and John Basque were in the first, De Rotter-

mond, Frank and Louis in the second, Murray, Baptiste and Michel in the third. Logan's equipment was more impressive than ever. He carried a Rochon micrometer telescope and a prismatic compass. But physical trials were nevertheless severe. "I am tired", Logan once reported, "My shins are black and blue all over with thumps against stumps and fallen trees and my foot has been squeezed by getting into the fork of a root . . .". And again, "It was nine o'clock [p.m.] before we could get our supper, and I had tasted nothing from 7 a.m. We took no dinner on our journey yesterday [August 13] for want of water. All the men were thirsty, and none could eat without drinking first". Logan speaks often of a special delicacy in the field, the taste of well-cooked porcupine!

On his return to Montreal from the field in 1843 Logan was faced with the prospect of finding storage space for his rock specimens. His government grant was inadequate, he had no palaeontologist to classify fossils, no museum in which to display collections and, in fact, no room space at all in which to unpack his boxes.[4] At this awkward juncture James Logan came to his brother's aid and provided an upper room in his Gabriel Street (Montreal) warehouse in which for a period the Survey properties were deposited. In 1844 the Survey headquarters were moved to a rented house at 40 St. James Street. At about this time Logan firmly rejected an attractive offer to take charge of the geological survey of India. The winter of 1844-45 proved to be the low point in Logan's career. The £1,500 already voted had been exhausted, as well as £800 of his own money. Nobody could assure him of the continuance of the survey organization. Nevertheless Logan worked unceasingly on the drafting of a new Geological Survey bill and interviewing members of the House. So convinced were the members of the gross inadequacy of the money being voted for Survey purposes that not a single dissenting voice was raised when on March 17, 1845, an act was passed providing for an annual amount of £2,000 on a five-year basis. This proved to be the only subject to come before that session of the assembly on which there was unanimous agreement.

In 1846 the Survey's offices, museum and laboratory were moved to a larger building on Little St. James Street and remained there for six years. In 1852 even more commodious quarters were found in a former residence of Hon. Peter McGill on St. Gabriel Street. Here the Survey headquarters were maintained until the Logan regime came to an end. Financial problems continued to plague Logan. In 1850 and again in 1856 renewal of grants to the Survey work were arranged by statutes and a somewhat increased establishment sanctioned. But it was not until after an inquiry by a Select Committee of Parliament that a fairly substantial annual sum was voted for the Geological Survey. The provision was for $20,000 annually for five years and, in addition, a sum of $8,000 for publishing a map and report on the geology of Canada. By 1868 the yearly government grant had reached $30,000.

About 1854 a map on the scale of 25 miles to the inch had been hastily constructed from various published maps of Canada. As the over-all result had not been satisfactory the map was discarded. It was decided to compile topography from original surveys and to establish by telegraph the longitudes of several principal points in the country. By 1861 the new map was ready for engraving. But Sir William's massive geological map dated 1866 was not actually published until 1869, the year in which he resigned.

Over the years from 1843 to 1856 Logan's field work continued — up the Ottawa River, through Lake Timiskaming, on to Lake Superior as well as on the north shore of the St. Lawrence, in the Gaspé and in the Eastern Townships. All the while, in off seasons, Logan kept all his business accounts in his own hand, carried on extensive office correspondence in longhand, plotted all his own surveys, wrote his reports on field trips, edited the reports of his assistants, examined all fossils, minerals and rock specimens

81. *Resolved*—That a sum not exceeding one thousand five hundred pounds, sterling, be granted to Her Majesty to defray the probable expense in causing a Geological Survey of the Province to be made. 81st Resolution: £1,500, st'g, Geological Survey.

ANNO OCTAVO

VICTORIÆ REGINÆ.

CAP. XVI.

An Act to make provision for a Geological Survey of this Province.

[17*th March*, 1845.]

Preamble. WHEREAS a Geological Survey of this Province of Canada has been instituted for ascertaining the Mineral Resources thereof; And whereas the sum of fifteen hundred pounds, already granted to Her Majesty to defray the probable expenses of the same, has been found inadequate for the effectual investigation of so extensive a Territory as is comprised within the limits of the Province; And whereas it is expedient that the said Survey should be continued to a completion: Be it therefore enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Legislative Council and of the Legislative Assembly of the Province of Canada, constituted and assembled by virtue of and under the authority of an Act passed in the Parliament of the United Kingdom of Great Britain and Ireland, and intituled, *An Act to Re-unite the Provinces of Upper and Lower Canada, and for the Government of Canada*, and it is hereby enacted by the authority of the same, That it shall and may be lawful for the Governor of this Province, in Council, to employ a suitable number of competent persons, whose duty it shall be, under the direction of the Governor in Council, to make an accurate and complete Geological Survey of this Province, and furnish a full and scientific description of its Rocks, Soils and Minerals, which shall be accompanied with proper Maps, Diagrams, and Drawings, together with a collection of Specimens to illustrate the same; which Maps, Diagrams, Drawings and Specimens shall be deposited in some suitable place which the Governor in Council shall appoint, and shall serve as a Provincial collection, and duplicates of the same, after they have served the purposes of the Survey, shall be deposited in such of the Literary and Educational Institutions of the Eastern and Western divisions of the Province, as by the same authority shall be deemed most advantageous. The Governor in Council may appoint proper persons to make a Geological Survey of this Province.

II. And be it enacted, That from the unappropriated public monies of the Province, a sum not exceeding two thousand pounds, shall be annually applied, for a term of years not exceeding five years from the passing of this Act, to defray the expenses of the said Survey, or any arrears of expenditure already incurred, which sum shall be paid at such times and in such manner as the Governor in Council may direct. A sum appropriated annually during five years for the said purpose.

III. And be it enacted, That the person or persons employed by the Governor in Council for the purposes mentioned in the first section of this Act, shall make a report to the Governor of this Province on or before the first day of May in each year, setting forth generally the progress made in the Survey hereby authorized. Reports to be made to the Governor.

IV. And be it enacted, That the words "Governor in Council," wheresoever they occur in this Act, shall be understood to mean the Governor, Lieutenant-Governor, or person administering the Government of this Province, acting by and with the advice of the Executive Council thereof. Interpretation clause.

V. And be it enacted, That the due application of the monies hereby appropriated shall be accounted for to Her Majesty, Her Heirs and Successors, through the Lords Commissioners of Her Majesty's Treasury, in such manner and form as Her Majesty, Her Heirs and Successors shall direct; and an account thereof shall be laid before the Provincial Legislature at the then next Session thereof. Accounting clause.

MONTREAL:—Printed by STEWART DERBISHIRE and GEORGE DESBARATS, Law Printer to the Queen's Most Excellent Majesty.

FIGURE 47. A composite of a Resolution of September 10, 1841, and an Act of March 17, 1845, of the Legislature of the Province of Canada, providing public monies in support of the Geological Survey of Canada in its formative years.

collected each year, kept himself up to date in the reading of geological reports of other countries and gave interviews to many visitors. In addition he prepared the Annual Report of the Geological Survey, also in his own handwriting, four manuscripts in all; one for the Governor General, one for the Legislative Council, one for the House of Assembly and one for the printer.

His field trips were not in the nature of holidays. In a letter to Murray he described his survey of the Ottawa and Mattawa rivers: "The bearings have been taken by a theodolite, and the whole of the map has been carefully protracted in the field on drawing paper as the work went on, on the scale of one mile to an inch. Every sight in levelling, every bearing, sometimes twenty at a station, every micrometer angle, every reduction of the distance to chains and links, and every line of the protraction has been worked out by my own hands. You may think, therefore, that I have been a little busy. I was up every morning at four or five o'clock to rouse my Indians (not one of whom would ever stir unless he had my special command), to be ready for an early breakfast and start. We seldom left our work until we could no longer see distinctly, and it was often one, two or three hours after midnight before my protractions were finished and I could creep into my blanket".

Logan's greatest work, in the writing field, was his volume *Geology of Canada, 1863*.[5] Although Prime Minister Sir John A. Macdonald was not sufficiently versed in science to appreciate the towering worth of this opus, both in Canada and internationally, its publication served to confirm Sir William's high place in the world of geology. His eminence had, in fact, been realized and recognized in 1856 when he received a knighthood at Windsor Castle and was showered with honors by many countries. From the Geological Society of Great Britain he was awarded the top honor in its power to bestow, the Wollaston Medal, annually given for "research concerning the mineral structure of the earth". It is not clear from available official records just precisely when Sir William became entitled to use the term "Director" in relation to the Survey. That title appears in some government reports as early as 1856 but he preferred to cling to the first Canadian description of his position, "Provincial Geologist" even after his colleagues made rather insistent use of the word "Director".

Very important parts of the *Geology of Canada, 1863* were written by T. Sperry Hunt, especially on mineralogy, mineral waters, petrography and economic geology. In his 25 years with the Survey Dr. Hunt made an immense contribution. He is credited with being the first to point out the relation of petroleum deposits to anticlinal folds. Recognition of this geological fact led in the long future to immeasurable economic results. He wrote reports on *Gold Mines of Canada* (1863); *On Petroleum in the Gaspé* (1865) and *On the Gold Regions of Lower Canada* (1866).

An Atlas of geological maps, published in 1865, accompanied the 1865 opus. It contains Logan's handsome map showing the distribution of Laurentian rocks (Grenville region). The maps were engraved on steel or copper and printed in oil colors by chromolithography.

Logan's relations with McGill University were, in effect, the story of his friendship with the man who became its Principal in 1855, namely, Dr. (Sir) John William Dawson. After lecturing at Dalhousie University Dawson had been appointed Superintendent of Education for Nova Scotia in 1850. Two years previously a son, George Mercer Dawson, had been born, destined to become a Director of the Geological Survey of Canada. The father's interest in geological matters never faltered and his most important writing was done in his book *Acadian Geology*. He had his heart set, however, on a professorship of geology and zoology at Edinburgh University. On the day

in 1855 that he planned to sail to Scotland to seek this post he received word that the vacancy had been filled. On that same day he received a letter from the board of governors of McGill inviting him to become principal of that institution. He had been suggested to the governors by the Governor General, Sir Edmund W. Head. Dawson continued in the principalship for 44 years, and in the post donated various objects of scientific value to the Survey. Logan, for his part, demonstrated his admiration for an old friend by instituting the Logan Gold Medal and by endowing a Chair of Geology at McGill.

Logan, though of small frame, was physically and mentally tireless in his resolve to make Canada's mineral resources more widely known and to have them more intensively developed. Any genuine effort to put Canadian mineral resources to good use had his constant encouragement. But for the fraudulent who tried to promote such spurious projects as 'salted mines' he had only contempt. On one occasion, according to Professor H. Y. Hind, Logan was urged to give his opinion on some quartz samples in the presence of men intent on purchasing the properties that had ostensibly produced this ore. His opinion was asked on whether the glittering metal, visible in small cavities in the quartz, was really gold. "No doubt about it", Logan said, examining it closely with a pocket magnifier, "No doubt of it; and with this glass you can see the marks of the punch perfectly!"

Logan remained a bachelor with the same singleness of purpose as he displayed in advancing the progress of Canada's geological survey. Personal discomforts he endured lightly and replied to any efforts to find him a bride that he was more interested in rocks than in the rocks of any cradle. He possessed a fine sense of humor and a hearty, infectious laugh. He delighted to tell such stories as that of his attempt in the field one day to get an idea of the width of a stream by tossing stones across it. Addressing his Indian helper Logan said, "John, bring me some stones to throw across this river". John Basque, proud of his ability to employ geological terms he had overheard replied, "Yes, sir, conglomerate, limestone or slate, Mr. Logan?".

But Logan's jollity failed him on one occasion. He was accustomed to plot his maps on foolscap sheets. At a wayside inn the housemaid took a fancy to the eminent geologist without realizing just who he was. To declare her undying love for him she wrote loving verses all across his precious map sheets. She was astonished at his visible annoyance. It is surmised that Logan failed to file these particular map sheets in departmental records.[6]

Over the critically important formative years of the Survey, Logan was probably its most active worker as well as its greatest individual financial benefactor. He was a guiding spirit and dedicated leader who had an unflagging passion for research and was intensely interested in exhibits of mineral samples as a means of drawing favorable attention to Canada and its natural resources. He was not parochial in any sense. His was not only a zeal for Canada but an outlook as wide as the world itself.

During the quarter-century Logan presided over the fortunes of the Geological Survey of Canada he built up its staff and obtained accommodation for them in Montreal. He himself carried out extensive geological investigations and directed the work of others in the field. He did much valuable mapping and sketching as well as collecting rock and fossil specimens. He arranged and supervised Canadian geological exhibits abroad. Although he retired in 1869 at the age of 71 he continued to be active in his beloved profession. Something of his profound faith in his country shines through a letter he wrote: "Just look at Arrowsmith's little map of British North America, dedicated to the Hudson's Bay Company, published in 1842. If you have not got a

copy, send for one; the expense won't kill you and there ought to be one in your Record Office. You will see that Canada comprises but a small part of it... It will be a great country hereafter. But who knows anything of its geology?"

Showered with honors in his lifetime Logan was not slow to appreciate worth in others. The acknowledgments in his preface to *Geology of Canada, 1863* are like a roll call of surveyors representative of all categories of the profession. There are tributes to Joseph Bouchette, Surveyor General of Lower Canada and to his son Joseph, Deputy Surveyor General, for their map work; to Sandford Fleming of Toronto for information supplied; to Dr. (Sir) J. W. Dawson for his donations of geological specimens and to Admiral Bayfield for his list of latitudes and longitudes of the coasts of Labrador, Nova Scotia, New Brunswick, Cape Breton, Prince Edward Island, Anticosti and the Magdalens.

By the time of Logan's retirement, appreciation of the value of geological surveys to the progress of the nation was immeasurably more widespread in Canada than was the case when he began his work 27 years earlier. His professional reputation outside of Canada was exceptionally high. Logan had a keen appreciation of the value of geological science and its application to Canadian mineral resources. He understood thoroughly the interdependence of scientific and applied geology and his demonstrations of this comprehension, especially in research on formations of the Canadian Shield generated a sounder popular realization at home and abroad of the extent and potential worth of Canada's natural resources.

On his death in 1875 the Natural History Society of Montreal heard a moving tribute to his work and memory:

"No man has done so much to bring Canada before the notice of the outside world and no man is more deserving of being held in remembrance by the people. Just as statesmen and generals have risen up at the moment of greatest need to frame laws or fight battles, so Sir William appeared to reveal to us the hidden treasures of nature just at a time when Canada needed to know her wealth in order to appreciate her greatness".

Logan's name lives on in the title of Canada's highest mountain peak; in mountains in the Yukon and of a great glacier in that same territory; in an island, mountain and township in the province of Quebec; in Logan Hall of the Geological Survey building in Ottawa and in the Logan Club with its membership open to all interested in geology; in the Logan Professorship at McGill University and in the Logan Medal given on an annual basis by the Geological Association of Canada for "meritorious work in geological science".

In addition to other plaques, such as the one at Percé in the Gaspé, there is one outside the Victoria Memorial Museum Building in Ottawa fastened to a large boulder of Ottawa gneiss, representative of a formation Logan named. On the bronze borne by the boulder is the simple yet eloquent inscription:

SIR WILLIAM LOGAN
K.B. LL.D. F.R.S.
1798-1875
THE FATHER OF CANADIAN GEOLOGY
FOUNDER AND FIRST DIRECTOR OF THE GEOLOGICAL
SURVEY OF CANADA
1842-1869
ERECTED BY THE TWELFTH INTERNATIONAL GEOLOGICAL CONGRESS
CANADA
MCMXIII

ACKNOWLEDGMENTS

I acknowledge with deep gratitude the assistance I have received from many sources in the organizing of factual and illustrative material for these volumes. Within the Department of Mines and Technical Surveys, in addition to appreciation expressed elsewhere in this volume to ministers and deputy ministers I wish to thank Assistant Deputy Ministers J.-P. Drolet and Dr. J. M. Harrison. I am most grateful to S. G. Gamble, Director, Surveys and Mapping Branch, for his unwavering encouragement and support. Dr. W. Kaye Lamb, Dominion Archivist and his staff have given indispensable help.

My special thanks are extended to those with whom I have been most closely associated in this history project: to Maurice Caron of Quebec City upon whom I have relied heavily for contributions in the form of translations and research work pertaining to early records of Quebec surveys and mapping; to T. E. Layng, Chief, Map Division, Public Archives of Canada; and to E. D. Baldock, Chief, Map Compilation and Reproduction Division, Department of Mines and Technical Surveys, and his competent staff for the selection and reproduction of maps; to Douglas Shenstone of Editorial and Information Division of the Department in his capacity as editor, and to Miss Florence Stephens as typist.

I am greatly indebted also to a number of archivists across Canada, all of whom placed their staffs, records and office facilities at my disposal.

For guidance in the field of military surveys and mapping I wish to gratefully acknowledge the assistance of officers of the Army Survey Establishment, R.C.E., Ottawa.

I have received valuable and willing assistance from Chief librarians and their staffs in the following institutions: Public Archives of Canada, Library of Parliament, Geological Survey of Canada Library, Geographical Branch and Surveys and Mapping Branch libraries of the Department of Mines and Technical Surveys; libraries of the Universities of New Brunswick and British Columbia; the Tri-Service Library, Department of National Defence, Ottawa; Toronto Public Library; St. John's (Newfoundland) and Charlottetown Public Libraries; Library of the Royal Military College, Kingston; Headquarters Libraries of the Canadian Pacific Railway and of the Canadian National Railways in Montreal. I derived much information as well from the resources of the legislative libraries of Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia as well as of the Redpath Library, McGill University.

I wish to extend special thanks also to officers and staff members of the Department of Mines and Technical Surveys, Ottawa, and the government survey offices in each of the ten provinces.

In the vitally important task of translating the English text into *la langue de Molière* for the French volumes of "Men and Meridians" I am under heavy obligation to the following members of the Translation Bureau, Department of the Secretary of State, Ottawa and Montreal offices: Louis Lebel, Chief, Translation office, Department of Mines and Technical Surveys; P. Guillemin, Montreal office, and C. E. Lamb.

In addition to these various forms of assistance I had the advantage of interview in person with the following survey officials and surveyors, active and retired, many of whom are Provincial or Dominion Land Surveyors or both:

Arthur Ames
G. S. Andrews
Col. W. S. Archibald
Roland J. Auger
E. W. Bassett
Dr. C. S. Beals
H. E. Beresford
A. I. Bereskin
Spencer Ball (Professor)
George T. Bates
C. Bickerton
Will R. Bird
W. V. Blackie
T. J. Blachut
Miss Phyllis Blakeley
Guy Blanchet
Joseph Blanchet
D. H. Bocking
Major C. C. J. Bond
Mrs. H. L. Boone
Fernand Boutin
Rev. M. W. Burke-Gaffney (Professor)
James Canning
W. F. Canning

A. J. Campbell
Dean S. J. Carewe
John Carroll
Major J. L. Charles
Ken G. Chipman
A. F. Chisholm (Professor)
Ralph W. Clark
Robert G. Code
Dr. Georges Côté
Walter C. Cunningham
Marc Dancose
W. Mel Dennis
Mlle. Jeanne Desilets
(Dean) Fred Dineen
Hartley G. Dwyer (Washington, D.C.)
A. J. Elder
John Elliott
H. McL. Elliott
J. M. C. Facey (Professor)
Dr. A. L. Farley (Professor)
Earle J. Fennell (Washington, D.C.)
Dr. C. Bruce Fergusson
R. H. Field
Fred Fleming
Ian Fox
A. M. Fraser
Eric S. Fry
Herman R. Friis (Washington, D.C.)
E. Gauer
A. C. Gerlach (Washington, D.C.)
Mrs. M. Glenday[1]
Lieut.-Col. L. F. Grant
Norman G. Gray
F. C. Green
L. E. Harris
Dr. D. C. Harvey
Mrs. P. E. Heather[1]
C. T. Helstrom
George H. Herriot
Dr. John H. Hodgson
D. C. Holmberg
Dr. L. E. Howlett
Wilfred Humphreys
Willard E. Ireland
Dr. J. D. Ives
Louis Joncas (Professor)
S. H. de Jong (Professor)
Admiral H. Arnold Karo (Washington, D.C.)
Dr. Max O. Klotz
J. O. Kilmartin (Washington, D.C.)
Dr. Paul E. Lachance
F. A. Lamb
A. Fred Lambert, D.T.S.
C. D. Landell
Major H. H. Lawson
T. A. Lendrum[2]
G. H. Leaver
Carl W. Lester
J. E. Lilly, D.T.S.
Mrs. Millicent Lord[3]
Col. C. C. Lindsay
R. G. Madill
S. E. March
J. R. March
Francis J. Marschner (Washington, D.C.)
O. W. Martyn
Major J. S. Mathews
Dr. A. E. MacDonald
W. G. MacElhanney
B. R. MacKay
Dr. Frank MacKinnon
David MacMillan
Major Edgar MacNutt
W. S. MacNutt (Professor)
Gilbert B. McColl, D.T.S.
Mrs. K. F. McCusker
K. McGrath
R. B. McKay
G. M. McKay
General A. G. L. McNaughton
William McPhillips
D. F. McQuat
O. M. Meehan
Mrs. L. Morrison[1]
C. H. "Marsh" Ney
Dr. N. L. Nicholson (Professor)
Commander Harley D. Nygren (Washington, D.C.)
Wilbert Norrish
Mrs. Margaret Ogilvie[4]
Miss Mary Ogilvie[4]
Noel J. Ogilvie
D. I. O'Gallagher
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John G. Pierce
Emilien Pouliot
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J. A. Reardon
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C. T. Smith
Nelson W. Smith (Washington, D.C.)
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Sutherland Brown, J. (Col.) See also under Brown.
West, H. A. S. Engineer survey services in the First Canadian Army. Can. Surveyor, v. 9, no. 1, 11, 1946.
A List of the General and Field Officers (Editions of 1758 and 1759). J. Millan, London, Eng.
Royal Military College Review, Kingston, Canada, and Log of H.M.S. Stone Frigate.
Anon. The Capture of Vimy Ridge. Canadian Army J. v. 5, no. 7.

Reference Notes

Chapter 1. EARLY MAN DRAWS HIS PLANS AND BOUNDARIES

[1]This is Assyrian in origin. It was found at Nuzi near Kirkuk and dates from the dynasty of Sargon of Akkad.
[2]An Eskimo aboard H.M.S. *Assistance* during the winter of 1850-51 drew a remarkable map, based upon memory and first-hand observations of the west coast of Greenland.
[3]The account of Herodotus of an interview between Aristagorus of Miletus and the Spartans relates how Aristagorus produced a tablet on which was inscribed "the circumference of the whole earth, the whole sea and all the rivers."
[4]A. E. Nordenskiold. *Periplus*, p. 5.
[5]This was the estimate of Poseidonius (130 B.C. - 51 B.C.) who used a star as the basis of his calculations rather than the sun.

Chapter 2. THE ROMANS AND RECTANGULAR LAND SURVEYS

[1]Del Catasto Romano e di Alcuni strumenti antichi di Geodesia. Padua, 1887.
[2]Fabricius. *Limitatio* in: Pauly-Wissowa, editor, Realencyclopädie der classischen Alterumswissenschaft, v. 13, p. 676.
[3]Fabricius, p. 690.

Chapter 3. MAPPING IN THE MIDDLE AGES

[1]Now in the Bibliothèque Nationale, Paris. Attributed to Cresques, a Jew.
[2]The earliest known description of a cross-staff, by Levi Gerson, was dedicated to Pope Clement VI in 1342. Gerson called the instrument "Jacob's Staff". The cross-staff was likely introduced to mariners by Martin Behaim, a celebrated navigator and mapper.

Chapter 4. THE GOLDEN AGE OF DISCOVERY

[1]The Portuguese historian Gomes de Azurara makes reference to the superstitions prevailing in Europe in the 15th century regarding the South Atlantic regions adjoining Africa in his "The Chronicle of the Discovery and Conquest of Guinea." This is available in English from *The Hakluyt Society*; 1896-99, ser. 1, vols. 95, 100.
[2]*Encyclopaedia Britannica*; 1962 ed., v. 5, 836.
[3]The Astrolabe: Its Uses and Derivatives; *Scot. Geog. Mag.*; 1927. v. 43, 135. See page 139.
[4]E. G. Racienstein. "Martin Behaim, His Life and His Globe." London, 1908, pp. 12-15.
[5]Fra Mauro, a monk of Murano near Venice, appears to have had an outstanding reputation as a cartographer in the 15th century. In 1457 he was commissioned by the King of Portugal to make a world map and for this purpose was shown charts depicting the latest Portuguese discoveries.

Chapter 5. THE RENAISSANCE IN THE ARTS OF MAPPING AND SURVEYING

[1]J. O. Halliwell, "Rara Mathematica". London, 1839.
[2]A modern theodolite is a precision surveying instrument similar to the present-day transit, but is larger and heavier in construction, with a more finely graduated circle and more sensitive levels. Readings are made by means of micrometer microscopes to the nearest second and by repetition and direction procedures to tenths. Two closely spaced vertical cross hairs are employed. Theodolites are principally used in geodetic triangulation where precise angles are needed and sightings made on distant light signals are required at night.

[7](Translation) "Map of the Three Rivers government which includes, when going down the St. Lawrence, the region from Lake St. Peter's exit to Ste. Anne. Surveyed in 1709 by orders of the Count of Pontchartrain, Commander of the King's Orders, Minister and Secretary of State, by Sr. Catalogne, Lieutenant of troops, and drawn by Jean Baptiste Decouagne."
[8]W. B. Munro. "Documents Relating to the Seigniorial Tenure in Canada". pp. 72-3 and 147.
[9]Introduction, p. 21.
[10]Conclusion of Introduction, p. 116.

Chapter 10. THE AGE OF THE EARLY ENGINEERS: REDUCTION OF LOUISBOURG

[1]Arthur Massé. "L'Arpentage sous le régime français". *Publ. Soc. Géod. Québec*, p. 4, 1945.
[2]Public Archives of Canada. Letter of May 8, 1686. C11A General Correspondence, v. 8, 15.
[3]Letter of September 10, 1686. C11A General Correspondence, v. 8, 225.
[4]Letter of June 8, 1687. C11A General Correspondence, v. 9, 47.
(Note: General Correspondence volumes in Public Archives of Canada carry alternate identification numbers, e.g. vol. 8 = vol. 9; vol. 9 = vol. 11.)
[5]J.S. McLennan. "Louisbourg: From Its Foundation to Its Fall." p. 288.

De Catalogne died in 1729 leaving a widow, four daughters and a son all in dire poverty. It is difficult to assess accurately the importance or extent of de Catalogne's contribution to the construction of Louisbourg defences. He occupied the post of assistant engineer (sous ingénieur) in relation to both Ile Royale and Ile St. Jean in 1720 and 1721. He was promoted to Captain in 1723. But Verrier's right-hand man and assistant at Louisbourg was Pierre Boucher. At least four of Boucher's signed maps of Louisbourg and vicinity are still extant.

[6]See text on Mitchell map, 3rd edition, reprint; 32 linen leaves. Public Archives of Canada, Map Division, Ottawa.
[7]See: "Voyage fait par ordre du roi en 1750 et 1751 dans l'Amérique Septentrionale pour rectifier les cartes des côtes de l'Acadie, de l'Isle Royale et de l'Isle de Terre-neuve, et pour en fixer les principaux points par des observations astronomiques", by M. de Chabert de l'Imprimerie Royale. Paris. 1753.
[8]A List of General and Field Officers. J. Millan, London. 1758-59 editions. Dept. of National Defence Tri-Service Library, Ottawa.
[9]See letter dated Quebec, January 11, 1792, in Simcoe Papers, Provincial Archives of Ontario, Toronto. (Major Samuel Holland to Governor J. G. Simcoe.)

Chapter 11. NOTABLE PIONEER SURVEYORS OF BRITISH NORTH AMERICA

[1]Quebec Instruction Book; no. 5, p. 9. *See also* 1886 Proceedings; *Assoc. Ont. Land Surv.*, p. 29.
[2]———————— no. 5, p. 11.
[3]———————— no. 5, p. 1.
[4]Public Archives of Canada; 1905, v. 1. Part 2, pp. 12-22.
[5]Land Grants in P.E.I.; v. 1, Part 2, Order in Council (Imp.) pp. 12-22, 1767.
[6]Public Archives of Nova Scotia. Publ. no. 2, p. 32.
[7]Provincial Archives of Ontario. Surveyors' Letter Book, 1784-1791. CPL Shelf 14, no. 8, p. 17.
[8]Description of Northern District: "All His Majesty's territories in North America which lie to the north of the Potomac River and of a line drawn due west from the head of the main branch of that river as far as His Majesty's dominions extend". See Royal Instructions, Feb. 10, 1764.
[9]Public Archives of Canada; ser. 3, MG 23, pp. 1-230.
[10]He ate poisonous fish in New Caledonia. See: Cook's Journals, Sept. 8, 1774. (Second Voyage).
[11]See: Summary of Selected Mss., Archives of Hydrographic Department, Admiralty, London, 1950.
[12]*Encyclopaedia Britannica*; 1962 ed. v. 6, p. 371.
[13]The Cambridge History of the British Empire, v. 6, ch. 5, p. 144.

Chapter 12. MARITIME PROVINCES SURVEYS AND THE LOYALIST INFLUX

[1]Surveyor General Holland to Lord Dorchester, letter dated January 31st, 1791, in accordance with terms of an Order-in-Council dated January 4th, 1791, requesting a report (list) of all surveying instruments in the office of the Surveyor General or in the hands of Deputy Surveyors. *Ont. Hist. Soc. Papers*, v. 21, 56.

[2]The following titles are listed in *Ont. Hist. Soc. Papers*, v. 21, 38:

Observations made on Islands of St. John and Cape Breton, 1769.
Astronomical Observations, 1769.
Eclipses of Jupiter's Satellites observed near Quebec, 1774.
Astronomical Observations, 1774.

[3]Arrêt du Conseil d'État du Roi concernant les concessions faites des terres de la Province d'Acadie dans la Nouvelle France. Archives de la Marine, série A1, liasse 39. Also: Winthrop Bell. "The 'Foreign Protestants' and the Settlement of Nova Scotia". Univ. Toronto Press, 1961, pp. 64-83.

[4]S. Bruce Fergusson. *The Dalhousie Review*, Spring, 1955, v. 35, no. 1, 16. Also: A. MacMechan, editor: Philipps to Board of Trade, August 16, 1721. Nova Scotia Archives II. A Calendar of Two Letter-Books and one Commission-Book in the possession of the Government of Nova Scotia, 1713-41. Halifax, 1900, 70.

[5]A. MacMechan, editor. Original Minutes of His Majesty's Council at Annapolis, 1720-39. Public Archives of Canada, p. 195.

[6]A Calendar of Two Letter-Books and One Commission-Book, p. 124.

[7]Beamish Murdoch. "A History of Nova Scotia". v. 2, 128.

[8]Public Archives of Nova Scotia; Commission Book, v. 1, 490.

[9]Beamish Murdoch. "A History of Nova Scotia". v. 1, 490.

[10]G. G. Campbell. "The History of Nova Scotia". The Ryerson Press, 1948. Ch. 16, 144; ch. 17, 152.

[11]Public Archives of Nova Scotia, v. 174, pp. 174, 290.

[12]*Bulletin* of the New York Public Library (Feb., March, May and Sept. 1931), v. 35. "Narrative of American Voyages and Travels of Captain William Owen, R.N. and the Settlement of the Island of Campobello in the Bay of Fundy, 1776-71".

[13]Dictionary of National Biography, v. 60. Macmillan, 1899.

[14]Collections of the New Brunswick Historical Society, v. 3, no. 7, 77, 112, no. 8, 204-277: "Benjamin Marston of Marblehead, Loyalist, His Trials and Tribulations During the American Revolution".

[15]Anthony Lockwood. "A Brief Description of Nova Scotia". G. Hayden, London, 1818, pp. 72-74.

[16]Provincial Archives of Nova Scotia. Letters from Surveyor General Morris to his Deputy Surveyors relating to Loyalist Land Grants, 1785-1800; v. 396, p. 97, Halifax, Sept. 5, 1792.

[17]Andrew H. Clark. "Titus Smith Jr. and the Geography of Nova Scotia, 1801 and 1802". *Annals Assoc. Amer. Geogrs.* Dec. 1954, v. 44, 291-314.

[18]Public Archives of Nova Scotia. Lieut.-Governor's Petitions, 1847.

[19]Nova Scotia Crown Lands Office. Record Book No. 1, Statutes of Nova Scotia, 1851-52, ch. 4.

[20]Public Archives of Nova Scotia. Loose file on "Surveys".

[21]A. B. Warburton. "A History of Prince Edward Island". p. 51.

[22]Land Tenure in Prince Edward Island; Orders in Council (Imp.) 1767. Also *Ont. Hist. Soc. Papers*, v. 21, 31.

[23]John Stewart. "An Account of Prince Edward Island in the Gulph of St. Lawrence, North America". W. Winchester, London, 1806.

[24]J.C. Fitzgerald, editor. "Writings of Washington". U.S. Government Printing Office, Washington, pp. 23, 144. Also A. B. Warburton. "A History of Prince Edward Island"; p. 184.

[25]Henry Youle Hind. "Geology of New Brunswick". Prelim. Report, ch. 1. Queen's Printer, Fredericton, N.B., 1865.

[26]G.H. Hay. "A History of New Brunswick". p. 93.

[27]See Revised Statutes, N.B., 1952, v. 4, 5 (Imperial Order in Council establishing Province of New Brunswick).

[28]George Sproule Letter Books. vol. A (1785-89), 1. Public Archives of New Brunswick, Fredericton, N.B.
[29]———————————————, 325. Public Archives of New Brunswick, Fredericton, N.B.
[30]———————————————, 373. Public Archives of New Brunswick, Fredericton, N.B.
[31]Surveys Branch, Government of New Brunswick, Fredericton. (Charlotte 1-173) v. 19 of Applications, 1763-1793.
[32]George Sproule Letter Books; vol. A, 1. Public Archives of New Brunswick, Fredericton, N.B.
[33]Alexander Monro. "New Brunswick, Nova Scotia and Prince Edward Island". Richard Nugent, Halifax, 1855.
[34]See ref. note 15 above.
[35]D.W. Prowse. "A History of Newfoundland". p. 61. Macmillan and Co., 1895; also Eyre and Spottiswoode, London, 1896.
[36]Colonial Records (1814). Public Archives of Newfoundland, St. John's, Nfld.
[37]H.M. Mosdell. "When was that in Newfoundland". p. 143. Trade Printers and Publishers, St. John's, 1923.
[38]J. R. Smallwood, editor. "The Book of Newfoundland". v. 2, p. 12. Newfoundland Book Publishers Ltd., St. John's, 1937.
[39]Appendix to Journal of House of Assembly, Sixth Session (1836), Newfoundland. p. 193.
[40]Journal of House of Assembly, Sixth Session (1836), Newfoundland. p. 70.
[41]Appendix to Journal of House of Assembly, Sixth Session (1836), Newfoundland, p. 189.
[42]Original Registry, Public Archives of Newfoundland. v. 1, folio 2.
[43]D. W. Prowse. "A History of Newfoundland". p. 427.
[44]Appendix to Journal of House of Assembly, Sixth Session (1836), Newfoundland. p. 200.
[45]*Encyclopaedia Canadiana*. v. 3, 115.
[46]*Encyclopaedia Canadiana*. v. 5, 377.
[47]Journal of House of Assembly, 4th Session of 8th Assembly (1864), Newfoundland. pp. 10, 16.
[48]Report of Select Committee, House of Assembly (1869), Newfoundland. Murray Evidence.
[49]Appendix to Journal of House of Assembly (1869), Newfoundland. p. 713.

Chapter 13. EARLY PROBERS OF CANADA'S SEAS AND GREAT LAKES

[1]"Boke of Hydrography". British Museum, Royal Mss. 20 E 9.
[2]British Museum. K MAR 1 (41).
[3]Edward Wright. *Certain Errors in Navigation*: "Suppose a spherical superficies with meridians, parallels, rumbes, and the whole hydrographical description drawne therefrom, to be inscribed on a concave cylinder, these axes agreeing in one . . . In this nautical planisphere thus conceived to be made, of places must needes bee situate in the same longitudes and directions or courses, and upon the same meridians, parallels, rumbes that they were in the globe".
[4]Hakluyt Society, 1904, VII, p. 162.
[5]J. Barrow. "Voyages Into the Arctic Regions". Murray, London, p. 118.
[6]*Encyclopaedia Canadiana*. v. 4, 287.
[7]T. E. Layng. Sixteenth Century Maps Relating to Canada. Ottawa, 1956, p. 23.
[8]Dr. John Dee's Journal, 1583. Also see Albert H. Markham. "The Voyages and Works of John Davis the Navigator". Hakluyt Soc. 1880.
[9]F. J. S. Parsons and W. F. Morris. "Imago Mundi" III, 1939, p. 61.
[10]*Encyclopaedia Canadiana*. v. 3, 208.
[11]"The Voyages of Captain Luke Foxe of Hull and Captain Thomas James of Bristol in Search of a North-West Passage in 1631-32." Hakluyt Society. London, 1894. v. 2, 324. Miller Christy, Editor.
[12]Prof. Paper No. 13. British Admiralty. Hydrographic Dept. London. 1950, p. 67.
[13]Parry, 1821, p. 296.
[14]*Contr. Dom. Obs.*, Ottawa. v. 1, no. 3. Also: *Polar Record*, No. 43, 387, 1952.

[15]British Parliamentary Papers, 1850a, p. 58.
[16]Sir John Franklin. "Narrative. Second Expedition to Shores of the Polar Sea". 1825-27. v. 2, 65.
[17]Prof. Paper No. 13. British Admiralty. Hydrographic Dept. 1950, p. 72.
[18]Andrew Taylor. *Geog. Mem. 3*, Geog. Br., Dept. Mines and Technical Surveys, Ottawa, 1955.
[19]"A Voyage of Discovery to the North Pacific Ocean and Round the World". Narrative by Captain George Vancouver. (3 vols.) Printed for G. G. and J. Robinson and J. Edwards, London, 1798. See v. 2, chap. 6, 379. Point Wales is the west point of Observatory Inlet.
[20]Captain Cook and Captain King: "A Voyage to the Pacific". (3 vols.) See v. 2, 263. See also Little: *Can. Geog. J.*, June, 1962, p. 195.
[21]Prof. Paper No. 13. British Admiralty, Hydrographic Dept. 1950. p. 26. Chart no. A317-88.
[22]See Annotations by W. Bligh on his copy of the Cook and King "Narrative of the Third Voyage". British Admiralty Library, London.
[23]William Faden, Geographer to the King, published a Chart (undated but definitely after 1780) of the Northwest Coast of America and the Northeast Coast of Asia explored in the years 1778 and 1779. Prepared by Lt. Henry Roberts, under the immediate supervision of Captain Cook.
William Strahan, London, in 1777 published a Chart of the Southern Hemisphere. See frontispiece of vol. 1, Cook's "Narrative".
[24]Capt. Vancouver. "Narrative". v. 1, 18, 19.
[25]——————————— v. 1, 18 (Apr. 26, 1791).
[26]——————————— v. 2, 312 (June 22, 1792).

Canadian Historic Sites plaque, erected 1929, near U.B.C. campus: "The Last Spanish Expedition: In commemoration of the first friendly meeting of the British and Spaniards in these waters near this place Captain George Vancouver on June 22, 1792, met *Sutil* and *Mexicana* under Captains Galiano and Valdes, last Spanish exploring expedition on what is now the British Columbia coast. They exchanged information, established mutual confidence and continued exploration together".
[27]Alexander Mackenzie. "Voyages". 1801, p. 349.
[28]Capt. Vancouver. "Narrative". v. 3, 295.
[29]Pacific Northwest Quarterly. 41 (October, 1950), 356.
[30]Public Archives of Canada. J. F. W. DesBarres. 1774-1807 Corresp. Series 3, pp. 1-230 M.G. 23.
[31]Public Archives of Canada. J. F. W. DesBarres. 1774-1807 Corresp. Series 3, pp. 1-230 M.G. 23.
[32]Milo M. Quaife, editor. "The Siege of Detroit in 1763". The Lakeside Press. Chicago, 1958.
[33]Lieut. Charles Robertson of the 77th Regiment, who commanded the King's vessels on Lake Erie in the early 1760s.
[34]Fred Landon. "Lake Huron". The Bobbs-Merill Co. N.Y. 1944, p. 286.
[35]Lieut. Edward Chappell, R.N. "Narrative of a Voyage to Hudson's Bay in His Majesty's Ship *Rosamond*". R. Watts, London, 1817. pp. 175-6. Tables of Soundings 179-80-1. Compass Variations p. 247, Thermometrical Observations p. 249.
[36]James Fisher. "Rockall".
[37]Public Archives of Canada. Map Division. "A Survey of the River St. Lawrence from Lake Ontario to the Galops Rapids, 1818".
[38]Capt. J. G. Boulton. Address in *Trans. Lit. Hist. Soc. Quebec.* No. 28 (Sessions of 1908-09). p. 94.
[39]Address in *Trans. Lit. Hist. Soc. Quebec*, No. 28 (Sessions of 1908-09) p. 49.
[40]Address in *Trans. Lit. Hist. Soc. Quebec*, No. 28. (Sessions of 1908-09) p. 73.
[41]Address in *Trans. Lit. Hist. Soc. Quebec*, No. 28. (Sessions of 1908-09) p. 86.
[42]Address in *Trans. Lit. Hist. Soc. Quebec*, No. 28. (Sessions of 1908-09). p. 95.

Chapter 14. THE EARLY PENETRATION OF CANADA'S WESTERN INTERIOR

[1]John Warkentin, editor. "The Western Interior of Canada". McClelland and Stewart, Toronto, 1964. The Carleton Library Series, No. 15.
[2]A. G. Doughty and Chester Smith, editors. "The Kelsey Papers". Public Archives of Canada, Ottawa, 1929, pp. 1-15.

[3]A. S. Morton. "A History of the Canadian West". Nelson and Sons, Toronto, 1939, p. 113.
[4]E. E. Rich. "Hudson's Bay Company" (2 vols.) v. 1, 589.
[5]Public Archives of Canada, Map Division. H2-902-1737.
[6]"Journals and Letters of Pierre Gaultier de Varennes de la Vérendrye and His sons, with Correspondence between the Governors of Canada and the French Court, touching the Search for the Western Sea". Champlain Soc. Toronto, 1927, pp. 43-58.
[7]"Journals and Letters of La Vérendrye". Champlain Soc. Toronto, 1927, pp. 302-17.
[8]L. J. Burpee, editor. "The Journal of Anthony Henday 1754-55". *Trans. Roy. Soc. Can.* Third Series (1907) I Section 2, pp. 322-53.
[9]A copy of the map is contained in "An Historical Abridgement of Discoveries in North America". Wm. Goldson, London, 1793.
[10]Samuel Hearne. "A Journey from Prince of Wales Fort in Hudson's Bay to the Northern Ocean". London, 1795, pp. 69-75.
[11]Samuel Hearne. "A Journey to the Northern Ocean". Richard Glover, editor, Macmillan Co. of Canada, Toronto, 1958.
[12]See map on inside back cover of Hearne's "Tracks On His Two Journeys for the Discovery of Copper Mine River in the years 1770-71-72 under the direction of the Hudson's Bay Company".
[13]Extract from letter, Isaac Ogden to David Ogden, Nov. 7, 1789. Canada Sessional Papers, 1890. Report on the Public Archives of Canada for 1889, 22, No. 6B, p. 30.
See also Alexander Mackenzie. "Voyages". p. 24.
[14]Alexander Mackenzie. "Voyages". p. 246.
[15]Extract from letter, Isaac Ogden to David Ogden, Nov. 7, 1789. Canada Sessional Papers, 1890.
[16]"Journals of Samuel Hearne and Philip Turnor Between the Years 1774 and 1792". Champlain Soc. Toronto, 1934, pp. 481-2.
[17]A. S. Morton. "A History of the Canadian West". London, 1939, p. 553.
[18]Public Archives of Manitoba. "Selkirk Papers". Miles Macdonell to Lord Selkirk, letter of July 17 1883, p. 787.
[19]H. E. Beresford. "Early Surveys in Manitoba". *Hist. Sci. Soc.*, Series 3, No. 9. Winnipeg, 1954, p. 12.
[20]Public Archives of Canada, Map Division, Ottawa. 8-11-701.
[21]Vera Fidler. *Can. Geog. J.* v. 59, No. 4 (1959) p. 120.
[22]Alexander Mackenzie. "Voyages from Montreal in the River St. Lawrence through the Continent of North America to the Frozen and Pacific Oceans, in the years 1789 and 1793". London, 1801, p. 293.
[23]———————, p. 367 and 377.
[24]———————, p. 440.
[25]———————, p. 441.
[26]*Mackenzie's Rock*. Dept. of the Interior, Ottawa, Historic Sites Series, No. 6. See Appendix. Government Printing Bureau, Ottawa.
[27]Walter E. Sheppe. "First Man West". Univ. Calif. Press, 1962, p. 304.
[28]J. B. Tyrrell, editor. David Thompson's "Narrative of His Explorations in Western America 1784-1812". Champlain Soc. Toronto, 1916, p. 173.
[29]E. E. Rich. "Hudson's Bay Company". v. 1, 148.
[30]———————, p. 151.
[31]———————, p. 151.
[32]David Thompson. "Narrative". pp. 171-2-3.
[33]H. E. Beresford. *The Can. Surveyor.* (Proceedings, 1941), p. 47.
[34]David Thompson. "Narrative". *Introduction*, p. 43.
[35]———————, p. 168.
[36]———————, p. 402.
[37]———————, p. 403.
[38]———————, p. 526.
[39]———————, p. 104-5.

[40]Report of David Thompson on the examination of the Ottawa River, the Muskrat Lake and River, under the instruction of Hon. John Macaulay, John Cartwright, Esq. and Captain Francis H. Baddeley, R.E., Commissioners for the Survey of the Ottawa River.
See: Report of the Commissioners, R. Stanton, Toronto, 1839.
[41]See: Records of Research and Special Services, Board of School Trustees, S.D. No. 39, Vancouver, B.C.
[42]Capt. John Palliser. "Papers Relative to the Exploration of British North America". 1859, p. 4.
[43]Map with James Hector article: "On the Geology of the Country Between Lake Superior and the Pacific Ocean". *Quart. J. Geol. Soc. London*, v. 17, 1861, pp. 385-445.
[44]James Hector. "On the Capabilities for Settlement of the Central Part of British North America". *Edinburgh New Phil. J.* New Series XIV, 1861, pp. 264-267.
[45]"Report on the Exploration of the Country Between Lake Superior and the Red River Settlement". Legislative Assembly, Toronto, 1858, p. 5.
[46]"Papers Relative to the Exploration of the Country Between Lake Superior and the Red River Settlement". Eyre and Spottiswoode, London, 1859, pp. 19-20.

Names of the Expedition Party, July 23, 1857:

H. H. Killaly	Leveller
Ed Cayley	Chainman and General Assistant
C. De Salaberry	Chainman and General Assistant
J. Cayley	Assistant Leveller, Rodman
S. J. Dawson	Surveyor
Lindsay Russell	Chainman
G. F. Gaudet	Chainman
Mr. Campbell	Chainman
Prof. H. Y. Hind	Geologist
W. Fleming	Assistant
A. W. Wells	Assistant to Mr. Dawson
J. Dickenson	Engineer.

[47]S. J. Dawson. "Report on the Exploration of the Country Between Lake Superior and the Red River Settlement and Between the Latter Place and the Assiniboine and the Saskatchewan". Legislative Assembly. John Lovell, Toronto (1859) pp. 15-48.
[48]H. Y. Hind. "Narrative". 1860, pp. 233-36.
See also: John Warkentin; "The Western Interior of Canada". Part VI, p. 230. McClelland and Stewart, Toronto, 1964.
[49]Irene M. Spry. "The Palliser Expedition". Macmillans of Canada. Toronto, 1963, p. 13.

Chapter 15. UPPER CANADA SURVEYS

[1]R. C. Gourlay. "Statistical Account of Upper Canada, 1822". v. 1, 122.
[2]*Haldimand Papers.* Public Archives of Canada, MG 21, G2, v. 126, 1. British Museum, Add. MS 21775 (May 26, 1783).
[3]*Haldimand Papers.* Public Archives of Canada, MG 21, G2, v. 124, 34-5-7. British Museum, Add. MS 21784 (June 26, 1783).
[4]In 1780 Col. J. Butler obtained Haldimand's permission to divide suitable farmland along the Niagara River into lots for refugee Loyalists. Surveyor Allan MacDonell submitted to Quebec an account for payment covering his 24-day period of work at 10 shillings a day and including expenses for two chainbearers and one "marker". This undated document could represent the first record of a local land survey in what was to become Upper Canada. (See R. M. Anderson, *Development of Township Surveys in Ontario*. The Canadian Surveyor, April, 1936 issue, p. 6). By August, 1782, more than 230 acres had been cleared in the vicinity of Niagara for 16 settlers and their 68 dependents and it must be assumed that surveys were necessary for this occupation. By the autumn of 1783 at least 710 acres had been cleared in this area for the use of 46 families.
[5]*Haldimand Papers.* Public Archives of Canada, MG 21, G2, v. 124, 90. British Museum, Add. MS 21784 (June 26, 1783).

[6]*Haldimand Papers*. Public Archives of Canada. MG 21, G2, v. 126, 42. British Museum, Add. MS 21786, v. 2 (September 11, 1783).
[7]*Haldimand Papers*. Public Archives of Canada. MG 21, G2, v. 124, pp. 45, 46. British Museum, Add. MS 21784.
[8]Public Archives of Canada. R.G. 4, No. 25.
[9]Colonial Office, London, Eng., 42, v. 61, 179 (July 17, 1788).
[10]*Simcoe Papers*. Letter to Evan Nepean (April 28, 1792). Public Archives of Ontario, I, 146.
[11]General Instructions for Deputy Surveyors in the Province of Upper Canada 1792, v. 1. Also: Ontario Crown Lands Office (Toronto) records (October, 1792 to April, 1794).
[12]Field Notes of Augustus Jones (1793). Bk. 366, Surveys and Maps Office, Ont. Dept. of Lands and Forests, Toronto. See also: No. 1760, *Plan of Niagara, 1787*, by Philip R. Frey, Deputy Surveyor.
[13]Edith G. Frith. "The Town of York 1793-1815". The Champlain Society, Toronto, 1962. Also in the Public Archives of Canada, see Plan of Township of York, November, 1813.
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