R. G. Blackadar

CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

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Geological Survey of Canada

Information Circular No. 2

# FIELD WORK, 1958



by

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The following notes describe briefly, by provinces, the seventy-six field projects undertaken by the Geological Survey of Canada during 1958, indicate progress made, and briefly summarize some of the results. The main purpose of most Geological Survey field work is to obtain basic data concerning the geology of Canada. These data, when assembled, interpreted, and published as appropriate maps and reports, guide those engaged in the search for and development of metallic and non-metallic mineral deposits, fuels, and construction materials. From time to time, however, as an incidental product of the field work, geological features or mineral occurrences are noted that may be of immediate or direct economic interest. Some of these warrant prompt release, in advance of the Survey's more formal Preliminary Series reports. A few such economic items are included in the following notes.

The field projects described involve the study and mapping of bedrock geology, unless otherwise specified.

All statements concerning the results of field work are subject to confirmation by office and laboratory study, and by publication by the officer concerned through Geological Survey or other media.

Map-areas are designated according to the National Topographic System in effect up to and including 1957.

## DISTRICT OF FRANKLIN

R.G. Blackadar mapped the following areas at Cape Dorset, on the southern coast of Baffin Island, for publication on the scale of 1 inch to 1 mile: 36 C SE¼, and the west half of 36 B SW¼. The areas are underlain by Grenville-type rocks. These are mainly gneisses, but include substantial bands of metamorphosed quartzite, marble, and schist. The trends of these sedimentary bands change from west in the northwest corner of the mapped area, to southeast at the east boundary of the mapped area.

In addition, a few traverses were completed in the Hobart Island (36 A) and White Bear Bay (35 P) map-areas, also on the southern coast of Baffin Island.

R.L. Christie, attached to Defence Research Board's Operation Hazen for logistical and administrative purposes, continued his geological reconnaissance in the Hazen Lake district, in northern Ellesmere Island. The reconnaissance included the area between Markham Inlet and Hazen Lake, the ice cap for about 70 miles west of Hazen Lake, the region between Alert and Hazen Lake, Judge Daly Promontory, and

territory in the vicinity of Discovery Harbour (Fort Conger).

The strata trend northeasterly. The oldest and most widespread rocks are the early Palaeozoic or older strata of the Cape Rawson group. These are mainly slate, sandstone, quartzite, and greywacke, and underlie the region between Archer Fiord and Hazen Lake, and some of the mountains north of that lake. Moderately inclined Permo-Carboniferous strata, comprising sandstone, limestone, arkose, and chert-pebble conglomerate, underlie much of the United States Range. Adjacent to Hazen Lake is a gently folded group of sandstone, shale, and coal beds from which were collected fossils of Permo-Carboniferous, probable Triassic, and probable Cenozoic age. Steeply to moderately inclined limestone, sandstone, quartzite, slate, and phyllite, of probable Palaeozoic age, underlie most of Judge Daly Promontory. Partly consolidated sandstone, shale, and coal underlie small areas on Judge Daly Promontory and near Fort Conger, and contain fossil leaves and tree trunks that indicate a probable Cenozoic age.

In addition to the coal occurrences noted in Information Circular No. 1, a bed of Tertiary coal at least 20 feet thick is exposed for a length of about 1,000 feet along a creek canyon near Fort Conger. This coal was used as fuel by explorers wintering at Fort Conger in 1875-76 and in 1882-83. Amber occurs as nodules in coal outcropping on Hazen Lake, and was noted on beaches at the east end of the lake. Carnelian, or pale yellow chalcedony, occurs as residual pebbles or nodules on the surface of a small basalt conglomerate deposit about 40 miles northeast of Hazen Lake.

R. Thorsteinsson and E.T. Tozer completed the mapping of Melville, Brock, Borden, Mackenzie King, and Prince Patrick Islands, and in doing so mapped about 20,000 square miles in sufficient detail for publication at 1 inch to 8 miles. The party comprised only the two geologists, and a pilot, and had full-time use of a Piper Super Cub supplied by Bradley Air Services of Carp, Ontario. The aircraft was used for moving camps, and by the geologists for traversing. The landing gear was fitted with large low pressure tires and with this equipment little difficulty was experienced in landing at about 300 different unprepared localities. The base of operations was a food and fuel cache established on eastern Melville Island in 1955 by the Geological Survey's Operation Franklin.

The strata range in age from Lower Ordovician (and possibly older) to Tertiary, all systems except the Mississippian being represented. A substantial unconformity occurs beneath the Pennsylvanian, and a lesser discordance beneath the Permian.

Ordovician and Silurian rocks are confined to Melville Island, where they occur in the Canrobert Hills,

the McCormick Inlet area, and the Weatherall Bay area. Substantial facies differences occur: the Ordovician-Silurian section of the Canrobert Hills is mainly graptolitic shale; that of McCormick Inlet area includes both carbonate and graptolitic facies; and the Silurian rocks of Weatherall Bay area are almost exclusively carbonate.

Brock, Borden, and Mackenzie King Islands expose the northwest limb of the Sverdrup basin with a section from Triassic to Cretaceous that dips regionally to the southeast.

Beaufort sands and gravels, of Pleistocene or Late Tertiary age, occupy the northwestern parts of Prince Patrick Island, Brock Island, and Borden Island.

## DISTRICT OF MACKENZIE

J.A. Fraser completed geological mapping of Fort Enterprise (86 A) map-area. The results of 1957 field work in this map-area have been published[1].

The 1958 work disclosed mainly massive and gneissic granitic rocks in the northwest corner of the map-area, and schist and gneiss in the northeast corner as might be expected from Map 16-1958.

In addition, preparations were made for helicopter-supported Operation Coppermine, planned for 1959. Caches of aviation fuel were established at Sawmill Bay and Coppermine, and an aerial reconnaissance was made of part of the Operation area to select camp sites and for other purposes.

F.C. Taylor was assigned to complete the reconnaissance geological mapping of the only outstanding map-areas within the Precambrian Shield of southeastern District of Mackenzie (75 A, the southeast half of 75 F, 75 G, and the west half of 75 H). The project area was completed for publication on the scale of 1 inch to 4 miles except for a central north-south strip comprising about one-third of 75 A, and except for the extreme southeast corner of that map-area.

The mapped area is underlain almost entirely by gneisses. The oldest rocks are biotite and hornblende para-gneisses. These form scattered bodies totalling about one-quarter of the mapped area. These rocks, particularly in

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[1] Fraser, J.A.: Fort Enterprise, Northwest Territories; Geol. Surv., Canada, Map 16-1958 (1958).

75 A, G, and H, include highly metamorphosed magnetite iron formation. However, no important concentrations of magnetite were noted. Granitic rocks, mainly gneissic, underlie nearly three-quarters of the mapped area. Sedimentary rocks of the Nonacho group underlie minor areas in 75 F, and in the west part of 75 G, but were not noted elsewhere. Some of the granite is younger than the Nonacho strata. Gossans derived from pyrite are common in the paragneisses.

J.V. Ross, of the Department of Geology and Geography, University of British Columbia, commenced and completed the geological study and mapping of the west half of Mesa Lake (86 B/14 W½) map-area. This map-area was chosen for mapping because it was thought that it would provide further information on the relations between the Yellowknife group and Snare group of rocks[1]. Field work failed to indicate a stratigraphic break between the metamorphosed Yellowknife rocks in the east and the metamorphosed rocks, previously assigned to the Snare group, in the west; and suggests that the metamorphic rocks of this map-area, previously assigned to two different age groups are, in fact, of the same age, differing only in facies.

R.D. Lawrence, a seasonal party chief now at University of Toronto, commenced and completed field work within Rodriques Lake (86 B/13 E½) map-area. It is not expected that this project will add much to data previously published[2].

## DISTRICT OF MACKENZIE, AND YUKON

J.A. Jeletzky continued his study of the stratigraphy and palaeontology of Cretaceous and uppermost Jurassic strata southwest of the Mackenzie River delta. The project was commenced in 1955, but no field work done on it during the summers of 1956 and 1957. A preliminary report[3] concerning the 1955 field work has been published.

Most of the 1958 field season was spent on the eastern flank of the Richardson Mountains, in Northwest Territories, between the latitudes of Aklavik and Fort McPherson. In addition, a few days were spent studying strata

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1 Lord, C.S., and Wilson, J.T.: Ingray Lake, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 697A (1942).

2 Lord, C.S., and Wilson, J.T.: op. cit.

3 Jeletzky, J.A.: Uppermost Jurassic and Cretaceous Rocks of Aklavik Range, Northeastern Richardson Mountains, Northwest Territories; Geol. Surv., Canada, Paper 58-2 (1958).

on parts of the Porcupine River between the mouths of the Bell and Driftwood Rivers, in Yukon; and another few days studying strata in an area including the junction of Porcupine and East Porcupine Rivers, Yukon.

On the east flank of the Richardson Mountains a detailed study was made of more than 5,000 feet of strata comprising an essentially complete succession of marine Lower Cretaceous and uppermost Jurassic strata. All units were found to be fossiliferous. Coal seams were mapped at about the middle of the Lower Cretaceous section, and these are correlated with those mined at Moose Channel northwest of Aklavik. The Lower Cretaceous strata are unconformably overlain by more than 550 feet of Upper Cretaceous marine rocks.

On the Porcupine River between the mouths of Bell and Driftwood Rivers strata were examined that had been mapped previously as Cretaceous[1]. They were found to comprise about 900 feet of fossiliferous marine Permian rocks unconformably overlain by more than 2,500 feet of mostly marine, fossiliferous Jurassic strata, in turn overlain by a thick non-fossiliferous conglomerate of an unknown but presumably late Jurassic or early Cretaceous age.

Near the junction of Porcupine and East Porcupine Rivers, late Lower Cretaceous fossils were found in the middle part of several thousand feet of sandstone and shale which, insofar as known, is otherwise unfossiliferous.

## DISTRICT OF KEEWATIN

G.D. Jackson commenced the geological study and mapping of Belcher Islands (33 M, 34 D), and completed field work within the eastern quarter of this project area.

## YUKON

L.H. Green commenced a preliminary reconnaissance of the following map-areas in west-central Yukon in anticipation of a helicopter-assisted project in this vicinity in the near future: 116 A, B, C E½, F E½, G, and H. Data were obtained from all map-areas except 116 A. Although the stratigraphic data obtained will facilitate the contemplated helicopter-assisted reconnaissance they do not warrant a preliminary report at this stage.

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[1] McConnell, R.G.: Report on Exploration in the Yukon and Mackenzie Basins, N.W.T.; Geol. Surv., Canada, Ann. Rept., vol. IV, 1888-89, pt. D, p. 123.

J.A. Roddick and J.O. Wheeler made a preliminary geological reconnaissance of 105 F, G, J, K, and part of B, all in southeastern Yukon. It is anticipated that a helicopter-supported geological reconnaissance of these map-areas, to be known as Operation Pelly, will be undertaken in 1959. The 1958 preliminary reconnaissance, supported by a Piper Super Cub, obtained in a relatively inexpensive manner much key geological data that will aid in planning Operation Pelly and enable it to be conducted at maximum efficiency. Dr. Roddick was responsible for the reconnaissance north and northeast of the Finlayson Lake-Pelly River valley, whereas Dr. Wheeler was responsible for the field work to the south and southwest. The results, because of their preliminary and scattered nature, do not warrant a preliminary map or report.

## BRITISH COLUMBIA

E.F. Roots completed field work required to fill in gaps and to solve critical geological problems outstanding from Operation Stikine (1956)[1] within Bowser Lake (104 A), Spatsizi (104 H), and Dease Lake (104 J) map-areas. Similar work outstanding from Operation Stikine within Iskut River (104 B) and Telegraph Creek (104 G) map-areas is the responsibility of J.G. Souther; and within Cry Lake (104 I) map-area, of H. Gabrielse.

Part of the season was spent in a study of the limits, stratigraphy, and structure of a large area of marine and continental clastic sedimentary rocks that underlies most of the Skeena Mountains and Nass Basin. These rocks appear to form the largest single sedimentary basin, uncomplicated by igneous activity, in the western Cordillera. The central part of the basin contains several thousand feet of Upper Triassic and Lower Cretaceous sediments which are in part intensely contorted and dislocated, and in places have suffered low-grade metamorphism. The basin is surrounded by rocks of varied lithology including considerable thicknesses of limestone, of Early Mesozoic and Late Palaeozoic age, some of which are less deformed than the younger rocks within the basin. The recognition of this basin during the mapping done by Operation Stikine lead to speculation as to its potential for petroleum deposits. The mapping done in 1958 confirmed the possibility that the intensity of deformation of the interior of the basin may decrease with

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[1] Roots, E.F., and Others: Stikine River Area, Cassiar District British Columbia; Geol. Surv., Canada, Map 9-1957 (1957).

depth, thereby increasing its attractiveness to those engaged in the search for oil and gas.

Asbestos was noted in Dease Lake (104 J) map-area 4 miles east of the south bay of Tachilta Lakes, 2½ miles west of Tuya River. This locality is approximately 35 miles up Tuya River valley from the Dease Lake-Telegraph Creek road, and at latitude 58°36', longitude 130°51'. Cross fibre veins of fibrous chrysotile occur on the northwest end of a hill of serpentinized peridotite. Veins wider than one-eighth inch appear to be spaced at least one to every square yard, and in several places are found several to each square foot, across two or three hundred yards of outcrop. Many of the veins have a central parting, but clean ½-inch fibre is abundant. The longest fibre noted was about 1¼ inches in length. Veins of green non-flexible fibrous serpentine, and of massive pale bluish grey and green serpentine are also present, and are cut by the veins of chrysotile. The ultramafic body in which the veins occur is about 3 miles long and ½ mile wide. This body was crossed by a single traverse only, and nothing is known of its asbestos content elsewhere.

J.G. Souther completed field work outstanding from Operation Stikine (1956) in Iskut River (104 B) map-area, except that about a week's work with a ski-wheel equipped aircraft is still required in and about an ice field adjacent to the central part of the north boundary[1].

In addition, he made a geological reconnaissance of Sumdum (104 F) map-area and the southern half of Tulsequah (104 K) map-area. Although additional field work is required to bring this reconnaissance up to 4-mile standard, the study of Sumdum map-area is sufficiently advanced to warrant publication of a preliminary map now being prepared. The western part of these map-areas is underlain by Coast Range granitic intrusions. The eastern part is underlain mainly by Permian, Triassic, and Jurassic sedimentary and volcanic rocks.

Abundant molybdenite was noted in hand specimens from a pink quartz monzonite stock on the eastern boundary of Sumdum (104 F) map-area 4½ miles north of Barrington River. In addition, specimens of pink quartz monzonite, well mineralized with molybdenite, were found 4 miles west of the north end of Chutine Lake. These were in the medial moraine of a glacier that flows easterly into the north end of the lake.

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[1] Roots, E.F., and Others: Stikine River Area, Cassiar District, British Columbia; Geol. Surv., Canada, Map 9-1957 (1957).

H. Gabrielse continued stratigraphic studies and preliminary geological reconnaissance of Kechika (94 L) and Rabbitt River (94 M) map-areas. This work, barely started in 1957, is intended as reconnaissance in preparation for future helicopter-assisted mapping for publication on the scale of 1 inch to 4 miles. Most of the northwest quarter of Kechika map-area west of the Rocky Mountain trench, and the southwest quarter of Rabbitt River map-area west of the trench and south of Turnagain River and Sandpile Creek, were mapped to about 4-mile standard. In addition, some reconnaissance was done in the southwest quarter of Kechika map-area. The 1958 work does, nevertheless, contain various gaps better completed at a later date with the aid of a helicopter, and the release of a preliminary geological map is not warranted at this stage.

The area mapped is underlain by tightly folded sedimentary strata ranging in age from Precambrian to Mississippian, and by granitic rocks of the Cassiar batholith. Fluorite was noted in Kechika map-area in a greenstone body about 10 miles east-northeast up a creek that flows into Dall River 2 miles north of Dall Lake. The greenstone is brecciated and contains amphibole, biotite, and epidote. Veinlets cutting the greenstone contain carbonate and dark purple fluorite. The extent of the fluorite-bearing rock is not known. Rocks intruded by the greenstone have been altered to fine-grained, cherty hornfels. Similar contact metamorphic rocks were noted several miles northwest of the fluorite-bearing greenstone.

H.W. Tipper completed the geological study and mapping of Quesnel (93 B) map-area except that part lying northeast of Quesnel River and a small area around the town of Quesnel. Both these uncompleted parts are in the northeast corner.

With the above exceptions, the northern two-thirds of the map-area was mapped in 1958. This part contains scattered minor areas of Cache Creek strata. Granitic rocks outcrop at and around Granite Mountain east of Fraser River. Similar granitic rocks outcrop west of Fraser River at the head of Deserters Creek, and as an elongated body extending 12 miles north-northeasterly from the junction of Narcosli Creek and Ramsey Creek. Otherwise, most of the area mapped during 1958 is underlain by Tertiary volcanic and sedimentary rocks, comprising three assemblages separated by two angular unconformities. A small area of post-Pleistocene basalt, breccia, and volcanic ash, outcrops 6 miles west of Nazco Indian Village, in the northwestern part of the map-area.

Pliocene or Miocene sedimentary rocks, here and there with diatomite, occur in Fraser Valley between Quesnel and Macalister. Several previously unrecorded occurrences of diatomite were noted near Buck Ridge, one of which is at least 25 feet thick.

H.W. Little commenced the revision of previous 4-mile geological mapping within Kettle River West Half (82 E W½) map-area[1]. Field work required for this revision was completed except in that part of the map-area lying north of latitude 49°50'.

Rocks shown as "Shuswap Complex" on Map 538A were remapped in accordance with the current concept that the term "Shuswap" should be restricted to rocks of pre-Permian age. Intrusions included in the "Shuswap Complex" of Map 538A were remapped as Mesozoic Nelson or Valhalla intrusions, or as Cenozoic Coryell intrusions, to correspond with the map-units used in the map-area immediately to the east[2]. The stratigraphy of the Tertiary volcanic and sedimentary rocks was found to require substantial revision. Undeformed Miocene (?) basalts were recognized for the first time. Major northerly-trending faults were noted near the east boundary of the map-area in Conkle Creek valley, and at various points between Carmi and the junction of Mission and Pearson Creeks.

H.H. Bostock, a post-graduate geology student now at the University of Wisconsin, commenced the geological study and mapping of Squamish (92 G W½) map-area, under the direct supervision of Dr. J.E. Armstrong. Field work was seriously hampered by circumstances beyond Mr. Bostock's control, including forest fire hazard. However, the mapping of much or all of the shoreline of Howe Sound, Salmon Arm, and Seechelt Inlet and vicinity, was completed, and substantial work done inland from Britannia Beach.

J.G. Fyles completed the field study and mapping of the surficial deposits of the lowland parts of the east coast of Vancouver Island between the towns of Cumberland and Campbell River (lowland parts of 92 F/10, 11, 13, and 14, and K/3, 4).

In addition, he commenced and completed a reconnaissance of the surficial deposits of the lowlands and islands of Strait of Georgia between Sooke on Vancouver Island and Howe Sound on the mainland. The main purpose of this project was to obtain a better understanding of the pre-Vashon stratigraphy and geological history of the Georgia Basin.

J.E. Reesor continued his studies of granitic rocks. He devoted the 1958 field season to detailed studies within

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1 Cairnes, C.E.: Kettle River (West Half), British Columbia; Geol. Surv., Canada, Map 538A (1940).

2 Little, H.W.: Kettle River (East Half), British Columbia; Geol. Surv., Canada, Map 6-1957.

the southeast quarter of Burton (82 F/13) map-area and the northeastern eighth of Passmore (82 F/12) map-area. This work included mapping, on the scale of 2 inches to 1 mile, of an area about 12 miles long and 7 miles wide. It is anticipated that field studies will be continued in the same region in 1959.

The area studied has a relief of several thousand feet, and is mainly above timberline and otherwise well exposed. The rocks appear to occupy an elongated dome in the centre of which erosion has exposed the oldest unit, mainly quartzite. Overlying the quartzite, in sharp contact with it, and presumably intrusive into it, is hornblende and biotite porphyritic gneissic granite (Nelson intrusions, Unit 12, Map 3-1956)[1]. The gneissic granite grades upward into fine- to very coarse-grained, heterogeneous, biotite and leucogranite (Valhalla Intrusions, Unit 13, Map 3-1956). The combined "stratigraphic" thickness of the gneiss and granite is between 2,000 and 3,000 feet. The granite grades upward into migmatite and paragneiss (Unit 10C, Map 3-1956). Work to date has involved detailed studies of the strata in order to establish field relations, and appropriate sampling for laboratory and office investigations, all intended to contribute to an overall comprehensive study of the mode of emplacement, origin, and other features of the granitic and associated rocks.

B.R. Pelletier and W.B. Brady commenced and completed field work within Tetsa River (94 K/9) map-area. All strata are folded along northwesterly trending axes. The southwestern two-thirds of the map-area is underlain mainly by Triassic sandstones and siltstones; except that Palaeozoic strata outcrop in two structurally "high" belts, the main one of which crosses the Alaska Highway and extends northwesterly across the north boundary of the map-area; and except that the overlying Lower Cretaceous strata outcrop in troughs that become progressively more abundant towards the northeast. The northeastern third of the map-area is underlain mainly by Lower Cretaceous formations. The Triassic strata thin from west to east, and sedimentary features indicate that they were deposited from easterly flowing waters.

## BRITISH COLUMBIA AND ALBERTA

R.A. Price commenced the geological study and mapping, for publication on the scale of 1 inch to 4 miles, of Fernie East Half (82 G E½) map-area. Field work was

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[1] Little, H.W.: Nelson (West Half), Kootenay and Similkameen Districts, British Columbia; Geol. Surv., Canada, Map 3-1956 (1957).

completed within part of 82 G/1, all of 82 G/2 E½, and part of 82 G/10.

The map-area contains an exceptionally complete stratigraphic section, the strata ranging in age from the Precambrian Waterton formation, to the Kishenehn formation of Eocene and Oligocene age. Many minor intrusions of trachyte and syenite were mapped, mainly in northern part of 82 G/2 E½. These range up to 3 miles in length, and are of late Mesozoic or younger age. Several windows of Upper Cretaceous rocks were mapped within the Precambrian strata of the Lewis thrust sheet. One of these, in British Columbia, is at the headwaters of Howell and Harvey creeks, in 82 G/2 E½. It suggests that the minimum horizontal displacement of the Lewis overthrust is 25 miles. A northwesterly trending normal fault along the east side of Flathead River valley marks a stratigraphic throw of about 23,000 feet. The strata on the northeast side have moved up relative to those on the southwest.

D.F. Stott completed stratigraphic studies of the Upper Cretaceous Smoky group and the Lower Cretaceous Fort St. John and Bullhead groups, and equivalent strata, in the foothills of Alberta and British Columbia between Smoky River and Red Willow River. It is anticipated that, in 1959, this work will be continued northerly towards Peace River.

D.C. McGregor spent about a month in Miette (83 F/4) map-area in Alberta (See E.W. Mountjoy), and about two months in the foothills between Smoky River and Red Willow River (See D.F. Stott). Macro and micro flora, as appropriate, were collected from Lower Cretaceous and adjacent strata.

H. Frebold studied the Lower, Middle, and Upper Jurassic fauna and stratigraphy of the Tyaughton Lake area, Bridge River District. Other time was spent in the study of the upper part of the Jurassic system in the central foothills of Alberta. This work suggested, but has not yet proven, that the Nikinassin strata are at least partly of late Jurassic age, and that the remainder are of Cretaceous age. In addition, Jurassic studies in the Nelson West Half (82 F W½) map-area were continued from 1957. This work demonstrated that the Elise and Beaver Mountain formations are of the same age. This conclusion, in turn, requires a re-interpretation of parts of Map 3-1956[1].

ALBERTA

D.K. Norris commenced and completed field work within Carbondale River (82 G/8 W½) map-area.

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[1] Little, H.W.: Nelson (West Half), Kootenay and Similkameen Districts, British Columbia; Geol. Surv., Canada, Map 3-1956 (1957).

The northern half of the map-area is underlain by highly deformed Lower and Upper Cretaceous strata and minor Jurassic formations. Field data suggest that the complex structures exposed along Carbondale River[1] are not due to a tear fault but to gentle folding of a major westerly dipping thrust fault.

The southern half of the map-area is underlain by Precambrian strata of the Lewis thrust sheet. These rocks have been thrust over the Mesozoic formations, and the surface trace of the Lewis thrust fault, which separates Precambrian and Mesozoic strata, trends easterly across the middle of the map-area. The trace continues easterly and southeasterly across the adjacent Beaver Mines map-area.[2] Preliminary studies in Carbondale River map-area indicate that the local easterly trend of the fault trace is the result of erosion of a gently warped Lewis thrust plate rather than of local overriding towards the north. It is thus possible that the southerly trending structural features of the Savanna Creek gas field extend beneath the Lewis thrust plate in Carbondale River map-area, and that structures of the Waterton Park-Castle River gas field likewise extend southerly beneath the thrust plate in Beaver Mines map-area.

E.W. Mountjoy completed geological study and mapping of Miette (83 F/4) map-area, the west half of which was done by him in 1957. It is anticipated that the results of this work will form the basis of a Ph.D. thesis, now being prepared in Ottawa for University of Toronto, in which particular attention will be paid to structural features. In addition, it is expected that an appropriate map and report will be prepared in due course for publication by the Geological Survey.

## ALBERTA AND SASKATCHEWAN

W.F. Fahrig commenced, in 1957, a comprehensive study of the rocks of the Athabasca Series exposed between Athabasca, Wollaston, and Cree Lakes. The 1957 field investigations were confined mainly to the Trout Lake (74 K) map-area and to the northern edge of the area underlain by the Athabaska rocks (74 L, N, O, and P). The remainder of the area underlain by Athabasca rocks was studied during

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1 Clow, W.H.A., and Crockford, M.B.B.: Geology of Carbondale River Area, Alberta; Research Council of Alberta, Report No. 59 (1951).

2 Hage, C.O.: Beaver Mines, West of 5th Meridian, Alberta; Geol. Surv., Canada, Map 739A (1943).

1958. In addition, a short time was spent studying Athabasca rocks on the north shore of the lake, including those exposed on the islands immediately south and southwest of Crackingstone Peninsula.

A continued study of the sedimentary features indicating flow-direction of the waters from which the sediments were deposited added much to what had been learned during the 1957 field season. It now appears that these waters flowed westerly to west-northwesterly along what is now the **northern boundary** of the Athabasca rocks, westerly over what is now the eastern boundary, and northwesterly to west-northwesterly over the present south and southwestern boundaries. These data suggest that the currents converged towards the northwest and attained their maximum constriction, insofar as records are **still** available, in Lake Athabasca between Uranium City and Fort Chipweyan.

E.M. Cameron collected samples of sandstone for geochemical studies. The samples are of various ages from Cambrian to Cretaceous, but about 75 per cent are from Cretaceous formations, and most were collected from Cypress Hills, Crowsnest, Canmore, Entrance, Lake Louise, and Golden Districts.

## SASKATCHEWAN

C.K. Bell concluded his work in Milliken Lake (74 N/7) map-area, which he commenced in 1954. Field work has been completed, for publication at 1 inch to 800 feet, within that part of Crackingstone Peninsula lying west of 108°40' and south of 59°30', except that part lying north of Milliken Lake between longitudes 108°40' and 108°45'.

The mapped area contains the Gunnar Mine. The most widespread rocks are those of the Tazin group. These comprise quartzose sediments and minor volcanic rocks, and their metamorphosed and granitized equivalents including the Gunnar granitoid gneiss and other gneisses. No publications have resulted from the current project, but the geology of much of the mapped area was published previously on a scale of 1 inch to 1 mile.[1]

E. Hall commenced a reconnaissance ground-water survey of that part of Saskatchewan lying within the Souris River watershed - that is, about 12,000 square miles comprising much of Saskatchewan south and east of Regina. The

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[1] Fraser, J.A.: Crackingstone (West Half), Saskatchewan; Geol. Surv., Canada, Paper 54-8 (1954).

survey was completed within Weyburn (62 E) map-area where about 25 per cent of the wells, mainly those penetrating bedrock, were examined. The object of this work was to bring the Survey's 1935 Ground-Water Inventory up-to-date on a reconnaissance basis, and to re-measure enough of the previously surveyed wells to permit a comparison between the 1935 and 1958 water-tables. The 1958 work indicates that the present height of the water-table, as measured in bedrock wells, is about the same as it was in 1935 when surveyed by Dr. B.R. MacKay of the Geological Survey. In addition, other reconnaissance studies were made during 1958 as required to aid planning for future ground-water surveys in the district.

J.S. Scott, a post-graduate geology student at University of Illinois, commenced the geological study and mapping of the surficial deposits of Elbow (72 O/2), Hawarden (72 O/7), and Outlook (72 O/6) map-areas. The project area includes the South Saskatchewan River dam and power site. About half the field work was completed, the mapping being done for publication on the scale of 1 inch to 1 mile, with special attention to the engineering requirements of the proposed dam and related construction, and to problems arising from the subsequent flooding. It is anticipated that the data obtained will form the basis of Mr. Scott's Ph.D. thesis at University of Illinois, and will provide an appropriate map and report for publication by the Geological Survey.

## MANITOBA

H.A. Quinn and W.L. Davison commenced and completed field work in Kettle Rapids (54 D) map-area. Widely scattered outcrops occur in the western half, and along Nelson River in the eastern half; elsewhere the map-area is almost devoid of exposed bedrock. The eastern third is underlain by Palaeozoic strata, probably not extending quite so far west as shown on Map 850A[1]. Exposed rock in the western two-thirds of the map-area is of Precambrian age and, with the following exceptions, mainly gneiss and granite. Northwesterly trending belts of metamorphosed sedimentary rocks outcrop along Moose Lake, and on Nelson River at Turtle Island. Similarly altered strata outcrop along Aiken River in the extreme southwest corner of the map-area. Sedimentary rocks of the Assean Lake belt of the adjacent map-area[2] were traced a few miles northeasterly into Kettle

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[1] Geological Survey of Canada: Geological Map of Manitoba, Map 850A (1946).

[2] Mulligan, R.: Split Lake, Manitoba; Geol. Surv., Canada, Map 10-1956 (1957).

Rapids map-area. In addition, abundant basic dykes were found in the southwest corner, between Split Lake and Ilford.

R. Kretz commenced and completed the geological study and mapping of Northern Indian Lake (64H) map-area, about 80 per cent of which is devoid of outcrops. Outcrops occur mainly in the centre of the west half of the map-area between Small Lake, Northern Indian Lake, and Partridge Breast Lake; and along Churchill River in the east half of the map-area. Except for a body of schist, gneiss, and amphibolite on the south side of Partridge Breast Lake, the observed rocks are mainly varieties of granites and gneisses.

H. Williams, a post-graduate geology student at University of Toronto, commenced a detailed study of an area (part of 63 K/16) including the Chisel Lake base metal deposit of Hudson Bay Mining and Smelting Company. The approximate boundaries of the map-area are: 54°49' to 54°52'; 100°05' to 100°10'. Field mapping is being done on a scale of about 1 inch to 500 feet. It is anticipated that this project will require another field season, and that it will provide data for Mr. Williams' Ph.D. thesis at University of Toronto, and an appropriate Geological Survey publication.

## ONTARIO

M.J. Frarey mapped the eastern half of Echo Lake (41 J/12) map-area in 1957, and the western half during 1958. Somewhat more than the northeastern half of the area mapped during 1958 is underlain by granite and gneiss, and somewhat less than the southwestern half is underlain by Huronian strata and younger gabbro. All rocks previously mapped[1] as Mississagi, except a minor band on the southwest side of McMahon Lake, have been reassigned, mainly to the Gowganda and Lorrain formations. A band of basaltic and andesitic lavas, trending northwesterly and lying between Aberdeen and McMahon Lakes, was demonstrated to be a part of the Bruce Series. In addition, the 1958 work mapped a number of post-Cobalt major faults, some of which trend northwesterly, others northeasterly.

N.R. Gadd continued his investigation of geological matters related to the safe, economical, and otherwise satisfactory disposal of radioactive waste materials from the

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1 Collins, W.H.: Bruce Mines, Algoma District, Ontario; Geol. Surv., Canada, Publication 1969 (1925).

Chalk River plant of Atomic Energy of Canada, Limited. Most of the 1958 field season was devoted to completing a map of the surficial geology of an area of about 25 square miles in the vicinity of the plant, including adjacent current and potential disposal areas. A map and report is being prepared for submission to Atomic Energy of Canada, Limited.

B.V. Sanford and C. Gauvreau used hammer percussion seismic (refraction) equipment on an experimental basis to determine depths to bedrock. Accurate depths would enable accurate contouring of bedrock surfaces, which would in turn indicate bedrock structures of interest to those engaged in the exploration for oil and gas, and bedrock depressions of interest to those engaged in the search for groundwater. The object of the seismic work was to determine the capabilities and limitations of the hammer equipment in southwestern Ontario. The results are still being evaluated although it appears, in general, that the depth determinations required (sometimes in the order of 200 feet) are beyond the capabilities of the equipment used.

In addition, Mr. Sanford visited the offices of various State Surveys to examine data from deep wells in order to facilitate his studies of stratigraphic relationships and structural trends of Palaeozoic strata beneath Lake Erie, and for purposes of regional correlation. The remainder of the field season was spent in offices of various oil and gas companies in southwestern Ontario in order to obtain further data required for current and contemplated subsurface geological studies of that district.

H.R. Wynne-Edwards mapped the west half of Westport (31 C/9) map-area in 1957, and the east half in 1958. It is anticipated that the field data, in particular those bearing on the influence of structure on the localization and development of granitic rocks, will provide the basis of a Ph.D. thesis for Queen's University and, at a later date, an appropriate map and report for publication by the Geological Survey.

S.M. Roscoe spent about 5 weeks in the field, mainly underground, completing the field phase of his subsurface study of the origin, distribution, and thorium content of the uranium ores of the Blind River district.

E. Mirynech, a geology student at University of Toronto, commenced the geological study and mapping of the surficial deposits of Trenton (31 C/4) and Presqu'ile (30 N/13) map-areas. This project is a Geological Survey contribution to cooperative studies of the Lake Ontario Basin being sponsored by the Great Lakes Geophysical Research group, and, in addition, is expected to provide data for Mr. Mirynech's Ph.D. thesis. The western half of the map-

areas was completed but a preliminary map is not warranted at this time.

L. Kirwan, a seasonal party chief, and currently a graduate geology student at McGill University, commenced and completed geological field work within Deer Lake East Half (53 D E½) map-area in extreme western Ontario. The map-area is underlain almost exclusively by granodiorite, granite, and related rocks, and granitic gneiss.

E.H. Chown, a seasonal party chief and currently a graduate geology student at Johns Hopkins University, commenced and completed the geological study and mapping of Carroll Lake East Half (53 M E½) map-area. Except in the extreme southeast corner, the map-area is underlain by granodioritic rocks, in part porphyritic and gneissic. In the extreme southeast corner are pre-granite basic volcanic rocks and sedimentary strata as previously mapped[1].

J. Terasmae spent most of the 1958 field season investigating surficial deposits temporarily exposed by the St. Lawrence Power and Seaway development and related construction. No report is planned, but the data obtained will greatly facilitate mapping of other surficial deposits in the vicinity.

## ONTARIO AND QUEBEC

N.R. Gadd, because of the higher priority assigned to his work at Chalk River, Ontario, limited his study of the surficial deposits of Ottawa (31 G/5) map-area to an examination of sections exposed in current temporary excavations. Miss J.M. Bostock, working on a phase of this project and under his direct supervision, compiled additional data concerning the thickness of drift within the city. This information is being used to revise the recent map[2] showing drift-thickness contours for the west part of the city, and to prepare for publication similar data concerning the east part of the city.

## QUEBEC

T.E. Bolton commenced a study of the Ordovician and Silurian stratigraphy and palaeontology of Anticosti Island

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1 Horwood, H.C.: Geology and Mineral Deposits of the Red Lake Map Area; Ontario Department of Mines, Pub. 49A (1940).

2 Bostock, J.M.: Drift-Thickness Contours, City of Ottawa (West Part), Carleton County, Ontario; Geol. Surv., Canada, Map 13-1958 (1958).

in 1957, and in 1958 completed his study by examining formations in the western 60 miles of the island. Two stratigraphic sections, each of which cross the Ordovician-Silurian contact, were measured and studied in detail; one of these extends from the mouth of Oil River south-south-easterly to Jupiter River, and the other from Martin Bay south to the mouth of Ste. Marie River. In addition, the Ellis Bay formation (top of the Ordovician) was measured and studied in detail at the type locality near Port Menier. The base of the Ellis Bay formation was traced in detail from West Point easterly for some 60 miles. Excellent collections of fossils were obtained, particularly from the Ordovician rocks. Studies of surficial deposits showed that the island was submerged to a depth of only 250 feet in post-glacial times, rather than completely submerged as previously believed.

E.I.K. Pollitt continued a ground-water survey of that part of Lachine (31 H/5) map-area lying south of St. Lawrence River, and Ile Perrot. That part of the map-area south of St. Lawrence River and east of the St. Martine-Caughnawaga Road was mapped previously; that part south of the river and west of the road was completed during 1958; and the survey of Ile Perrot remains to be completed at a later date.

Much of the area mapped in 1958 is underlain by Potsdam sandstone[1]. This rock was found to be an excellent aquifer, much the best in the map-area. For instance, industrial wells between 100 and 200 feet deep were found to yield 400 to 500 gallons of water a minute. The water is of good quality.

Two belts of relatively thick drift (60 to 110 feet) were outlined. These are potential sources of groundwater. One is near St. Philomene Station; the other, 1 mile to 2 miles wide, extends from the extreme southwest corner of the map-area to Chateauguay.

C. Gauvreau, of the Geophysics Division, spent about two-thirds of the field season with Mr. Pollitt. He experimented with the use of hammer percussion seismic equipment as a means of measuring the depth of overburden. The results are being evaluated to determine the accuracy of this equipment under conditions encountered in Lachine (31 H/5) map-area.

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[1] Clark, T.H.: Montreal Area, Laval and Lachine Map-Areas; Department of Mines, Quebec, Geol. Rept. 46 (1952).

E.R. Rose examined iron-titanium deposits of the Morin anorthosite body north of Montreal, and of the St. Urbain anorthosite body. Particular attention was paid to the mineralogy of the mineral deposits, and to the relations of these deposits to the composition and structure of the enclosing anorthosite and related rocks. Appropriate samples were obtained for further investigations in the office and laboratory.

## NEW QUEBEC AND LABRADOR

K.E. Eade and W.W. Heywood continued helicopter-supported Operation Fort George. The following areas, totalling about 35,000 square miles, were mapped during 1958: NTS 33 east of 75°30'; part of 23 M; and an area between latitudes 52°00' and 52°50', and longitudes 74°30' to 76°00'. A preliminary map on a scale of 1 inch to 8 miles, embracing the results of the 1958 field season, has been forwarded for publication.

Operation Fort George differs from previous Geological Survey helicopter-supported projects in the Canadian Shield in that it involved one instead of two helicopters, and employed three instead of five geologists. Furthermore the previously standardized system of radial helicopter traverses was abandoned in favour of a system whereby the aerial traverses are parallel and spaced at intervals of 6 miles. The cost of the Operation to date, about $2.03 a square mile[1], is the lowest so far achieved by a Survey helicopter project in the Shield.

Greenstones, the oldest rocks recognized, occur as three main bodies in the southern half of the area mapped in 1958. The largest of these is about 35 miles long and 6 miles wide. Otherwise, most of the southern third of the 1958 area is underlain by gneiss and schist derived from sedimentary formations, and most of the northern two-thirds by gneissic or massive granitic rocks. Four bodies of pink, crossbedded and ripple-marked Proterozoic (?) quartzite were encountered. The largest body is about 12 miles long and 4 miles wide. The quartzite is younger than the surrounding granitic rocks, and the dip of the beds is commonly less than 30 degrees. Most structural features within the 1958 area trend east to east-northeast.

J.A. Donaldson, a graduate geology student at Johns Hopkins University, continued and completed the

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[1] This figure does not include staff wages, cost of equipment, or overhead.

geological study and mapping of Marion Lake (23 I/13) map-area. It is anticipated that the results of this project will provide a Ph.D. thesis for Mr. Donaldson, and an appropriate map and report for publication by the Geological Survey.

S. Duffell and R.A. Roach completed field work within Mount Wright (23 B W½) map-area. Charnockites are the oldest rocks, and underlie the northwest quarter of the map-area. Younger biotite-hornblende gneisses, and associated rocks, underlie about half the map-area as a northeasterly trending belt passing through its centre. Within this belt are small, scattered, intricately folded areas of still younger quartzite, marble, iron formation, and iron ore. These areas are common in the northeast part of the belt, less common in the central part, and abundant in the southwest part. The youngest rocks mapped are hornblende-garnet gneisses, and these underlie the southeast part of the map-area. Two periods of folding were recognized, one along northeasterly axes, the other along northwesterly axes. The latter may be the younger.

W.R.A. Baragar commenced the geological study and mapping of Wakuack Lake (23 O) map-area and completed field work within the southern three-quarters of the west half. Trough rocks trend diagonally through the centre of the map-area from southeast to northwest, and granitic and gneissic rocks underlie the southwest and northeast corners. Most of the Trough rocks have been mapped by mining and exploration companies, in part in considerable detail. Mr. Baragar will do sufficient field work to enable these data to be incorporated into a Geological Survey report and map for publication on a scale of 1 inch to 4 miles. No preliminary map is planned or warranted at present.

## NEW BRUNSWICK

H.A. Lee continued the geological study and mapping of the surficial deposits of St. John River valley, a project carried on intermittently since 1950. This project, when completed, is expected to provide maps of the surficial deposits of the valley between Edmundston (21 N/8)[1] and Fredericton (21 G/15)[2] map-areas. The results, in addition to their usefulness for engineering geology and soils

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1 Lee, H.A.: Surficial Geology of Edmundston, Madawaska and Temiscouata Counties, New Brunswick and Quebec; Geol. Surv., Canada, Paper 55-15 (1955).

2 -------- Surficial Geology of Fredericton, York and Sunbury Counties, New Brunswick; Geol. Surv., Canada, Paper 56-2 (1957).

purposes, should be of particular scientific interest inasmuch as the St. John River valley presents a unique opportunity to study the surficial record in a valley crossing the Appalachian Mountains and trending parallel with the direction of ice retreat.

Field work in connection with this project has been completed within the following map-areas: Grand River (21 O/5), Grand Falls (21 O/4), Aroostook (21 J/13), Andover (21 J/12), north half of Florenceville (21 J/5), and north half of Woodstock (21 J/4). Field work within the following map-areas is required to complete the project: south half of Florenceville (21 J/5), south half of Woodstock (21 J/4), and north half of Canterbury (21 G/14). Field work was completed within the following map-areas during the 1958 field season: north half of Florenceville (21 J/5), and north half of Woodstock (21 J/4). Preliminary maps are currently being prepared for the following map-areas: Grand River (21 O/5), Grand Falls (21 O/4), and Aroostook (21 J/13).

A barite occurrence was found in 1958 a few miles northeast of Woodstock. The barite does not outcrop and its extent is not known, but it occurs in a topographic depression that is about 20 feet deep, 500 feet wide, and continuous southeasterly for upwards of a mile. The mineral was found by digging, while mapping the surficial geology. About 50 pounds of barite in pieces approximately 6 inches in diameter were collected. It is mainly white and of good paint grade. It contains a little galena. The occurrence can be found by following these instructions: proceed 1.3 miles north of the east abutment of the Woodstock-Grafton bridge, along the river road; thence 1.7 miles southeast along the Woodstock-Millville highway to where the highway leaves the valley and bends to the left; thence to the second farm on the left of the road beyond the bend; thence 0.5 mile north along a private tractor road to the intersection of this road and an alder swamp. Otherwise stated, the locality is: latitude 46°09.8'; longitude 67°31.4'.

F.D. Anderson completed field work in Big Bald Mountain (21 O/1) map-area, and started his geological study and mapping of Nepisiquit Lakes (21 O/7), Riley Brook (21 O/3), and Serpentine Lake (21 O/2) map-areas. The current study of the latter three map-areas will make use of unpublished results of field work by B.R. Rose between 1935 and 1938, and will bring this early field work up to modern 1-mile standards. Field work was completed within Nepisiquit Lakes and Serpentine Lake map-areas in 1958, but additional mapping will be required to complete Riley Brook. Several new collections of fossils were obtained which should add much to our knowledge of the age of the pre-Carbonifercus strata.

W.H. Poole mapped the southeast half of Napadogan (21 J/7) map-area in 1957[1], and the northwest half in 1958. In addition, the 1958 work included some revision of the geology of the pre-Carboniferous rocks as shown on Map 11-1958.

A linear magnetic anomaly[2] that trends northeasterly across the map-area lies in most places along the southeast border of a quartzite and slate belt (Map Unit 1, Map 11-1958). On Lower and Middle Hayden Brooks, the anomaly coincides with a basic volcanic rock; and in the southwest corner of the map-area it extends into a body of closely fractured, reddened, granitic rock.

One piece of float, well mineralized with arsenopyrite and comprising about one cubic foot of material, was found on Brewer Brook 2.85 miles from its mouth on Hovey Brook. Drusy quartz cements a breccia of light grey slate and quartzite similar to Map Unit 1 of Map 11-1958. In addition to arsenopyrite, the piece contains a little sphalerite, galena, and pyrite.

E.D. Kindle continued and completed his geological study and mapping of Waterford East Half (21 H/11 E½) map-area, and extended this work to include all of Fundy National Park lying east of that map-area.

R.W. Boyle started geochemical studies of the Bathurst-Newcastle base metal district, and devoted about a month of the 1958 field season to this project. About a square mile around the Nigadoo deposit was mapped on a scale of 1 inch to 500 feet, and appropriate samples obtained from mineral deposits and country rock for laboratory and office study. In addition, J. Kalliokoski, of the Department of Geology, Princeton University, and a member of Dr. Boyle's field party, obtained specimens from all the principal base metal deposits for geothermometry studies expected to indicate the temperature of the formation of the contained sphalerite.

J.M. Johnston, a seasonal party chief, commenced the geological study and mapping of St. Leonard (21 O W½) map-area, and completed the southern half. Most of the rocks examined were mapped many years ago[3] as tightly folded

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[1]Poole, W.H.: Napadogan, York County, New Brunswick; Geol. Surv., Canada, Map 11-1958 (1958).

[2]Geological Survey of Canada: Aeromagnetic Map, Napadogan, York County, New Brunswick: Geol. Surv., Canada, Geophysics Paper 135 (1953).

[3]Bailey, L.W., and MacInnes, W.: Report on Explorations in Portions of the Counties of Victoria, Northumberland, and Restigouche, New Brunswick; Geol. Surv., Canada, Ann. Rept. (New Series), vol. 2, 1886, pt. N.

pre-Carboniferous strata. Fossil collections obtained during 1958 promise to provide further information concerning the age of these strata.

NOVA SCOTIA

W.G. Smitheringale completed field work within Bridgetown East Half (21 A/14 E½) and Gaspereau West Half (21 A/15 W½) map-areas. The results of this project are expected to provide data for Mr. Smitheringale's doctorate dissertation at Massachusetts Institute of Technology, and an appropriate map and report for publication by the Geological Survey. After completing the above field project he commenced field work within Clementsport (21 A/12 E½) map-area.

I.M. Stevenson continued and completed field work in Chedabucto Bay (11 F/6) map-area. In addition, mapping was completed in the Cape Canso appendage that projects into 11 F/7, and in the Port Howe appendage lying in the northeast quarter of 11 F/3; and some field work was done within the northwest quarter of 11 F/3.

G.A. Collins, a seasonal party chief from the staff of Nova Scotia Technical College, Halifax, commenced and completed the geological study and mapping of Arichat (11 F/11 E½) map-area.

R.H.C. Holman completed a geochemical reconnaissance of mainland Nova Scotia, commenced in 1956, by sampling and analyzing stream sediments in the following places: mainland Nova Scotia northwest of the New Glasgow-Truro line; a small area surrounding the village of East River St. Marys; and an area between Halifax and Lunenburg. The zinc content of the stream sediments was found to be anomalously high within the Cobequid Mountains between Parrsboro and Pictou. Within this zinc anomaly, high local lead anomalies were found: at Lakelands, north of Parrsboro; centred on Newton Lake, which drains into Economy River; and centred on Totten Lake, which drains into Folly River. The significance of these anomalies is being assessed.

D.G. Kelley commenced field work within St. Ann's (11 K/7) map-area, and completed the eastern three-quarters of the east half. This is the last unmapped 1-mile map-area of Cape Breton Island. The geology of the area mapped in 1958 is much as would be expected from an examination

of adjacent previously published maps[1]. Disseminated pyrite is common in rocks of the Precambrian George River group on a branch of McDonald Brook, 3 miles due west of the village of North River Bridge.

## PRINCE EDWARD ISLAND

G.H. Crowl, Chairman, Department of Geology and Geography, Ohio Wesleyan University, as a seasonal party chief employed by the Geological Survey, continued the geological study and mapping of the bedrock and surficial deposits of the island. This project has been going on continuously since 1953, at the rate of one or two field parties each season. Field work within about 80 per cent of Mount Stewart West Half (11 L/7 W½) map-area was completed during 1958.

## MARITIME PROVINCES AND QUEBEC

K.H. Owens made an aeromagnetic survey of those parts of New Brunswick, Nova Scotia, and Prince Edward Island for which aeromagnetic maps were not previously available, except that he did not complete the extreme northwestern corner of New Brunswick. In addition, the survey covered parts of the eastern tip of Gaspé; parts of southeastern Anticosti Island; Gulf of St. Lawrence between Gaspé, Anticosti Island, Port aux Basques of Newfoundland, Cape North of Cape Breton Island, and mainland Nova Scotia and New Brunswick; and Bay of Fundy.

Flight altitude was 1,000 feet above surface. Flight lines over land were one-half mile apart. Flight lines over water were controlled by the Decca system of navigation. This is believed to be the first time that an aeromagnetic survey has used Decca control. In these instances the flight lines followed the Decca "lanes" and their spacing was, therefore, commonly greater than one-half mile.

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[1] Bell, W.A. and Donaldson, E.A.: Bras d'Or Sheet, Cape Breton and Victoria Counties, Nova Scotia; Geol. Surv., Canada, Map 359A (1938).

MacLaren, A.S.: Cheticamp River, Inverness and Victoria Counties, Cape Breton Island, Nova Scotia; Geol. Surv., Canada, Map 55-36 (1956).

Kelley, D.G.: Baddeck, Victoria, Cape Breton, and Inverness Counties, Cape Breton Island, Nova Scotia; Geol. Surv., Canada, Map 14-1956 (1957).

An Aero-Commander aircraft was used for this project, in place of the Canso employed on previous aeromagnetic surveys. The aircraft was leased for the season, and operated by Spartan Air Services Limited under contract to the Department of Mines and Technical Surveys. As in previous similar surveys, the magnetic data were obtained with Geological Survey equipment operated by Survey staff, and will be compiled and published by the Survey.

The project involved 748.25 hours flying, and 87,931 line-miles of surveying. The field operation cost about $1.10 a line-mile, excluding salaries of continuing employees, purchases of equipment, and overhead. Similar work with the Canso aircraft during past years has cost about $2.29 a line-mile, calculated on the same basis.

The results of the aeromagnetic survey have not yet been compiled, but it is anticipated that they will provide significant information concerning submarine geology, including the extent and thickness of the New Brunswick-Nova Scotia-Prince Edward Island Carboniferous basin beneath the Gulf of St. Lawrence.

NEWFOUNDLAND

E.P. Henderson continued and completed field work required for the geological study and mapping of the surficial deposits of Conception Bay (1 N) map-area. The project has, however, been re-defined to include all of Avalon Peninsula, and about another field season will be required to complete those parts of the peninsula lying beyond the Conception Bay map-area.

Most of that part of the map-area lying west of the longitude of Holyrood, except Bay de Verde Peninsula, was mapped during 1958. This work demonstrated that Avalon Peninsula was glaciated from a local ice cap in the central part of St. Mary's Bay. No evidence was recognized that would indicate that ice from the main part of the island of Newfoundland ever extended across Avalon Peninsula; although it was demonstrated that the ice moved east-southeasterly to slightly beyond Rantem Station on the peninsula.

G.C. Riley continued the geological study and mapping of Burgeo-Ramea (11 P/11, 12, 13, and 14) map-area, and completed field work in detail appropriate to publication on a scale of 1 inch to 4 miles. Probably all the map-area was under concession at the close of the 1958 field season.

The southern part (11 P/11, 12) is underlain mainly by granitic rocks and gneisses, except on Grey River and

Goose Head Peninsulas. These peninsulas are underlain by schist and gneiss derived from sedimentary and volcanic rocks, and by minor shale, limestone, and quartzite. Tungsten-bearing quartz veins, explored by Buchans Mining Company, are in the non-granitic rocks of Grey River Peninsula.

The northern part (11 P/13, 14) is underlain by substantial areas of non-granitic rocks. The oldest formations, of Devonian (?) age, occupy a belt about 15 miles long and up to 4½ miles wide. This belt trends east-northeasterly and lies mainly within the central part of 11 P/13, but extends into the west-central part of 11 P/14. Shale, quartzite, and sandstone, likewise of Devonian (?) age, were traced from the adjacent map-area[1] westerly across the northern part of 11 P/13, and southeasterly across the northeast part of 11 P/14. These strata are accompanied by tuff in 11 P/13. Devonian (?) granitic rocks, and gneisses derived partly or wholly from sedimentary and volcanic strata, are the youngest abundant rocks and underlie most of the remainder of 11 P/13, 14.

E.R.W. Neale, who investigated the east half of Baie Verte (12 H/16) map-area in 1957[2], completed field work within the west half during 1958. In addition, field work was started in Fleur de Lys (12 I/1) map-area, and almost completed. Both map-areas were included in the Advocate Mines Concession.

The west half of Baie Verte map-area is underlain by quartz-feldspar gneisses and minor gneissic conglomerate of the Fleur de Lys group, previously regarded as Precambrian[3]. Traced northeastward into Fleur de Lys map-area, these gneisses appear to be conformably intercalated with schistose meta-volcanic rocks of the Ordovician (?) Baie Verte group. Also, it is probable that chloritic schists previously mapped within the Fleur de Lys group[4]

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1 Riley, G.C.: Red Indian Lake (West Half), Newfoundland; Geol. Surv., Canada, Map 8-1957, Map Unit 11.

2 Neale, E.R.W.: Baie Verte, White Bay and Green Bay Districts, Newfoundland; Geol. Surv., Canada, Map 10-1958 (1958).

3 Fuller, J.O.: Geology and Mineral Deposits of the Fleur de Lys Area; Geol. Surv., Newfoundland, Bull. 15 (1941).
Baird, D.M.: The Geology of the Burlington Peninsula, Newfoundland; Geol. Surv., Canada, Paper 51-21 (1951).

4 Fuller, J.O.: op. cit.

are equivalent to Baie Verte meta-volcanic rocks and merit the same attention from prospectors as the latter, a well-mineralized group. For instance, it was noted that chloritic schists of this type in the Coachman Cove region contain abundant disseminated pyrite and minor chalcopyrite.

Several thin sills and discontinuous lenses of ultrabasic rocks were mapped within the Fleur de Lys gneisses of Fleur de Lys map-area. These ultrabasic rocks occur within a belt that extends southwestward from ultrabasic bodies previously mapped[1] near Fleur de Lys village. The largest mapped in 1958 is 1½ miles north of what is locally known as Duck Island or Airbase Lake. The ultrabasic bodies may warrant prospecting for asbestos and chromite.

A preliminary map of Fleur de Lys map-area is being prepared, but a second preliminary map of Baie Verte map-area is not warranted because that part mapped during 1958 is underlain by gneisses of the Fleur de Lys group.

D.M. Baird, a seasonal party chief now on the staff of University of Ottawa, commenced and completed the geological study and mapping of Deer Lake (12 H W½) map-area. The oldest rocks, Precambrian gneisses, occupy most of the north half of the map-area. On the west, south, and southeast these are overlain by Cambrian slate and quartzite. The Cambrian strata are overlain, on the west and south, by Ordovician limestones which, in turn, are overlain by Ordovician shale, sandstone, and conglomerate. The latter outcrop throughout the western margin of the map-area except that they are intruded, between Bonne Bay and North Arm of Bay of Islands, by ultrabasic and associated intrusions. Except for Devonian (?) granite southeast of Grand Lake, much of the map-area southeast of Big Bonne Bay Pond is underlain by gently inclined sandstone, shale, and conglomerate of Mississippian and Pennsylvanian age. These strata form a northeasterly-trending basin. They are displaced by major faults that strike north-northeasterly through Grand Lake.

## GENERAL

B.A. Latour continued to collect data required to maintain an up-to-date estimate of the coal reserves of Canada. Visits for this purpose were made to all producing coal mines of southern Saskatchewan, Alberta, and southeastern British Columbia.

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[1] Fuller, J.O.: Geology and Mineral Deposits of the Fleur de Lys Area; Geol. Surv., Newfoundland, Bull. 15 (1941).

C.H.R. Gauthier collected about 10 tons of material in Ontario and Quebec from which to prepare suites of rocks and minerals for sale to the public.

G.A. Gross continued his field studies of the iron deposits of Canada, spending most of the field season in southern Quebec and southern Ontario, between St. Urbain and extreme western Ontario.

C.R. McLeod continued his investigation, commenced in 1957, of the heavy mineral content of sand and gravel deposits in the Maritime Provinces. About 35 beaches were sampled, mainly on the north, east, and south coasts of New Brunswick, and on the north coast of Nova Scotia. About 70 inland deposits were sampled. These were mainly eskers, kames, kame terraces, and flood plain deposits; and delta deposits along St. John River, Miramichi River and its tributaries, and in Annapolis Valley.

R. Mulligan started a study of beryllium deposits of Canada, a project expected to culminate in an Economic Geology Series report for publication by the Geological Survey. Although only part of the field season was available for this project, an examination was made of the helvite deposit of the Low Grade claims, Needlepoint Mountain, near Cassiar, northwestern British Columbia; and of beryllium occurrences in extreme western Ontario, in the Nipigon-Beardmore district, near Mattawa, and near Renfrew.

P.M. DuBois collected samples for palaeomagnetic laboratory studies. About half the 1958 field season was spent obtaining appropriate samples of Devonian, Pennsylvanian, and Triassic rocks of Gaspé, New Brunswick, and Nova Scotia. It is anticipated that palaeomagnetic data from these samples, when compared with similar data obtained in Great Britain, will give further information concerning continental drift.

In addition, about six weeks were spent in western Ontario, including a brief excursion to Duluth in the United States. Specimens were collected from various Proterozoic rocks including the Logan sills and Lower Keweenawan sediments near the Lakehead, Duluth gabbro near Duluth, and Keweenawan lavas north of Sault Ste. Marie. Palaeomagnetic measurements made on these samples appear to have confirmed and supplemented our knowledge of the relative ages of various Keweenawan rocks as determined previously by classical geological methods. For instance, palaeomagnetic data suggest that the Duluth gabbro and Keweenawan lavas are of essentially the same age, whereas the Logan sills appear to be substantially older than the Duluth gabbro.

F.M. Vokes examined molybdenum deposits of western Quebec and eastern Ontario, of western Ontario near Sioux Lookout, and of British Columbia between Smithers and the 49th Parallel. Mr. Vokes resigned in October, but it is expected that the 1958 field work, supplemented by published and unpublished data, will permit him to prepare an Economic Geology Series report for publication by the Geological Survey.

C.H. Smith, as part of his continuing study of the ultrabasic rocks of Canada, made a reconnaissance investigation of ultrabasic bodies of the Cordillera between the 49th Parallel and Clinton Creek, Yukon, and of Northwest Territories. Some of these bodies contain asbestos, chromite, or nickel. Appropriate samples were obtained for office and laboratory investigations.