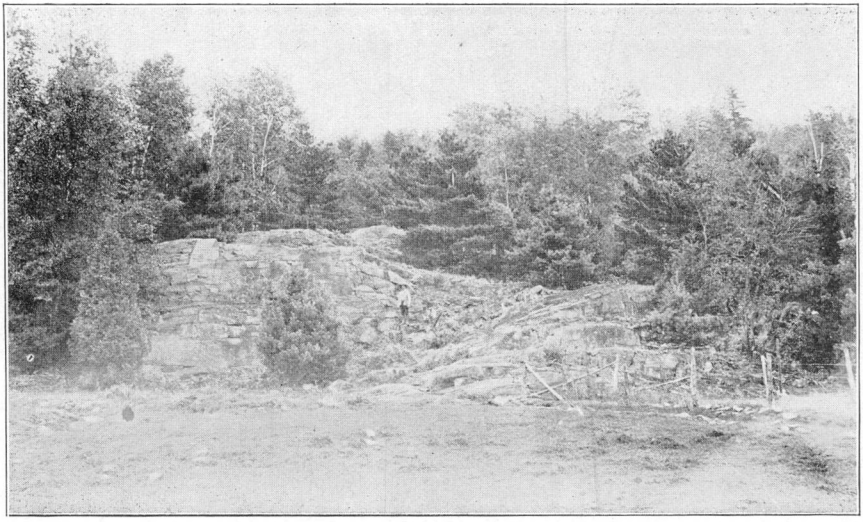
MEMOIR 99

ROAD MATERIAL SURVEYS IN 1915

BY

L. REINECKE

PLATE I.



Diabase dyke outcropping south of Charette lake, Montebello, Que. It is 100 feet wide at this place. Part II, outcrop 158.

CANADA
DEPARTMENT OF MINES
HON. ES. L. PATENAUDE, MINISTER; R. G. MCCONNELL, DEPUTY MINISTER.

GEOLOGICAL SURVEY
WILLIAM MCINNES, DIRECTING GEOLOGIST

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Road Material Surveys in 1915

BY

L. Reinecke

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PREFACE.

The surveys for road materials made by the Geological Survey in 1915 are reported on in the following pages.

Field work was done in two areas, and these are treated separately in the report. Part I deals with road materials lying near the proposed highway from Ottawa to Prescott, Ontario, and Part II with the materials which are within hauling distance of the route of a highway between Hull and Montreal, Quebec. A map showing all outcrops of bedrock and gravel near the roads in question accompanies each report. On the map belonging to Part I the locations of piles and fences of field stone have also been indicated. Sixty-four samples of stone and forty of gravel were collected and tested in the laboratories of Columbia university. Some knowledge of the comparative values of different varieties of stone for road building and of the relation between test values obtained in the laboratory and the behaviour of the stone in a road-bed under traffic conditions is necessary toward an understanding of the results of the laboratory tests given in the report. For a discussion of this subject, the reader is referred to Geological Survey, Canada, Memoir 85, Part I.

PART I.

DEPOSITS OF STONE AND GRAVEL AVAILABLE FOR A HIGHWAY BETWEEN OTTAWA AND PRESCOTT, ONTARIO.

PART I.

Deposits of Stone and Gravel Available for a Highway between Ottawa and Prescott, Ontario.

CHAPTER I.

INTRODUCTION.

SCOPE OF THE REPORT.

This report is the result of a detailed survey of the materials lying within wagon-hauling distance of the route proposed for an improved highway between the city of Ottawa and the town of Prescott, Ontario. The area examined includes some 550 square miles and embraces a strip of territory at least 10 miles wide, with the route of the proposed road through the middle; near Ottawa it was extended to include all the townships of Nepean and Gloucester. The report deals with all materials within the area that could be used for road-making—bedrock, glacial boulders or field stone, and gravel. The amount of material examined and the extent of territory covered are far in excess of what would have been necessary for the needs of the trunk highway alone, but this was so planned to obtain a more thorough knowledge of the various kinds of road material in the district, and to be of as much assistance as possible to road officials in the townships traversed.

ARRANGEMENT.

The report has been prepared with the idea that those interested in building the trunk road or any of the feeders for that road, would require all the detailed information possible about certain of the deposits lying near the roads in question. The details have been placed in tabular form in the appendices. Rock outcrops, field stone deposits, and gravel deposits have been numbered in different colours on the map, each having a set of consecutive numbers with corresponding numbers placed at their proper places in the tables. Information on any deposit shown on the map can, therefore, be found at once by turning to the tables. Chapter II contains a description of the geology and general features of the district. In Chapter III the road-making qualities of the outcrops, field stone and gravel, together with their possibilities of commercial

development, are discussed at some length. The conclusions regarding the relative value of these materials are to be found at the beginning of Chapter III.

ACKNOWLEDGMENTS.

Thanks are due to Mr. C. H. Pinhey and Mr. Alex. Stuart of the Ottawa Improvement Commission for information regarding the macadam roads in the neighbourhood of Ottawa. Tests on samples of stone and gravel collected during the course of the work were made under the direction of Professor A. H. Blanchard in the laboratories of Columbia university, New York.

The field work was begun in May and finished in November. The writer was assisted by F. H. McCullough, K. A. Clark, H. Gauthier, R. H. Picher, R. S. Adams, J. Macfarlane, and D. H. Sutherland. After the middle of July the work was in charge of F. H. McCullough, with R. H. Picher, J. Macfarlane, and D. H. Sutherland as assistants. The surveying of the gravel and bedrock deposits as well as the somewhat laborious estimation of fences of field stone, was accomplished by Mr. McCullough and his assistants in a conscientious and efficient manner.

CHAPTER II.

GENERAL CHARACTER OF THE DISTRICT.

TOPOGRAPHY.

The topography of the district surveyed and of the country for many miles around is that of a plain, with very low average slopes relieved by small, irregular hillocks of boulder clay and sand. This plain lies between elevations of 275 and 375 feet above sea-level, and the hills are in few places more than 25 feet above the general level of the country in their neighbourhood. The area is drained almost entirely by Ottawa river and its tributary, Rideau river. The watershed between the St. Lawrence and the Ottawa does not lie more than a few miles from the north bank of the St. Lawrence. Perhaps two-thirds of the area traversed is cleared land and under cultivation.

GENERAL GEOLOGY.

The names of formations encountered have been placed in tabular form on page 4. The solid rocks underlying the area are nearly all sediments of Palæozoic age, although some very small areas of Pre-Cambrian age occur in Nepean, Oxford, and Edwardsburgh townships. Of the Palæozoic rocks the Beekmantown system occupies fully three-quarters of the area lying near the proposed route. Over the bedrock unconsolidated deposits carrying large quantities of field stone, and sands and gravel of glacial and marine origin are widely distributed. Blue stratified clay of marine origin is found on low ground near the Ottawa river and lower part of the Rideau.

The divisions of the Palæozoic given on page 4 and the geological boundaries of the map are after Ells.[1] Although Ells himself regarded the Potsdam and Calciferous as practically the same formation,[2] and later palæontological investigation[3] has caused the Chazy to be divided at a new horizon, the older divisions are retained here because they conveniently separate deposits of fair macadam stone from those that are useless.

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[1] Ells, R. W., "Geology and natural resources of the city of Ottawa and vicinity," Geol. Surv., Can., Ann. Rept., vol. XII, 1899, pt. G, p. 18.

[2] Ells, R. W., "The Potsdam and Calciferous formations of Quebec and eastern Ontario," Trans. Roy. Soc., Can., sec. IV, 1894, p. 26.

[3] Raymond, P. E., "Ordovician of Montreal and Ottawa," Geol. Surv., Can., Twelfth Inter. Geol. Cong., Guide Book No. 3, pp. 140, 141.

Table of Formations.

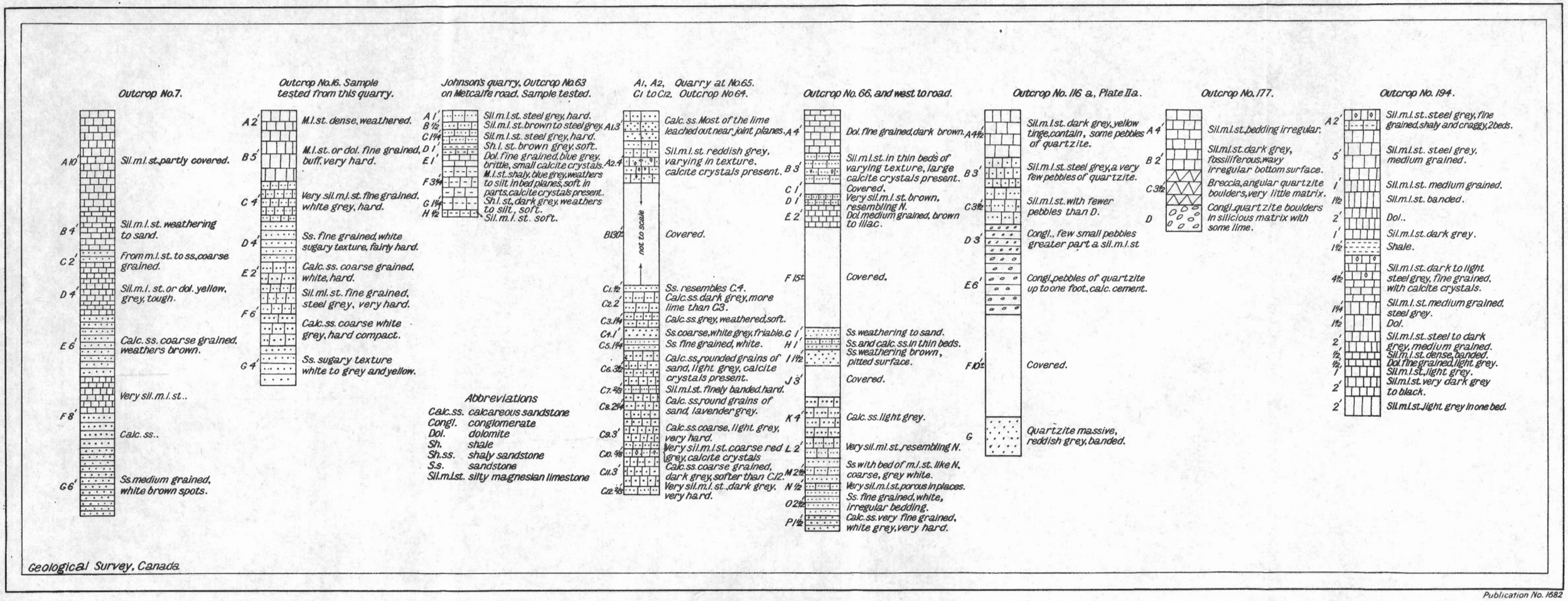
Era.	System or formation.	Lithological characters
		Unconsolidated Materials
Quaternary.	Glacial	Unstratified boulders and sand. Partly stratified sands and gravels containing marine fossils. Stratified blue clay containing marine fossils. Unstratified boulder clay.
		Consolidated Bedded Sediments
Palæozoic	Lorraine	Sandstones and shales.
	Utica.	Shale.
	Trenton.	Limestone with very little shale.
	Black River.	Limestone.
	Chazy limestone.	Limestone, shaly limestone, and shale.
	Chazy shale.	Sandstone and shale.
	Beekmantown.	Dolomite, magnesian limestone, calcareous sandstone, and sandstone.
	Potsdam.	Sandstone.
		Metamorphosed Sediments and Igneous Rocks.
Pre-Cambrian.		Quartz diorite, binary granite, quartzite, schist.

Pre-Cambrian.

A small area of Pre-Cambrian is found in the northwestern part of Nepean about 2 miles northwest of Bells Corners. Very small areas of Pre-Cambrian were also met with in Oxford and Edwardsburgh townships. Within the area in Nepean there are outcrops of rather coarse-grained binary granite with some schist and two small hills of quartz diorite. The occurrences in Oxford and Edwardsburgh are of quartzite. The quartz diorite is a dark grey, medium-grained rock of granitoid texture in which hornblende, feldspar, and quartz can be detected with a hand lens. The outcrops are massive with few shear zones through them. The quartzites are white to greyish white rocks, consisting of quartz with a few flat plates of mica lying in parallel planes through the stone. The quartzites are much more compact and of greater strength than the Potsdam sandstones of nearly similar mineral composition.

Potsdam.

The two areas mapped as Potsdam lie in the northwest section of Nepean. The Potsdam lies apparently conformably under the Beekmantown at this place and the separation is made wholly on lithological grounds. One or two of the lower beds of the Beekmantown may be found within the area marked Potsdam, and the Potsdam undoubtedly underlies the Beekmantown area east and northeast of Fallowfield.



Publication No. 1682

Fig.1. Lithological sections in the Beekmantown formation

Scale of feet

5 0 10 20 30

To accompany memoir by L. Reinecke

The Potsdam is made up of sandstones only. These rocks are white to grey white in colour with rusty brown streaks along the bedding planes. They consist almost wholly of more or less rounded quartz grains with a little kaolin and iron oxide between the grains.

Beekmantown.

The Beekmantown formation underlies all the western and southern part of Nepean township, except the extreme southwestern corner, and outcrops in the southwestern part of Gloucester. There are three or four small areas of Pre-Cambrian in Oxford and Edwardsburgh, but all other outcrops in the area south of Gloucester and Nepean are of Beekmantown age.

The formation is made up of beds of sandstones, calcareous sandstones, siliceous dolomites, and siliceous magnesian limestones (Figure 1). The sandstones occur in the lower portions of the sections in Nepean and Gloucester townships, and in some of the occurrences in Augusta. Interbedded with the sandstones but in the greater number of cases overlying them, are the dolomites, forming most of the outcrops south of Gloucester and Nepean. In several outcrops occurring directly over or near Pre-Cambrian quartzites there are conglomerates formed of rounded and angular fragments of quartzite in a matrix containing varying amounts of silica, lime carbonate, and magnesium carbonate (Plate IIA). This matrix is, in many cases, very similar to the typical magnesian limestone which in some of the outcrops lies conformably upon, or is found between, the beds of conglomerate. There is very little shale in these outcrops but some of the dolomites contain clayey material, and in many cases there is a thin shaly parting between them.

All of the samples from this formation, which were examined under the microscope or analysed chemically, contain silica, calcium carbonate, and magnesium carbonate, as well as other impurities, and the relative amounts of silica and carbonate vary greatly. In this report the term *calcareous sandstone* (Plate VIIE) is applied to a sandstone with sufficient limy matrix to bind the sand grains firmly together so that the rock is tough and hard; this rock is light grey in colour and has a blotchy appearance. The term *sandstone* is applied to a sandstone that does not contain enough lime cement to be detected by the naked eye and which is friable and breaks easily under the hammer; this rock is thinner bedded than the calcareous variety and usually has rusty streaks parallel to the bedding planes.

The terms *dolomite* and *magnesian limestone* are applied to rocks in which the quartz grains are not visible or only sparingly so and which are composed chiefly of calcium and magnesium carbonate. The two types, dolomite and magnesian limestone, differ mineralogically and

chemically in that the molecular proportion of calcium to magnesium carbonate is greater than 1·3 to 1 in the magnesian limestone, and lies between 0·8 to 1 and 1·3 to 1 in the dolomites. The dolomites are very fine, even-grained rocks of a steel to buff grey colour (Plate VIIA). The magnesian limestones are coarser-grained, uneven in texture, and generally rather light grey in colour. They vary in chemical composition and grade into the dolomites. The average physical properties of the samples of calcareous sandstone, magnesian limestone, and dolomites which were tested did not differ very materially. The sandstones with little or no lime cement are of poorer road-making qualities.

Chazy.[1]

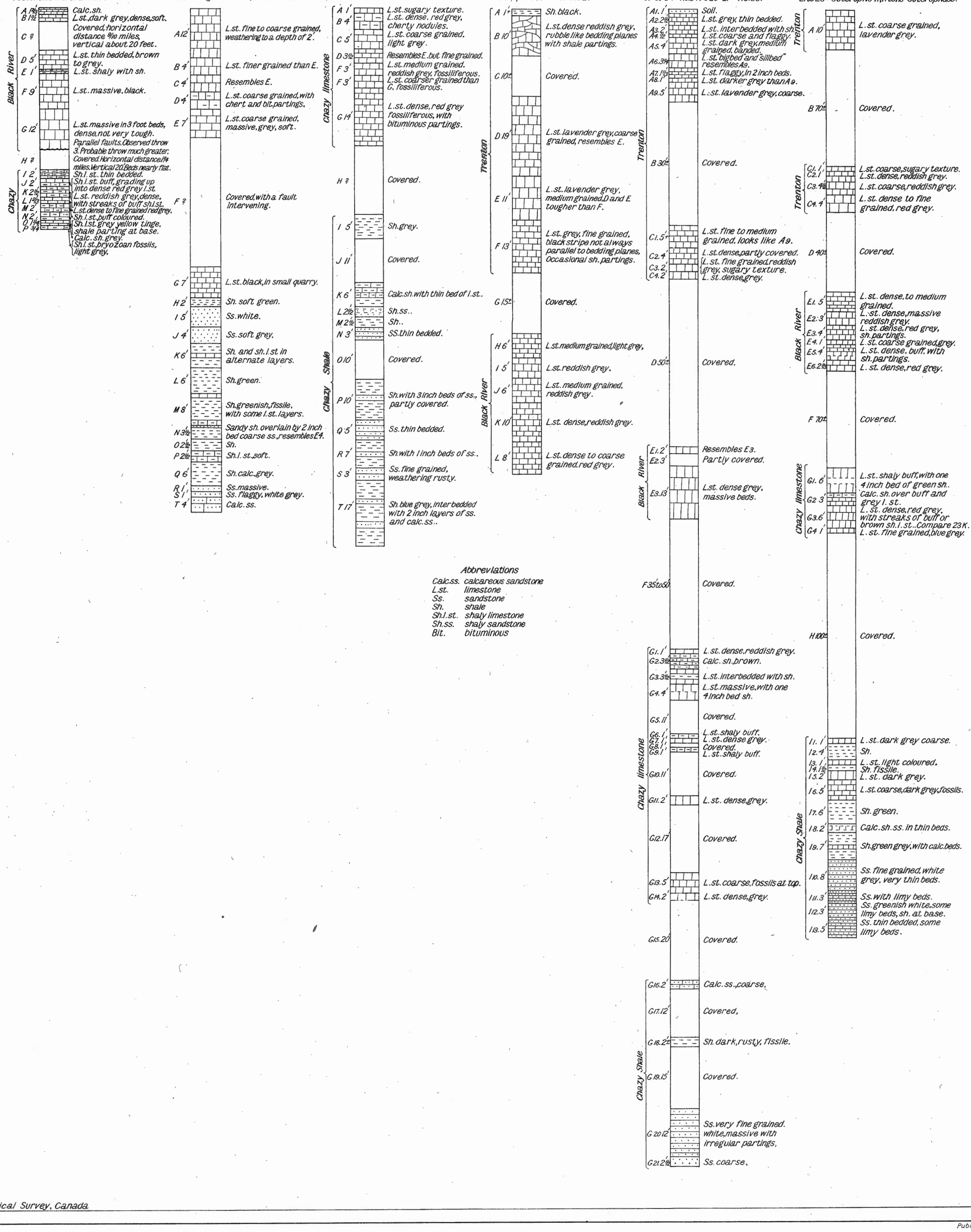
The Chazy formation has been mapped in two colours, one representing the Chazy shale and the other the Chazy limestone. This is a convenient classification as it divides a series of shales and sandstones which are of no value in road work from a series of limestones with interbedded shales, parts of which have been used to advantage on roads carrying light traffic.

The two divisions of the Chazy outcrop in the northern parts of Gloucester and Nepean, in narrow belts lying, for the most part, close to Ottawa river.

Chazy Shale. Extensive outcrops of Chazy shale are to be seen at Britannia Bay, Hogsback, Rockcliffe park, and near the Montreal road, east of Greens creek. They consist of fine-grained sandstones and shales with cross-bedded coarse sandstone and conglomerate near the base, together with fissile shales and calcareous beds toward the top. The formation is over 80 feet thick. The sandstones at the base are in places 15 feet thick. The rest of the formation is thin-bedded and shales alternate continually with the firmer and harder sandstones and limy beds (Figure 2). The formation is not considered promising for road work.

Chazy Limestone. Sections of Chazy limestone are exposed at and southwest of the village of Woodroffe, at Rockcliffe park, on the Skead road, and east of Greens creek on the Montreal road. It has been quarried for road metal at Rockcliffe park and east of Greens creek. The outcrops consist of dense to medium-grained grey limestones, interbedded with shales and shaly limestones. Dense limestones with a reddish tint on the fresh fractures make up a large part of certain sections. At Rockcliffe park there are cherty nodules in certain beds and many fossils in others. Two or three beds of a yellow or buff shaly limestone, generally not over a foot or two in thickness, are characteristic

[1] The Chazy has of late been divided on fossil grounds, the lower sandstones being called the Aylmer and the rest of the Chazy above it the Pamelia formation.



To accompany memoir by L. Reinecke

Fig. 2. Lithological sections in the Chazy Black River and Trenton formations near Ottawa

Scale of feet
10 0 20 40 60 80

of this formation (Figure 2). Under the microscope the limestones appear to be made up nearly wholly of calcite, kaolin, and some brown indefinite material probably iron oxide or bituminous material and with practically no visible quartz.

Black River.

The Black River formation lies above the Chazy limestone and below the Trenton. Extensive outcrops of it are found near City View in Nepean. In Gloucester it outcrops near the Canadian Northern Railway crossing of the Rideau, from Hogsback southeast for 2 or 3 miles, and in a narrow belt near the Montreal road.

The Black River exposures which were examined are almost wholly made up of limestones. The greatest total thickness of actual outcrop, measured on the concession road 2 miles north of Bowesville, is a little over 40 feet; but the formation must be more than 80 feet in thickness. The limestones vary in density, but in places much of the outcrop consists of dense grey limestone with a red tint, resembling the dense limestone of the Chazy. A few thin beds of calcareous shale are also present in some of the outcrops (Figure 2). Three thin sections of limestone from this formation were examined; they consisted of calcite, kaolin, and iron oxide (Plate VII B).

Trenton.

There is a belt of Trenton in the southwestern part of Nepean. The formation underlies a large part of the city of Ottawa and is found in a narrow belt south of the Black River area in the northern part of Gloucester.

The outcrops of Trenton examined were made up almost wholly of limestone, although a few thin beds of shale were seen near the top of the sections. About 50 feet of limestone of Trenton age outcrops in the road east of Notre Dame de Lourdes cemetery (Figure 2). The formation is over 60 feet and may be 80 feet thick at this place.

The limestones vary from fine-grained, dark grey, to quite coarse-grained, light grey stone with a lavender tint. In certain outcrops there are fine black partings, and in one of the quarries in Hull certain of the beds are cherty. Under the microscope the limestone is found to consist of calcite, kaolin, and brown material which is probably largely iron oxide with perhaps some bituminous matter (Plate VII C and D).

Utica and Lorraine.

The Utica and Lorraine formations occupy fully one-half of Gloucester township. The area has the shape of a blunt wedge extending east and southeast from the apex of the wedge at the city of Ottawa.

The formations are made up principally of shales with occasional thin beds of sandstone and limestone. Outcrops are not abundant and there is seldom more than a foot or two of strata exposed. These two formations contain very little, if any, stone that can be used for road metal and no attention was paid to them in this work.

Glacial Deposits.

Glacial drift in the form of boulder clay is found distributed over nearly all of the area surveyed. Sands and gravels which may be attributed indirectly to glacial action are not so widespread, but are fairly plentiful. Wherever the land has been cultivated, boulders which interfere with the tilling, that is those ranging from about 5 inches in diameter up, have been piled together in fences or heaps (Plates III B, IV A). On the map the fences are shown as grouped together in boulder areas. The compositions of the individual fences have been estimated as well as the average composition of the fences included in each of the boulder areas. For the purposes of this estimate boulders are classed as hard, soft, and limestone (page 55, footnote). With the exception of a few weathered gneisses and soft schists the Pre-Cambrian boulders are all classed as hard; and, since no rocks of Palæozoic age are classed as hard, the percentage of hard as given is practically equivalent to the percentage of Pre-Cambrian boulders in the deposits. The Pre-Cambrian border lies north of Ottawa river, and the small patches of Pre-Cambrian rocks south of the river are only of local importance as sources of border supply. The limestones and soft boulders are usually of local origin, that is, they are derived from the underlying Palæozoic strata, and have not been moved more than 20 miles from their original position in the bedrock. The northern Chazy, Black River, and Trenton limestones outcropping in Nepean and Gloucester townships, for instance, were practically never seen in the fences to the south of those townships. A number of small hills covered with large angular blocks of stone are found within this area (Plate IV B). Most of the boulders are of the same composition as the bedrock near by. They lie nearly flat in a matrix of boulder clay and may be mistaken for outcrops of bedrock. The angularity of the boulders and their great size indicate that they were moved for a short distance only. Boulder hills are especially common north of Rideau river below Kars.

The boulder clays were undoubtedly deposited by continental ice-sheets and it is possible that several distinct ice advances contributed to the deposit. A large amount of the gravel described in this report is to be ascribed to rivers within or directly connected with the glaciers. Certain boulder and sand deposits lying above the marine clays and sands may have been laid down by floating ice (Plate VI B).

Marine Deposits.

Deposits of blue stratified marine clay are found near Ottawa river and in the lower stretches of Rideau river. Sands and gravels carrying marine shells are found near Jock river in the south of Nepean and along the northern edge of North Gower, in the long ridge running from Bowesville to Kemptville, and from Kemptville south to Prescott in ridges which lie, in general, near the edges of clusters of glacial boulder areas rather than among them. These sands and gravels are generally stratified and the shells lie in most cases near the top of the deposit, the lower part being in many cases a fluvioglacial gravel. Shells are found in one or two instances with deposits containing large boulders. Certain marine sands and gravels overlie the blue marine clay and both overlie the boulder clays and sands and gravels of glacial origin. In several localities near Ottawa, however, and in one near Kemptville there are boulder sand deposits lying over or mixed in with the marine sands. The marine clays and sands are generally believed to have been deposited during the Champlain epoch in an arm of the sea which occupied the Ottawa-St. Lawrence basin at that time. Many of the marine gravels have been used for road and concrete work.

STRUCTURAL GEOLOGY.

The structure of the formations encountered is of importance in so far as it affects quarrying operations, and the strength of the stone.

The outcrops of Pre-Cambrian quartz diorite and quartzite are generally massive and show very little, if any, sign of foliation. The quartz diorite, outcrop No. 5, has a few irregular fractures through it with fairly solid stone between. The rock has been weakened as the result of earth strains which have torn, sliced, and granulated some of the constituent minerals, noticeably the hornblendes and quartzes. The quartzite outcrops are also massive and the bedding planes have been more or less obliterated by recrystallization. Fine plates of mica lying in parallel planes within the stone indicate that it has been subjected to stress. The resulting strains have been largely taken up by recrystallization of the rock mass.

The limestones, dolomites, sandstones, and shales of the Palæozoic formations occur in strata or layers. In the district traversed the beds are in general flat or dip at low angles to the horizon (Plate II B). Several fault planes traverse these beds in the northern part of the area examined. These faults represent breaks in the earth's crust and the beds on either side of them have been shifted in a greater or less degree from their original position relative to each other. Near such faults the beds generally dip at a high angle and are, in places, folded and brecciated. One of the most important of these faults crossses Gloucester

township in a northwesterly direction; it cuts the Metcalfe road to the south of Leitrim, Rideau river just above the Canadian Pacific Railway bridge, and the Ottawa just above Lemieux island. East and west faults are seen in Nepean north of Fallowfield, and a southwesterly trending fault lies about one-half mile north of Rideau river from Becketts landing west. Minor faults occur at Hogsback, in Rockliffe park, west of Greens creek, and at other places.

The beds of Palæozoic age do not show any marked evidence of mechanical strain. Joint planes cross the bedded rocks and they generally lie at right angles to the bedding planes and to each other. The Beekmantown appears to have been subjected to greater static pressure since its formation than the younger rocks, for the original grains of the rock lie close together with few interspaces (Plate VII A). In the Chazy, Black River, and Trenton limestones, many of the older grains are rounded, and in certain cases do not touch, the interspaces being filled with clear calcite of later origin (Plate VII B, C, D). In nearly all cases both the limestones and dolomites have been thoroughly cemented by calcite, iron oxide, and kaolin.

CHAPTER III.

MATERIALS SUITABLE FOR HIGHWAY CONSTRUCTION.

Three classes of material in the area examined are available for road construction. They are: bedrock that is stone in place, field stone or glacial boulders transported for a greater or less distance from their original outcrops, and gravel.

SUMMARY.

Relative Values of Bedrock, Field Stone, and Gravel.

In the detailed discussion in the latter part of this chapter the values of the three kinds of material mentioned are treated separately. A number of samples of each have been tested and their service in roads has been studied wherever possible. The results of both laboratory and service tests indicate that the bedrock found near the larger part of the proposed Ottawa-Prescott highway is the best local material obtainable and much better than the field stone. The comparative values of field-stone and gravel as surfacing materials in any given locality are not always the same.

Of the bedrock, the quartzites and quartz diorites of the Pre-Cambrian, and the calcareous sandstones, magnesian limestones, and dolomites of the Beekmantown formations give nearly equivalent results in the laboratory tests. The results of tests on the limestones of the Chazy, Black River, and Trenton formations are also nearly equivalent, but the values are not as good as those obtained for the rocks tested from the Pre-Cambrian and Beekmantown. Dolomites, magnesian limestones, and calcareous sandstones of the Beekmantown have given excellent service for four years in water-bound macadam, under traffic of about 100 vehicles a day with very little if any maintenance. Chazy limestone has also given good service under the same conditions with much more expenditure for repairs. The Black River and Trenton stone apparently fail somewhat sooner under the same amount of traffic. No water-bound macadam roads were seen, which were constructed of any of the kinds of stone referred to above, that were in good condition after being subjected for one year to traffic of 150 to 200 vehicles per day; in most of these cases the top started to break in six months. Since a part of the highway when completed will have to carry that amount of traffic and more, stone of the kinds referred to will, if used on it, require some bituminous binder. Although the Chazy has done well with a bituminous mat, carefully selected Beekmantown stone should require

less maintenance because of its higher toughness and lower average wear. The Beekmantown dolomites, magnesian limestones, and sandstones, and the quartzites of the Pre-Cambrian should also stand up better than the Chazy, Black River, or Trenton limestone in a bituminous macadam or bituminous concrete surface.

The values of the field stone deposits vary from place to place and in many cases from fence to fence. Only good firm stone should be used in any case. Where less than 10 per cent of the stone is composed of shale, schist, friable sandstone, or badly weathered stone, the material may be considered fit for the foundation course of a trunk highway (Figure 3). Very little if any of the stone examined is of use in the wearing course of macadam roads subject to moderately heavy traffic (Plate III A), but a large proportion of the field stone can be used to advantage on roads carrying less than 100 vehicles per day.

The amount of variation that exists in the lithological character of the gravels is nearly as great as in the case of the field stone. Gravels that carry less than 10 per cent soft pebbles may be expected to make excellent macadam. Nearly all of those in which the percentage of soft pebbles is less than one-half of the whole will do well under light farm traffic. The failures observed in gravel roads were very numerous, but they were due three times out of four to poorly drained or weak foundations, or to the failure to screen pebbles over 3 inches in diameter out of the gravel. Certain of the gravels carrying less than 10 per cent soft stone and free from impurities are fit to be used in concrete road construction. One such piece of concrete road in the village of Kemptville is in excellent condition after three years service. Kemptville has a population of about 1,200.

Materials to be Avoided.

With few exceptions, the following classes of materials found in this area may be considered of extremely doubtful value for road work: all kinds of weathered rock, especially weathered calcareous sandstones of the Beekmantown; light coloured coarse-grained granites and the schists of the Pre-Cambrian; outcrops within areas marked Potsdam; friable sandstones of the Beekmantown containing little or no lime; outcrops within areas marked Chazy shale; shales within the Chazy limestone, Black River, and Trenton formations; outcrops within the areas marked Utica and Lorraine formations; aggregates of field stone which carry too high a percentage of soft boulders to make the elimination of such boulders by hand sorting practicable; and gravel deposits carrying over 50 per cent soft pebbles.

BEDROCK.

Outcrops of bedrock are comparatively plentiful near the Ottawa and the lower part of the Rideau rivers, in the southwestern and western part of Nepean township, in parts of Oxford and Edwardsburgh townships, and near the St. Lawrence in Augusta township.

In the following section the comparative values of the better classes of stone outcropping as bedrock are discussed. They include quartzites and quartz diorites of the Pre-Cambrian; calcareous sandstones, magnesian limestones, and dolomites of the Beekmantown; and limestones of the Chazy, Black River, and Trenton. The stone is compared both as to its relative strength as shown in laboratory tests and the service it has given under actual traffic conditions.

Laboratory Tests.

The results of tests made upon stone from this area are given in Appendix A, Table I.

In order to have a standard of comparison it is well to mention the limits that have been set upon the values for the toughness and percentage of wear of stone that is to be used in macadam construction.

The specification adopted in October 1914 by the American Society of Municipal Improvements stated that broken stone used in a broken stone road "shall show a French coefficient of wear of not less than 7 (per cent of wear 5·7) and its toughness shall not be less than 6." The maximum per cent of wear suggested by a committee of the American Society of Civil Engineers in 1917 was 5. The broken stone used in the wearing courses of a bituminous macadam or bituminous concrete road "shall show a loss on abrasion of not over 3·7 per cent—and its toughness shall not be less than 13."

The United States Office of Public Roads[1] sets the limits of toughness for stone used on roads subjected to a traffic of less than 100 vehicles a day at from 5 to 9 except in the case of bituminous concrete where the lower limit is 7. On roads subjected to from 100 to 250 vehicles a day the minimum toughness is 10 for macadam and bituminous macadam, and 13 for bituminous concrete. For roads carrying over 250 vehicles the minimum toughness is 19 for water-bound macadam, 10 for macadam with bituminous mat and bituminous macadam, and 13 for bituminous concrete.

The Pre-Cambrian quartz diorite and quartzite tested (page 38), have a toughness value high enough and per cent of wear low enough to fit them for use on roads subjected to light traffic. The sample of

[1] "Relation between the properties of hardness, and toughness of road building rock," by Prevost Hubbard and F. H. Jackson, jun., Jour. of Agricultural Research, vol. V, No. 19, Feb. 7, 1916, pp. 906, 907.

Potsdam sandstone with a toughness of 4, and per cent of wear of 8, is unsuitable for road work.

The eleven samples tested of the calcareous sandstones, dolomites, and magnesian limestones of the Beekmantown, range from 5 to 13 in toughness with an average of 9, from 3·6 to 5·4 in percentage of wear with an average of 4·5, and from 25 to 149 in cementing value with an average of 63. Five samples tested of the same type of stone in a Beekmantown area some 50 miles to the northeast averaged slightly higher in toughness with practically the same percentage of wear (Part II, Appendix A). According to the specifications mentioned above practically all the stone tested from the Beekmantown is suitable for use on roads subjected to light traffic. Its toughness is probably in most cases sufficient for use in bituminous macadam subjected to a traffic of up to 250 vehicles a day. Its percentage of wear is, however, somewhat higher than the limits set by the specifications mentioned. Tests on limestones from the Chazy, Black River, and Trenton formations show that these are very similar but they are of lower grade than the Beekmantown. Samples tested from these three formations ran from 4·4 to 6·4 in percentage of wear with an average of 5·3, and from 4 to 7 in toughness with an average lying halfway between 5 and 6. The Trenton shows a slightly lower toughness than the other two. It is evident that the average qualities of wear and toughness of these limestones lie at the very lowest limits which have been set for stone used on macadam roads. The samples tested contained little or no shale and they represent the limestone members of the formations in question.

Service Tests.

Summary. As far as could be discovered no Pre-Cambrian quartz diorites or quartzites have been used in macadam construction in the area examined. Potsdam sandstone blocks have been used for paving in Ottawa but not in macadam work.

On roads subjected to light traffic Beekmantown dolomite, magnesian limestone, and calcareous sandstone have given good service for one to two years when placed on a good foundation and rolled wet. When properly constructed, roads made from these materials remained in good condition for four years without maintenance under traffic of over 100 vehicles a day, but developed slight longitudinal ruts; and they have also proved durable, but the top has been drawn out, under slightly heavier traffic, for six years. Without a bituminous binder, and under traffic ranging over 150 vehicles a day, such roads have become rough with many shallow holes, in four years. A tarvia B dressing on a wearing course of this stone has kept the road in good shape for one year, under traffic ranging from 150 to 200 vehicles a day, and has failed in the same length of time under heavier traffic.

A road of Chazy limestone, water-bound, properly constructed and maintained has given excellent service for four years under light traffic. Chazy limestone with a constantly renewed mat of tarvia B was in good condition under moderately heavy automobile traffic after five years and with a tarvia X top after two years service.

A road of Black River limestone, water-bound, and properly conconstructed has remained in good condition under light traffic for one year. With a tarvia B top the same stone has failed under moderately heavy traffic in one year. Waterbound Black River limestone from another quarry has become very dusty and worn in one season under moderately heavy motor traffic.

A road of Trenton limestone has worn well under moderately heavy traffic for one year, and required repatching in two. After thorough repatching with the same stone it has kept in fair shape for one year under moderate traffic but started to break badly under heavy teams. A tarvia A top with the same stone went to pieces in two years under very heavy traffic.

Details of Service Tests.[1] Beekmantown calcareous sandstone, dolomite, and magnesian limestone have been used on roads leading from Ottawa, on a road going north from near Becketts landing, and on several pieces of road near Prescott. On one of the roads leading from Ottawa a stretch of 2½ miles over which the traffic is heavy in summer, running from 200 to 500 vehicles a day, about one-third of which are motor drawn, was surfaced with Beekmantown stone from quarry 19, showing a toughness of 10, per cent of wear 4·9, and cementing value of 101. This stretch was covered with a dressing of tarvia B and sand in 1914. In July 1915 it was rough with large shallow holes 2 to 3 inches deep and was somewhat dusty. A part of it surfaced with tarvia B a month previously was in good shape. For about 1½ miles farther out the same road surfaced with the same stone in 1909 and rolled wet and treated with tarvia B in 1914 was smooth and in good shape. The traffic on this stretch is considerably lighter than on the first, from 125 to 225 vehicles per day. Still farther out a stretch of about three-quarters of a mile, surfaced in 1909 and rolled wet, was rough in July of 1915 with the binder gone, but contained no holes and was otherwise in good shape. Practically all such stretches of the road as required repairs were patched and resurfaced with tarvia B late in the summer of 1915, after the time the observations recorded here were made. The construction and maintenance of this road is done under the supervision of a properly qualified engineer.

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[1] Details regarding the traffic over roads near Ottawa were obtained from "Traffic Census 1914," by Robt. C. Muir, which appears in "Annual Report on Highway Improvement, Ontario, 1915," Appendix D, Toronto, 1915.

A road leading southeast from Ottawa was resurfaced in 1911 upon an old macadam foundation. The foundation was reinforced with cobblestone in places. Over this the broken stone was placed in two courses and rolled wet. The first 2 miles out of Ottawa were surfaced with Black River limestone, the remaining 9 to 10 miles with Beekmantown dolomite and magnesian limestone (quarry 63, toughness 9, per cent of wear 4·4, cementing value 25). On the section 6 to about 11 miles outside the city limits the traffic is from 100 to 175 vehicles per day running up to 200 on certain days in the summer. Nearer the city it gets heavier but not very much over 200 vehicles a day. In June 1915 the section of the road 2 to 6 miles from the city was rough with longitudinal ruts and broad shallow holes; the part nearer the city, surfaced with Black River limestone, was especially bad. From 6 to 11 miles out there were shallow longitudinal ruts, but few cross ones, and the road could be driven over at high speed. In July 1915 this last section and a small part of the section nearer the city were patched and in part entirely resurfaced and put in good shape by wet rolling, largely with Beekmantown stone from quarry 63. In November 1915 the new surface had begun to break in the wheel ruts, in some places every 10 feet and in others every 50 feet. The unrepaired portion nearer the city was then in bad shape. The road in Marlborough north of Becketts Landing was surfaced in 1914 with Beekmantown dolomite and magnesian limestone from quarry 79 (toughness 13, per cent of wear 4·4, cementing value 73). The traffic is light, certainly under 100 vehicles a day. The broken stone was placed on an old macadam foundation in three sizes and rolled wet. In September 1915 the road was in good condition with the horse track slightly worn and a few loose stones. A stretch of the river road near Prescott, surfaced with Beekmantown dolomite in May 1914, was in good condition in November 1915. The Prescott-Ottawa road in concessions II and III of Augusta, just north of Prescott, was resurfaced over an old macadam foundation in 1912 with Beekmantown dolomite and magnesian limestone; the stone was not rolled. In November 1915 this stretch of road was rough with longitudinal ruts all over the surface to a depth of 2 inches and almost covered with water after a heavy rain.

A driveway in Rockcliffe park, surfaced with Chazy limestone from quarry 29 (toughness 6, per cent of wear 5·1, cementing value 104) in 1910 and since covered with three coatings of tarvia B, was in good shape in 1915. The traffic over this driveway is moderately heavy and is largely motor drawn. A driveway in the city constructed of the same limestone with tarvia X in 1913 and carrying heavy traffic was in excellent condition in 1915. Both roads were well constructed and maintained. A stretch of macadam road east of Ottawa was resurfaced with Chazy limestone from quarry 40 (toughness 7, per cent of wear 5·0, cement-

ing value 29) in 1911. The material was properly placed and has been well maintained since. The traffic over this road varies from 100 vehicles a day up to nearly 200 in the summer. It was in good shape in 1915.

A stretch of macadam road about 3 miles long, in Nepean township, was resurfaced in 1914 with Black River limestone from quarry 24, (toughness 7, per cent of wear 6·4, cementing value 22). A bed of 2-inch stone, 3 inches thick, was laid down and rolled, and one mile of this was treated with tarvia B. Of the latter portion about three-quarters of a mile is subjected to a traffic of 60 to 90 heavy wagons a day, some of them carrying up to 5 tons of stone, and an additional traffic of nearly 200 farm rigs and some motors. In 1915 this surface had worn to broad ruts up to 3 inches deep, but was still in fair shape. The rest of the road was water-bound macadam, in fair condition for one mile past the point where heavy traffic stops and in excellent condition for the rest of the way under traffic of less than 100 vehicles a day.

A road in Gloucester just outside of Ottawa surfaced with Black River stone from quarry 50 (toughness 6, per cent of wear 4·7, cementing value 20) was patched in May 1915 with 2 inches of stone from the same quarry. The stone was rolled wet and the road put in good shape all through. The new stone cemented quickly and began to wear immediately. By September the road was very dusty and ruts had begun to form again. The traffic varies from about 80 vehicles at one end of the road to nearly 300 at the other.

Part of a macadam road leading east from Ottawa was surfaced in 1910 with Trenton stone from quarry 32 (toughness 5, per cent of wear 4·4, cementing value 40). The broken stone was rolled wet. In 1913 a surface of broken stone with tarvia A, 2 inches thick, was placed on two stretches near town, each about one-quarter mile long. The first, a suburban street, under heavy traffic, 600 vehicles a day and over, was in very bad shape and full of holes in 1915; the other, outside the same suburb with traffic of 300 vehicles or over a day, was in fair shape with some large shallow holes. A stretch from 1 to 3½ miles out of Ottawa was surfaced in 1910 with Trenton stone from quarry 38 (toughness 4, per cent of wear 4·7, cementing value 75) and patched at intervals since. Part of this road is subjected to the heavy traffic of stone wagons and all of it to automobile traffic. The total traffic is over 200 and is probably close to 300 vehicles a day on the part near town. In the summer of 1915 that part of the road over which the stone wagons passed had numerous shallow holes and ruts, but the other portion was in better condition with only occasional holes. The maintenance on this road is excellent. Another road nearby, subjected to light or medium traffic, was surfaced in 1912 with Trenton limestone from quarry 38 and repatched in 1914. It was in excellent condition in 1915.

Relation between Strength and Texture.

The relation between certain textural characters of the sedimentary rocks and their toughness was studied under the microscope and by means of chemical analyses. The conclusions arrived at are only tentative as yet, but they will be stated here without the detailed evidence from which they were deduced. The comparative strength of the dolomites and limestones is apparently dependent upon the manner in which the different grains of calcite or dolomite are arranged in regard to each other within the rock. Grains containing kaolin, silica, and other impurities are believed, with good reason, to be stronger than those of pure calcite or dolomite. The toughest limestones and dolomites appear to be those in which rather small, angular grains, of nearly the same size, of impure carbonate, are closely packed together (Plate VII A), the weaker rocks are those in which impure grains of carbonate or aggregates of such impure grains are separated by large areas of pure carbonate. Where the grains are large and vary greatly in size the rock tends to be of lower toughness (Plate VII D). The toughness depends not so much on fineness of grain, however, nor on the total amount of impurities present as on the texture, that is the relation of pure and impure grains to each other. Plate VII A, B, C, D, illustrates dolomites and limestones of different textures and toughness values. The strength of the calcareous sandstones of the Beekmantown is due partly to the thoroughness with which the lime cement has penetrated the voids between the sand grains and to the partial recrystallization of the quartz by means of which the rounded grains of sand have been changed to angular individuals with crystal faces (Plate VII E).

Potsdam sandstones also show evidences of recrystallization but the lime cement is absent and their toughness is low. The low toughness of certain friable sandstones of the Beekmantown is to be ascribed to the same cause.

Commercial Development.

Small quarries have been opened at a number of places in the Beekmantown formation, but in very few cases have more than a few hundred cubic yards been removed. Stone from quarries Nos. 19, 63, 79, 110, 172, and from several others near Prescott have been crushed and used in macadam work; stone taken from the rest of the quarries in the Beekmantown has been used mainly for building purposes. The stone is sold at from 25 to 50 cents per cord in place; other prices range from $1.25 to $4 per cord, the higher prices, presumably, for quarried stone. Several large quarries have been developed in Chazy, Black River, and Trenton stone in the immediate neighbourhood of Ottawa. The Trenton stone has been extensively developed and one excavation, Nos. 37, 38, is about one-quarter of a mile long by over 100 yards in width

with a depth of about 5 yards. There are numerous smaller quarries, especially in the Trenton. Stone from quarries 24, 29, 31, 37, 38, 40, 49, 50, and 51 has been crushed and used for macadam work. The stone is sold at 20 cents per ton in place, 40 cents to $1 per ton quarried, and $1 to $2 per ton crushed and delivered at the work in Ottawa. According to their respective managers the Rideau Canal Supply Company of Ottawa produces 4,000 tons of crushed stone in summer at their quarry No. 24, and H. Dupuis and Son of Hull, Quebec, produce 150,000 tons per year, of which a large proportion is crushed stone. There are no large crushing plants on the Ontario side of the river outside of the one mentioned although at least two small portable crushers were in operation in 1915. Limestone from the Black River and Trenton is used extensively for building and dimension stone.

Near Ottawa a great many of the outcrops lie in escarpments facing the river and there are no great obstacles to be overcome in the actual process of quarrying. Escarpments of this kind ranging from 5 to 15 feet are also found in the ridge north of Jock river in Nepean, near the Metcalfe road in Gloucester, in places near the Rideau river in Marlborough, in concessions VIII and IX of Oxford, near Spencerville, and near the river front at Prescott. There are also a great many outcrops, especially of Beekmantown stone, which scarcely rise over the general level of the country and which would be more difficult to quarry both because of poor drainage and lack of natural faces to blast to.

Outside Sources of Supply.

Stone can be transported to the neighbourhood of the proposed road by the Canadian Pacific and Great Northern railways and by scow on the Rideau canal. The Ottawa-Prescott branch of the Canadian Pacific lies near the road from Kemptville to Prescott but not north of that section. Between Kempton and Prescott there is a siding approximately every 4 miles; two of these are close to the road, the farthest 2½ miles from it. Rideau junction is the only unloading point on the Canadian Northern which lies close to the route.

Rideau Canal. The Rideau canal lies to the east of the route from Kemptville to Ottawa. Mr. A. T. Phillips, superintending engineer of the Rideau canal, has kindly furnished the following information regarding the chances of transporting stone to the vicinity of the road on that waterway:

"The water in the sills and in the cuts of the Rideau canal has a minimum depth of from 4½ to 5 feet. Scows carrying from 100 to 175 tons of broken stone can pass through the canal, and landings can be made at the following points between the city of Ottawa and Kemptville:

(1). At Moffat's gravel pit about one mile above Hogsback Lock station.

(2). At Hungry bay about one mile above the last mentioned place and opposite Pollard's farm.

(3). At the site of an old wharf, since removed, above the locks at Black Rapids and around the point above Howe's camp.
(4). On Johnston's farm 1½ miles above the last point; this is on private property.
(5). From 1 to 1½ miles farther up a landing can be made at Mansfield's farm, close to the road.
(6). Manotick wharf. This wharf is in very poor condition.
(7). Farther up the river a landing can be made near the former site of a Methodist church.
(8). From this place (No. 7), to Kars, landings can be made at a number of points on private grounds.
(9). The facilities for landing are not very good from Kars to Kemptville creek.
(10). A loaded scow can be taken up Kemptville creek through Kemptville to a wharf below the swing bridge. The wharf is the property of the town of Kemptville.

The land on both sides of the Rideau canal from Kingston to near Smiths Falls was prospected by the writer in the autumn of 1916, for deposits of first grade road material. Only three localities seen need be mentioned here. Between Adam lake and Noble bay on the farm of James Tully there is a diabase or dolerite dyke from which, under favorable conditions, from 5,000 to 8,000 cubic yards of solid rock can be obtained. This will have to be hauled about one mile over a hilly road before it can be loaded into scows. From that point to Becketts Landing, where the first unloading can be done for the Prescott road, is about 45 miles with sixteen locks to pass. Deposits of a fine-grained stone, which may be spoken of as meta-andesite, occur on the shore of Opinicon lake south of Chaffey Locks. About 15,000 cubic yards of rock can be obtained within one-half mile of Chaffey Locks station on the Canadian Northern railway, from whence it can be hauled by rail to Rideau Junction, a point on the Prescott road near Ottawa. The water offshore is too shallow to consider hauling of the stone by boat. Near Seeley bay there is a deposit of diabase containing nearly 50,000 cubic yards of solid stone that can be developed without great difficulty. This locality is about 75 miles from Becketts Landing on the Prescott road with twenty-four locks to pass. The small amount of stone which can be carried by barge through the canal, will probably make the cost of hauling by water rather high. The meta-andesite is a tougher and more durable stone than the diabase.

Canadian Pacific Railway. The north shore-line of this railway between the cities of Ottawa and Montreal passes close to a large number of deposits of diabase and other igneous rocks, which were examined and tested in the summer of 1915. None of these deposits have been quarried for road stone except in a small way for local use. Good stone, kersantite, augite syenite, and diabase, lies near a spur of the railway at the town of Buckingham, 20 miles from Ottawa; and rather coarse diabase, of fair quality only, lies on a lumber railway north of Fassett at a distance by rail from Ottawa of 57 miles. The other deposits are a mile or more from the railway. For further details see Part II of this report.

The Gatineau branch of the Canadian Pacific was prospected for diabase for 20 miles north of Ottawa, but without success. From 4½ to 10 miles northwest of Hull station there are large deposits of diabase in the Laurentian hills. They cannot be considered available for this road without the building of special spur lines to them. The tests made upon them have, however, been included in Appendix A, Table I.

The Canadian Pacific main line from Montreal to Toronto passes through Pre-Cambrian rocks between Perth and Tweed. Perth is about 32 and Tweed 99 miles west of Kemptville junction. From Tweed west to Havelock trap deposits lie only a few miles north of the railway. About 3 miles this side of Havelock the Ontario Rock Company, Limited, of Toronto, operates a trap quarry and crushing plant. The quarry is about 127 miles west of Kempton junction where connexions are made with the Ottawa-Prescott line. The Ontario Rock Company[1] produces first class crushed trap. At the writer's request the managing director of the company has furnished the following information regarding the quantity of stone that can be produced at the quarry, and prices. The annual production has been about 20,000 tons, the amount being regulated by the demand. The amount can be increased to 60,000 tons without an increase of equipment and by working a day shift only.

"The ordinary crusher run is 55 per cent of stone passing 2½-inch and retained on 1-inch screen (or 1½-inch as required); price $1.15 per ton.
20 per cent passing 1-inch and retained on ½-inch; price $1.65 per ton.
17 per cent passing ½-inch and retained on ¼-inch; price $1.75 per ton.
8 per cent passing ¼-inch; price $1.65 per ton.
All prices are f.o.b. quarry and on carload lots. The company is ready to accommodate their price very materially to the size of the order. Railway rates are, in general, about 60 cents for the first 100 miles and 90 for the first 200, but are, of course, also materially modified according to circumstances."

This is undoubtedly a more durable stone than is found close to the road, and in the neighbourhood of Ottawa, Kemptville, and Prescott, where the traffic will be heavier than elsewhere, it would, no doubt, stand up better than the local stone as a wearing course.

BOULDER DEPOSITS OR FIELD STONE.

Nearly 800,000 cubic yards of stone was estimated to be in the fences and piles found within the area mapped between Ottawa and Prescott. The distribution of the stone is in round numbers as follows: 55,000 cubic yards in Nepean, 81,000 in Gloucester, 100,000 in North Gower, 49,000 in Marlborough, and 83,000 in Osgoode. In the mapped portion of Oxford there is 216,000 cubic yards, in South Gower 28,000, in Edwardsburgh 138,000, and in Augusta 42,000.

[1] A report on the quarry including results of tests is to be found in "Road material surveys in 1914," by L. Reinecke, Geol. Surv., Can., Mem. 85.

The information obtained regarding this stone is to be found in Appendix B. The work was done with as much accuracy as the time available permitted and the estimate is thought to be close enough for practicable road building purposes. Estimates of the composition were made whenever a marked variation of the boulder content appeared. The variation was greater in certain areas than in others, but on an average probably more than one estimate of composition was made for every 200 cubic yards of stone measured. The amount of variation to be expected is indicated in that part of Table IV, Appendix B, which

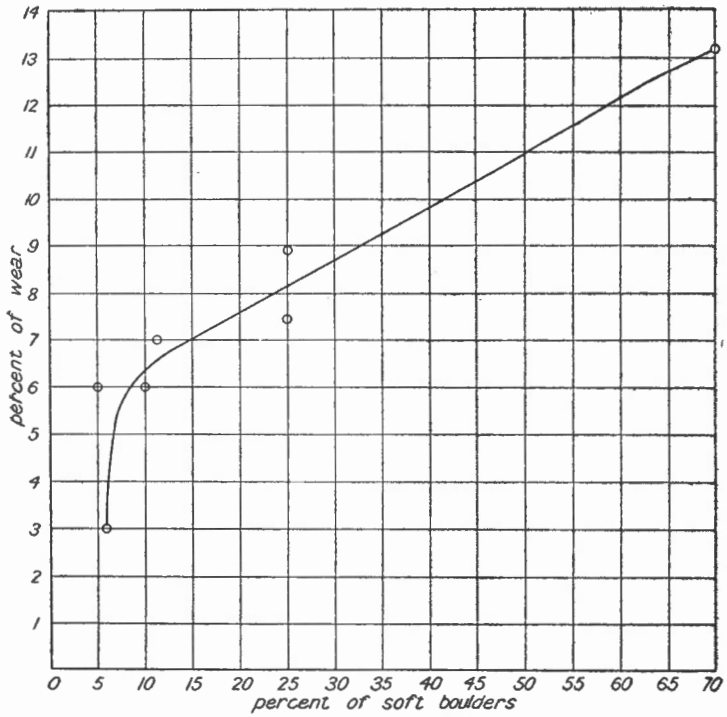


Figure 3. Relation between the composition of field stone aggregates and their per cent of wear.

gives the details of the stone in Nepean and Gloucester townships. The average composition of the different areas in the tables must be read with this variation taken into consideration. The composition of individual fences and even of large portions within any given area in many cases varies widely from the general average.

The specifications drawn up by the American Society for Municipal Improvements for broken stone roads specify that only material which has a French coefficient of wear of 7 or more (per cent of wear 5·7 or less)

shall be used in the surface of a water-bound macadam road. Only one of the samples tested comes up to the required standard and two others approach it (Figure 3). All three contain a small percentage of soft boulders.

Many miles of road in the southern townships have been surfaced with broken field stone. The stone is in many cases not screened, dumped in the middle of the road, and not rolled. It is then avoided by traffic for the first year and wears fast after it is driven over. When properly constructed, stone carrying about 10 per cent of soft material in the deposit and either 70 to 90 per cent of limestone or 70 to 90 per cent of hard boulders, has in nearly all cases given good service for two years and in some cases for four. When there is a nearly equal proportion of hard and limestone boulders the road surface seems to wear faster. This may be caused by greater abrasion in the road bed of adjacent particles differing somewhat in hardness than between those that are of the same hardness or toughness. Stone which carries a considerable amount of soft material should not be used at all without sorting.

Practically all of the piled stone is within hauling distance of a public road and none of it is of intrinsic value except as rather poor fence material. It should, therefore, be obtainable for little more than the price of hauling and crushing. Since none of the stone over 1 foot in diameter can be crushed in the portable machines commonly in use, the total amounts given in Table IV (pages 64 to 75) are much greater than that of the material which can be readily used. The table gives quantities of stone measuring over and under 2 feet in diameter. The number of boulders measuring between 1 and 2 feet is generally greater than the number measuring over 2 feet.

Table IV is largely self explanatory. The scheme of recording was changed after the townships of Nepean and Gloucester had been surveyed, so as to include separate estimates for the composition of stone under and over 2 feet.

Description of Field Stone Deposits.[1]

Nepean. Nearly 80 per cent of the field stone in Nepean lies in a belt a few miles wide stretching from Eagleson corners to a point south of the mouth of Jock river. To both the southwest and northeast of this belt are wide areas devoid of any stone, gravel, or bedrock. The greater part of the remainder lies between City View and Ottawa river at Westboro, and a smaller deposit is found west of Graham bay.

Out of an aggregate of 55,000 cubic yards of stone, only seven areas with a total quantity of less than 6,000 yards carry less than 25 per cent soft stone, that is, sandstone and shales, and seventeen carry over

[1] For details the reader is referred to Appendix B, Table IV.

40 per cent. Judging from the results of tests on field stone, Appendix B, Table III, material that carries over 25 per cent soft stone is not durable enough for even the foundation course of a macadam road. Upon these grounds, therefore, by far the largest part of the stone in this township is unfit for use either as the foundation or wearing course of a macadam road. It must be remembered that the compositions given are averages of rather arbitrarily selected areas and that within such areas there are often fences and piles of better quality than the average. It might be possible by careful selection of material at the crusher to get a large quantity of fair stone from the deposits mapped, but in areas where more than 40 per cent of the stone is soft, selection would hardly be practicable. The most promising deposits are Nos. 1, 9, 20, and 31 (see Map 188A).

Gloucester. There are over 81,000 cubic yards of piled field stone in Gloucester township; about 20,000 cubic yards lie in the northwestern quarter of the township, the rest is nearly all concentrated in the southwestern quarter. The eastern half of the township is practically free from glacial stone. The field stone in Gloucester varies greatly in character from place to place. In general the stone lying southwest of the Bowesville-South Gloucester gravel ridge is very high in soft material, and, therefore, of poor quality. The stone lying south of the Montreal road and east of that part of the Metcalfe road north of Leitrim is low in soft material.

North Gower. About 108,000 cubic yards of field stone deposits are scattered over the township of North Gower. Perhaps 90 per cent of the areas in the township average 10 per cent or less soft material, and the majority of them carry in the neighbourhood of 15 per cent hard material and 75 to 80 per cent limestone. The limestones are practically all siliceous magnesian limestones or dolomites which lose much of their lime upon weathering. The thoroughly weathered dolomites are generally as soft as a friable sandstone; the unweathered stone is, as a rule, excellent road material. The field stone is more or less weathered, and the quality of any particular material from this neighbourhood can be much improved by sorting out the partly disintegrated stone.

The result of tests made upon two samples of stone from North Gower and from the neighbouring portion of Marlborough is given in Table III. The percentage of wear is 3 in one case and 7 in the other, indicating a wide range in durability.

A number of roads were seen in which field stone carrying about 80 per cent limestone and 10 per cent soft boulders was laid from one to four years previously. In all the surfaces that had been down more than one year there were longitudinal ruts; in two years the ruts in the wheel

tracks were one-half to one inch deep. The road surfaces were somewhat dusty after the first year. In some cases, where not rolled or rolled dry, the field stone did not cement readily; however, one road that had been rolled wet upon construction had cemented quite firmly in about one month's time under light to medium country traffic.

Marlborough. The portion of Marlborough that was mapped contained over 49,000 cubic yards of field stone in piles or fences. The stone from Malakoff south appears to be of better quality than that to the north. Two samples of stone from Marlborough were tested, Table III. The road from Becketts Landing to Pierces corners, concessions I and II, in 1914 was surfaced with field stone and was smooth and well cemented in 1915, but was beginning to get slightly dusty; a part of the same road surfaced with bedrock appeared to wear better.

Osgoode. Over 83,000 cubic yards of field stone was estimated to be in fences and piles in Osgoode west of the Prescott road. The portion south of Osgoode Station is relatively bare of stone except in the neighbourhood of the Prescott road. The stone varies in quality but a very large number of the deposits are high in soft material (Table IV); this is especially true of the areas along the northern border of the township. A road near Manotick station, built in May, 1915, of material carrying from 25 to 75 per cent soft boulders, was not firmly cemented in August, and showed signs of wear at that early date. In this township field stone should be selected with care and deposits with a high percentage of soft boulders avoided wherever possible.

Oxford. There is more than 215,000 cubic yards of stone in that part of Oxford which was surveyed, and except near Rideau river, the distribution of the material is comparatively uniform throughout that area. Nearly one-fourth of the stone is over 2 feet in diameter. The greater number of deposits carry on an average less than 10 per cent soft stone (Plate III B). Two patches of road made in 1911 from field stone laid on an old gravel or stone macadam foundation were examined in 1915. The roads were in fairly good condition, smooth but with shallow ruts and a few shallow holes beginning to form. They are subject to a traffic of say from 50 to 150 vehicles a day. The field stone did not, in either case, carry over 10 per cent soft material. One piece of road south of Kemptville surfaced in 1910 with stone from a deposit which averaged 89 per cent limestone, 9 hard and 2 soft, was just beginning to break in 1915.

South Gower and Mountain. About 28,000 cubic yards of stone are estimated in the fences and piles of South Gower. The stone resembles that in Oxford except that the percentage of hard material is higher in a number of the deposits. Over 2,600 cubic yards of stone were examined

in Mountain township. The deposits are described in Table IV, partly under Osgoode and partly with those in South Gower.

Edwardsburgh. The western and northwestern two-thirds of Edwardsburgh was examined and deposits are to be had nearly everywhere in that area. More than 138,000 cubic yards were estimated to be present in fences and heaps, of which about one-fifth was over 2 feet in diameter. In the great majority of the deposits less than 10 per cent of the boulders are of sandstone, shale, or other very soft rock, but a considerable amount of the limestone is partly weathered and rather soft.

A good deal of road has been surfaced with stone in this township. In many instances the crushed stone is spread in the middle of the road to a width of about 5 feet without rolling and is then avoided by the traffic for the first few months, and in some cases for more than one year. Where the traffic has gone over the stone, it had in two cases become dusty and developed shallow ruts in one year. Four patches were examined which were surfaced in 1913 with stone carrying 10 per cent or less soft material; all of them were slightly dusty in dry weather. Two were in good condition although not firmly cemented, and two had shallow ruts and were rough in places due to loose stone. Two patches surfaced in 1913 with stone carrying about 15 per cent soft material were beginning to wear decidedly in 1915, one was in poor shape with wheel ruts 4 inches deep in places. Three or four patches of road placed in 1911 or 1912 were uneven, generally dusty, and ruts had developed to a depth of 3 inches. One patch five years old was in a similar condition, another surfaced with softer stone at about that time had gone to pieces. Field stone placed over gravel in 1906 and 1909 had worn through to the foundation and the road was rough and much in need of repairs. The traffic over these roads was in all cases light, though near some of the villages it might have amounted to nearly one hundred vehicles a day at certain seasons of the year.

Augusta. The amount of field stone estimated to be in the southern and eastern part of Augusta is about 42,000 cubic yards, of which nearly one-sixth is over 2 feet in diameter. The stone is not as uniformly low in soft material as that in Edwardsburgh, and varies in composition from one deposit to the other. A considerable amount of field stone has been used in surfacing the roads and in nearly all cases the stone was obtained from deposits carrying less than 10 per cent soft material.

In two cases observed, where the stone, carrying about 5 per cent soft material and over 90 per cent limestone, had been graded and rolled, the road was in one place good after two years service and in another still good but with some one-half-inch ruts after four years' service under light traffic. In two instances observed where the stone ran 10 per cent limestone, 80 to 85 per cent hard and 5 to 10 per cent soft material, the

road was good after one year's wear and had developed ruts in the wheel tracks of from one-half to one inch in four years. Four stretches of road surfaced with stone carrying under 10 per cent soft material but about the same amount of hard and limestone boulders have worn badly in two years' time. Two of these were portions of the Prescott road and were subjected to medium heavy traffic—the others were side roads.

GRAVEL.

Location.

Two large irregularly disconnected ridges of gravel lie along Rideau river, one on either side. One commences south of Jock river in Nepean and follows close down the west side of the Rideau to Kars in North Gower, the other begins near Bowesville in Gloucester and stretches south for nearly 24 miles to a point in South Gower some 3 miles east of Kemptville. Outside of these two main ridges there are a number of small deposits in North Gower, Marlborough, and the southwestern part of Nepean, but the deposits are not very large or numerous. Only an occasional occurrence of gravel was found in the northern parts of Nepean and Gloucester. South of Kemptville in Oxford and South Gower there are numerous gravel deposits trending in a southerly direction. They are also found, but in fewer numbers, in Edwardsburgh and to the margin of the river in Augusta where certain of them trend east and west. The form of the deposits varies. Many of them are long and narrow, some extremely irregular in outline.

Character.

The gravels were examined in order to determine their adaptability in the construction of gravel macadam or of concrete roads and to obtain some knowledge of their probable durability in macadam and concrete road surfaces and of their ability to bind quickly in a macadam surface; also to gather information bearing on the probable strength of concrete in which they would be used as the aggregate. In Appendix C, Table VI, estimates of the average composition of the pebbles in the gravel and of the relative proportion of sand, gravel, and boulders, as seen in the excavations, are given, together with notes on the impurities present below the surface weathering, and such other notes as bear on the character of the material present. It should be borne in mind that excavations have exposed only a small part of the deposits present in this area and that all estimates made in the field are, therefore, necessarily approximate only. Except where a statement is made to the contrary the estimates are based on examinations of unweathered gravel. It is assumed that weathered gravel will not be used where the harder and cleaner unweathered product

is obtainable. The relation between the durability, as expressed by percentage of wear determined in the laboratory, and of pebble composition is discussed below. The actual wear of the different gravels under traffic is discussed on pages 31 to 37.

The binding or cementing values of the thirty-eight representative samples of gravel tested were so uniformly good that that question is not touched upon further than to point out that the presence of calcium carbonate and clay in appreciable amount below the weathered surface gravel would indicate a gravel with good cementing value. Angular pebbles are apt to compact under traffic more rapidly than rounded pebbles and so aid in producing a firm road bed in a short time; the shape of the pebbles is also, therefore, mentioned. An example of angular slab gravel is shown in Plate V B.

The strength of concrete mortar depends on the grading of the aggregate used, on its relative coarseness, and on its freedom from impurities. The more uniform the proportion of the different sizes present the stronger the ensuing bond is apt to be, but on the other hand a rather coarse sand makes a better concrete than one in which there is a large proportion of fine material. An approximate estimate of the relative amounts of boulders, gravel, and sand present in the pits has been made and is given in Table VI, and the mechanical analyses of the samples which were tested in the laboratory in Table VA (page 80). A closer determination of the relative amounts of fine and coarse material present in the different deposits examined was not practicable. The presence of impurities in the unweathered portions of the gravel is mentioned in the tables.

Relation between Durability and Composition.

Because of the expense involved samples from only thirty-eight out of some two hundred deposits examined, were tested in the laboratory. The average composition of the pebbles was, however, determined in nearly all of the deposits in which excavations had been made. It is, therefore, necessary to compare the composition of the gravels with their physical characters as determined in the laboratory, in order to make the results of the work of value to road builders. A list of the gravels tested and their respective compositions are given in Table V (pages 76 to 79). Because of the uniformly high cementing value of the gravels and their great variation in wear, a comparison of the variation in per cent of wear with the variation in composition is of interest. This relation is illustrated in Figure 4.

In determining this relation the percentage of soft material was considered to be the total percentage of shales, sandstones, and schists listed as "soft" in the tables, plus one-half the percentages of silty limestones. The pebbles classified as silty limestones are partially weathered

Beekmantown dolomites and magnesian limestones. Weathering has greatly weakened the original fresh pebbles.

Unfortunately only forty-eight samples of gravel tested in 1914 and 1915 were available for comparison and the correlation between their percentages of wear and the amount of soft material was not as definite as could have been wished. In general, however, the percentages of wear increase with an increase in the amount of soft material in the gravel.

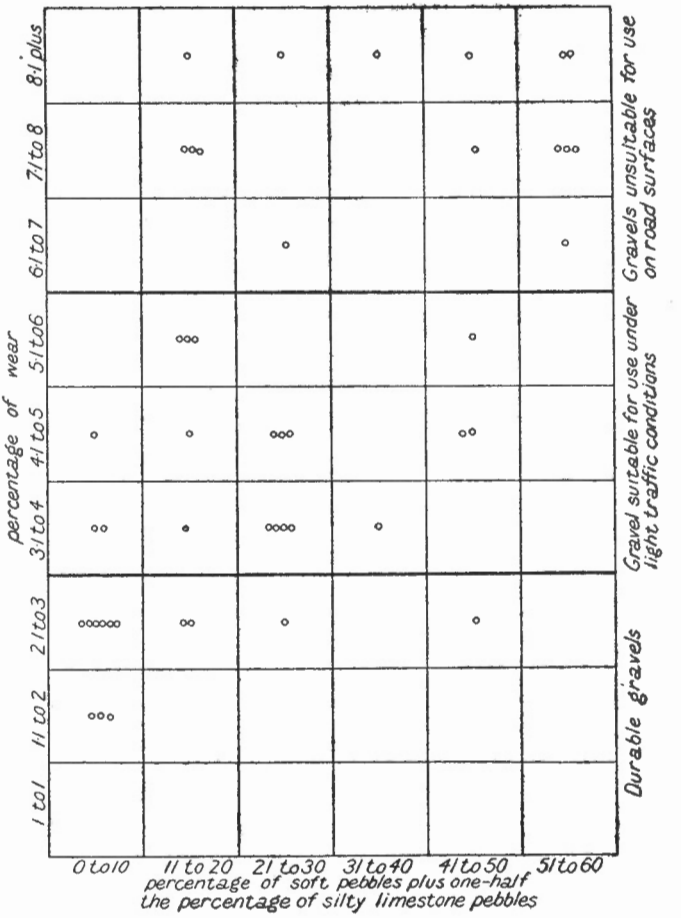


Figure 4. Relation between the pebble composition of gravels and their per cent of wear.

The American Society of Municipal Improvements recommend that the stone for use in water-bound macadam road shall have a percentage of wear of not more than 5·7 (French coefficient of 7) and for

use in a bitumen bound road a per cent of wear of not more than 3·3 (French coefficient of 12).

If samples of gravel and broken stone give the same results for wear in laboratory tests, then considering the methods of testing, it may be assumed that the stone will actually wear better on the roads than the gravel. For this reason one may expect that gravel having a percentage of wear of over 6 will not be suitable for any but the lightest country traffic and should not be used if better material is obtainable. For medium heavy traffic the limiting value for gravel cannot be much higher than 3 per cent wear. Gravel with a wear of from 3 to 6 per cent should be suitable for light country traffic. For convenience in the present instance we may classify a gravel with a percentage of wear of less than 3 as first class, from 3 to 6 as second, and of more than 6 as third class respectively.

From Figure 4 it appears that of the twelve samples with percentage of soft material lower than 10, nine rank as first class, and three as second. Of the twenty-nine samples carrying from 10 to 50 per cent soft material four rank as first and sixteen as second. All of those over 50 per cent rank in the third class.

Partial weathering is responsible for abnormally high wear in certain of the samples tested. Other factors, such as the variation in resistance to wear of different types of limestone for example, also tend to prevent close correlation between durability and composition. It may be said with some degree of safety, however, that of the gravels found in this area those that are clean and unweathered and carry less than 10 per cent soft material, using the term to include one-half of the soft limestones as well as all the shales and sandstones, will wear well on nearly any country road in the district. Those with more than 10 and less than 50 per cent soft material will generally be suitable for light country traffic and those composed of over 50 per cent soft pebbles will very seldom give satisfactory service.

Gravel-Pebble Classification.

Because of the unsatisfactory results obtained in comparing pebble composition and per cent of wear with gravel classified according to the method used in this report a new scheme of classification for gravel pebbles has been adopted for future use. The rocks are divided into durable, intermediate, and soft types according to their average toughness values and percentages of wear.[1]

Durable Types. Average per cent wear 2·2 to 3·9, average toughness 12 to 25. Diabase, basalt, andesite, trachyte, rhyolite, porphyritic rocks, fine-grained granite (except those with high percentages of biotite), syenite, diorite, gabbro, amphibolite, hornblende and pyroxene gneiss, quartzite.

[1] Lord, E. C. E., "Relation of mineral composition and rock structure to the physical properties of road minerals," U.S. Dept. Agric., Bull. 348, Table I, Washington, D.C., 1916, p. 2.

Intermediate Types. Average per cent wear 4 to 5·6, average toughness 5 to 12. Very coarse-grained granites and granite carrying a large percentage of biotite, syenites, diorites, gabbros, peridotite, granite gneiss, gneiss and schist (with large percentage of hornblende), mica schist (fairly tough), limestone, dolomite, calcareous sandstone, slightly weathered rocks belonging to the durable types.

Soft Types. Average per cent wear above 5·6. Gneiss (carrying large percentage biotite), most of the schists, sandstone, shale, marble, chert, thoroughly weathered stones of all kinds.

Twenty-nine of the samples considered in Figure 4 were re-examined and their pebbles classified according to the above plan. Four samples with per cent of soft material under 10, came into the first class (percentage of wear under 3); of eighteen samples with from 11 to 40 per cent soft material, three ranked as first, 11 as second (per cent of wear from 3 to 6), and 4 as third (per cent of wear over 6). Of the seven samples running over 40 per cent soft material, all but one ranked as third class. The percentages of soft material are more closely related to the percentage of wear than under the old classification; but the great variation in the physical properties of the same kind of rock may be expected to cause correlations of this kind, based on averages of rock types, to be approximate only. To meet this condition a knowledge of the variations of the physical properties of the bedrock from which the gravel pebbles were derived is required.

In Appendix C, Table V, the results of laboratory tests upon samples of gravel in the area mapped between Ottawa and Prescott have been placed alongside the field estimate of their composition.

Description of Gravel Deposits.

In the following pages the character of gravels in the different townships is briefly described, together with such information as could be obtained regarding their actual service on gravel roads. This section should be read in conjunction with the tables in Appendix C.

Nepean. Large deposits of gravel lie in the southeastern part of the township between Jock river and the North Gower townline. Smaller areas lie just north of the mouth of the Jock, north and southeast of Fallowfield at Eagleson corners, Britannia, and south of City View. Two large deposits lie south of Jock river, one 2 miles the other 2½ miles long. Six pits have been opened in the northwesterly one. These excavations show that the deposit varies greatly in the proportions of sand and gravel, as is generally the case (Plate VI A). The proportion of soft pebbles, shales, sandstones, and soft limestones is unusually high. Samples from two of the deposits were tested (Table V) and show a very high percentage of wear. Their composition indicates that the gravels from any part of the deposit are apt to wear very poorly in a macadam road and in the only instance observed of the use of these gravels upon roads the results were unsatisfactory although the cementing

values of both samples tested are good. In the other large deposits lying to the east and closer to Jock river the gravels are very similar in character to the one just described. They carry high percentages of soft material and tests made upon them show that their wearing qualities are poor and their cementing value good. In most instances the gravel has failed when used upon roads subjected to light country traffic. A road surfaced from pit No. 26 has, however, given fairly good results under light traffic.

Deposits whose composition resembles that of the above are found north of the mouth of Jock river and at the point where the Canadian Northern railway crosses the Jock. Two deposits lying north and east of Fallowfield carry a lower percentage of soft material. The gravels have been used in local roads with fair results; a test on gravel from the northerly one, No. 11, indicates excellent wearing and good cementing qualities. Nearly all the other deposits in the township carry a high percentage of soft material indicating that they will not wear well.

Gloucester. A gravel ridge begins at Gloucester station in Gloucester and extends down the east side of the Rideau to a point a few miles from Kemptville. Two large flat deposits lie east and southwest of Bowesville and a gravel ridge crosses the Metcalfe road about 2 miles to the north of that village. A smaller deposit is found just west of Johnston corners in the southern part of the township. There is a deposit of gravel at Mackay lake, Rockcliffe park, and on the road east of Beechwood cemetery, but no gravels were seen in the northern and eastern parts of the township.

All the gravels in Gloucester carry high percentages of soft material and none of them can be considered first class macadam gravel nor can they be recommended for concrete road construction, although the unweathered portions of several deposits have been used in concrete buildings with success. The depth of weathering varies from 1 to 4 feet. The material near Bowesville and in the ridge to the south is in general rather sandy. There is 3 feet of marl over parts of the gravel deposit at Rockliffe.

The results of tests upon five samples are given in Table V. That portion of the Rockcliffe pit, No. 31a, of which the sample was taken, is of fair quality, but it is better than the average of the whole deposit at that place. The gravel from Lecuyer's pit, No. 41, has been used on the Bowesville road. This gravel and the great majority of gravels used on the country road south of Ottawa would have given much better service if boulders over 3 inches had been screened out of the top dressing.

North Gower. A discontinuous ridge of gravel lies in a southeasterly direction on the eastern side of the township. Other small deposits lie within a few miles of the village of North Gower. Part of one large

gravel deposit in North Gower has been included with the Nepean township deposits. The pits that have been opened in the main ridge or ridges lying along the concession north of Kars and also the pits on the river road south of Kars contain gravel high in soft pebbles. Pit No. 57 just west of this ridge is, however, low in soft material and so are some of the other deposits in the township. The gravel roads examined in the township did not give very satisfactory service, but their failure was in very many cases partly due to the inclusion of too big boulders or too much sand in the gravel. The results upon samples tested from North Gower (Table V) indicate that the gravels in question are not durable. One or two of the deposits which carry a small amount of soft material and of silty limestone might prove to be of better quality.

Marlborough. Several deposits of gravel are scattered through that part of the township which was mapped. The better class of deposits lie in narrow bars north of concession III. The material has not been extensively excavated.

A number of roads have been surfaced with gravel in this township, the material has evidently been spread in a good many instances but is seldom or ever rolled. The gravel is in the greater number of cases low in soft material (Table VI) and the condition of the various road surfaces in 1915, together with the results of the three tests made on samples from the township (Table V) give a fair idea of what may be expected from gravels of this type under the existing methods of construction.

About ten different stretches of road surfaced with gravel from J. McCurdy's pit, No. 75, were examined. The surfaces had been laid from one month to six years before and all of them subjected to light and largely horse drawn country traffic. One portion six months old had not yet entirely cemented; stretches from one to two years old were smooth and firm, although slightly dusty, and only one piece of road had shallow ruts. Two stretches four and six years old contained round holes and the older was badly in need of repair. There is 28 per cent soft limestone in this gravel and 4 per cent soft shales and sandstones; the percentage of wear is 2·5, and cementing value 40. The material from pit 84, with shaly limestone 10, soft material 3, and a percentage of wear of 4·8, made a good road under medium traffic when repairs were made every year. The gravel from pit No. 73, with 90 per cent shaly limestone, 5 per cent soft shales, and a per cent of wear of 4·6, has worn to 3-inch ruts in one year. Gravel from the pit of R. B. Bowrin, No. 72, with 10 per cent shaly limestone and 7 per cent soft shales and sandstones has worn well for one year. There is no doubt that in many cases this gravel would have worn better if 3-inch stone had been screened out, drainage had been attended to, and the road maintained with more care.

Osgoode. The gravel mapped in this township is nearly all on or close to the Prescott road. A few small deposits are found in the banks of the Rideau. According to Table VI practically all the gravels carry a high percentage of soft pebbles and so are of poor quality for road work.

A sample from the pit of the Canadian Pacific Railway Company near West Osgoode, with 38 per cent soft limestone and 22 per cent soft shales and sandstones, had a percentage of wear of 4·8 and cementing value of 114, indicating a gravel suitable for light traffic only. The gravel from the pit of Mr. Allan Mussel on Rideau river (Pit No. 105), with 11 per cent soft limestone and 35 per cent shale, had a percentage of wear of 2·6 and cementing value of 76. The low percentage of wear is rather surprising in this case because of the large amount of soft material present. The gravel is said to have given satisfactory results on road surfaces under light traffic.

Gravel from other pits in this township has also been used on roads and in many cases with satisfactory results. Concrete blocks made from certain of these gravels are used for building at Osgoode station, and gravel from the Canadian Pacific railway pit has been used for making concrete culverts as well as for ballast.

The large pit near Osgoode station has presumably been excavated by steam shovel; other excavations are small and have in most cases been opened without the aid of machinery. The amount of material available along the Prescott road is very large, but great portions of the areas mapped as gravel are undoubtedly largely sand.

Oxford. Only the eastern half of Oxford was examined and in nearly all of that area gravel deposits are to be found. They are very abundant within about 3 miles of Kemptville and to the south of it.

The composition of the gravels in this township varies greatly as an examination of Table VI will show. The gravel from the pit of the Canadian Pacific railway, No. 133, may be taken as an example of the better class. The total amount of soft material in this gravel is less than 5 per cent, its percentage of wear in the laboratory 2·8, and cementing value 26. Eight pieces of roadway surfaced with this material were examined. The under soil was in most cases gravelly loam, the traffic light to medium, and the material was as a rule simply dumped on the road without rolling. The gravel started to cement in about three months and at the end of one year a good firm roadway resulted. Patches of road from two to three years old had shallow ruts developed but were otherwise in good condition. One piece ten years old was in fair shape although with ruts 2 inches deep, and another very much older, had stayed in fair condition with some patching. On the other hand a gravel with a percentage of soft pebbles 5, silty limestone 15, percentage

of wear 2·6, and cementing value 69, laid over black muck and sand, had failed utterly in one year, due to poor foundations and inadequate drainage. A gravel with a percentage of soft material 5, silty limestone 50, wear 8·4, cementing value 53, laid on gravelly loam, had developed ruts in two or three years and was dusty and loose.

Gravel from pits No. 124 and No. 131 was used in 1913 in the construction of a concrete roadway in the main street of the village of Kemptville. This road was in excellent condition in October 1916.

Ten samples of gravel from Oxford have been tested in the laboratory Table V.

South Gower and Mountain. The greater number of gravel deposits in South Gower township are in the southern half and are in many cases associated with boulder deposits. Two deposits described in Table VI under the heading, Mountain township, lie in the northwestern corner and extend into neighbouring townships: the northern one is very irregular in outline and overlaps into Osgoode; the southern one extends in a southwesterly direction for over 4 miles, only one-half of it lying in South Gower township.

The material in the long gravel bar extending from Mountain township into South Gower township is high in soft pebbles. The estimate of composition from No. 120 is evidently too low in soft material, for its percentage of wear is 7·8 and it has not given satisfactory service on roads. The gravels from these two townships have not as a rule proved satisfactory on road surfaces; in only one or two cases have they worn well after more than one year's service. Their failure here, as elsewhere, is very largely due to lack of proper drainage and adequate foundations.

Edwardsburgh. Small deposits of gravel are scattered rather sparingly through the northwestern and western portions of Edwardsburgh. Of recent years they have not been used as extensively as field stone for surfacing but they have been used in the foundations of many roads surfaced with field stone. The greater number of gravels examined in this township were comparatively low in soft material and of the four samples tested only one had a percentage of wear as high as 5·2. Gravels from the same pit give contradictory results when used as surfacing material, a condition which may probably be ascribed to differences in the amount of sand present and differences in the care with which the roads were constructed. Gravel from the pit of John Spencer at Ventnor, for instance, with 5 per cent shaly limestone pebbles, 5 per cent soft pebbles, 1·8 per cent of wear, and cementing value 67, has been used quite extensively for gravel work. A road built of this gravel was hard, smooth, and very satisfactory after a year of use; another road was dusty and full of ruts after the same length of time. Part of a road laid

in 1913 was decidedly dusty in 1915; another part was in good condition although it had a few ruts. Gravels from these deposits, which are free from clay and carry a low percentage of soft material, should be satisfactory for concrete work.

Augusta. The southern part of Augusta near St. Lawrence river contains more gravel than that part of the area mapped lying back from the river. The gravels resemble those of Edwardsburgh in composition although the amount of soft material appears in general to be somewhat higher. The per cent of wear of all three samples tested is over 5·5 and the cementing value quite high.

Stone is being extensively used on the roads in preference to gravel and not much definite information was available regarding the gravel that had been placed on road surfaces.

Gravel from G. W. Robinson's pit, No. 204, with percentage of silty limestone pebbles 5, other soft pebbles 8, percentage of wear 8·4, cementing value 86, was placed on part of the road between concessions II and III, in 1913. In November 1915 the road surface had ruts to one inch deep along the wheel tracks and a few shallow holes, but was in fair condition and not very rough; that is, its service on the road is more in accordance with the low percentage of soft pebbles found in the estimate of its composition than with the results of the laboratory test. The traffic over this road was light and the road foundation sandy gravel and bedrock.

A road surfaced with gravel carrying 30 per cent silty limestone and 15 per cent other soft pebbles was in good condition after one year under light traffic. In this case the road could have been improved by the elimination of some of the sand.

COMMERCIAL DEVELOPMENT.[1]

The quantity of sand and gravel found within the district surveyed aggregates many million cubic yards. The gravel areas were mapped from such data as could be obtained from excavations in the deposits, from surface indications, and from neighbouring residents. Neither time nor funds were available for the sinking of test pits or auger holes to prove the presence of gravel in the areas mapped as such. The boundaries of the gravel deposits cannot, therefore, be considered more than approximately correct. The same lack of data has prevented close estimations of the amount and relative proportions of sand and gravel present. Practically all the information gathered as to the depth and extent of each of the deposits is to be found in Appendix C and in most instances an estimation of the quantity present has not been attempted.

[1] Details regarding the commercial development of the gravels are to be found in Appendix C, Table VII.

Not all of the gravel deposits have been exploited and in a great many only one or two small openings have been made. Seven pits were located that had been opened by railway companies. These ranged from 100,000 to 500,000 cubic yards in size, had in nearly all cases been excavated by steam shovel, and most of the product was used for railway ballast.

Practically all other excavations were less than 10,000 cubic yards in size, had been excavated without machinery, and the products were used on the surfaces of gravel roads, or for concrete and plaster work. The unweathered gravel is used for concrete, but a careful effort is not always made to omit unweathered gravel in excavating for road purposes.

Very many barn foundations in this area have been built of gravel concrete. There are also firms in Osgoode and Oxford townships which make concrete culverts, tiles, and building blocks.

The gravel is sold at from 10 to about 25 cents per cubic yard in the country and for as much as 70 cents per yard, in the pits near Ottawa. The township councils generally own several gravel pits from which citizens engaged in their annual statute labour road work can draw gravel without cash payment.

Appendix A.

Table I.—Tests Made upon Bedrock.

Map No.	Location.	Owners.	Rock species.	Formation or age.	Specific gravity.	Water absorbed pounds per cu. ft.	Per cent of wear.	French coefficient of wear.	Hardness.	Toughness.	Cementing value.
304	East of dynamite storehouse 1½ miles s. e. of Kingsmere, Que., lot 16, range vii, Hull tp.	Canadian Explosives Co., Montreal.	Diabase.	Pre-Cambrian.	3·00	0·11	4·0	10·0	18·6	10	157
305	Quarry, lots 10 and 11, range v, Hull tp., north of mountain road 3½ miles n. w. of Hull, Que.	Ottawa Improvement Commission, Ottawa.	Diabase.	Pre-Cambrian.	3·01	0·01	2·8	14·3	18·9	8	163
109	Lots 20, 21, con. viii, Oxford, ½ mile n. w. Oxford station.	James Sanderson, Oxford station.	Quartzite.	Pre-Cambrian.	2·60	0·46	4·0	10·0	19·4	9	20
5	On Grand Trunk ry., 3 miles n. w. Bells Corners, lot 3, con. A, Ottawa front.	T. Rock, R.R. 1, Britannia Bay.	Granite.	Pre-Cambrian.	2.82	0·16	4·1	9·8	16·9	8	40
Between 5 and 6	Quarry, lot 6, con. ii, Ottawa front, 2 miles west of Bells Corners.	T. W. Tilson, R.R. 1, Britannia Bay.	s. s.	Potsdam.	2·44	2·25	8·0	5·0	16·1	4	59
7a	Quarry, lot 5, con. ii, Ottawa front, 2 miles west Bells Corners.	Fred. Droeski, Bells Corners.	Sil. magn. lime.	Beekmantown.	2·78	0·59	4·2	9·5	16·1	9	39
9a	Ry. cut at or near road crossing between cons. v and vi, Nepean, 2 miles s. w. Bells Corners.		Cal. s. s.	Beekmantown.	2·72	0·63	3·6	11·2	17·5	8	53
19	Quarry, lot 16, con. ii, Ottawa front, 1 mile n. e. Bells Corners.	John Graham, Bells Corners.	Sil. magn. lime. and dol.	Beekmantown.	2·82	0·32	4·9	8·2	18·8	10	101
16	Quarry, lot 18, con. iii, Nepean, 1½ miles n. by e. of Fallowfield station.	Wm. Burnett, Fallowfield.	s. s. and impure lime. dol.	Beekmantown.	2·73	0·15	5·0	8·0	16·6	5	149
63	Quarry, lot 23, con. iv, Gloucester, on Metcalfe road, 2 miles s. of Leitrim.	M. Johnston, R.R. 1, Billings Bridge.	Sil. magn. lime. and dol.	Beekmantown.	2·74	2·27	4·4	9·0	16·5	9	25
79	Quarry, lot 6, con. i, Marlborough, ½ mile n. w. of Becketts Landing.	Robert McCulla, R.R. 4, Kemptville.	Sil. magn. lime.	Beekmantown.	2·76	0·58	4·4	9·1	16·9	13	73

89	Quarry, lot 30, con. iv, Oxford, 1¼ miles e. by s. Kemptville.	Mrs. Martin, Kemptville.	Sil. magn. lime.	Beekmantown.	2·76	0·80	4·0	10·0	16·8	10	46
95	Lot 18, con. v, Oxford, ¼ mile n. e. Oxford Mills.	Sam Harris, Oxford Mills	Sil. magn. lime. and dol.	Beekmantown.	2·73	1·95	4·4	9·1	16·6	8	42
98	Lot 26, con. vi, Oxford, 1½ miles s. by e. of Kemptville Junction.	John Flannigan, Kemptville.	Sil. magn. lime. and dol.	Beekmantown.	2·80	0·42	4·0	10·0	16·5	8	48
151	Lot 26, con. vi, Edwardsburgh, directly n. w. of Spencerville.	T. Rickett, Spencerville.	Sil. magn. lime. and dol.	Beekmantown.	2·82	0·65	5·4	7·4	16·7	8	52
	Quarry on Prince street, Prescott.	Town of Prescott.	Sil. mag. lime. and dol.	Beekmantown.	2·80	0·44	4·8	8·3	16·3	12	64
40	Quarry, lot 11, con. i, Gloucester, south Montreal road, ¼ mile east Greens Creek crossing.	S. O'Rourke.	Lime, shaly, lime., and shale	Chazy.	2·71	0·21	5·0	8·0	16·1	7	29
29	Quarry, Rockcliffe park, Ottawa.	Ottawa Improvement Commission, Ottawa.	Lime.	Chazy.	2·71	0·30	5·1	7·9	15·9	6	104
50	Quarry, lot 23, Junction gore, Gloucester, Hogsback, Ottawa.	Richard O'Connor, Billings Bridge, R.R. 1.	Lime.	Black River.	2·70	0·26	4·7	8·5	15·5	6	20
49	Quarry, lot 23, Junction gore, Gloucester, Hogsback, Ottawa.	Adelard Thibault, Billings Bridge.	Lime.	Black River.	2·71	0·11	6·1	6·5	15·0	5	53
24	Quarry, lot 33, con. ii, Ottawa front, on Merivale road, ¼ mile n. City View.	Rideau Canal Supply Co. R. F. Foster, manager, Slater st., Ottawa.	Lime.	Black River.	2·71	0·25	6·4	6·3	16·5	7	22
32	Quarry, lot 26, con. i, Gloucester, n. Montreal road, n. e. of Roman Catholic cemetery.	Rogers and Kirby, Ottawa.	Lime.	Trenton.	2·70	0·29	4·4	9·1	14·7	5	40
38	Quarry, lot 23, con. i, Gloucester, s. Montreal road, The Quarries.	H. Robillard and Son, 195 Nicholas st., Ottawa.	Lime.	Trenton.	2·70	0·28	4·7	8·5	14·9	4	75
12	Outcrop, lot 30, con. vi, Nepean, 2 miles n. w. of Fallowfield.	A. M. Dewy, R.R. 2, Stittsville.	Lime.	Trenton.	2·70	0·52	4·8	8·3	14·2	5	81
	Quarry, east Brewery creek, and on west side of Hull, Que.	H. Dupuis and Sons, Hull, Que.	Lime.	Trenton.	2·68	0·61	6·4	6·3	15·7	5	60

Abbreviations: s.s. = sandstone, lime. = limestone, dol. = dolomite, sil. = siliceous, calc. = calcareous, magn. = magnesian.

Table II.—Description of Deposits of Bedrock.

Map No.	Location.	Lithological character.	Remarks.
1	Lots 2-4, con. A, Ottawa front, Nepean.	Beekmantown. In quarry 3½ beds of shaly magn. lime. over 1½ ft. of sil. dol.; on n. w. end dol. resembling the vuggy beds in No. 2; on s. w. edge 4 ft. sil. dol. over 3 ft. magn. lime. over 3 ft. s. s.; sil. lime. in outcrop 2 miles to north.	Quarry small, beds in this area in terraces and better class stone can be readily worked separately.
2	Lots 4-6, con. A, Ottawa front, Nepean.	Beekmantown. 10 ft. fine-gr. sil. dol. middle area and east side; vuggy dol. on n. w. edge area; 3 ft. of lime. and dol. at Carp road; shaly lime. along shore near Beatties point, area to s. w. contains s. s. and calc. s. s.	Rather low, exposures frequent.
3	Lots 8, 9, con. A, I, Ottawa front, Nepean.	Beekmantown. S. w. edge 5 ft. s. s. weathering rusty probably friable; dol. and sil. magn. lime. occur farther north in this outcrop; sh. lime. on road to n. e.	No overburden, well above drainage; about 50,000 yds. available in area s. w. of No. 3.
4	Lot 10, con. i, Ottawa front, Nepean.	Beekmantown. About 3 ft. s. s. overlain by 9 ft. dol. and sil. magn. lime. in small quarry near creek.	Small quarry, 6 ft. over creek bed.
5	Lots 3, 4, con. i, Ottawa front, Nepean.	Pre-Cambrian. Two small hills of fine-gr. quartz diorite. The other outcrops in Pre-Cambrian area are coarse-gr. acid granites and schistose rocks.	Material tested; about 50,000 cu. yds. available in two small hills next to track.
6	Lots 4-6, con. i, Ottawa front, Nepean.	Potsdam. White, thin-bedded, friable s. s. weathering to rusty colour; 18 ft. exposed; area to south included in Potsdam contains stone of same character.	Used in Parliament buildings, Ottawa; top of ridge extensively quarried; also used for paving blocks.
7	Lots 2, 3, con. ii, Ottawa front, Nepean.	Potsdam and Beekmantown. 6 ft. white s. s. overlain by 34 ft. of calc. s. s. and very sil. magn. lime.	Stone in flat topped hill easy to quarry.
7a	Lot 5, con. ii, Ottawa front, Nepean.	Beekmantown. Quarry about 11 ft. magn. lime.	Stone tested; quarry; stone can be worked without difficulty, lies in flat topped hill.
8	Lot 35, con. vi, Nepean.	Potsdam and Beekmantown. Outcrop on road light yellowish grey magn. lime.; ¼ mile to southwest there is 9 ft. of s. s. with 6 ft. calc. s. s. in the middle; farther to s. w. is 7½ ft. of s. s. with peculiar concentric structure.	
9	Lot 34, con. v, Nepean.	Beekmantown. 4 ft. sil. lime. and s.s. over 5 ft. friable s.s.	Small hill ¼ mile to n.e. has about 20,000 cu. yds. of stone.
9a	Lot 34, con. vi, Nepean.	Beekmantown. East end of railway cut 9 ft. sil. magn. lime. and dol. over 6 ft. calc. s.s. over 5 ft. friable s.s.; s.s. and calc. s.s. outcrop for ¼ mile to south.	Calc. s.s. tested; east end near railway lies 20 ft. over swamp, can be easily developed and transported.
10	Lot 31, con. v, Nepean	6 ft. of friable s.s. with a 2 ft. bed calc. s.s. lying within the s.s., to s.e. at road; Trenton lime. with s.s. to north of it.	Not of very great value.

11	Lot 31, con. vi, Nepean.	About 5 ft. friable s.s. over 1½ ft. calc. s.s.; to the s.e. in this area there is more s.s. with concentric structure; this area has been included in the Potsdam although it may not strictly belong there.	Stone not of good quality.
12	Lot 30, con. vi, Nepean.	Trenton. About 15 ft. lime. reddish to lavender grey varying slightly in texture.	Stone tested. Plate VII C.
13	Lot 33, con. v, Nepean	Beekmantown. Calc. s.s. and sil. magn. lime.; s.w. along road 2 ft. of s.s. with some calc. s.s.; small outcrops calc. s.s.	Small deposit on low ground.
14	Lot 30, con. v, Nepean.	Beekmantown. 3 ft. calc. s.s. over 3 ft. sil. magn. lime.; ½ mile n.e. 6 ft. sil. magn. lime. over 3 ft. s.s.; ½ mile to s.e. 4 ft. of sil. magn. lime. and calc. s.s. with 2 ft. s.s. at bottom; 1 mile to east thin-bedded sil. magn. lime.	½ mile to east is a wide area of outcrops, the upper beds are easily quarried and should be good stone.
15	Lot 25, con. v, Nepean.	Trenton. About 15 ft. lime. exposed; dark grey, dense to fine-gr. with 1 ft. of shaly lime. near bottom.	Quarry owned by Wallace, Fallowfield; overburden thin, rock on high land.
16	Lot 18, con. iii, Nepean.	Beekmantown. About 12 ft. of calc. s.s. and 8 ft. of s.s. with 7 ft. of magn. lime. on top; material like this in the ridge 1½ miles to the n.w.	Quarry owned by Wm. Burnett, Fallowfield; stone tested; stone in ridge can be easily quarried.
17	Lot 20, con. ii, Nepean.	Beekmantown. Grey sil. magn. lime. coarse-gr.; s.s. outcrops on the ridge s.e. of 16 and 17.	About 18,000 cu. yds. available.
18	Lots 13–15, con. ii, Ottawa front, Nepean.	Beekmantown. 6 ft. of calc. s.s. under 1 ft. sil. lime.	
19	Lot 16, con. ii, Ottawa front, Nepean.	Beekmantown. 1½ ft. of calc. s.s. overlain by about 13 ft. of magn. lime. and dol. with one 2-inch shale parting. There is some dol. in outcrop to east. Plate VII E.	Stone tested; quarry owned by John Graham, Bells Corners; stone used on Bells Corners, Ottawa road; amount available not great.
20	At Deschenes rapids, Nepean.	About 10 ft. of sh. and s.s. of Chazy sh. exposed; same material under village to south and in Chazy shale area to the east.	Of no value as road metal.
21	Lot 27, con. i, Ottawa front, Nepean.	10½ ft. of Chazy lime. and sh.; over 1 ft. of this is sh. and 5 ft. shaly lime.; the rest is dark grey dense to coarse-gr. lime.	Quarry owned by McKellar Townsite Co., Ottawa.
22	Lot 27, con. ii, Ottawa front, Nepean.	Outcrop Chazy lime. and shaly lime. in shallow quarry.	Quarry owned by Fred Baker, Woodroffe; plenty of stone available in ridge ½ mile to east.
23	Where road crosses electric line, Westboro.	Resembles 21. About 13 ft. of buff and grey shaly lime. and one bed of dense reddish grey lime.; Chazy lime. formation.	This is in village and no great quantity is to be had.
24	West Merivale road, con. ii, Ottawa front.	Black River. Ascending section west end quarry; dense, dark grey lime. 12 ft; black massive lime. 9 ft.; shaly lime. 1 ft.; thin-bedded grey-brown lime. 5 ft.; several faults through quarry. There is about 1 ft. of shale in thin beds at east end of quarry. Plate VII B.	Stone tested; quarry of Rideau Canal Supply Co., Slater st., Ottawa; about 4,000 tons crushed stone produced per month in summer; 5 sizes selling at from $1 to $2 per ton, delivered at job in Ottawa; used in concrete work on city streets.

Abbreviations: sil. = siliceous; calc. = calcareous; dol. = dolomite; magn. lime. = magnesian limestone; s.s. = sandstone; n = north; s = south, etc.; ft. = foot; sh = shales; gr. = grain; s.w. = southwest, etc.

Table II.—Description of Deposits of Bedrock—Continued.

Map No.	Location.	Lithological character.	Remarks.
25	Lot 34, con. A, Rideau front, Nepean.	Black River. 1½ ft. of soft dark grey lime. overlain by nearly 2 ft. of calc. sh.	A great deal of stone ½ mile to south.
26	Lot 33, con. i, Nepean.	Chazy lime. Dark reddish grey lime. contain buff spots and streaks and a few thin beds of sh.	Quarry owned by Wm. Sullivan; overburden 1 to 5 ft.; a good deal of stone in sight.
27	Lot 31, con. A, Rideau front, Nepean.	Chazy lime. shale. 1 ft. of conglomerate with pebbles of sh. 5 in. across overlain by 3 to 5 ft. of friable grey s.s. with irregular fracture.	Useless for road work.
28	Experimental farm, Ottawa.	Black River. 8 ft. of fine-gr. lime. with one soft bed with shaly partings.	More than 60,000 cu. yds. available; 1 to 2 ft. of sandy overburden.
29	In Rockcliffe park, Ottawa.	Chazy shale. 21 ft. of rather dense reddish grey lime.; about 10 ft. of fairly coarse and 3 ft. of medium-gr. lime.; some chert in the upper beds.	Quarry owned by Ottawa Improvement Commission; stone tested; used by the Commission on park ways in city.
30	In Rockcliffe park, Ottawa.	Chazy shale. 82 ft. of grey and blue grey sh. and s.s. interbedded, beds thin.	Outcrops in cliffs on river; useless for road work.
31	East Notre Dame Cemetery, Ottawa.	Trenton. 13 ft. of fine-gr. grey lime. with thin black bands and occasional sh. partings overlain by 20 ft. of light lavender grey coarse-gr. lime. with fossils toward top; extensive outcrops to north and east.	Quarry owned by Rogers and Kirby; crusher and screening equipment not worked at present; plenty of stone available.
32	In Notre Dame cemetery, Ottawa	About 10 ft. of lime. in irregular rubblelike masses with sh. partings of the Trenton; over this is 1 ft. of black Utica sh.	This material is in the cemetery and probably not available.
33	On Skead road, east Ottawa, Gloucester.	Chazy shale. 2½ ft. of coarse s.s. overlain by 12 ft. of very fine-gr. friable s.s. with irregular cracks through it and no evidence of regular bedding on fresh surface.	Useless for road work; small quarry at this place.
34	On Skead road south of 33, Gloucester.	Chazy lime. 8½ ft. of dense reddish and brown grey lime. with 3½ ft. of calc. sh. near top; outcrops of like character to the n.w.	Small quarry; plenty of stone available.
35	On Skead road to south of 34.	Black River. About 15 ft. of dense grey lime.	Outcrops in small opening and along road to south.
36	East of Skead road south of 35.	Trenton. About 7 ft. of dense grey lime. overlain by 6 ft. of fine to medium-gr. lime. resembling upper beds in 31.	Stone of similar character in several openings to the east.

37 38	South of Montreal road at 'The Quarries' P.O., Gloucester.	Trenton. 15 to 20 ft. of medium to coarse-gr. lime., lower beds light lavender grey, upper beds dark grey; top beds at east and contain some shale; lower beds resemble top beds in 31; outcrops between Nos. 31 and 38. Plate VII D.	Lower 15 ft. of stone tested; H. Robillard & Son own western and larger part, No. 38; C. Gosselin the eastern end No. 37; excavation very large; sold as building and dimension stone at from 40 cents to $1 per ton; waste stone crushed and used to some extent on Montreal and other roads.
39	North Montreal road east Greens creek, Gloucester.	Chazy shale. About 50 ft. of s.s. and sh. with calc. beds; nearly all very thin bedded; similar stone to west.	Useless for road work.
40	South Montreal road north of No. 39, Gloucester.	Chazy lime. 7 ft. of dense to fine-gr. reddish grey lime. overlain by 11 ft. of interbedded buff shaly lime., dense grey lime., and sh.; there is about 1½ ft. of sh.	Stone tested; quarry owned by S. Rourke used on Montreal road from Greens creek to Orleans; in small escarpment.
41	On road s.w. of No. 40.	Black River. 16 ft. of lime. exposed; about 15 ft. of this is a dense reddish grey lime.	Outcrops in small escarpment can be easily quarried.
42	Lot 12, con. ii, Ottawa front, Gloucester, directly south of No. 41.	Black River. About 11 ft. of alternating beds of dense and coarse-gr. light to dark grey lime.	Extensive outcrops on flat hill; can be easily quarried.
43	Lots 11, 12, con. ii, Ottawa front, Gloucester.	Trenton. About 10 ft. of coarse light brown to lavender grey lime.	Exposure in low hill.
44	Lot 3, con. i, Ottawa front, Gloucester.	Chazy lime. 4 ft. of lime. with 1½ ft. of alternating lime. and sh.	Exposed in creek bed; unsuitable for road work.
45	Lots 1, 2, con. i, Ottawa front, Gloucester.	Chazy lime. 14 ft. of dense to fine-gr. reddish grey lime. and 12 to 14 ft. of coarser-gr. reddish grey lime. on top.	In railway cut and small hill to south; plenty of stone available.
46	Lots 2 to 6, con. ii, iii, Ottawa front, Gloucester.	Black River. Extensive outcrops 3 ft. of fine-gr. reddish grey lime. seen.	No overburden; lies near roadway.
47	Just below bridge over Rideau river, Hogsback, Ottawa.	Chazy shale. 51 ft. of white to grey s.s. and green fissile sh. with a few calc. beds overlain by 7 ft. of lime. on the east bank.	The sh. and s.s. are unsuitable for road work and difficult to quarry; beds folded with fault line to east.
48	On road east of No. 47, Gloucester.	Black River. About 50 ft. of dense grey lime. with coarser beds toward top.	Dominion Government quarry; stone used in locks of Rideau canal; large excavation.
49	Lot 23, Junction Gore, Gloucester.	Black River. 31 ft. of lime.; lower 15 ft. grey coarse soft stone, some chert, and bituminous partings, 11 to 15 ft. over floor; upper 16 ft. has some fine-gr. lime. as well as coarse; beds in open syncline, fault along west edge dipping 75° to west, brecciated beds along fault line.	Quarry of Adelard Thibault; the bed with bituminous partings in this quarry has been used for road work.
50	Lot 23, Junction Gore, Gloucester.	Black River. Medium-gr. grey lime. rather soft; about 9 ft. exposed.	Stone tested; small opening and stony hill to east owned by Richard O'Connor, Billings Bridge P.O.; sold at 15 to 20 cts. per ton; unquarried; used on Hunt Club road.
51	Lot 2, con. ii, Gloucester.	Black River. 16 ft. of lime. with some sh., lower 5 ft. dense reddish grey, upper coarser and vuggy in places.	In hill overlooking Rideau river small opening; plenty of stone available.

Table II.—Description of Deposits of Bedrock—Continued.

Map No.	Location.	Lithological character.	Remarks.
52	South C.N.R. track east Hunt Club road, Gloucester.	Chazy or Black River. In railway cut 40 ft. sh., shaly lime., and lime. exposed; 10 ft. of this is sh. 11 ft. is sil. or shaly; to east behind barn 4 ft. of medium-gr. lime.; farther east in quarry 9 ft. of dense grey to reddish lime.	Stone in quarry at top of section probably the best and also most easily available.
53	Along south of C.N.R. track from Rideau river to Hunt Club road, Gloucester.	Chazy shale. About 8 ft. of grey s.s. at river; 13 ft. covered 11 ft. of green grey sh. with 6 in. of lime. and 2 ft. of calc. sh. on top.	The material is of no value for road work.
54	In railway cut, lot 24, Junction Gore, Gloucester.	Black River. 17 ft. of fairly dense thin-bedded to massive lime. with one 3-in. sh. bed; over this is 3 ft. of sh. 12 ft. is covered, then 1 ft. of coarse and 15 ft. of dense grey lime.	Fault nearby to east.
55	Lot A, con. ii, iii, Gloucester.	Chazy lime. 18 ft. exposed in small quarry of which 3½ ft. is sh. the rest grey dense to medium-gr. soft lime.; dark grey fairly tough lime. with sh. partings every 6 in. in small opening across road to north.	Outcrops on 2 roads at this locality; a small quarry across road to north from which stone has been used on Metcalfe road.
56	Lots 3, 4, con. iii, Gloucester.	Black River. About 20 ft. of lime. exposed in quarry; 6 ft. of this is shaly, most of the rest is a dense grey stone; 2 ft. of it is cherty; to south on top of hill there is 4 ft. of vuggy lime. overlain by 46 ft. of dense lime. partly covered.	There is a great deal of stone available, the overburden is thin or wanting, and it lies on a high hill; the beds lie nearly flat.
57	Lot 4, con. iii, Gloucester.	Black River. About 9 ft. of lime. with sh. partings; some of the beds are hard, others soft.	A great deal of stone is available.
58	Lot 23, con. i, Gloucester.	Beekmantown. About 5 ft. of sil. dol. exposed.	Small quarry, about 90,000 cu. yds. of stone available; owned by R. Gamble, Manotick.
59	Lot 24, con. ii, Gloucester.	Beekmantown. 16 ft. fine-gr. steel grey sil. dol. west road; east of hill 10 ft. of medium-gr. magn. lime. with dol. farther up hill.	Three small excavations, overburden about 6 in. thick; easy to quarry.
60	Lot 24, con. ii, Gloucester.	Beekmantown. West side area 2 to 5 ft. of snow-white s.s.; on north end white s.s. followed by calc. s.s. magn. lime. with dol. on top.	Can be developed without difficulty.
61	Lot 25, con. ii, Gloucester.	Beekmantown. Light grey sil. magn. lime. or dol.; steel. grey sil. dol ¼ mile to the s.e.	Heavy overburden.
62	Lot 23, con. ii, Gloucester.	Beekmantown. Grey sil. lime. weathers yellow on south end; on the north end there is a dark blue black sil. lime. lying under the stone to the south.	Two small quarries at south end; more stone can be quarried to advantage.
63	Lot 23, con. iv, Gloucester, on Metcalfe road.	Beekmantown. 5 ft. of sil. or silty magn. lime., 1 ft. of light grey dol. with 4 ft. of brown to steel grey magn. lime. on top; outcrops of s.s. to the n. by e. ¼ mile; soft dol. on outcrops west of Leitrim; dense sil. dol. on outcrops near church to south.	Stone tested; quarry owned by M. Johnston, Billings Bridge, stone used extensively on Metcalfe road; there is an overburden of 3 to 6 ft. of clay and dol. boulders at the quarry; stone extends for 100 yds. to s.w.

64	Lot 26, con. iv, v, Gloucester.	Beekmantown. 20 ft. exposed; from 5 to about 2 ft. from top there is a white grey rather friable s.s., below the beds are calc. s.s. and very sil. magn. lime.; some of the material very hard.	Exposed on a hill with low ground to the east.
65	Lot 27, con. v, Gloucester.	Beekmantown. 4 ft. of dark grey fine-gr. sil. magn. lime. overlain by 3 ft. of calc. s.s.; the latter is weathered and friable.	The quarry is in a small escarpment, drainage good; upper beds weakened by weathering.
66	Lot 28, con. vi, Gloucester.	Beekmantown. East end of sec. there is 16½ ft. exposed of interbedded s.s., calc. s.s., and very sil. magn. lime.; about 7½ ft. is s.s. with little or no calc. cement and less than 1 ft. is magn. lime.; the rest is hard calc. s.s., over this there is 15 ft. of covered strata, followed by this there is 10 ft. of interbedded sil. dol. calc. s.s. and sil. magn. lime.; 6 ft. of this outcrop is dol.	The calc. s.s. and dol. in the upper outcrop can be quarried and should be good stone; the lower and eastern outcrop contains a good deal of poor s.s.
67	Lot 5, con. ii, North Gower.	Beekmantown. Dense steel grey sil. dol., only a foot or two seen; heavy lime. boulders to east.	Lies on hill on property of S. Carson; heavy overburden to the east.
68	Lot 8, con. ii, North Gower.	Beekmantown. 5½ ft. of steel grey sil. dol.	Small pit owned by D. McNeice, R.R. 2, Kars; low lying, overburden light.
69	Lot 11, con. v, Marlborough.	Beekmantown. Blue grey fine-gr. sil. magn. lime. or dol.	Lies on creek bottom.
70	Lot 7, con. v, Marlborough.	Beekmantown. Light grey sil. magn. lime. vuggy; in large flat blocks.	Only top bed seen, outcrop very small.
71	Lot 10, con. iii, Marlborough.	Beekmantown. 2 ft. of sil. grey magn. lime. or dol. vuggy; a good deal of this is in large loose blocks; directly north is a hill covered with lime. boulders; about 1½ miles to n.e. there is a long hill along the con. road covered with boulders of sil. magn. lime.; solid rock is found in places 6 ft. from the surface.	Outcrop small and flat lying.
72	Lot 11, con. iii, Marlborough.	Beekmantown. Sil. grey magn. lime. vuggy.	Only one bed exposed. Low lying.
73	Lot 17, con. ii, Marlborough.	Beekmantown. Dark grey, coarse-gr. vuggy sil. magn. lime.	Transportation difficult; overburden 1 to 4 ft.
74	Lot 18, con. ii, Marlborough.	Beekmantown. Dark grey vuggy sil. magn. lime.	Can be quarried to a depth of from 4–5 ft.
75	Lot 14, con. ii, Marlborough.	Beekmantown. Dark grey vuggy sil. dol. weathering to silt.	Not very promising.
76	Lot 13, con. ii, Marlborough.	Beekmantown. Dark grey vuggy sil. dol. weathering to silt.	On low ground; some stone can be obtained north of the con. road.
77	Lot 15, con. i, Marlborough.	Beekmantown. 5 or 6 beds exposed of sil. magn. lime. and dol. with one 8-in. bed of s.s. in the middle; the stone is brecciated in places; outcrops of sil. dol. occur nearby to the s.w. and some stone of the same kind lies on hill top about 300 ft. to the north.	Beds lie in small hill facing the road; a quarry could be opened to advantage in the front where the beds dip steeply; it may be possible to tap the flatter beds to the north; outcrops to s.w. dip steeply.
78	Lot 12, con. i, Marlborough.	Beekmantown. Light grey sil. magn. lime. and dol.	There is about 4,500 cu. yds. of stone lying over water level; beds dip steeply to the north; low ground in that direction.
79	Lot 6, con. i, Marlborough.	Beekmantown. Sil. magn. lime. and dol.; the upper beds denser and more dolomitic; beds dip about 40° to the n.w. Plate VII A.	Stone tested; quarry owned by Robert McCulla, R.R. 4, Kemptville; the excavation is small; there is about 2,000 cu. yds. available; used on road to east with success.

Table II.—Description of Deposits of Bedrock—Continued.

Map No.	Location.	Lithological character.	Remarks.
80	Lot 8, con. iii, Osgoode.	Beekmantown. Sil. magn. lime. in thin beds.	Outcrops on hill top 15 ft. over swamp; there is over 100,000 cu. yds. available.
81	Lot 6, con. iii, Osgood.	Beekmantown. Grey fine-gr. dol. or magn. lime. deep weathered; small outcrops of dol. and magn. lime. to the north and south.	Only a small amount of stone can be obtained from these outcrops.
82	Lot 4, con. iii, Osgoode.	Beekmantown. Steel grey, fine-gr. dol.; similar stone on outcrop to the east.	Exposures poor and on rather low ground.
83	Lot 12, con. iv, Osgoode.	Beekmantown. Medium to fine-gr. sil. magn. lime. weathering into blocks of a brownish colour.	Outcrop small.
84	Lot 12, con. iii, Osgoode.	Beekmantown. Grey to buff fine-gr. hard dol.	Large blocks on hill top with occasional outcrop.
84a	Lot 24, con. iii, Osgoode.	Beekmantown. Steel grey fine-gr. dol. with yellow tinge.	Large flat slabs lie at all angles; it is doubtful whether any of it is in place.
85	Lot 20, con. ii, Oxford.	Beekmantown. Sil. magn. lime. medium-gr. steel grey, rather soft; 2 ft., yellow steel grey sil. magn. lime. or dol. below.	Outcrop on low ground near stream.
86	Lots 10,11, con. vi, South Gower.	Beekmantown. Sil. dol. fine-gr., yellow grey, rather soft.	1 to 2 ft. of overburden.
87	On C.P.R. South Gower.	Beekmantown. Sil. magn. lime. thin-bedded shaly, yellow to buff, soft, 6 ft. exposed.	Railway cut, small in extent but can be easily quarried.
88	Lot 26, con. iv, Oxford.	Beekmantown. Sil. magn. lime., sugary texture, steel grey, under this dark blue or dol.	This outcrop in stream bed.
89	Lot 30, con. iv, Oxford. Lot 13, con. vi, S. Gower.	Beekmantown. Sil. dol. grey to buff; in six or more beds total thickness about 8 ft.; beds exposed in different parts of area.	Stone tested; three small quarries, overburden 6 in. thick; used for building stone; owned by Mrs. Martin, Kemptville.
90	On C.P.R. South Gower.	Beekmantown. Sil. magn. lime. to calc. s.s. thin-bedded.	Overburden thin to west and south.
91	Lot 2, con. iii, South Gower.	Beekmantown. Dol. light grey fine-gr. few feet exposed.	Overburden thin, quarried many years ago.
92	Lot 19, con. iii, Oxford.	Beekmantown. Sil. magn. lime. or dol., steel grey, fairly hard.	
93	Lot 16, con. iv, Oxford.	Beekmantown. Sil. magn. lime. medium-gr., vuggy, the cavities carrying quartz, chert, and calcite, rather soft.	
94	Lot 19, con. iv, Oxford.	Beekmantown. 2 ft. of sil. magn. lime. yellow to steel grey, fine-gr. to dense, fairly hard over dol.	In railway cut.

95	Lot 18, con. v, Oxford.	Beekmantown. 8 ft. of thin-bedded sil. dol., medium-gr. dense to light grey, upper beds weathered, sh. in bottom	Stone tested; sold at 50 cents per cord in place; quarry 870 cu. yds.; owner Sam Harris, Oxford Mills.
96	Lot 26, con. iv, Oxford.	Beekmantown. Sil. magn. lime. or dol., steel grey with streaks of silty or shaly lime., about 2 ft. exposed.	In railway cut; can be quarried to the west.
97	Lot 27, con. v, Oxford.	Beekmantown. Sil. magn. lime. dark to steel grey, 4½ ft.	Quarry size about 500 cu. yds. 3 ft. of sandy overburden, stone sold at $5 per cord.
98	Lot 26, con. vi, Oxford.	Beekmantown. Sil. magn. lime. and dol., light grey with reddish tinge, medium to fine-gr., hard; near east quarry about 4 ft. of sil. lime. varying in texture.	Quarry opening of about 1,000 cu. yds.; sample tested from west, quarry outcrops low lying; owner, John Flanningan, Kemptville.
99	Lot 30, con. v, Oxford.	Beekmantown. Sil. magn. lime. grey to yellowish, dense to coarse-gr.	Owned by James Rock; can be obtained without difficulty near house.
100	Lot 28, con. v, Oxford.	Beekmantown. Dol. dark steel grey, 1 ft.	On low ground.
101	Lots 27–29, con. vi, Oxford.	Pre-Cambrian and Beekmantown. Pre-Cambrian quartzite and 10 ft. of Beekmantown conglomerate and sil. magn. lime. and calc. s.s.; beds exposed at various places within the outcrop area.	Stone can be quarried at many points in the area; outcrops immediately to west and south.
102	Lot 29, con. vi, vii, Oxford.	Beekmantown. Sil. magn. lime. coarse-gr., steel grey yellowish.	Hard to develop.
103	Lot 29, con. vi, Oxford.	Beekmantown. Steel grey sil. dol. fine-gr.	In small hill.
104	Lot 10, con. iv, S. Gower.	Beekmantown. Sil. magn. lime., dark grey coarse-gr., thin-bedded, soft.	Not promising, too soft.
105	Lot 11, con. iv, S. Gower.	Beekmantown. Sil. dol. fine-gr. to dense, steel grey.	Hard to work.
106	Lot 1, con. iii, S. Gower.	Beekmantown. Sil. dol. fine-gr. to dense, steel grey.	Below water level.
107	Lot 18, con. vii, Oxford.	Beekmantown. Sil. magn. lime., light grey with calcite crystals, thin-bedded.	Small excavation; outcrops on west side of hill; heavy overburden near top.
108	Lot 20, con. viii, Oxford.	Beekmantown. Coarse-gr. to vuggy, sil. magn. lime. and dol. with quartzite pebbles in lower beds; probably 12 ft. exposed.	Overburden light; easy to quarry.
109	Lot 20, 21, con. viii, Oxford.	Pre-Cambrian. Massive white quartzite showing banding which strikes e.w. and dips south; in places secondary mica in parallel lines.	Stone tested; owner James Sanderson, Oxford Station; in isolated hill up to 18 ft. high; no overburden.
110	Lot 23, con. viii, Oxford.	Beekmantown. Several outcrops sil. magn. lime. light grey, vuggy with calcite crystals.	Sold by owner, Pat McGinty, $4 per cord; easy to work; used on a nearby road with satisfactory results.
111	Lot 22, con. ix, Oxford.	Beekmantown. Sil. dol. dark grey flinty and hard, lying over 3½ ft. of medium-gr. steel grey sil. magn. lime. with pebbles of quartzite.	Veins of calcite in this indicate beds have been disturbed. Hill 10 ft. over ground water level; plenty stone available.

Table II.—Description of Deposits of Bedrock—Continued.

Map No.	Location.	Lithological character.	Remarks.
112	Lot 24, con. viii, Oxford.	Beekmantown. Sil. dol. dark grey with a light grey softer bed of magn. lime. within it, 6½ ft.	Stone removed from the outcrops; near road, easily quarried.
113	Lot 24, con. viii, Oxford.	Pre-Cambrian. Quartzite massive reddish white with some secondary mica.	On low swampy ground.
114	Lot 21, con. ix, Oxford.	Beekmantown. Flat outcrop with fissure across it str. 130° mag.; stone on north side differs to some extent from that on south, both sil. dol. of medium hardness.	Quarry about 100 cu. yds. in size; owned by S. Black, Oxford Station; large in extent, upper surface broad and flat.
115	Lot 25, con. ix, Oxford.	Beekmantown. 13 ft. of sil. magn. lime. with quartzite pebbles in some of the beds, interbedded with conglomerate.	Occurs in escarpment near road.
116	Lots 27–30, con. viii, ix, Oxford.	Beekmantown. About 7½ ft. of sil. magn. lime. carrying quartzite pebbles.	Can be quarried to advantage.
116a	Lots 28–30, con. viii, Oxford.	Pre-Cambrian and Beekmantown. 9 ft. coarse conglomerate followed by 6½ of sil. magn. lime. with pebbles of quartzite followed by 7½ ft. of sil. magn. lime., quartzite underneath.	Stone in south facing ridge, easy to work. Plate II A.
117	Lot 11, con. iii, S. Gower.	Pre-Cambrian. White to brownish massive quartzite.	Prospected for gold.
118	Lot 11, con. ii, S. Gower.	Beekmantown. About 20 ft. of sil. steel grey magn. lime. and dol. exposed with quartzite under it.	Can be quarried to advantage.
119	Lot 11, con. ii, S. Gower.	Beekmantown. Sil. magn. lime., coarse-gr., vuggy.	Some stone to be had near Sloan's residence.
120	Lot 11, con. ii, S. Gower.	Beekmantown. Sil. magn. lime., medium-gr., dark to light grey.	Overburden very thin.
121	Prescott road, con. x, Oxford.	Beekmantown. Sil. magn. lime., some of it quite cherty and hard.	Outcrop flat, not very promising.
122	Lot 3, con. ii, S. Gower.	Beekmantown. Sil. dol., fine-gr., steel grey to dark grey, 5 ft.	Stone can be taken from 122 and 123 without difficulty.
123	Lot 2, con. ii, S. Gower.	Beekmantown. 2 ft. of dol. resembling that at 122, 4 ft. ±, fine-gr. steel grey overlying medium-gr. magn. lime.	
124	Lot 3, con. ix, Augusta.	Beekmantown. Sil. dol., light grey, dense with calcite crystals and shaly in places.	On low wet ground, top outcrop used on nearby road.
125	On C.P.R., con. ix, Edwardsburgh.	Beekmantown. Sil. dol., light yellowish grey, fine-gr., rather soft.	Low lying ground.
126	Lots 24, 25, 26, con. ix, Edwardsburgh.	Beekmantown. Sil. lime., brown, grey, porous, rather soft.	

127	Lot 24, con. ix, Edwardsburgh.	Beekmantown. Medium-gr. brownish steel grey magn. lime. or dol. very soft.	
128	Lots 23, 24, con. viii, ix, Edwardsburgh.	Beekmantown. Sil. magn. lime., fine-gr., light grey, soft, vuggy. Exposed in cut in ditch. More outcrops to the north in this area.	Partly covered with drifting sand; good chances for quarrying in this area.
129	Lots 20–23, con. viii, ix, Edwardsburgh.	Beekmantown. Sil. magn. lime., thin-bedded varying in character, but all beds rather soft.	Not very large.
130	Lots 11, 12, con. ix, Edwardsburgh.	Beekmantown. Sil. dol., 3 beds total thickness 4 ft., upper bed hardest.	Lies on fairly high ground.
131	Lot 9, con. ix, Edwardsburgh.	Beekmantown. Sil. dol., calcite crystals fairly tough.	Small excavations in this outcrop.
132	Lot 11, con. ix, Edwardsburgh.	Beekmantown. Sil. dol.; yellowish grey, fine-gr. fairly tough, 4 feet exposed.	Lies in a hill.
133	Lot 12, con. viii, Augusta.	Beekmantown. Sil. magn. lime., soft.	On low wet ground.
134	Lots 28–30, con. viii, Edwardsburgh.	Beekmantown. Sil. magn. lime. soft at eastern and less sil., and harder at western end of outcrop.	A good face can be opened on west edge of area.
135	Lots 22, 23, con. viii, Edwardsburgh.	Beekmantown. Sil. dol., fine gr., light steel grey, rather soft.	In creek bottom.
136	Lots 14–16, con. vii, viii, Edwardsburgh.	Beekmantown. In quarry sil. magn. lime., medium-gr. with a few calcite crystals; fairly tough fine-gr. thin-bedded dol. near river level becoming sh. upwards; at cheese factory an altered and mineralized lime.	Altered lime. prospected for gold at cheese factory; deposit low and flat, 1 to 5 feet overburden.
137	Lot 24, con. v, Augusta.	Beekmantown. Sil. magn. lime., light yellow grey medium-gr. soft with harder denser dol. over it.	Outcrops on flat ground, only top beds over water level.
138	Lots 23, 24, con. v, Augusta.	Beekmantown. Three beds s.s., calc. s.s., and sil. magn. lime. at east end outcrop area; same beds across forced road to south.	Beds faulted in one instance; stone not promising.
139	Lot 24, con. v, Augusta.	Beekmantown. Calc. s.s., sil. and shaly magn. lime. exposed for a total thickness of 5 feet.	Stone in flat hill, can be easily quarried; outcrops stripped for road work in places.
140	Lot 19, con. v, Augusta.	Beekmantown. About 3 feet of soft magn. lime. and s.s. exposed in creek bottom.	Hard to work.
141	Lots 15-17, con. v, Augusta.	Beekmantown. Sil. magn. lime. shaly and cherty, medium-gr., soft.	Overburden up to 6 feet, difficult to work.
142	Lots 11, 12, con. vi, Augusta.	Beekmantown. Sil. magn. lime. medium-gr., vuggy, dark grey.	Outcrop covered by drifting sand.
143	Lots 9–12, con. v, vi, Augusta.	Beekmantown. 2 ft. of sil. magn. lime. fairly hard, light steel grey, coarse to medium-gr.	Small quarry owned by Dav. Perrin, Domville, R.R. 1.
144	Lot 12, con. vi, Augusta.	Beekmantown. Sil. thin-bedded magn. lime., light grey, fairly hard; weathers to silt in bedding planes.	On low wet ground.
145	Lot 12, con. vi, Augusta.	Beekmantown. Sil. magn. lime., brown grey, shaly, medium-gr.	Can be worked to depth 9 ft. with ease.
146	Lot 11, con. vi, Augusta.	Beekmantown. Sil. magn. lime., thin-bedded, vuggy, only top beds seen.	Easy to work.

Table II.—Description of Deposits of Bedrock—Continued.

Map No.	Location.	Lithological character.	Remarks.
147	Lot 9, con. vii, Augusta.	Beekmantown. Sil. magn. lime. dark grey vuggy, one bed only.	Top bed broken up; difficult to work properly.
149	Lot 33, con. v, Edwardsburgh.	Beekmantown. Sil. magn. lime. or dol., soft fine-gr.	Flat lying.
150	Lot 26, con. vii, Edwardsburgh.	Beekmantown. Sil. magn. lime. medium or thin-bedded rock varies, rather soft.	Owner, M. Connell, Spencerville.
151	Lot 26, con. vi, Edwardsburgh.	Beekmantown. Sil. dol. rather soft; total of about 12 feet exposed from 150 to 151.	Stone tested; good quarry faces can be developed in a number of places in 150 and 151; owner, J. Rickett, Spencerville.
152	Lots 22 and 23, con. v, Edwardsburgh.	Beekmantown. Sil. magn. lime with sh. partings yellow grey medium-gr.; in eastern part of same outcrop sil. dol. fine-gr. dense tough.	Lies fairly high can be worked to advantage.
153	Lot 21, con. v, Edwardsburgh.	Beekmantown. Sil. dol. fine-gr. rather tough.	
154	Lot 23, con. vi. Edwardsburgh.	Beekmantown. Sil. dol. dark grey, dense tough.	Surface layers used, easy to work.
155	Lots 19, 20, con. v, Edwardsburgh.	Beekmantown. Sil. dol. dark grey, fine-gr. fairly tough.	Sold at $1.25 per cord.
156	Lot 17, con. vi, Edwardsburgh.	Beekmantown Sil. dol. steel grey, fine-gr. tough, 3½ feet.	Quarry owned by Dr. Jones, Prescott.
157	Lots 15 and 16, con. vi, Edwardsburgh.	Beekmantown. Sil. dol. steel grey, fine-gr. 3 feet.	Stone sold $1 per cord; quarry owned by Mrs. Dove, Spencerville.
158	Lot 19, con. vii, Edwardsburgh.	Beekmantown. Steel grey sil. magn. lime. with brown tinge.	In bottom of ditch.
159	Lots 12–14, con. vii, Edwardsburgh.	Beekmantown. About 9½ ft. of sil. magn. lime. medium to coarse-gr. exposed. Small outcrop of sil. fine-gr.; dark grey dol. in thin beds, one-half mile to the south.	Easy to work; good drainage, thin overburden.
160	Lot 11, con. vii, Edwardsburgh.	Beekmantown. Sil. magn. lime. dark grey quite sandy on weathered surface; lighter grey magn. lime. in outcrop across road to south.	
161	Lot 23, con. iii, iv, Augusta.	Beekmantown. S.s. and calc ss. white, rather soft.	Southern part of area the more favourable for quarrying.
162	Lot 23, con. iii, Augusta.	Beekmantown. Over 20 feet of dol., calc. s.s., and sil. magn. lime. quite hard; more sil. lime. near gravel ridge to south; about 7 ft. of magn. lime. at s.e. end of outcrop area.	Exposed in slope of a hill 25 feet high, can be worked in some parts of this area.
163	Con. ii, Augusta.	Beekmantown. About 7 feet of rather soft silty magn. lime. with sh. partings.	Flat hill 10 ft. above drainage on top.

164	Lot 17, con. ii, Augusta.	Beekmantown. Silty lime., soft, reddish brown, 3 feet; on extreme west edge of outcrop area sil. magn. lime. with interbedded s.s.	South of road is a quarry owned by Jos. H. Lane, R.R. 2, Prescott.
165	Lots 14, 15, con. iii, Augusta.	Beekmantown. Sil. magn. lime. and conglomerate near con. road; about 300 yds. west on road sil. magn. lime. and calc. s.s. outcrops in a hill on the road.	164, 165 in large area extending lots 12 to 21.
166	Lot 19, con. iv, Augusta.	Beekmantown. S.s. overlying calc. s.s. with sil. magn. lime. on east edge of outcrop area.	Not promising.
167	Lot 11, con. iv, Augusta.	Beekmantown. Sil. magn. lime. weathered.	
168	Lot 6, con. iii, Augusta.	Beekmantown. Section in hill 3 feet of s.s. overlain by 3 ft. sil. magn. lime. and over that 1½ ft. of s.s.; farther up more sil. magn. lime 10 ft. or so exposed with 1 ft. calc. s.s. near top; sil. magn. lime. in quarry ½ mile to the s.w.	Small quarry owned by Judson Polite, R.R. No. 1, Domville, lies to west about ½ mile; stone in outcrop 168 can be quarried near forced road.
169	Lot 5, con. ii, Augusta.	Beekmantown. Shaly lime. soft, of no value.	Quarry.
170	West Prescott road, con. ii, Augusta.	Beekmantown. Sil. magn. lime. medium-gr. steel grey, soft.	Abandoned quarry; on low ground.
171	East Prescott road, con. iii, Augusta.	Beekmantown. Sil. magn. lime. and dol. medium-gr. steel grey, soft, 3½ feet.	Lies in low land of poor quality and hard to quarry.
172	Lots 1–3, con. iv, Augusta.	Beekmantown. 2 ft. very s l. magn. lime. over 4 ft. of hard thin-bedded magn. lime.	Can be quarried near Domville; used on Prescott road; sold at $2 per cord.
172a	East of 172.	Beekmantown. There is about 7 feet of sil. magn. lime. or dol. exposed.	Can be quarried along east side without difficulty.
173	Lot 37, con. iii, Edwardsburgh.	Beekmantown. Sil. magn. lime. quite hard.	Isolated hill, swamp to west.
174	Lot 37, con. iv, Edwardsburgh.	Beekmantown. 4 feet of sil. magn. lime. and dol.	Can be quarried along the west edge with 8-foot face.
175	Lot 35, con. v, Edwardsburgh.	Beekmantown. 1½ feet of light grey sil. magn. lime.	In low wet place, poor chance for development.
176	Lot 34, con. iv, Edwardsburgh.	Pre-Cambrian and Beekmantown. Sil. magn. lime. and hard limy s.s. with quartzite on east edge.	176 is small but easy to quarry.
177	Lots 33, 34, con. iv, Edwardsburgh.	Pre-Cambrian and Beekmantown. The Pre-Cambrian quartzite occupies the centre of area with conglomerate and sil. magn. lime. on its flanks; the quartzite is on low ground.	Limestone is variable in composition but lies on fairly high ground.
178	Lot 25, con. iii, Edwardsburgh.	Beekmantown. 10 ft. of very sil. magn. lime. and dol.	Exposed in two small quarries; sold at $1.25 a cord in quarry. See also 180.
179	Lots 23, 24, con. iii, Edwardsburgh.	Beekmantown. Sil. magn. lime. brown grey, medium-gr. with calcite crystals; about same material in smaller area to south.	

Table II.—Description of Deposits of Bedrock—Continued.

Map No.	Location.	Lithological character.	Remarks.
180	Lots 24–30, con. ii, iii, Edwardsburgh.	Beekmantown. South end outcrop about 2 ft. sil. magn. lime., on road between con. ii and iii about 4 ft. of dol. and sil. magn. lime.; in front church on Johnstown road tough sil. magn. lime.	Number 180 applies to whole area except the north end which is numbered 178; quarrying can be carried on at many places in this area.
181	Lot 24, con. ii, Augusta.	Beekmantown. Sil. dol. dark grey, medium-gr. rather soft 4 ft.; to north in small outcrop there is sil. dol. medium-gr., quite hard, 3½ ft.	Small hill 8 to 10 ft. over ground water level.
182	Lots 16-23, con. i, ii, Augusta.	Beekmantown. A few beds along east and south sides of area 2½ ft. of medium-gr. dol. overlain by 1 ft. of dense dol.; sil. dol. or lime. at west end.	The depth of overburden varies, there are no promising quarry sites, the upper beds are weathered.
183	Lot 14, con. i, Augusta.	Beekmantown. 3 ft. of medium and fine-gr. sil. lime. or dol.	Area used for summer resort.
184	Lot 14, con. i, Augusta.	Beekmantown. Dol. light grey, fine-gr.	Rock near surface, no faces exposed.
185	Lots 10-12, con. i and ii, Augusta.	Beekmantown. This area contains scattered outcrops; a 5-ft. face of fine-gr. dol. in lot 11 halfway between railway and con. road.	About 15,000 cu. yds. available at 5-ft. face mentioned.
186	Lots 6 and 7, con. ii, Augusta.	Beekmantown. Near quarry about 5 ft. of tough light grey dol. and 6 ft. of dol. with paper thin wavy partings, which is also rather tough.	Good opportunity for quarrying in this area, face up to 10 ft. can be obtained.
187	Lot 3, con. ii, Augusta.	Beekmantown. About 5½ feet of sil. magn. lime. in quarry all of it rather soft, weathers to silt.	This quarry can be further developed without trouble; stone sold at $2 per cord.
188	East of 187.	Beekmantown. A ft. or so of upper beds of 187 exposed.	On low ground.
189	Lots 5, 6, con. vi.	Beekmantown. 5 ft. of sil. dol. with a 3-inch. bed of calc. s.s.	Amount of overburden varies.
190	Prince st., Prescott.	Beekmantown. In quarry 2 ft. of fine-gr. sil. magn. lime. and dol., brown grey, varying in composition, overlying 6 ft. of same material; a shaly parting separates them.	Stone tested, about 4,500 cu. yds. available, excavation 9 ft. deep.
191	Wood st., Prescott.	Beekmantown. Sil. dol., light to dark grey, brownish, about 6 ft.	Quarry; amount available small; sold at 50 cents per cu. yd. Plate II B.
192	Lot 33, con. i, near railway, Edwardsburgh.	Beekmantown. Dol. sil. magn. lime. sh. and s.s. 4 ft.	Easy to work.
193	Lot 34, con. i, Edwardsburgh.	Beekmantown. About 4½ feet of sil. magn. lime.	Small quarry; quarried stone at $2 per cord.

194	Lot 33, con. I, Edwardsburgh.	Beekmantown. Steel grey sil. magn. lime. and dol., with one bed of limy sh.; about 30 ft. exposed in quarry at Windmill point.	Excavation on river bank, sold at 25 cents a cord in place, and $2 quarried; owner Mrs. Plumb, Prescott, Ont.; nearly worked out.
195	Lot 32, con. i, Edwardsburgh.	Beekmantown. Very sil. lime. medium to fine-gr., brown grey.	
196	Lot 32, con. ii, Edwardsburgh.	Beekmantown. Sil. magn. lime., steel grey, medium-gr. 5 ft.	
197	Lot 31, con. i, Edwardsburgh.	Beekmantown. Sil. lime. steel grey, medium-gr.	
198	Lot 31, con. I, Edwardsburgh.	Beekmantown. Thin-bedded sil. dol., steel grey, banded, tough.	Small quarry, stone used in river road.
199	East end of large outcrop in lots 29–34, Edwardsburgh.	Beekmantown. About 7 ft. of sil. magn. lime. and dol. at river's edge, dirty grey sil. lime. in small outcrop to north.	Stone can be quarried near road at east end.
200	Lots 28, 29, con. i, Edwardsburgh	Beekmantown. Sil. magn. lime., light grey, 2½ ft. in northern quarry, in southern excavation about 3 ft. of sil. magn. lime.	Owned by Evans, R.R. 3, Prescott, sold at 40 cents per cord in place.
201	Lot 26, con. i, Edwardsburgh.	Beekmantown. Sil. magn. lime. and dol., steel grey, 3½ ft.	On low ground.

Appendix B.

Table III.—Tests Made upon Field Stone.

Map No.	Location.	Composition of boulders—percentage of			Physical character.				
		Limestone.	Hard—granite, etc.	Soft—sandstone, etc.	Specific gravity.	Water absorbed—pounds per cu. ft.	Per cent of wear.	French coefficient of wear.	Cementing value.
27a	Lot 6, con. ii, Nepean.	24	5	70	2·46 to 2·78	0·32 to 1·18	13·2	3	45
97a	Lot 25, con. iv, Gloucester.	5	70	25	2·51 to 2·83	0·11 to 0·90	8·9	4·5	68
102a	Lot 9, con. iii, North Gower.	80	9	11	2·71 to 2·81	0·72	7·0	5·7	21
179c	Stockpile on road about 2 miles s.e. of Pierces Corners, Marlborough.	82	12	6	2·55 to 2·77	0·42 to 0·76	3·0	13·3	31
179c	Lot 7, con. ii, Marlborough.	90	5	5	2·57 to 2·80	0·29 to 2·01	5·9	6·8	40
240b	Lot 29, con. ii, Osgoode.	18	57	25	2·35 to 2·81	0·21 to 1·71	7·4	5·4	43
287c	Lots 21 and 22, con. ix, Oxford.	10	80	10	2·67 to 2·96	0·19 to 0·91	6·0	6·6	91

Table IV.—Character of Deposits of Field Stone.

NEPEAN TOWNSHIP.

Map No.	Location.	Field estimate of composition.									Remarks.
		Extreme variation fence to fence, per cent of			Average of whole deposit, per cent of			Cu. yds. of stone, diameter			
		Limestone	Hard*	Soft*	Limestone	Hard*	Soft*	Under 2 ft.	Over 2 ft.	Total	
1, 2	Lots 6, 8, 9, 10, on. A and i, Ottawa front, 1 5 to 45.	15–45	30–75	5–30	30	60	10	1,477	122	1,599	N. w. and west of these deposits and between them and Nos. 3, 4, 5 are scattered deposits of field stone seldom as much as 100 cu. yds. in one field. The total amount present is between 500 and 600 cu. yds.; their average composition runs about 75 per cent hard and 25 soft with very little limestone. Great variation in composition in area 5.
3	Lot 1, con. i, Ottawa front.		50–80	25–50		55	45	106		106	
4a 4b	Lots 2, 3, con. ii, Ottawa front.	10–80	10–50	20–80	32	27	41	1,273	37	1,310	
5	Lots 4, 5, con. ii, Ottawa front.				41	20	39	1,091		1,091	
6	Lots 29, 30, con. i, Ottawa front.	15–100	40–80	5–45	32	46	22			1,788	Great variation fence to fence, one fence of 300 yds. in extent is all limestone; a fence ½ mile east of area included in estimate.
7	Lots 27, 28, 29, and 30, con. ii, Ottawa front.	0–100	10–75	5–60	28	47	25			2,154	Two fences in area between 6, 7, and 8 are included in the estimate for 7 though not included with it on map; s. w. 7, ½ mile there is a fence containing 94 cu. yds.
8	Lots 31, 32, 33, con. ii, Ottawa front.	10–50	50–80	5–20	20	65	15			1,363	S.e. of No. 8 about ½ mile is a fence containing about 80 cu. yds., 75 % hard, 25% limestone.
9	Lots 30, 31, 32, con. ii, Ottawa front.	45–60	40–60	0–5	52	46	2	450	230	680	
10	Lots 32, 33, 34, 35, con. A, and i.	10–70	20–80	15–75	48	33	19	967	200	1,167	Small fence ½ mile west of Merivale road, west of No. 11.
11 12	Lot 32, con. vi.	0–5	3–20	80–90	1	9	90	481		481	The greater part of the soft is s.s. (probably Potsdam) 120 cu. yds. in a fence ½ mile n.e. of No. 12 with 32% lime., 10 hard, 58 soft; 100 cu. yds. ½ mile to south contains about 21 lime., 23 hard, 56 soft.

13	Lots 33, 34, con. v.	0–10	20–40	50–80	5	35	60	814	17	831	Between Nos. 13, 14, 15, 16, and 17 are scattered piles amounting to over 400 cu. yds. of which about 45% is soft, 30 hard, and 25 limestone.
14	Lots 29, 30, con. vi (east side con.).	5–30	5–15	60–90	21	8	71	266	5	271	
15	Lot 28, con. v.	0–35	10–15	50–90	7	13	80	118	11	129	
16	Lots 29, 30, con. iv (west side).				39	27	34	303		303	
17	Lots 31, 32, con. iv (east side con.).				59	17	24	246	6	252	
18	Lots 23, 24, 25, con. iv.	9–90	0–20	10–80	40	10	50	888	132	1,020	120 cu. yds. in two fences to n.w. contains over 80% soft.
19	Lots 25, 26, con. iii, iv.				17	27	56	445		445	
20	Lots 23, 24, con. ii.	60–100	0–25	0–20	90	5	5	890	155	1,045	Limestone sil. of Beekmantown age.
21	Lots 21, 22, 23, 24, con. iii, iv.	30–100	5–20	5–50	62	11	27	589		589	50 cu. yds. in lot 21, con. iii, 30% lime.
22	Lots 16-21, con. iv, v.	5–75	5–50	10–95	29	12	59	5,580	1,020	6,600	20 hard and 50 soft; a number of small deposits lie n.e. and east of Fallowfield. In lot 21, con. v near road there is over 200 yds. running more than one-half soft, to the n.e. of the village there is probably 200 more running 90% soft.
23	Lot 24, con. vi.				60	15	25	735	130	865	
24	Lots 20, 21, con. iii, iv.	20–50	20–60	15–75	28	29	43	900	127	1,027	
25	Lots 10-20, con. ii and iii, north of Jock river.	0–70	5–40	20–95	24	13	63	11,077	3,173	14,250	This block is remarkably uniform in composition.
26	Lot 12, con. i.	20–45	20–60	15–35	25	50	25	165	160	325	The dividing line between 25 and 26 is uncertain.
27a	Con. ii from lot 6 north to the Jock river and west of the forced road.	15–40	0–30	45–90	22	7	71	3,467	1,137	4,604	This includes a fence east of the river road in lots 6 and 7.
27b	Part b lies to the east of the forced road in con. ii.	5–30	0–15	70–95	14	7	79	3,011	1,681	4,692	
28	Lots 16 and 17, con. v.				19	45	36	60	39	99	
29	Lots 11, 12, 13, con. iv.				5	61	34	900	44	944	
30	Lots 7, 8, 9, con. iv.				8	64	28	712	130	842	
31	Along road between lots 5 and 6, con. iii and iv.				5	90	5	7	63	70	
32	Lots 6, 7, 8, 9, con. iii n.e. of forced road.	0–75	5–75	0–95	29	25	46	4,889	1,224	6,113	
33	Lots 5 and 6, con. ii and iii.	8–20	25–60	32–70	12	41	47	781	529	1,310	
34	Lots 1, 2, 3, 4, 5, con. ii and iii s.w. of forced road in con. iii on both sides of con. road.	0–25	10–30	50–90	8	21	71	923	54	977	
35	Lots 1, 2, 3, 4, 5, con. ii, along and west of forced road in con. ii.				19	28	53	681	74	755	
								44,292	10,500	54,792	Total yardage in Nepean tp.

*In the composition columns hard refers to hard granites, traps, and other igneous and to many hard metamorphic rocks; soft refers to sandstones. shales, schists, and badly weathered limestones very rarely to partly disintegrated igneous rocks; limestone refers to dolomites as well as to limestones. From the southern border of Nepean and Gloucester south nearly all of the limestone is dolomite or magnesian limestone.

Table IV.—Character of Deposits of Field Stone—Continued.

GLOUCESTER TOWNSHIP.

Map No.	Location.	Field estimate of composition.									Remarks.
		Extreme variation fence to fence, per cent of			Average of whole deposit, per cent of			Cu. yds. of stone, diameter			
		Limestone	Hard*	Soft*	Limestone	Hard*	Soft*	Under 2 ft.	Over 2 ft.	Total	
36	Lot 24, con. i, Ottawa front.				8	54	38			154	Estimate made on 110 cu. yds. only; some of fences nearly 100% hard.
37	Lot 21, con. i, Ottawa front.	0–100	40–60	40–60	9	43	48			170	To n.e. across the road is a pile of about 22 cu. yds.
38	Lots 20, 21, con. i, Ottawa front.				33	44	23	120	25	145	
39	Lots 10, 11, con. i, ii, Ottawa front.				27	35	38	5	65	70	
40	Lots 10, 11, 12, con. ii, Ottawa front.				18	34	48	230	25	255	Outside of 26 yds. north of Orleans, area n.w. of 40 bare of field stone.
41	South Montreal road and west railway at Cummings Bridge.			10–20	30	50	20	41	16	57	
42	South of 41 ½ mile.	0–5	70–100	0–25	8	80	12	406	414	820	
43	On road ½ mile south Notre Dame cemetery, Ottawa.		50–90		10	80	10	19	45	64	
44	About ½ mile south Notre Dame cemetery.	0–20	60–90	10–30	12	68	20	77	31	108	A good deal of this stone is not piled.
45	On both sides of Canadian Northern railway n.e. Hurdman's Bridge.	0–50	40–100	0–30	15	75	10	698	212	910	Along the s.e. corner of this block the boulders are small and largely made up of limestone. There is great variation throughout.
46	On the Can. Northern north by east of Cyrville.	0–15	60–100	0–25	10	75	15	159	74	233	Greatest variation along west boundary north of C.N.R. tracks.
47	South Montreal road west of quarries.	0–30	40–95	5–30	10	65	25			202	Two big fences only.
48	South of quarries.	10–20	60–80	10–20	17	67	16	231	36	267	One pile of 54 cu. yds. all hard.
49	Lots 24, 25, con. i, ii, east and		55–90		15	70	15	252	58	310	
50	n.e. of Cyrville, Ottawa front.										
51	Lots 22, 23, con. ii, Ottawa front	5–20	60–80	10–25	10	75	15	441	100	541	Lies on either side of the C.N.R.
52	Lots 20, 21, con. i, s.e. of quar-	5–30	45–80	10–25	14	66	20	1,300	236	1,536	
53	ries, Ottawa front.										
54	Lot 21, con. ii, Ottawa front.	0–25	60–100	0–20	15	70	15	446	161	607	
55	Lot 18, con. i, Ottawa front.	10–15	70–80	10–15	10	75	15	637	107	744	Includes a pile directly south of Montreal road.
56	On Hawthorne road just east of Rideau river.	5–75	15–90	5–25	15	5	20	63	37	100	The extreme variation due to one pile.
57	West Cyrville ½ mile.	0–5	90–100	0–10	2	90	8	72	15	87	
58	Lots 24, 25, 26, 27, con. ii and	0–12	80–100	0–15	9	82	9	658	160	818	
58a	iii, Ottawa front.										

59	Lot 25, con. ii, Ottawa front.		80–100		7	85	8	138	79	217	
60	Lots 21, 22, 23, con. ii, Ottawa front.	0–15	65–100	0–20	11	77	12	241	74	315	
61	Lot 16, Junction Gore.				0	97	3	11	64	75	At Billings Bridge to s.w. are two piles containing 15 cu. yds.
62	Lots 13, 14, 15, Junction Gore.	0–30	50–90	5–25	12	72	16	688	75	763	Large percentages of lime. and soft boulders at western end of area.
63	Lot 26, con. iii, Ottawa front.					90	10	60	16	76	
64	Lot 7, con. iv, Gloucester.				12	60	28	150	160	310	20 cu. yds. about 2 miles to north.
65	Between Heron and Walkley				8	75	17	329	14	343	On farm of Richard O'Connor at
66	roads, Junction Gore.										Hogsback there is about 4 yds. and of Mrs. Wm. McGrath. 53; latter, 60 lime., 30 hard, 10 soft.
67	North Heron road, Junction Gore.	0–15	90–100	0–10	5	90	5	205	86	291	The lime. is all in western end of the area.
68	Lot 4, con. iii, Gloucester.				65	35	0			413	Composition estimate made on portion at west end.
69	Con. iii, east and near Ellwood.				10	73	17			112	
70	Lots 5, 6, con. iii, Gloucester.	25–70	25–70	5	50	45	5			277	Big lime. blocks partly buried in this area.
71	Lots 6, 7, 8, con. iii and iv,				18	68	14			1,725	No. 73 including piles to south and
72	Gloucester.										east contains 500 cu. yds. and
73											runs 5% soft, 75 hard, and 20 lime.
74	Lots 4-9, con. v, vi, Gloucester.	0–5	65–100	0–35	0	78	22	1,025	563	1,588	Lime. was seen in only one or two fences in this area; a small pile of 14 yds. lies in lot A near eastern baseline.
75	Lots 12, 13, con. ii, west Bowesville road				10	75	15	151	115	266	
76	Lots 8-15, con. ii, iii, Gloucester,	0–30	30–80	5–60	15	50	35			3,146	30 cu. yds. west Bowesville road in
77	east Bowesville road.										lot 15.
78	Lots 12-17, con. iii, iv, mainly east of Metcalfe stone road.		80–100	5–20	0	88	12			4,713	The stone in this block runs very uniformly in composition except at the northern end where some lime. is present and the percentage of hard drops to 60 in one fence.
79	Lots 13, 14, 15, con. iv, west Metcalfe and north of cross-road.	0–60	20–90	10–50	15	57	28			4,180	Lime. rarely over 15% n.w. but often 50% and over s.w. of outcrops; to s.w. of outcrops variation is greater.
80	Lots 15, 16, 17, 18, con. iv in n.w. corner block.				1	88	11			1,088	Variation not very great in this block.
81	Lots 16, 17, con. iv.	15–85	10–80	5–15	41	51	8			338	This area lies west and northwest of an outcrop of sandy lime.
82	Lots 17, 18, con. iv.				6	84	10			681	The northern edge of this area runs 60 to 75% hard and up to 40% of lime., the southern part runs about 90% hard and 10% soft.
83	Lots 19, 20, con. iv, v.	5–90	5–90	5–10	43	51	6			308	The composition is probably influenced by outcrops lying close under the surface directly to the east.

Table IV.—Character of Deposits of Field Stone—Continued.

GLOUCESTER TOWNSHIP.—(Cont.)

Map No.	Location.	Field estimate of composition.									Remarks.
		Extreme variation fence to fence, per cent of			Average of whole deposit, per cent of			Cu. yds. of stone, diameter			
		Limestone	Hard	Soft	Limestone	Hard	Soft	Under 2 ft.	Over 2 ft.	Total	
84	Lots 16-20, con. v.	0–15	70–100	5–20	3	85	12			1,564	Including some large boulders there is about 400 cu. yds. more stone in the areas 78 to 84 than here recorded.
85	Lot 25, con. BF.	0–85	25–80	15–75	40	37	23			600	The fences on north side of this block are nearly all lime. and s.s., to the south they are two-thirds of hard Pre-Cambrian rocks.
86	Lots 23, 24, 25, con. i.	10–75	0–45	10–60	48	19	33			3,806	
87	Lots 22-25, con. i.	40–50	5–30	30–45	49	10	41			529	This block is very uniform in composition.
88	Lots 26-29, con. BF. and i.				31	16	53	2,663	1,035	3,698	In the western part of this area the stone averages 58% lime., 8% hard, 34% soft.
88a	Four areas on Long island on the Rideau river.				78	9	13	889	724	1,613	Stone can be hauled by lanes to the road through Manotick.
88b											
88c											
88d											
89	Lots 23-29, con. i and ii.				45	5	50	3,609	323	3,932	In the northern part of the area it runs about 60% lime., 5 hard and 35% soft; the lime. is dol. of Beekmantown age and occurs in flat slabs.
90	Lots 26, 27, 28, con. ii.				6	7	87	2,576	318	2,894	
91	Lots 18-21, con. iii.				0	99	1	228	60	288	To the north the material contains up to 10% lime. and 20% soft.
92	Lots 23-26, con. ii.				17			1,312	147	1,459	
93											
94	Lots 27, 28, con. ii and iii.				6	6	88	297	25	322	
95	Lots 29, 30, con. iii.				2	22	76	198	0	198	
96	Lots 24-28, con. iii.	20–50	5–15	35–75	37	15	48	2,106	166	2,272	In the area south of road the variations are as given north of the road, the variation between s.s. and lime. is much greater; the lime. is soft silty dol. of the Beekmantown, near the outcrop to the s.w. it appears as numerous flat slabs on the surface of the fields.

97	Lots 21-30, con. iv and v Gloucester, lots 1 and 2, con. v, Osgoode.				31	45	24	24,784	2,700	27,484	
97a	Part in lots 21-25, con. iv.										
	Eastern half.	20–85	20–70	10–35							
	Western half	0–10	50–85	10–50							
97b	Part in lots 27-29, con. iv.	0–15	40–70	20–55							A few fences near Metcalfe stone road run high in lime. In western part of this section lime. 0 to 5 hard 45-60, soft 40-50.
97c	Part in lots 21-25, con. v.	15–100	10–25	0–70							In northern part lime. low, in southern over 85% of whole.
97d	In lots 25-30, con. v, near Metcalfe road.				60	20	20				On east side block nearly all sil. lime. or dol.
97e	Southern end near townline, con. iv and v, in both Gloucester and Osgoode.				10	55	35				A few fields at point east of where Metcalfe road crosses townline run high in limestone.
98	Lots 28-30, con. vi.			5–20	53	34	13	1,064	37	1,101	Great variation in composition from place to place, lime. in thin flat slabs; a few piles lie to the n.e. near the Russell road; they do not average nuch more than 20 yds. a piece.
										81,183	Total yardage in Gloucester tp.

NORTH GOWER TOWNSHIP.

Map No.	Location.	Field estimate of composition. Average of whole deposit. Material under 2 ft.—per cent of			Material over 2 ft.—per cent of			Cu. yds. of stone, diameter			Remarks.
		Limestone	Hard	Soft	Limestone	Hard	Soft	Under 2 ft.	Over 2 ft.	Total	
99a	Lots 1, 2, 3, 4, con. iv.	79	11	10	80	10	10	2,549	47	2,596	
99b, 102b	Lots 5-10, con. iv.	75	14	11	72	26	2	2,878	346	3,224	
100	Lot 1, con. iii.	80	10	10				70	0	70	
101	Lots 3, 4, 5, con. iii,	70	18	12	66	22	12	1,884	41	1,925	
102a	Lots 8, 9, 10, con. iii.	81	14	5	79	16	5	5,961	3,230	9,191	
103	Lots 3, 4, con. ii.	92	8	0				937	775	1,712	
104	Lots 6, 7, con. iii.	73	15	12	80	15	5	1,447	547	1,994	
105	Lots 6, 7, con. ii in middle of con.	77	17	4	78	17	5	2,758	694	3,452	
106a	Lots 6, 7, con. ii, near forced road.	69	26	5	48	49	3	1,009	685	1,694	
106b	Lots 4, 5, con. ii.	92	8	0				4,739	1,004	5,743	
106c	North half lots 1, 2, con. i.	76	23	1				1,055	306	1,361	Variation lime. 25 to 90, hard 10 to 60, soft 0 to 5.

Table IV.—Character of Deposits of Field Stone—Continued.

NORTH GOWER TOWNSHIP.—(Cont.)

Map No.	Location	Field estimate of composition. Average of whole deposit. Material under 2 ft.—per cent of			Material over 2 ft.—per cent of			Cu. yds. of stone, diameter			Remarks.
		Limestone	Hard	Soft	Limestone	Hard	Soft	Under 2 ft.	Over 2 ft.	Total	
106c	South half lots 1, 2, con. i.	81	19	0				1,733	453	2,186	
107	Lots 11, 12, 13, 14, con. iv.	79	14	7	72	25	3	2,889	198	3,087	Some stone from this area used on roads; this includes a small area in the n.e. corner of lot 11, con. iv, mapped with 101.
108	Lot 13, con. iv.	80	15	5	80	15	5	287	21	308	
109	Lots 11, 12, 13, con. iii.	80	15	5	69	28	3	2,330	421	2,751	45 cu. yds. s.w. road crossing n.e. of 109.
110	Lots 9, 10, 11, con. ii, south,	88	6	6	84	8	8	1,107	411	1,518	
111	Mud creek.										
112	Lots 12, 13, con. ii, west forced road.	75	15	10	75	15	10	1,959	241	2,200	
113	Lots 11-15, con. ii, along forced road.	80	15	5	80	15	5	4,109	1,123	5,232	
114	Lots 8, 9, 10, west side, con. i.	86	8	6	80	14	6	3,096	246	3,342	
115	Lot 6, south road.	61	19	20	80	14	6	140	14	154	
116	Lots 3, 4, con. i, near eastern con. road.	68	32					99	35	134	Some boulder piles along road to north included in this estimate.
117	Lots 5, 6, con. A.	88	6	6	76	12	12	442	26	468	To the n.e. next to river road in lot 4 there is 90 cu. yds. of about the same composition as No. 117.
118	Lots 1, 2, con. A, West Manotick.	80	7	13	88	8	4	311	123	434	
119	Lots 6-11, con. A and i.	18	54	28	6	90	4	2,013	544	2,557	This area lies on a ridge near the con. road.
120a	Lots 6-10, con. A.	78	16	6	58	35	7	6,533	396	6,929	Includes two small unnumbered areas to the n.w. and east respectively.
120b	Lots 11-14, con. A.	79	10	11	71	20	9	4,853	124	4,977	
121a	Lots 11-15, con. i.	78	12	10	65	24	11	4,036	336	4,372	
121b	Lot 11, north part of 12, con. A.	11	73	16	11	71	18	497	437	934	One pile of 60 yds. is 90% lime., 5 hard, 5 soft.
121c	Lots, south part of 12, also 13, 14, 15.	30	20	50	10	40	50	1,322	671	1,993	Soft material composed of firm s.s. boulders.
122	Lots 17, 18, 19, con. iv.	81	13	6	70	25	5	1,815	531	2,346	In lot 20, con. iv, there is 170 cu. yds. averag. 45 hard, 44 lime., 6 soft.

123	Lot 18, con. iv.	76	18	6	10	90	0	501	5	506	
124	Lots 19, 20, con. iv.	11	83	6	11	86	3	72	189	261	
125	Lot 15, con. iii, s.w. corner.	60	25	15	50	50	0	40	76	116	
126	Lots 15, 16, 17, con. iii.	68	19	13	60	36	4				
127	Lots 18, 19, 20, con. iii.	60	30	10	50	47	3	387	263	650	
128	Lots 16, 17, 18, con. iii.	82	12	6	65	31	4	2,194	737	2,931	
129	Lots 18, 19, 20, con. ii, iii.	85	10	5	83	12	5	562	254	816	
130	Lot 19, con. ii.	85	10	5	85	10	5	70	40	110	
131	Lots 19, 20, 21, con. ii.	84	10	6	85	9	6	358	121	479	Lime. both silty and sil. in flat slabs.
132	Lots 16, 17, 18, con. i.	82	11	7	81	11	8	1,304	72	1,376	
133	Lots 16-20, both sides road between con. A and i.	11	28	61	3	85	12	333	61	394	Most of the soft stone under 2 ft. is white s.s.
134	Lots 18-21, con. A along river road.	81	14	5	80	15	5	1,528	175	1,703	Lime. sil. and in flat slabs.
135a	Lots 21, 22, con. iv.	56	35	9	29	59	12	325	97	422	Variation lime. 40-60, hard 30-50, soft 5-10.
135b	Lots 22-24, con. iv, and lot i, con. v, Marlborough.	62	31	7	32	66	2	1,148	142	1,290	Very little variation in this area.
136	Lots 22, 23, 24, con. iv	62	26	12	52	41	7	263	27	290	
137	Lots 24, 25, con. iii, iv.	74	19	7				117		117	
138	Lot 23, con. iii.	66	24	10				152		152	
139a	Lots 21-24, con. iii.	72	20	8	58	42		401	33	434	Stone used on road between con. iii and iv.
139b	Lot 21, con. iii.	27	59	14	89	11		58	18	76	
140	Lots 21, 22, con. iii.	84	10	6	75	25	0	145	12	157	This area is on a boulder hill of rounded lime. boulders.
141	Lots 23-26, con. ii, iii.	93	5	2	93	7		1,825	85	1,910	
142	Lots 21, 22, con. ii.	96	4	0	95	5	0	771	62	833	Flat slabs of sil. lime.
143	Lots 21, 22, con. i.	97	3	0	100	0	0	380	29	409	
144a	Lots 23-26, con. i, ii.	91	7	2	93	6	1	840	116	956	
144b		95	3	2				141	21	162	
145	Lot 28, Rideau front, near river road.	95	5	0				53	18	71	
146a	Lot 1, con. iv, Marlborough.	56	29	15				184	239	423	Marlborough tp.
146b	Lots 25-28, con. iii, iv, North	68	24	8	32	62	6	4,486	104	4,590	In western half of con. iv in this
147	Gower.										area the average is 56L, 54H, 10S; in eastern portion 80L, 14H, 6S; in the western part of the area there is about 2,450 cu. yds.
148	Lots 29-32, con. iv.	78	17	5	56	44	0	1,196	34	1,230	Very little variation in composition.
149	Lot 31, con. iii.	98	2	0				93	0	93	
150	Lots 26, 27, con. ii.	92	5	3				939	386	1,325	
151	Lot 29, con. iii.	85	5	10				176	155	331	
152											
153	Lots 32-34, con. ii.	97	2	1				1,189	695	1,884	Limestone rather silty and soft with vugs of calcite; 30 yds. of lime. on gravel hill to west.
154	Lot 32, Rideau front.	100			100	0	0	167	48	215	Boulder hills with many lime. boulders half buried; estimate on loose surface blocks only.
155	Lots 37, 39, con. iv.	92	7	1	92	7	1	269	130	399	Boulder hill, many buried boulders, none of which included in estimate; lime. silty and sil.
156a	Lot 26, con. iv.	92	7	1	92	7	1	108	23	131	Boulder hill.
156b	Lots 34, 35, con. iii, iv.	72	23	5	60	40	0	736	5	741	Note difference in adjacent area No. 156a. Boulder hills largely of
157	Lots 34, 35, con. ii.										limestone.
								89,104	18,704	107,808	

Table IV.—Character of Deposits of Field Stone—Continued.

MARLBOROUGH TOWNSHIP.

Map No.	Location	Field estimate of composition. Average of whole deposit. Material under 2 ft.—per cent of			Material over 2 ft.—per cent of			Cu. yds. of stone, diameter			Remarks.
		Limestone	Hard	Soft	Limestone	Hard	Soft	Under 2 ft.	Over 2 ft.	Total	
158 159	Lots 1, 2, con. x.	21	11	68	56	44	0	816	83	899	
160a	Lots 2, 5, con. viii, ix, x, west forced road.	76	13	11	25	75	0	7,318	110	7,428	
160b	Lot 1, con. ix, east forced road.	72	11	17	0	100	0	1,947	3	1,950	
161	Lots 5, 6, con. viii, ix.	50	30	20	4	96	0	1,402	72	1,474	
162	Lots 1, 2, 3, con. vii, viii, along forced road.	10	17	73	10	90	0	1,744	81	1,825	
163 164	Lots 8-11, con. vi, vii.	82	11	7	71	29	0	1,049	49	1,098	In No. 164, lots 8-10, con. vi, composition 45-90 lime., 15-45 hard, 5-10 soft; lot 11, con. vi, 20-45 lime., 40-70 hard, 10-15 soft; lots 9-11, con. vii, 50-80 lime., 15-35 hard, 5-10 soft.
165	Lot 8, con. vii.	35	45	20				264		264	
166	Lots 6, 7, con. vii.	37	48	15	0	100	0	673	4	677	Three patches of nearly same composition with an aggregate of over 200 cu. yds. of stone lie within one mile to the north.
167	Lots 5, 6, con. v, vi.	31	47	22	10	90	0	876	58	934	
168	Lots 1-3, con. v, vi.	39	58	3	56	35	9	1,126	109	1,235	Variation lime. 40-65, hard 25-55, soft 5-10.
169 170	Lots 9-13, con. v, vi.	82	12	6	9	91	0	1,535	11	1,546	Variation lime. 70-95, hard 5-20, soft 5-10; dolomite bluish grey and hard in eastern fences.
171a	Lots 5-9, con. v, vi.	74	19	7	30	70	0	2,249	89	2,338	Variation lime. 55-85, hard 10-45, soft 5-15.
171b	Lots 7-10, con. iii, iv, both sides of forced road.	77	18	5	64	36	0	8,763	470	9,233	Sil. lime. and dol. boulders, lime. weathers to a porous surface.
172	Lots 5, 6, con. iv.	83	15	2	25	75	0	170	97	267	Lime. predominates vuggy and sil. hard varies from 0-35 per cent; the estimate includes that part of 171b which lies in lot 6 n.w. corner con.
173a	Lots 2, 3, 4, con. iii, iv.	87	10	3	87	10	3	4,325	803	5,128	No great variation.
173b	Lot 3, con. v.	82	11	7	71	29	0	455	87	542	

174 part of 171b	Lots 12, 13, con. iii, iv.	71	23	6	71	29	0	846	21	867	Variation 65-80 lime., 15-35 hard, 5-10 soft; one field south of forced road 64, hard, 25 lime., 11 soft.
175 176	Lots 15-18, con. i, ii.	85	13	2	75	25	0	863	195	1,058	Sil. rather soft lime.
177	Lots 13, 14, con. ii, iii.	84	12	4	91	9	0	1,191	11	1,202	Lime. in thin flat slabs badly weathered.
178a	Lots 10, 11, con. iii.	79	16	5	0	100	0	338	2	340	
178b	Lots 10-13, con. ii.	91	5	4	33	67	0	512	177	689	Variation lime. 80-100, hard and soft 0-10 respectively.
179a	Lot 7, con. iii,	75	20	5	40	60	0	361	5	366	
179b 179c	Lots 6, 7, con. ii, iii.	91	6	3	66	34	0	2,571	255	2,826	Variation lime. 80-100, hard 5-20, soft 0-5; half of the yardage is in a stock pile which is to be used on roads.
180	Lots 4, 5, con. iii.	69	24	7	30	70	0	429	69	498	On gravel hill to n.w. the boulders are nearly all lime.
181	Lots 4, 5, con. ii, iii.	77	15	8	50	50	0	686	240	926	Lime. is highest in No. 182.
182											
183	Lot 3, con. ii, iii.	72	21	7				118	53	171	Lime. sil. and silty; higher percentage of hard in the boulders.
184	Lot 2, con. ii.	97	3	0	97	3	0	215	72	287	Boulder hill; a large quantity of unpiled boulders have not been included in the estimate.
185	Lots 34, 35, con. iv, North Gower, and lot 1, con. ii, Marlborough.	84	14	2	92	8	0	391	65	456	
186a	Lots 16, 17, 18, con. i.	93	5	2	27	60	13	599	73	672	
186b	Lots 14, 15, con. i.	100±			100±			589	62	651	Very soft sil. lime.
187	Lots 12, 13, con. i.	84	13	3	25	60	15	223	45	268	Directly north in second con. are 13 yds. of same composition.
188	Lot 11, con. i, ii.	90	8	2				140	8	148	Lime. very weathered and vuggy; directly east in lot 8 there is 60 yds. carrying about 40% hard, 25 soft, 35 lime.
189	Lots 11-13, con. i.	89	8	3	53	43	4	333	117	450	
190	Lot 7, con. i.	93	7	0				35	14	49	
191	Lots 4, 5, con. i.	96	3	1	70	30	0	113	113	226	Material hard to haul; near gravel the boulders are all lime.
192	Lots 2, 3, con. i, ii.	97	3	0	97	3	0	79	5	84	
								45,344	3,728	49,072	

OSGOODE TOWNSHIP.

193a	Lot 30, con. i, and BF., Gloucester.	52	23	25				424	57	481	
193b	Lots 1-3, con. i, Osgoode	72	16	12				3,362	345	3,707	
194	Lots 4, 5, con. i.	80	15	5				1,146	132	1,278	Variation lime. 60-80, hard 10-25, soft 10-15.
195	Lots 5-8, con. i.	70	20	10				4,315	480	4,795	Variation as in 194.

Table IV.—Character of Deposits of Field Stone—Continued.

OSGOODE TOWNSHIP.—(Cont.)

Map No.	Location	Field estimate of composition.									Remarks.
		Average of whole deposit.						Cu. yds. of stone, diameter			
		Material under 2 ft.—per cent of			Material over 2 ft.—per cent of						
		Limestone	Hard	Soft	Limestone	Hard	Soft	Under 2 ft.	Over 2 ft.	Total	
196	Lots 1, 2, con. ii.	21	6	73				947	84	1,031	This average refers to the fences in 196.
197b		68	5	27							This average refers to northern fences in 197b.
		47	9	44							This average refers to southern fences in 197b.
		21	6	73							
197a	Lot 30, con. ii, Gloucester.	35	10	55				279	79	358	
198	Lot 4, con. ii, Osgoode.	43	19	38				235	22	257	
199	Lots 3, 4, 5, con. ii.	51	11	38				614	77	691	
200	Lot 3, con. ii.	45	10	45				282	59	341	
201	Lot 4, con. ii.	32	10	58				406	172	578	
202	Lots 3, 4, con. ii.	27	11	62				642	124	766	
203	Lots 3, 4, con. ii.	25	10	65				252	28	280	
204	West part lot 3, con. iii.	30	15	55				418	73	491	
205	Lots 1, 2, con. iii.	18	11	71				96	10	106	
206	Lots 1, 2, con. iii.	30	21	49	28	43	29	188	14	202	
207	Lots 5, 6, con. iii.	60	5	35				796	103	899	
208a	Lots 3, 4, 5, con. iii, iv.	47	7	46				1,764	147	1,911	Western part of this area carries up to 65% lime.
208b	Lots 6, 7, con. iii, iv.	69	8	23				1,537	125	1,662	
209	Lots 3, 4, 5, con. v.	0	78	22	0	100	0	360	23	383	
210											
211	Lots 7, 8, con. i.	75	15	10				217	27	244	
212	Lots 8, 9, 10, con. i.	70	16	14				2,454	134	2,588	With this is included a small detached area in lot 9.
213	Lot 6, con. i.	50	20	30				88	22	110	
214	Lot 6, con. ii.	65	7	28				551	129	680	
215a	Lots 5, 6, con. ii.	60	10	30				255	29	284	This is that portion of 215 on the north along the road.
215b	Lots 6, 7, con. ii.	72	7	21				1,972	231	2,203	This is that portion of 215 south of the road.
216	Lot 5, con. ii.	56	4	40				544	106	650	Eastern part s.s., western more of lime.
217	Lots 6, 7, con. ii.	58	7	35				964	69	1,033	Variation 40-60 lime., 5-10 hard, 5-55% soft.
218	Lots 7, 8, 9, con. iii.	63	6	31				2,337	313	2,650	Variation marked from fence to fence.

219	Lot 7, con. iv, close to Prescott road.	6	77	17				154	8	162	
220	Lots 8, 9, 10, con. iv.	7	72	21				639	185	824	More lime. in 221 than in 220.
221											
222	Lot 10, con. i.	80	12	8				871	100	971	
223	Lots 11-14, con. i.	80	12	8				5,373	630	6,003	Very little variation.
224	Lots 8, 9, con. ii, west of Canadian Pacific track.	75	5	20				87	4	91	
225a	Lots 8-11 and north fences of 12, con. ii.	69	5	26				6,020	680	6,700	Variation lime. 60 to 80%, hard 5 to 10, soft 15 to 35.
225b	Lots 13-16, and all but north fences of 12.	76	5	19	78	4	18	2,950	300	3,250	
225c	Lots 7-12, con. iii.	83	5	12				6,724	288	7,012	Very little variation, includes a few fences at the northern extreme of No. 226.
226	Lots 12-15, con. iii.	77	7	16				979	101	1,080	
227	Lot 12, con. iii.	80	6	14	88	0	12	325	17	342	
228	Lot 15, con. iii.	44	5	51				194	21	215	
229	Lots 11-15, con. iv, v.	25	54	21				1,272	214	1,486	A good deal of variation from fence to fence, a patch of 60 yards in lot 15, con. iii, is of about same composition.
230	Lots 15, 16, con. i.	85	5	10	85	3	12	400	40	440	
231	Lots 18, 19, 20, con. i.	76	8	16	72	8	20	688	51	739	Lime. in flat slabs, silty in composition.
232	Lots 16, 17, con. ii.	78	3	19	75	5	20	471	44	515	Lime. of same character as in No. 231.
233	Lots 18, 19, 20, con. ii.	73	8	19	63	10	27	385	30	415	
234a	Lots 10-11, con. ii, and north fences of lot 12.	67	6	27				2,201	208	2,409	Near road percentages are 75 lime., 10 hard, 15 soft.
234b	Lots 13-16 and all but north fences lot 12, con. ii.	70	6	24	73	3	24	2,953	301	3,254	
235	Lots 20, 21, con. i.	69	6	25	73	7	20	94	15	109	
236	Lots 21, 22, con. i.	82	13	5	79	16	5	209	19	228	15 cu. yds. in lot 22 about ¼ mile to the east, 236 is made up of 2 separate patches.
237	Lots 23-25, west of con. i. 1 mile east of Kars.	87	8	5	86	11	3	311	66	377	55 cu. yds. ¼ mile to south.
238	Lots 26-28, con. i.	87	7	6	74	22	4	317	46	363	¼ mile east in lot 25, con. i, there is about 70 cu. yds. about ¾ lime.
239	Lots 22-24, con. ii.	71	20	9	83	11	6	586	35	621	70 cu. yds. in lot 23 about ¼ mile to west.
240a	West Prescott road north of West Osgoode, con. ii, iii.	23	43	34	12	65	23	4,534	853	5,387	In con. iii, lots 27-28, the stone averaged 38% lime. 26% hard, 36% soft; to the north and west of this section 11% lime., 57% hard, 32% soft.
240b	Lots 27-31, con. ii.	13	69	18				1,125	792	917	In lot 30 on the s.w. edge is a patch that is all lime. near the road, the percentage of hard is high in the south but the percentage of soft increases to 30 in the neighbourhood of West Osgoode.

Table IV.—Character of Deposits of Field Stone—Continued.

OSGOODE TOWNSHIP.—(Cont.)

Map No.	Location	Field estimate of composition. Average of whole deposit. Material under 2 ft.— per cent of			Material over 2 ft.— per cent of			Cu. yds. of stone, diameter			Remarks.
		Limestone	Hard	Soft	Limestone	Hard	Soft	Under 2 ft.	Over 2 ft.	Total	
241	West Prescott road, lots 32 to 37, con. ii, lots 33-37, con. i.	44	28	28				1,894	1,005	2,899	
242	Lot 38, con. i.	55	37	8				67	29	96	
243	Lots 38, 39, con. ii.	34	40	26				883	589	1,472	
244	Lots 34, 35, west con. i on river.	100	0	0				67	82	149	This is a boulder hill, estimate includes piled material only, whole hill covered with half buried blocks of silty lime.; the same remarks apply to No. 245.
245	In n.e. corner of South Gower.	100	0	0				55	35	90	
246	Lots 39, 40, con. i and West Osgoode.	90	?	?				371	195	566	The lime. is silty.
247a	West Prescott road, lots 40-42, con. ii, Osgoode.	20	40	40				1,000	155	1,155	
247b	Lot 6, con. xii, Mountain.	2	66	32				312	748	1,060	
								71,956	11,100	83,056	

OXFORD TOWNSHIP.

248	Lots 18-20, con. ii, iii.	78	16	6	4	96	0	5,259	252	5,511	
249	Lot 21, con. ii.	85	10	5	0	100	0	160	17	177	
250	Lot 21, con. ii.	88	10	2	70	30	0	602	50	652	
251	Lots 23, 24, con. ii.	91	7	2	81	16	3	2,355	164	2,519	
252	Lot 21, con. iii.	80	15	5	7	93	0	1,134	28	1,162	
253	Lot 24, con. iii, n.e. corner.	85	10	5	0	100	0	217	10	227	
254	Lot 24, con. iii.	81	12	7	70	30	0	704	82	786	
255	Lots 25, 26, con. iii.	90	8	2	57	39	4	179	54	233	48 cu. yds. lie just to the north in lot 26.
256	Lots 16, 17, con. ii, iii.	65	25	10	0	100	0	1,346	15	1,361	Including fences north of the gravel deposit.
257	Lots 19-23, con. iii, and lots 20, 21, con. iv.	82	12	6	49	49	2	4,483	341	4,824	

258	Lots 24-29, con. iii, iv, v.	89	9	2	87	12	1	4,619	5,893	10,512	
259	Lots 29, 30, con. iv, v.	81	15	4	66	34	0	433	67	500	50 cu. yds. of same composition about 300 yds. to north, 30 cu. yds. to south near railway.
260a	Lots 28-30, con. v.	82	14	4	75	22	3	1,473	181	1,654	On gravel lime. small and angular, elsewhere in flat slabs.
260b	Lot 30, con. vi.	81	12	7	52	43	5	216	21	237	
261	Lot 16, con. iii.	75	20	5	0	100	0	321	10	331	
262	Lots 16-18, con. iv.	80	15	5	17	80	3	2,861	425	3,286	
263	Lots 18-20, con. iv and along river bank.	80	15	5	44	56	0	791	57	848	
264	Lot 16, con. v.	80	10	10	75	25	0	337	87	424	
265	Lot 16, con. v.	89	6	5	63	31	6	149	94	243	
266	Lot 17, con. v, vi.	90	5	5	50	50	0	157	59	216	
267	Lot 18, con. v.	88	8	4	40	60	0	763	197	960	
268	Lots 20, 21, con. v.	97	3	0	50	50	0	863	155	1,018	
269	Lot 18, con. vi.	79	15	6	0	100	0	99	95	194	
270	Lots 19, 20, con. vi.	90	5	5	100			684	180	864	
271	Lots 20, 21, con. v, vi.	87	9	4	51	49	0	1,172	356	1,528	The material in lot 21, con. vi, is all lime.
272	Lots 19, 20, con. vi.	85	11	4	30	53	17	197	119	316	Hard to draw out.
273	Lot 21, con. vi.	93	4	3	80	20	0	121	57	178	
274	Lots 22, 23, con. v, vi.	92	4	4	75	25	0	1,013	280	1,293	Sil. lime. and dol.
275	Lot 23, con. v.	89	10	1				172	7	179	
276	Lots 23-25, con. v.	92	5	3	95	5	0	1,437	214	1,651	
277a	Lots 22-24, con. vi, west of railway.	93	5	2				321	38	359	
277b	Lots 24, 25, con. vi, east of railway.	78	13	9	40	55	5	728	213	941	
278	Lot 24, con. v, Oxford.	93	3	4				133	9	142	
279a	Lots 25-27, con. v, vi.	86	8	6	63	30	7	2,235	740	2,975	Small deposit of same type to n.w.
279b	Lots 27-29, con. v, vi.	79	14	7	40	54	6	1,665	152	1,817	Sil. lime. conglomerate with quartzite pebbles and boulders.
280a	Lots 25-27, con. vi, vii.	74	15	11	20	70	10	2,024	462	2,486	
280b	Lots 27, 28, con. vi.	71	16	13	66	28	6	582	50	632	Flat slabs of lime.
281	Lots 16, 17, con. vii.	75	18	7	30	70	0	695	246	941	There is a ridge of hard boulders in this area.
282	Lot 17, con. vii.	60	31	9	7	93	0	91	72	163	Another ridge of hard igneous boulders.
283	Lots 15-18, con. vii, viii.	68	24	8	25	75	0	3,319	1,432	4,751	H lls of boulders largely hard.
284	Lot 17, con. viii.	84	10	6	35	62	3	293	208	501	
285	Lots 19-21, con. vii.	59	30	11	5	95	0	1,845	590	2,435	Hill in middle of this area of hard Pre-Cambrian boulders.
286	Lots 22-24, con. vii.	74	15	11	43	53	4	299	62	361	
287a	Lot 18, con. ix.	33	57	10	7	93	0	688	359	1,047	
287b	Lots 19, 20, con. viii.	78	15	7	49	51	0	1,157	567	1,724	
287c	Lot 21, con. viii.	66	24	10	5	95	0	111	48	159	
287d	Lots 18, 19, con. ix.	50	36	14	16	83	1	2,269	201	2,470	
287e	Lot 20, con. ix, west railway.	76	16	8	66	28	6	1,909	75	1,984	
288a	Lots 22-24, con. viii, east of railway.	39	53	8	5	95	0	3,311	2,582	5,893	Hills of igneous boulders.

Table IV.—Character of Deposits of Field Stone—Continued.

OXFORD TOWNSHIP.—(Cont.)

Map No.	Location	Field estimate of composition. Average of whole deposit. Material under 2 ft.—per cent of			Material over 2 ft.—per cent of			Cu. yds. of stone, diameter			Remarks.
		Limestone	Hard	Soft	Limestone	Hard	Soft	Under 2 ft.	Over 2 ft.	Total	
288b	Lots 21, 22, con. ix, east railway.	43	48	9	21	68	11	11,270	3,548	14,818	On west edge about 4,000 cu. yds. carrying 90% hard, on north, middle, and east plenty of flat slabs of lime.
289	Lots 24, 25, con. viii, ix.	51	40	9	5	95	0	759	455	1,214	
290	Lots 25, 26, con. vii, viii.	37	56	7	5	95	0	135	45	180	
291	Lot 27, con. viii.	75	17	8				111	23	134	
292	Lots 26-29, con. vii.	75	19	6	25	74	1	1,649	225	1,875	Material west of road higher in hard boulders.
293	Lots 28, 29, con. vi, vii.	78	15	7	36	62	2	787	61	848	Flat slab of lime., quartzite present.
294	Lots 29, 30, con. vi, vii, Oxford and lots 11-13, con. iv, S. Gower.	71	22	7	10	89	1	996	147	1,143	There is a higher percentage of hard along southern border of this area than north of con. road.
295	Lots 28-30, con. vii, viii.	32	58	10	0	100	0	1,328	140	1,468	Near road to south over 200 cu. yds. nearly all lime.
296	Lot 30, con. viii.	85	10	5	0	100	0	216	5	221	
297	Lot 30, con. viii, and in South Gower.	20	65	15	5	95	0	244	0	244	
298	Lot 15, con. ix, Oxford.	88	7	5				275	20	295	
299	Lots 14, 15, at McReynolds corners partly in Edwardsburgh.	80	15	5	76	20	4	3,930	1,044	4,974	
300	Lot 15, con. x.	56	34	10	50	40	10	1,177	320	1,497	
301	Lot 16, con. x.	57	28	15	20	80	0	297	44	341	
302	Lots 17, 18, con. x, 19, ix.	8	80	12	7	83	10	3,575	1,381	4,956	
303	Lot 17, con. x, and lot 28, con. x, Edwardsburgh.	5	86	9	5	88	7	838	182	1,020	
304	Lot 21, con. x, and in Edwardsburgh lot 22, con. x.	33	60	7	39	53	8	756	395	1,151	A good deal of variation from fence to fence.
305 306	Lots 22-24, con. ix, x.	50	43	7	49	44	7	1,098	146	1,244	
307	Lot 24, con. ix.	83	12	5	70	25	5	576	53	629	
308	Lot 25, con. ix.	90	5	5	50	50	0	40	10	50	
309	Lot 25, con. ix.	85	10	5	66	32	2	413	47	460	
310	Lot 23, con. x	34	55	11	30	63	7	165	88	253	

311	Lots 25, 26, con. x.	81	13	6	67	28	5	1,613	343	1,956	
312	Lot 24, con. x.	85	10	5	22	73	5	1,072	318	1,390	
313	Lot 25, con. ix.	80	15	5	43	57	0	383	70	453	
314	Lot 26, con. ix.	77	18	5	75	20	5	241	109	350	
315	Lot 26, con. ix.	80	10	10	40	60	0	505	3	508	60 yds. of same character s.w. of Millar corner.
316	Lots 26, 27, con. x.	87	9	4	80	15	5	540	18	558	Lime., flat, sil.
317	Lots 27, 28, con. x.	50	40	10	13	85	2	969	124	1,093	A good deal of variation.
318	Lot 29, con. x.	59	31	10	0	100	0	247	5	252	
319	Lot 29, con. x.	15	70	15	0	100	0	39	20	59	
320a	East Millar north forced road	87	11	2	80	20	0	121	6	127	Fence at west end all lime.
320b	South forced road.	80	10	10				395		395	
321	Lots 29, 30, con. ix.	87	7	6	11	89	0	158	9	167	
322	Lots 29, 30, con. ix.	66	27	7	25	72	3	1,336	251	1,587	
								166,513	49,073	215,586	

SOUTH GOWER TOWNSHIP.

323	Lots 10-12, n.w. corner of South Gower.	90	5	5	100	0	0	126	4	130	A few cu. yds. to north and n.w.
324	Lots 8-10, con. vii.	78	12	10	90	10	0	106	10	116	18 yds. on road half mile to south.
325	Lots 3-5, con. x, Mountain.	51	27	22	0	100	0	1,528	37	1,565	40 cu. yds. ¼ mile to north; the stone in 325 resembles gravel on which it lies; composition of gravel 70 lime., 3 sh. lime., 5 hard, 22 soft. 84 cu. yds. 1 mile west on Prescott road.
326	Lots 8, 9, con. vi, South Gower.	73	23	4	45	53	2	484	19	503	There is more hard stone in the northern part of the area.
327 and 328	Lots 10-13, con. vi.	75	18	7	5	95	0	620	107	727	
329	Lot 13, con. v.	76	13	11	20	80	0	398	45	443	
330	Lots 11-13, con. v.	79	11	10	15	85	0	738	44	782	
331	Lot 12 on Prescott road.	69	24	7	46	54	0	256	13	269	
332	Lot 10, con. iv.	82	13	5	27	73	0	38	11	49	30 cu. yds. ¼ mile to n.e.
333a	Lots 1, 2, con. v, north and west of small creek.	42	47	11	8	89	3	757	145	902	
333b	Lots 1-4, con. iv, v, south of road and small creek.	55	39	6	14	80	6	1,677	515	2,192	On gravel ridges the fences run 70 lime., 25 hard, 5 soft.
334	Lots 4-6, con. iii, iv.	37	52	11	23	71	6	1,038	364	1,402	
335	Lots 11, 12, con. iv.	14	75	11	0	100	0	173	138	311	
336	Lots 11, 12, con. iii.	7	86	7	0	100	0	139	14	153	
337	Lots 11, 12, con. iii.	4	89	7	2	96	2	2,823	329	3,152	
338	Lots 10, 11, con. iii.	19	74	7	0	100	0	278	93	371	
339	Lot 9, con. iii.	6	90	4	1	97	2	71	141	212	
340	Lot 7, con. iii.	55	39	6	0	100	0	85	6	91	
341	Lots 11, 12, con. ii, partly in Oxford.	77	17	6	35	60	5	1,771	120	1,891	

Table IV.—Character of Deposits of Field Stone—Continued.

SOUTH GOWER TOWNSHIP.—(Cont.)

Map No.	Location	Field estimate of composition. Average of whole deposit. Material under 2 ft.—per cent of			Material over 2 ft.—per cent of			Cu. yds. of stone, diameter			Remarks.
		Limestone	Hard	Soft	Limestone	Hard	Soft	Under 2 ft.	Over 2 ft.	Total	
342	Lot 8, con. ii.	2	82	16	0	100	0	53	19	72	
343	Lots 5, 6, con. iii.	40	52	8	0	100	0	120	66	186	
344a	Lots 8-11, con. ii, north of road.	77	20	3	71	26	3	1,367	213	1,580	
344b	Lots 8-11, con. ii, south of forced road.	47	45	8	3	95	2	1,252	221	1,473	
344c	Lot 11, con. i, partly in Oxford.	14	76	10	4	90	6	2,195	607	2,802	In the part lying in Oxford material under 2 ft. averages 5% lime., 85% hard, 10% soft.
345a	Lots 7-9, con. ii, north of forced road.	16	74	10	1	98	1	1,537	185	1,722	
345b	Lots 7, 8, con. ii.	15	77	8	2	96	2	1,249	287	1,536	
345c	Lots 4-6, con. ii, iii.	9	83	8	1	98	1	1,079	601	1,680	
345d	Lot 9, con. i.	9	81	10	4	88	8	429	232	661	
346	Lot 7, con. ii.	4	87	9	100	0	0	106	10	116	
347	Lots 1-4, con. ii.	9	82	9	3	97	0	466	216	682	
348	Lot 6, con. i.	5	90	5	3	95	2	48	87	135	
349	Lot 4, con. ii.	4	92	4	0	100	0	89	35	124	
350	Lot 2, con. ii.	44	44	12	0	100	0	72	20	92	
351	Lot i, con. ii.	44	44	12	0	100	0	152	33	185	
								23,320	4,987	28,307	

EDWARDSBURGH TOWNSHIP.

352	Lot 36, con. x.	80	10	10	80	10	10	158	15	173	
353	Along township line in con. x.	80	15	5		60	40	688	5	693	
354	Lot 36, con. ix.	80	15	5				167	0	167	
355	Con. ix, partly in Augusta.	80	15	5	74	22	4	1,824	98	1,922	
356	Lots 28-30, con. ix.	68	23	9	72	25	3	1,019	381	1,400	
357	Lot 29, con. viii, ix.	90	5	5	90	10	0	388	66	454	
358	Lots 24-27, con. viii, ix.	86	8	6	90	9	1	4,649	382	5,031	
359	Lots 25, 26, partly in Oxford.	43	41	16	34	52	14	1,239	241	1,480	

360	Lots 22, 23, con. ix, x.	7	89	4	5	95	0	1,375	222	1,597	Two fences between 360 and 363 are included in the estimate of these areas.
361	Lot 21, con. x.	30	60	10	33	57	10	389	89	478	
362	Lots 19-23, con. viii, ix.	83	11	6	80	16	4	5,652	727	6,379	
363	Lots 19, 20, con. ix.	61	34	5	7	93	0	756	28	784	
364	Lot 17, con. x.	83	14	3	50	50	0	192	26	218	
365	Lot 16, con. x.	62	32	6	12	88	0	87	40	127	A fence s.e. of the Prescott road is included in this estimate.
366	Crossing of Prescott and town-line road, con. x.	75	20	5	0	0	0	238		238	
367	Lot 15, con. ix.	85	10	5				125		125	
368	Lots 13, 14, con. ix.	83	12	5	0	100	0	1,571	50	1,621	
369	Lots 9, 10, 11, con. ix.	78	15	7	36	62	2	2,029	322	2,351	
370	Lot 11, con. ix.	75	15	10	13	87	0	80	30	110	40 cu. yds. ¼ mile to south.
371a	Lot 36, con. viii.	80	12	8	80	12	8	414	171	585	
371b	Lots 33, 34, con. viii.	85	9	6	79	13	8	3,292	748	4,040	
372a	Lots 30, 31, 32, con. viii, west of railway.	74	16	10	70	24	6	2,977	1,081	4,058	
372b	Lots 27-29, con. viii, east of railway.	48	44	8	36	60	4	30,787	809	3,887	
373	Lots 28, 29, con. vii.	65	26	9	46	47	7	643	116	759	
374	Lot 28, con. viii.	80	10	10				100		100	
375	Lots 20-23, con. viii.	77	19	4	62	34	4	9,466	1,944	11,410	
376	Lots 16-18, con. viii.	78	16	6	22	77	1	2,990	171	3,161	
377	Lots 14-17, con. viii.	76	11	13	30	50	20	3,942	574	4,516	At north end of 124, 80% lime. 10% hard, 10% soft.
378a	Lots 14, 15, con. viii.	90	5	5				602		602	
378b	Lot 13, con. viii.	86	10	4	12	88	0	170	33	203	
379	Lot 35, con. vii.	60	30	10	30	70	0	40	39	79	
380	Lots 34, 35, con. vii.	10	80	10	10	90	0	86	256	342	
381	Lot 36, con. vii.	10	85	5	0	100	0	91	419	510	The high percentage of hard due to fact that softer stone has been used in the roads. 15 yds. to west on township line.
382	Lot 32, con. vi, vii.	62	30	8	20	80	0	179	58	237	
383	Lots 29-33, con. vi, vii, west railway.	27	66	7	0	100	0	1,309	1,828	3,137	
384	Lots 32-34, con. v, vi.	5	89	6	0	100	0	359	1,208	1,567	
385	Lot 30, con. vi.	55	40	5	10	90	0	44	129	173	
386	East of railway, con. v.	46	41	13	50	44	6	54	14	68	
387	Lot 28, con. vi.	67	24	9	38	52	10	746	500	1,246	
388	Lot 27, con. vi.	80	10	10	45	45	10	104	6	110	
389	Lot 26, con. vi.	70	15	15	44	46	10	302	48	350	
390	Lots 26, 27, con. vi.	75	16	9	0	30	70	321	12	333	
391	Lots 28, 29, con. vi, vii.	81	11	8	56	35	9	3,369	1,047	4,416	
392	Lots 27, 28, con. vii.	81	11	8	39	61	0	946	18	964	
393	Lot 27, con. vii.	95	5	0				111	0	111	A large number of lime. boulders nearby.
394	Lot 26, con. vii.	48	36	16	17	83	0	159	23	182	
395	Lot 25, con. vii.	60	30	10	0	100	0	127	28	155	
396	Along Prescott road in con. vii.	56	30	14	15	78	7	1,904	1,103	3,007	

Table IV.—Character of Deposits of Field Stone—Continued.

EDWARDSBURGH TOWNSHIP.—(Cont'd.)

Map No.	Location	Field estimate of composition. Average of whole deposit. Material under 2 ft.—per cent of			Material over 2 ft.—per cent of			Cu. yds. of stone, diameter			Remarks.
		Limestone	Hard	Soft	Limestone	Hard	Soft	Under 2 ft.	Over 2 ft.	Total	
397	Lots 22, 23, con. vii.	80	10	10	64	29	7	967	246	1,213	
398	Lot 22, con. vii.	80	10	10	37	52	11	116	58	174	
399	Lot 20, con. vii.	81	9	10	39	55	6	688	31	719	
400	Lots 23, 24, con. vi.	71	24	5	2	98	0	239	56	295	
401	Lots 19-22, con. vi, vii.	77	16	7	11	87	2	1,235	185	1,420	Fences on boulder hills lime. sil. and in flat slabs.
402	Lots 20, 21, con. v, vi.	83	11	6	18	82	0	566	56	622	
403a	Lots 16-18, con. vii.	{79	14	7	14	86	0	805	104	909	Northern half of area.
		{32	57	11	0	100	0	346	98	444	Southern half of area.
403b	Lots 16-20, con. v, vi.	91	8	1	39	60	1	4,151	409	4,560	Flat slabs of sil. lime.
404	Lots 12-14, con. vii.	89	9	2	11	89	0	2,248	324	2,572	
405	Lots 15, 16, con. vi.	84	12	4	26	74	0	384	23	407	
406	Lots 14-16, con. vi.	88	9	3	38	53	9	2,876	321	3,197	Flat slabs sil. lime.
407	Lots 11-14, con. vi to viii.	91	7	2	38	62	0	2,055	263	2,318	
408	Lot 14, con. vi.	20	65	15	0	100	0	459	24	483	
409	Lots 13-17, con. v, vi.	75	18	7	18	80	2	2,750	500	3,250	Sil. and silty lime. in flat slabs.
410	Lot 13, con. vi.	81	15	4	0	100	0	136	19	155	
411	Lots 11, 12, con. vi.	8	84	8	0	100	0	476	255	731	
412	Lots 8-11, con. vi.	68	25	7	14	80	6	314	185	499	
413	Lots 10, 11, con. vi, vii.	83	11	6	5	93	2	812	231	1,043	
414	Lot 7, con. vi.	80	14	6	28	72	0	195	109	304	
415	Lot 8, con. vii.	94	6	0	100	0	0	36	55	91	
416	Lot 7, con. vii.	76	20	4	0	100	0	409	123	532	
417	Lots 9-11, con. vii.	73	22	5	20	80	0	217	48	265	
418	Lots 10, 11, con. vii.	89	6	5	0	100	0	171	8	179	
419a	Lots 7-9, con. vii, lot 9, viii.	63	31	6	0	100	0	495	168	663	North of con. road in lots 4, 6, con. viii, are two areas containing 55 and 28 yds. of stone.
419b	Lots 4-7, con. viii.	61	27	12	27	71	2	1,644	436	2,080	East of 419b in lot 3 there is about 100 yds. running high in hard.
420	Lots 33, 34, con. iv, v.	80	12	8	0	100	0	874		874	North end.
	Lots 33, 34, con. iv, v.	5	90	5	0	100	0	1,256	764	2,020	South end; 764 is total amount over 2 ft. in whole block.
421	Lots 31, 32, con. v.	7	86	7	0	100	0	479	382	861	
422	Lot 37, con. iv.	15	80	5	0	100	0	30	32	62	
423	Lot 37, con. iii.	45	45	10	0	100	0	69	40	109	
424a	Lot 34, con. iv.	12	76	12	0	100	0	165	214	379	

424b	Lots 33, 34, con. iii.	7	85	8	0	100	0	639	258	897	
425	Lot 34, con. iv.	41	52	7	0	100	0	414	8	422	
426	Lots 32, 33, con. iv.	24	64	12	0	100	0	1,112	334	1,446	A great deal of variation in composition from fence to fence.
427	Lots 29, 30, con. iv, v.	6	87	7	0	100	0	582	231	813	
428	Lot 27, 28, con. v, vi.	8	82	10	0	100	0	676	712	1,388	
429	Lot 26, 27, con. v.	5	90	5	0	100	0	603	235	838	
430	Lots 29, 30, con. v.	25	66	9	10	80	10	440	319	759	
431a	Lot 24, con. v, west of road.	72	19	9	14	80	6	897	205	1,102	
431b	Lot 23, con. v.	63	31	6	9	87	4	251	83	334	
432	Lots 19-21, con. v.	87	10	3	43	57	0	215	28	243	
433	Lots 17-18, con. v.	79	16	5	4	94	2	344	55	399	
434	Lots 19, 20, con. v.	89	6	5	35	65	0	473	55	528	56 cu. yds. to n.e.
435	Lot 18, con. v.	74	20	6	66	28	6	128	79	207	
436	Lot 21, con. iv.	65	30	5	0	100	0	27	1	28	
437	Lot 20, con. iv.	74	18	8	10	90	0	76	61	137	
438	Lot 20, con. iv, v.	58	32	10	4	96	0	251	177	428	
439	Lots 22, 23, con. iv.	78	17	5	3	85	12	296	33	329	
440	Lot 24, con. iv.	30	54	16	0	100	0	37	137	174	
441	Lots 33-35, con. ii.	9	78	13	0	98	2	2,418	469	2,887	
442	Lots 29, 30, con. ii.	49	42	9	12	88	0	1,089	57	1,146	
443	Lots 23-29, con. ii, iii.	76	18	6	11	89	0	2,990	383	3,373	
444	Lots 25-30, con. i, ii.	64	27	9	13	85	2	3,773	335	4,108	On northern end east of road there is 452 yds. average 31 L, 55 H, 14 soft.
445	Lot 27, con. i.	85	10	5	0	100	0	133	15	148	
446	Lots 25, 26, con. i.	15	62	23	0	100	0	133	16	149	
447	Lots 23, 24, con. i, ii.	63	27	10	14	83	3	1,263	184	1,447	Lime. hard and sil.
448	Lots 19, 20, con. ii.	19	61	20	17	66	17	349	18	367	
449	Lots 20, 21, con. i.	8	72	20	0	100	0	351	202	553	
450	Lot 35.	10	65	25	6	94	0	349	207	556	
451	Lot 34, con. i.	16	69	15	0	100	0	243	46	289	
452	Lots 33, 34, con. i.	49	43	8	20	75	5	852	106	958	Fences near river high in lime.
453	Lots 30, 31, 32, con. i.	29	56	15	5	95	0	654	111	765	
454	Lots 30, 31, con. i.	25	61	14	7	93	0	162	107	269	Northern half of area.
		61	26	13	30	55	15	220	11	231	Southern half of area.
455	Lots 28-30, con. i.	82	14	4	31	69	0	145	32	177	
456	Lot 23, con. i.	31	56	13	6	94	0	251	34	285	
457	Lot 23, con. i.	21	58	21	8	84	8	117	13	130	
458	Lots 21, 22, con. i.	22	57	21	4	88	8	540	95	635	
459	Lot 21, con. i.	20	65	15	0	100	0	87	11	98	
								111,794	26,335	138,129	

AUGUSTA TOWNSHIP.

460	Lot 3, con. ix.	77	18	5				45	8	53	
461	Lot 6, con. ix.	10	75	15	0	100	0	37	11	48	
462	Lots 5, 6, con. ix.	10	85	5	0	100	0	147	197	344	
463	Lots 7, 8, con. viii.	5	90	5	0	100	0	41	133	174	

Table IV.—Character of Deposits of Field Stone—Continued.

AUGUSTA TOWNSHIP.—(Cont'd.)

Map No.	Location	Field estimate of composition. Average of whole deposit. Material under 2 ft.—per cent of			Material over 2 ft.—per cent of			Cu. yds. of stone, diameter			Remarks.
		Limestone	Hard	Soft	Limestone	Hard	Soft	Under 2 ft.	Over 2 ft.	Total	
464	Lots 10-12, con. viii.	5	90	5	0	100	0	233	224	457	
465	Lot 2, con. viii.	80	15	5				429	39	468	83 cu. yds. of this is a stock pile.
466	Lots 11, 12, con. vi, vii.	24	70	6	0	100	0	469	73	542	
467	Lots 6, 7, con. vii.	33	60	7	0	100	0	345	401	746	A large amount of lime. boulders removed for use in the roads, hence high percentage of hard.
468	Lot 24, con. v.	90	4	6	25	75	0	122	19	141	
469	Lots 22, 23, con. v.	69	27	4	0	100	0	229	110	339	There is about 70 cu. yds. at the forced road to the south.
470	Lots 20, 21, con. v.	75	17	8	0	100	0	205	61	266	72 cu. yds. in a stock pile.
471	Lots 17, 18, con. v.	50	40	10	0	100	0	91	15	106	
472	Lot 16, con. v.	45	55	0	0	100	0	69	43	112	
473	Lot 12, con. v, vi.	13	80	7	0	100	0	165	48	213	
474	Lot 10, con. v.	55	35	10	0	100	0	161	34	195	84 in stock pile to be used on roads.
475a	Lots 6, 7, con. v, vi.	70	22	8	15	85	0	311	359	670	
475b	Lots 4, 5, con. vi, vii.	61	32	7	25	75	0	135	109	244	
476	Lot 5, con. vi.	25	65	10	10	90	0	27	112	139	
477	Lot 5, con. v.	31	53	16	0	100	0	30	97	127	
478	Lot 23, con. iv.	100	0	0	20	80	0	142	15	157	About 45 yds. in lot 24, north end con. iii; 142 yds. in a stock pile.
479	Lots 23, 24, con. iii.	94	4	2	40	60	0	167	8	175	Lime. soft weathered; about 45 yds. in lot 24, north end con. iii.
480a	Lots 17, 18, con. iii.	62	11	27				383	55	438	
480b	Lots 16, 17, con. iii.	50	25	25	15	85	0	463	116	579	
480c	Lots 16-19, con. ii.	45	32	23	35	48	17	4,151	687	4,838	
481a	Lots 17, 18, con. iv.	95	5	5				215	5	220	
481b	Lots 17, 18, con. iii.	35	46	19	15	70	15	876	209	1,085	
482	Lot 15, con. iii.	5	85	10	0	100	0	105	41	146	This is a hill of hard boulders.
483	Lots 11-15, con. iii.	21	38	41	0	100	0	2,195	570	2,765	The north and east ends of this area run high in hard, a continuation of the hill of hard stone in 482.
484	Lots 13, 14, con. iii, iv.	10	80	10	0	100	0	165	61	226	The north end is a hill of hard boulders.
485	Lots 11, 12, con. iv.	25	65	10	0	100	0	275	169	444	

486	Lot 10, con. iii.	12	75	13	0	100	0	146	92	238	Hill of hard boulders.
487	Lots 8, 9, con. iii.	8	80	12	0	100	0	157	74	231	
488	Lots 6, 7, con. iii.	51	37	12	0	100	0	525	113	638	
489a	Lot 7, con. iii.	30	50	20	0	100	0	439	38	477	
489b	Lots 7, 8, 9, con. ii.	43	44	13	26	66	8	2,452	723	3,175	
490a	Lot 9, con. ii.	8	77	15	6	83	11	242	18	260	
490b	Lots 8, 9, 10, con. i.	10	75	15				492		492	
491a	Lot 8, con. ii.	100	0	0				260	0	260	On east side of area.
		5	90	5				384	0	384	On west side of area.
491b	Lots 7, 8, con. ii	40	50	10	60	40	0	100	40	140	
		100	0	0				420		420	Part of 491.
492	Lots 5, 6, con. ii.	15	70	15	0	100	0	500	100	600	There is 25 cu. yds. on road to south.
493a	Lots 3-5, con. ii.	5	90	5	0	100	0	912	179	1,091	
		75	15	10				138	0	138	Part of 493a.
493b	Lot 2, con. ii.	5	80	15	0	100	0	110	10	120	
494	Lot 5, con. ii.	80	10	10	0	100	0	120	10	130	
495	Lot 6, con. iii.	50	10	40	90	10	0	71	15	86	
496	Lots 1, 2, con. ii.	0	90	10	0	100	0	309	105	414	
497	Lot 3, con. iii.	15	75	10	0	100	0	146	28	174	Small hill of hard boulders, only those piled are calculated, 20 cu. yds. to s.w.
498	Lot 3, con. iii.	90	5	5				94		94	
499	Lot 3, con. iv.	60	30	10	20	80	0	251	199	450	
500	Lots 3, 4, con. iv.	58	37	5	0	100	0	381	230	611	Hill of hard igneous boulders.
501	Lot 5, con. iv.	15	75	10	0	100	0	83	71	154	2 fences.
502	Lot 4, con. iv.	30	60	10				129	4	133	Stock pile for use on roads.
503	Lot 24, con. ii.	10	80	10	10	80	10	40	60	100	
504	Lot 23, con. ii.	70	5	25	70	5	25	114	15	129	
505a	Lots 21, 22, con. ii.	46	30	24	40	38	22	294	55	349	
505b	Lot 22, con. i.	40	45	15				780		780	
506	Lots 22-24, con. i.	10	70	20	0	100	0	3,300	200	3,500	
507	Lots 19-23, con. i.	10	70	20	0	100	0	5,300	300	5,600	Composition of certain fences along the front road in this area and on east of road as in second line.
		50	35	15							
508	Lots 14, 15, con. i.	10	70	20				115	5	120	
509	Lot 14, con. i.	30	55	15				245	10	255	
510	Lot 12, con. i.	30	35	35				173		173	
511a	Lot 13, con. i.	65	20	15				450		450	
511b	Lot 13, con. ii.	90	5	5				276		276	Flat slabs of Beekmantown lime.
512	Lot 12, con. i.	50	40	10				170		170	
513	Lot 12, con. i.	100						190		190	
514	Lots 11, 12, con. i.	20	55	25				530		530	
515	Lot 10, con. i.	100	0	0				200		200	
516	Lot 11, con. i.	50	35	15	0	100	0	140	10	150	
517	Lot 10, con. i.	20	65	15	0	100	0	235	30	265	
518	Lot 9, con. i.	100	0	0				250		250	
519	Lots 8, 9, con. i.	25	60	15	25	60	15	620	30	650	
520	Lot 6, con. i.	45	45	10	0	100	0	90	5	95	
521	N.w. corner of Prescott village.	15	70	15	0	100	0	310	20	330	
522	Lot 5, con. i.	10	75	15	0	100	0	180	20	200	
								35,291	6,838	42,129	

Appendix C.

Table V.—Tests Made upon Gravels.

Map No.	Location.	Owners.	Impurities—clay, etc.	Composition, percentage of				Physical characters.					
				Lime-stone pebbles.	Silty lime-stone pebbles.	Hard pebbles—granite, etc.	Soft pebbles—shales, etc.	Specific gravity.	Per cent wear.	French co-efficient of wear.	Cement-ing value.	Per cent voids, materials loose.	Per cent voids, material compacted
11	Pit lot 25, con. v, Nepean, ½ mile north of Fallowfield.	Robert Wallace, Fallowfield.	Some $CaCO_3$.	68	6	3	23	2·65	3·0	13·3	82	39·2	30·5
19	Pit lot 12, con. v, Nepean, south of Jock river.	Wm. Little, Fallowfield.	Some $CaCO_3$.	20		20	60	2·69	7·4	5·4	74	28·4	20·5
21	Pit lot 13, con. iv, Nepean, south of Jock river.	Andrew Todd.	Some $CaCO_3$.	20	22	20	38	2·72	9·7	4·1	80	32·1	23·7
27	Lot 2, con. i, North Gower (unweathered part of deposit) 2 miles s.w. of Manotick.	James Tobin, Kars.	Some $CaCO_3$, plenty of clay.	25	15	10	50	2·65	8·6	4·6	80	33·6	25·8
27	Lot 2, con. i, North Gower (weathered part of deposit).	James Tobin, Kars.	Some $CaCO_3$, plenty of clay.	25	15	10	50	2·52	7·8	5·1	100	36·8	27·8
31a	Pit south of McKay lake, Rockcliffe park, Ottawa.[1]	Chas. Keefer, Rockcliffe Sand and Gravel Co.		21	22	41	16	2·66	3·6	11·1	125	27·0	19·2
37	Pit, lot 8, con. ii, Gloucester, ½ mile north of Bowesville.	Michael Nolan, Bowesville.	Some $CaCO_3$	30		15	55	2·70	7·6	5·3	113	28·4	21·4
41	Pit, lot 13, con. il, ¾ mile s.e. of Bowesville.	L. L. Lecuyer, Bowesville.	Some $CaCO_3$, clay and iron oxide.	22	43	9	22	2·71	5·1	7·8	70	29·9	22·4
42	Pit, lot 19, con. iii, Gloucester, on Bowesville road ½ mile s.w. of Gloucester station.	Road allowance	Some $CaCO_3$ and clay.	45		20	35	2·71	9·0	4·4	35	31·7	21·1

43	Pit lot 26, con. iv, Gloucester, at Johnston Corners.	Allen Johnston, R.R. 2, Billings Bridge.	Some $CaCO_3$.	20		20	60	2·70	8·2	4·9	88	32·0	24·6
50	Lot 13, con. iv, North Gower, 2½ miles n.w. of North Gower.	J. R. Beckett, R.R.3, Richmond.	Traces $CaCO_3$, some clay.		80	5	15	2·77	7·0	5·7	69	31·8	22·7
53	Lot 15, con. iii, North Gower 1½ miles north of North Gower.	W. J. Graham, North Gower.	Some $CaCO_3$ and clay.	93		1	6	2·81	2·8	14·3	43	30·5	21·3
55	Lot 17, con. iii, North Gower, 1 mile north of North Gower.	Nixon Craig.	Traces $CaCO_3$.		93	1	6	2·77	6·4	6·3	39	29·8	22·8
60	Lots 23 and 24, con. iii, North Gower, 1½ miles east of North Gower.	Robert Clark, Marlborough; and George Dolson, North Gower.						2·70	5·1	7·9	92	41	27·4
73	Lot 4, con. ix, Marlborough 1½ miles s.w. of Baxters Corners.	P. B. Bowrin, R.R. 3, Richmond.	Some $CaCO_3$		90	5	5	2·75	4·6	8·7	51	31·4	21·1
75	Lot 11, con. vii, Marlborough, 1½ miles s.w. of Malakoff church.	J. McCurdy, Malakoff	Small amount $CaCO_3$.	64	28	4	4	2·74	2·5	16	40	32·0	22·9
84	Lot 4, con. iii, Marlborough 1½ miles east Pierces Corners.	W. Moffatt, R.R.1, North Gower.	Some $CaCO_3$.	85	10	2	3	2·76	4·8	8·3	25	27·0	18·8
96	Lot 26, con. ii, Osgoode, 2 miles n.e. of Osgoode Station.	Canadian Pacific Railway Co.	Some $CaCO_3$.	26	38	14	22	2·71	4·8	8·3	114	29·2	22·8
105	Lot 30, Rideau front, Osgoode, 1½ miles s.w. of Osgoode Station, on Rideau river.	Allan Mussell, Osgoode Station.		30	11	25	35	2·72	2·6	15·4	76	30·6	22·0
120	Lot 6, con. vi, South Gower, about 3 miles east of Kemptville.	John Coleman, R.R.3, Kemptville.	Some shells, little $CaCO_3$.	65	16	9	10	2·76	7·8	5·1	65	29·7	22·2
121	Lot 18, con. ii, Oxford, 3½ miles west of Kemptville.	J. J. Dolan, R.R.5, Kemptville.		75	20	2	3	2·79	7·8	5·1	22	28·1	19·0

[1] The quality of the gravel in this deposit varies and the greater part of it is of decidedly poorer grade than this sample.

Limestone includes limestone and dolomite; silty limestone includes weathered limestones and dolomites of the Beekmantown and limestones of the Chazy formations; hard includes hard igneous rocks, gneisses, and quartzites; soft includes sandstones, shales, and much weathered pebbles; $CaCO_3$ = lime carbonate.

Table V.—Tests Made upon Gravels—Continued.

Map No.	Location.	Owners.	Impurities —clay, etc.	Composition, percentage of				Physical characters.					
				Lime-stone pebbles.	Silty lime-stone pebbles.	Hard pebbles—granite, etc.	Soft pebbles—shales, etc.	Specific gravity.	Per cent wear.	French co-efficient of wear.	Cement-ing value.	Per cent voids, materials loose.	Per cent voids, material compacted
124	Lot 25, con. ii, Oxford, ¼ mile west of Kemptville.	The Dominion Concrete Co., Kemptville.		90		2	8	2·75	3·4	11·8	45	29·5	22·8
126	Lot 24, con. iv, Oxford, 1 mile south of Kemptville.	R. J. and A. Sommerville, Kemptville.		93	6	0·5	0·5	2·81	2·4	16·7	25	28	19·7
127	Lot 27, con. iv, Oxford, 1½ miles s.e. of Kemptville.	Oxford tp.	Some $CaCO_3$.	50	25	2	23	2·72	3·8	10·5	74	28·6	22·5
131	Lot 22, con. iii, Oxford, about 2 miles s.w. of Kemptville.	N. Seymour, Kemptville.	Shells, clay, and $CaCO_3$.	93	6	0·5	0·5	2·79	2·0	20·0	50	26·5	20·0
133	Lot 21, con. iv, Oxford, on railway 2 miles west of Kemptville Junction.	Canadian Pacific Railway Co.	Some $CaCO_3$.	96	1	1	2	2·76	2·8	14·3	26	28·5	20·2
138	Lot 16, con. vii, Oxford, ½ mile n.e. of Pattersons corners.	Oxford tp.	Traces $CaCO_3$ and iron oxide.	74	15	6	5	2·74	2·6	15·4	69	23·5	19·1
141	Lot 20, con. vii, Oxford, 1½ miles n.w. of Oxford station.	Oxford tp.	Traces $CaCO_3$ and iron oxide.	55	21	9	15	2·76	4·8	8·3	48	28·0	22·2
143	Lot 21, con. ix, Oxford, ½ mile south of Oxford station.	Oxford tp.	Traces $CaCO_3$.	36	49	10	5	2·69	8·4	4·8	53	26·5	19·5
150	Lot 26, con. x, Oxford, 1 mile s.e. of Millar corners.	South part Edwardsburgh and North Oxford tps.	No impurities.	40	53	5	2	2·66	3·2	12·5	45	25·5	18·8
170	Lot 24, con. viii, Edwardsburgh, 1¼ miles north of Spencerville.	Mrs. F. Whitley R.R.3, Spencerville.	Some $CaCO_3$ and silt.	76	12	5	7	2·73	5·2	7·7	75	25·2	19·0

171	Lot 12, con. vii, Edwardsburgh, ½ mile east of Ventnor.	John Spencer, Ventnor.	Trace to abundant $CaCO_3$.	85	5	5	5	2·71	1·8	22·2	67	25·6	20·0
176	Lot 30, con. vii, Edwardsburgh, 1 mile west of Spencerville.	James Black, Spencerville.	Moderate amount $CaCO_3$.	87	6	2	5	2·72	7·8	5·1	83	25·5	19·5
179	Lot 33, con. vi, Edwardsburgh, 2½ miles s.w. of Spencerville.	Henry Keeler, R.R. 2, Spencerville.	Traces $CaCO_3$.	51	34	10	5	2·70	5·0	8·0	52	26·0	19·1
181	Lot 24, con. v, Edwardsburgh, 1½ miles s.e. of Spencerville.	Dr. P. A. McIntosh, Spencerville.	Traces of clay, $CaCO_3$ iron oxide.	82	9	3	6	2·79	3·4	11·8	35	27·5	19·8
189	Lot 3, con. vi, Augusta, ½ mile east of Roebuck.	Miss Mary Johnson, Roebuck.	Traces $CaCO_3$.	67	23	5	3	2·74	5·5	7·3	43	30·0	22·0
203	Lot 8, con. iii, Augusta, ½ mile n.e. of Maynard.	Wm. Robinson, R.R. 2, Prescott.	Traces $CaCO_3$ iron oxide.	63	18	12	7	2·79	5·8	6·9	71	28·9	23·8
204	Lot 9, con. ii, Augusta, ½ mile east of Maynard.	G. W. Robinson R.R. 2, Prescott.	Plenty of clay, some $CaCO_3$.	77	5	10	8	2·79	8·4	4·8	86	28·8	22·8

Table Va.—Mechanical Analyses of Gravels.

Map No.	Percentages retained on screens and sieves																	Passing 200 mesh	Total
	3 in.	2½ in.	2 in.	1½ in.	1¼ in.	1 in.	¾ in.	½ in.	¼ in.	10 mesh	20 mesh	30 mesh	40 mesh	50 mesh	80 mesh	100 mesh	200 mesh		
11	0	0	0	0·5	5·7	7·0	10·4	19·3	32	8·3	4·2	2·7	2·4	1·4	2·6	0·7	0·9	1·7	99·8
19	0	6·1	8·2	10·4	4·7	11·8	7·4	6·2	8·2	6·9	6·7	9·9	6·5	2·5	2·3	0·2	0·7	1·0	99·7
21	0	7·3	10·7	12·8	7·4	4·7	5·1	5·5	8·2	10·7	9·9	6·1	3·1	1·6	2·5	0·5	2·0	1·6	99·7
27 (Unweathered)	0	0	12·6	10·2	5·5	4·0	3·4	5·3	9·7	13·0	11·2	11·4	6·6	2·8	2·4	0·3	0·9	0·6	99·9
27 (Weathered)	0	0	0	11·0	2·9	6·7	4·3	5·5	10·4	20·0	17·2	10·6	4·2	1·5	2·3	0·1	1·2	2·0	99·9
31a	0	0	10·3	13·9	5·5	4·4	6·6	8·3	12·1	9·8	9·4	9·4	4·4	2·0	1·9	0·4	0·7	0·6	99·7
37	0	6·4	7·7	10·6	6·1	6·1	4·7	5·5	7·9	9·7	6·5	6·7	9·3	5·3	4·4	0·5	1·2	1·2	99·8
42	0	0	11·9	11·0	6·6	10·1	8·4	10·6	10·4	11·5	8·6	3·5	1·5	0·4	1·3	0·4	1·5	2·0	99·7
43	0	18·4	8·3	6·1	8·8	4·0	5·0	4·3	6·4	11·8	13·5	5·6	2·6	1·1	1·4	0·2	0·8	1·5	99·8
50	0	10·6	11·3	7·8	4·5	4·5	6·8	7·3	10·9	15·7	7·2	1·9	0·8	0·4	0·8	0·4	6·7	2·1	99·7
53	3·9	3·9	4·4	11·0	9·7	10·3	7·4	6·5	6·5	13·8	10·4	3·7	1·3	1·1	2·1	0·2	1·3	2·2	99·7
55	3·5	11·1	7·7	8·9	10·4	5·3	4·3	2·6	4·8	10·3	16·5	6·2	1·5	0·5	0·8	0·1	1·8	3·5	99·8
60	0	0	5·4	8·7	11·8	9·7	9·4	12·2	7·0	5·8	10·8	5·3	1·5	0·6	1·5	0·6	3·3	6·4	100·0
71	0	0	1·8	6·5	5·3	7·2	7·2	7·3	9·9	15·9	15·1	7·4	3·5	2·1	3·5	4·0	1·2	1·8	99·7
72	0	3·7	11·3	19·3	9·1	8·0	7·2	5·4	9·8	9·4	6·1	4·0	1·9	0·6	0·6	0·1	1·3	1·8	99·6
75	0	5·1	4·4	6·5	6·3	13·7	12·3	13·2	13·6	10·7	5·2	2·0	1·4	0·8	1·3	0·3	1·2	1·7	99·7
84	0	3·2	7·0	7·9	5·1	4·9	8·6	11·3	11·3	9·9	7·4	6·8	4·3	2·3	5·6	0·7	1·6	1·8	99·7
96	0	19·4	11·5	8·8	5·9	4·2	4·5	3·5	5·7	4·6	6·0	10·7	8·2	3·2	2·4	0·2	0·5	0·6	99·9
105	0	0	0	4·5	4·1	6·1	9·4	17·6	23·8	18·5	4·5	2·4	2·1	1·6	2·7	0·4	1·1	1·1	99·9
120	0	0	3·6	5·3	3·6	5·8	4·9	9·2	19·9	18·8	3·8	1·6	3·6	8·0	8·2	0·5	1·2	1·6	99·6
121	0	10·5	6·1	2·0	6·4	7·0	4·1	5·1	10·5	17·1	7·0	2·8	2·0	1·2	2·4	0·7	9·8	5·2	99·9
124	0	0	10·0	4·3	2·6	2·6	5·2	7·0	9·8	16·4	18·9	12·2	4·3	1·3	1·9	0·4	1·1	1·6	99·6
126	0	8·5	10·0	12·0	7·8	6·9	6·9	8·2	15·3	10·0	1·7	0·9	0·8	0·6	1·7	0·7	4·5	3·5	100·0
127	0	6·8	12·8	15·5	3·3	8·2	5·0	6·6	10·9	10·4	6·6	3·6	2·2	1·1	1·3	0·4	2·4	2·9	100·0
131	0	14·9	12·2	8·8	4·8	3·4	6·4	5·3	7·0	8·0	8·6	11·5	2·8	1·1	1·1	0·3	1·5	2·2	99·9
133	0	0	0	1·5	1·4	2·8	13·2	18·2	31·8	14·5	0·2	0·3	1·1	2·4	6·5	1·0	3·3	1·4	99·6
138	0	5·4	16·1	13·4	5·5	7·2	6·0	5·3	5·1	5·0	3·6	6·9	6·7	3·6	6·3	0·9	1·9	1·0	99·9
141	0	0	10·3	21·1	6·8	6·4	5·7	7·9	9·5	9·2	6·8	3·7	2·9	2·2	2·8	0·9	1·1	2·6	99·9
143	0	12·6	10·0	9·3	5·7	3·6	4·9	5·7	8·4	10·0	7·7	5·5	4·4	3·3	3·3	1·0	1·7	2·8	99·9
150	0	5·2	6·9	7·0	7·9	8·0	7·3	8·0	10·5	10·3	10·4	6·7	4·3	2·6	2·3	0·7	0·7	1·1	99·9
170	0	10·5	12·0	9·2	3·0	5·7	4·8	8·5	11·6	12·5	7·2	4·0	2·4	1·1	1·5	0·7	3·3	2·0	100·0
171	0	0	0	2·8	5·2	4·3	6·3	9·4	17·6	27·4	9·8	4·4	4·4	3·1	2·0	0·2	1·0	2·0	99·9
176	0	14·3	9·7	8·8	5·1	5·7	6·3	6·9	10·7	10·7	5·7	3·9	4·2	2·8	2·8	0·4	1·0	1·0	100·0
179	0	14·5	5·9	9·4	6·4	8·0	5·4	7·8	14·9	8·4	2·0	2·8	3·8	2·8	4·0	0·6	1·7	1·6	100·0
181	0	5·1	7·5	5·9	3·7	5·9	6·4	10·5	17·2	14·0	6·0	3·1	3·1	2·7	4·2	0·9	1·8	1·8	99·8
189	0	6·8	3·6	8·6	2·7	0·0	1·6	2·0	12·0	36·2	6·8	3·2	3·0	2·7	4·5	1·4	2·3	2·5	99·9
203	0	0	0	4·9	4·2	7·5	6·2	10·4	16·6	16·9	6·7	5·8	8·9	5·6	3·8	0·2	1·1	1·1	99·9
204	0	3·8	3·6	5·4	3·8	7·4	7·1	10·2	15·1	15·4	9·4	6·7	4·5	2·0	2·2	0·4	1·4	1·4	99·8

Explanation Table VI.

Location. The numbers in the table refer in general to pits, but where there are no excavations they refer to the whole deposit as mapped. Certain deposits mapped from surface indications only have not been numbered.

The location of the gravel pits or deposits is given by map number only in this table. The location by lot and concession is to be found after the corresponding map numbers in Table VII.

Sizes. Field estimates of the sizes, that is the relative amounts of boulders, gravel, and sand present, were made in the excavations. It must be remembered that they do not represent the average for the whole deposit.

Composition. Estimates of the impurities present and of the pebble composition were made on the unweathered positions of the deposits except where otherwise specified. The symbols $CaCO_3$ and Fe_2O_3 are used for lime carbonate and iron oxide respectively.

The composition of any one deposit is more apt to be uniform than the relative amounts of sand and gravel present, but the composition also varies in certain deposits, as is indicated in the tables. Where pits exist at regular intervals along a gravel bar an average of the pebble composition of the pits should represent a fair average of the deposit. Pebbles composed of firm unweathered igneous rocks such as granites and traps, quartz pebbles and quartzites, together with tough foliated rocks such as granite gneiss, are classified as hard. Soft pebbles include sandstones, shales, and occasional examples of schists and soft gneisses. The term silty limestone was applied to partly weathered dolomites and limestones of the Beekmantown and Chazy formations, which contain varying proportions of silty and clayey matter and of lime. Fresh dolomites and limestones carrying silica or sand in a form coarser than silt have been classed with the limestones.

Table VI.—Character of the Sands and Gravels.

NEPEAN TOWNSHIP.

Map No.	Depth of weathering in ft.	Percentage of			Impurities	Shape of pebbles	Pebble composition, percentage of				Remarks.
		Boulders 3 in. and over	Gravel ¼ to 3 in.	Sand ¼ in. and under			Limestone	Silty limestone	Hard	Soft	
1	1 to 3. Layer of rusty weathered material, 17 to 24 ft. from surface.	17	45	38	Fe_2O_3 in places, traces of $CaCO_3$ coating clay in lower weathered bed.	Rounded; lowest 6 ft. contains more angular pebbles.	33	10	23	34 mostly shale	Wall of pit stands up very firmly; great lateral variation, the gravel beds running into sand toward east and material cemented into masses; distinctly bedded.
2	1	12	20	68	Some clay and $CaCO_3$.	Gravel angular to rounded, boulders are rounded.	18	2	31	49	Pit walls stand up fairly well.
3	½ to 3				Abundance of clay.	Angular.					The gravel is very dirty. Most of the boulders and pebbles are soft and shaly limestone.
4			20	80	Some Fe_2O_3.		10		50	40	The deposit is chiefly sand but contains a pocket of gravel; the sand is cross-bedded and fairly coarse and sharp.
5	1, partially to bottom.	50	50	0	Much reddish brown clay and Fe_2O_3 and a little $CaCO_3$.	Flat and angular.	15		5	80	Deposit of 1 ft. of weathered gravel over lime. Deposit contains blocks of lime. up to 4 ft. through, the gravel falls apart easily.
6	3			60	A little $CaCO_3$ and some Fe_2O_3 in the sand.	Angular.					Deposit is 3 ft. thick and lies on bedrock; the gravel is dirty; the boulders are angular slabs of sil. lime. with some s.s.; the walls stand up poorly and are talus covered; no estimate possible.
7	6	30	50	20	A little $CaCO_3$ and large amount of Fe_2O_3.	Flat, angular.	65		10	25	The gravel is very dirty; the floor of the pit is thin-bedded shaly lime. the walls are mostly talus covered; gravel stratified and pebbles of local origin.
8	5	10	75	15	Small amounts of $CaCO_3$ and considerable Fe_2O_3.	Flat, angular.	50		2	48	The gravel is of the same type as Nos. 6 and 7.

9											Same type of gravel as Nos. 6, 7, 8.
10	2	0	10	90	Probably considerable clay and Fe_2O_3.	Rounded to subangular.			72	28	The gravel faces do not stand up well.
11	1 to 3	10	73	17	Moderate amount $CaCO_3$, traces Fe_2O_3.	Round and flat.	68	6	3	23	Gravel dirty and contains a large amount of loamy earth; sample tested.
12	2½	10	59	31	Moderate amount of $CaCO_3$.	Round and angular.	55	8	5	32	Deposit is stratified; pit occurs in the same deposit as No. 11.
13		67	33	0	Large amount of $CaCO_3$.	Flat and angular.					The gravel is dirty and mixed with a fine brown loamy earth; the lime. pebbles are fairly dense and hard; boulders up to 10 in.
14	½ to 1	80	20	0	Some $CaCO_3$.	Flat and angular.	100	0	0	0	Walls of pit are talus covered; the pebbles are soft grey sil. lime. resembling the local bedrock; flat slabs up to 3 ft. across. Plate V B.
15 West bank	3½ to 5	10	85	5		Round.	50	13	8	20	Estimates of sizes are given for the west and east faces of the pit; the composition refers to the whole pit; south face stands up straight.
East bank	½	20	70	10	Moderate amount of $CaCO_3$ and Fe_2O_3.	Round.					Boulders up to 4 ft. through.
16	1½	20	50	30	Small amount of $CaCO_3$.	Round and flat.	15	17	5	63	The pit walls are talus covered; some boulders over 2 ft. are present; there are large quantities of broken shells.
17	1½	20	40	40	Some $CaCO_3$ and Fe_2O_3.	Round.	20		30	50	Boulders up to 1 ft.
18											Notes were made every 50 ft. on the north face starting from the east end, a and b are sand.
c											2 ft. 8 in. of weathered gravel.
d					Traces of Fe_2O_3 and clay.						2½ ft. of uncovered wall of which 9 in. is gravel and sand; a clay layer in this portion carries marine shells.
e		40	20	40	Much clay.		28		20	52	3½ ft. of uncovered wall, sand with thin streaks of gravel.
f											
g		45	35	20	Traces of Fe_2O_3.		16		30	54	6 ft. of uncovered wall, top 4 ft. sand, lower 2 ft. gravel; estimates refer to the lower 2 feet.
h											4 ft. of uncovered wall, sand with thin streaks of gravel;
i											4 ft of sand.
j	2	30	45	25			10		40	50	4½ ft. of gravel in 6 ft. face.
k	2½	25	50	25			29		30	41	6 ft. of gravel in 9 ft. face.

Abbreviations: Fe_2O_3 = iron oxide; $CaCO_3$ = lime carbonate; lime. = limestone; s.s. = sandstone; dol. = dolomite; sh. = shale; sil. = siliceous; cal. = calcareous.

Table VI.—Character of the Sands and Gravels—Continued.

NEPEAN TOWNSHIP.—(Cont.)

Map No.	Depth of weathering in ft.	Percentage of			Impurities	Shape of pebbles	Pebble composition, percentage of				Remarks.
		Boulders 3 in. and over	Gravel ¼ to 3 in.	Sand ¼ in. and under			Limestone	Silty limestone	Hard	Soft	
1		75	15	10	Traces clay, many shells.		24		23	53	10 ft. face marine shells abundant.
m	2	17	43	40			13		25	62	The pit is very largely sand at its east and west ends and entirely so toward the south.
19	2½	30	45	25	Some $CaCO_3$ traces Fe_2O_3.	Round and flat.	20		20	60	The deposit is uniform laterally; sample tested.
20	1 to 2	25	25	50	Small amount $CaCO_3$, traces Fe_2O_3.	Flat and angular.	5	20	15	60	Some lateral variation, gravel is stratified; boulders up to 2 ft.; deposit carries marine shells.
21	1½ to 2	50	30	20	$CaCO_3$ abundant.	Flat and angular.	20	22	20	38	Soft pebbles are sh. and s.s. 5 ft. of 9-ft. wall is talus covered; sample tested.
22	3	50	40	10	$CaCO_3$ coating on most of the pebbles.	Flat angular to rounded.	15	25	25	35	The pit has a 10-ft. wall which is almost entirely talus covered; the soft pebbles are sh. and cal. s.s.
23 West bank South bank	2½	0 0	20 15	80 85	Practically none.	Round.	20 20	20 10	28 30	32 40	South wall 22 ft. high, north wall 11 ft. high; the deposit is stratified and with some lateral variation.
24	4 to 5	50	25	25	Abundant $CaCO_3$.	Round and flat.					The pit is about 6 ft. deep and shows one layer of gravel 2 ft. to 3 ft. thick underlain by clay coloured fine sand.
25	½ to 2	75	25	0	$CaCO_3$ abundant.	Flat and angular.	15	30	0	55	The gravel is very dirty, the walls are talus covered.
26	3	12	33	55	Traces of $CaCO_3$ clay Fe_2O_3.	Rounded.	27	12	11	50	The estimated percentage of sand and boulders is probably too low; estimates made from hole in bottom of pit; this deposit extends into North Gower tp.

27	3 to 4	25	40	35	Traces of $CaCO_3$ and abundance of clay.	Subangular with many flat shaly s.s pebbles.	25	15	10	50	Quantities of shells.
28	3 to 4	10	55	35	Traces of $CaCO_3$ abundance of clay.	Subangular with many flat pebbles.	14	13	5	68	The gravel is uniform in character and is very dirty; stratified, greenish s.s. abundant.
29	1	5	15	80	Moderate amount of $CaCO_3$ with loam and organic impurities in places.	Rounded with flat pebbles.					The gravel face is 4 ft. high, 2 ft. being covered; the composition is essentially the same as in No. 28.
30		0	5	95		Flat.					Deposit is of very coarse clean sand and fine gravel in alternate layers; flat green s.s. pebbles abundant.
31		60	30	10	Some $CaCO_3$	Subangular.	75		0	25	Gravel dirty at top, quite clean near bottom of pit.

GLOUCESTER TOWNSHIP.

31a	4	20	50	20	Layer of marl and clay over the gravel; pebbles stained with Fe_2O_3 and covered with $CaCO_3$.	Round to subangular.	10		15	75	These estimates refer to the western end of the pit; in this part of the deposit in descending order, there are 3 ft. marl, 3 in. of clay, 2 ft. gravel, then sand; pebbles are mostly sh. and are rotten.
	3	25	50	25	Fe_2O_3 and $CaCO_3$.	Angular to rounded.	15		15	70	These two estimates were made in the west and east end of the main part of the pit, east of the first estimate.
		5	45	50		"	5		45	50	
							21	22	41	16	Fairly high content of boulders, sand and gravel equal in amount; this estimate was made in a small pit to the south of the main pit; the character of the gravel here is quite different from the main pit; a sample was taken from this pit.
32	4						18		30	52	This pit is mostly all in the weathered portion; the lower part appears to be about 60% sand, upper part about 50% of 8 in. boulders; considerable amount of sh. in excavated gravels; the walls stand up very poorly; Leda shells present.
33	2½ to 3	Low.		High.	Trace of $CaCO_3$.	Soft pebbles flat, hard pebbles rounded.	22		30	48	Gravel exposed on n. side to depth of 8 ft. very few boulders, 25% sand; on s. side pit runs from 15% gravel to practically all sand, 4 ft. to 6 ft. exposed; fresh face stands up very poorly.

Table VI.—Character of the Sands and Gravels—Continued.

GLOUCESTER TOWNSHIP.—(Cont.)

Map No.	Depth of weathering in ft.	Percentage of			Impurities	Shape of pebbles	Pebble composition, percentage of				Remarks.
		Boulders 3 in. and over	Gravel ¼ to 3 in.	Sand ¼ in. and under			Limestone	Silty limestone	Hard	Soft	
34	3	5	30	65	Trace of $CaCO_3$.	Rounded to subangular.	30		20	50	Variation in size from average of material to north end of pit; the gravel is said to be underlain by clean sharp sand to depth of 35 ft.
35	1	2	38	60	None.	Boulders, rounded; gravel, flat and elliptical, rounded to subangular.	10		40	50	Coarser gravel on n.e. and sand to s.e. of pit; fresh face stands up poorly; there is an 8 ft. layer of gravel underlain by sand.
36		10	20	70	$CaCO_3$, traces of Fe_2O_3.		25		15	60	Pit wall is 4 ft. high with 2 to 3 ft. covered with talus; the gravel is weathered; there is a 1-ft. layer of gravel underlain by coarse sand.
37	2	40	35	25	Moderate amount of $CaCO_3$.	Subangular.	30		15	55	Estimates are the average of two determinations on the west bank.
38	2–3			100							The sand is rather fine with subangular grains; it appears to be mostly quartz with pinkish feldspar particles and black specks giving the sand a light coloured black speckled appearance; 50 ft. of sand overlies blue marine clay; distinct and regular stratification.
39	3	30	35	35	Moderate $CaCO_3$, traces Fe_2O_3.	Rounded.	27	30	6	37	Boulders up to 3 ft. in diameter.
40	1·5–2	20	40	40	Traces of $CaCO_3$.	Rounded.	25		20	55	Estimates were made on west bank every 100 yds.; the average of these is given in the table; variation, boulders 10 to 35%, gravel 10 to 60%, sand 25 to 75%, lime. 15 to 35%, hard 10 to 35%, soft 30 to 65%; deposit is stratified; average height of wall is 5 yds., 3 yds. of it being talus covered.

41	0.5–2	20	60	20	Abundance of $CaCO_3$, clay with Fe_2O_3 in lower ft. of gravel 5 ft. from top.	Angular.	22	43	9	22	Shells occur in the gravel. Plate V A.
42	3	20	50	30	Moderate amounts of $CaCO_3$ and clay.		26	27	15	32	Gravel lies in a flat topped ridge; deposit covered by hills of wind blown sand 5 ft. to 10 ft. high; gravel is found between hills under 4 ft. of sand in s.e. limit and according to Mr. Cumming's information the gravel was found near his house at a depth of 30 ft.
43	1½	10	35	55	Moderate amount of $CaCO_3$.	Mostly rounded but with broken angular soft pebbles.	20		20	60	Gravel face stands up well; deposit is stratified; 35 ft. of the 40 ft. wall is talus covered.
44	2½	10	30	60	None.	Round	30		10	60	The walls are all talus covered; there are a few shells in the pit.
45	2	7	62	31	Abundance of $CaCO_3$ and clay and shells.	Rounded to angular.	65	10	5	20	Large quantities of broken shells; the gravel is exposed on a 3 ft. face of which 2½ ft. is weathered, below there is a very fine gravel of coarse sand; the gravel becomes better farther north in the deposit.
46	3–4	30	20	50	Some $CaCO_3$.	Rounded.	65		10	25	Pit walls talus covered.
47	1	10	60	30	Some $CaCO_3$. and clay.	Rounded and subangular.	45		5	50	The gravel face stands up well.

NORTH GOWER TOWNSHIP.

48	3	2	20	78	Small amounts of $CaCO_3$, Fe_2O_3, and clay.	Rounded to subangular.	37	10	8	45	This pit shows little or no variation but 50 ft. east there is a sand pit.
49		40	50	10	Trace of $CaCO_3$ and some clayey loam.	Rounded to subangular.	90–95		2	5–10	Pit has been abandoned.
50	1–3	20	40–50	30–40	Traces of $CaCO_3$; gravel dirty with reddish coloured clayey silt.	Angular to subangular with a few rounded pebbles.		80	5	15	There is no stratification; the gravel is very dirty and the walls of the pit are talus covered.

Table VI.—Character of the Sands and Gravels—Continued.

NORTH GOWER TOWNSHIP.—(Cont.)

Map No.	Depth of weathering in ft.	Percentage of			Impurities	Shape of pebbles	Pebble composition, percentage of				Remarks.
		Boulders 3 in. and over	Gravel ¼ to 3 in.	Sand ¼ in. and under			Limestone	Silty limestone	Hard	Soft	
51											Pit abandoned on account of boulders; it is of the same character as No. 50.
52											Pit abandoned and overgrown with grass and trees.
53	2–4	30–40	40–45	20–25	$CaCO_3$ abundant, gravel dirty.	Flat angular to rounded.	60	33	1	6	Pit walls are talus covered; gravel is rather evenly graded.
54	3	30	45	25	Some clay and traces of $CaCO_3$.	Flat and angular.	90		5	5	Pit is abandoned; deposit lies in form of a narrow ridge on west side of a drift hill; sand is exceptionally fine silt.
55		40	40	20	Abundant $CaCO_3$.	Flat with corners rounded.	60	33	1	6	Pit unused for 4 yrs., walls talus covered; the sand is a fine brownish coloured silt giving the gravel a dirty appearance and obscuring the depth of weathering; the deposit forms a narrow ridge along the western side of a drift hill.
56	2½–3	Rare.	5	95	Some Fe_2O_3.	Subangular to rounded.					The deposit is essentially sand; there is 1½ ft. layer at the top containing 30% of gravel but the gravel thins out downward; the sand is fairly clean and is cross-bedded with coarser sand; fresh walls stand up well.
57	1–3				Some Fe_2O_3.	Rounded to subangular.	85		5	10	Pit walls are talus covered; most of the gravel exposed runs 60% in boulders, some 5 ft. in size; at north end of pit the gravel grades off to coarse sand fairly free from boulders; the sand is full of shells often with the two valves still together; sand is dirty looking and shows flat stratification; 4 ft. below surface the sand is clean and becomes even more so lower down.
58	2	10	75	15	None.	Rounded to subangular.	15	12	13	60	Pit wall is 5 ft. high.

59	2½										5 ft. face exposed; below the deposit consists of clean coarse sand.
60		10–50	50–90				100				There is no pit but four test pits have been dug to depths of from 1½ to 4 feet; pebbles are all of limestone.
61					Moderate amounts of clay and $CaCO_3$	Angular.					There is no pit; deposit consists of boulders of lime. mixed with loam and clay.
62					Traces of $CaCO_3$.	Angular.					There is no pit; gravel is bouldery carrying lime. pebbles mixed with fine sand and loam.
63	2–2½	10	20	70	Traces of $CaCO_3$.	Flat to sub-angular.	15	45	10	30	The sand is very clean; gravel is underlain by fine white sand.
64	2–2½	5	15	80	$CaCO_3$ abundant.	Flat to sub-angular.	10	50	10	30	The gravel is underlain by a deposit of pure white to greyish clean sand in which there are well marked layers cemented with $CaCO_3$.
65	4	0	5	95	Traces of $CaCO_3$.						Overburden of yellow sand.
66	2–3	15	70	15	Some $CaCO_3$ and clay.	Rounded and subangular.	75	25	0	0	Pit has not been used for several years; the highest wall is 5 ft.; the walls have fallen; from outside information the gravel varies greatly being very bouldery in places and in the lower levels of the deposit.
67	2	30	70		Clay.						The pebbles are all lime.; the gravel is 2 ft. in depth and underlain by clay.
68											Of same character as 69.
69											Gravel consists of boulders of lime. mixed with clay.
70	1	25	60	15	Moderate amount of $CaCO_3$ and a little clay.	Rounded.	30	20	20	30	No pit; 3 ft. of gravel exposed in road cut.
71											No pit; deposit is largely of lime. boulders and is mixed with loam.

Table VI.—Character of the Sands and Gravels—Continued.

MARLBOROUGH TOWNSHIP.

Map No.	Depth of weathering in ft.	Percentage of			Impurities	Shape of pebbles	Pebble composition, percentage of				Remarks.
		Boulders 3 in. and over	Gravel ¼ to 3 in.	Sand ¼ in. and under			Limestone	Silty limestone	Hard	Soft	
72	2½–3	20	55	25	Some $CaCO_3$.	Flat and angular to subangular; small pebbles mostly round.	80	10	3	7	Broken shells occur in the pit; gravel is somewhat stratified; lies on western edge of a boulder clay hill.
73					Some $CaCO_3$.		0	90	5	5	Character of this pit is similar to that of 10 with possibly a somewhat smaller per cent of boulders.
74	2	20–30	40–50	20–30	$CaCO_3$ present.	Flat and angular to subangular.					Pit is dug to depth of 4 ft. broken shells present.
75	1–3	10	70	20	A little $CaCO_3$.	Flat and angular to subangular.	64	28	4	4	Walls of pit stand up well; there is more sand than the average toward the west; boulders all limestone.
76	½–2	10	65	25	Some $CaCO_3$.	Angular.	90	10	0	0	Only one face remains which stands up well.
77	1–2	5	75	20	Some $CaCO_3$.	Angular to subangular.	75	25	0	0	Estimate was made in road cut 3 ft. deep into the top of the gravel hill; no good face.
78	2	50	25	25	Abundance of $CaCO_3$.	Angular to subangular.					The pit is from 2 to 3 ft. deep; gravel pebbles and boulders are practically all sil. lime.; boulders up to 3 ft. in diameter.
79	1	60	20	20	Abundance of $CaCO_3$.	Angular to subangular.					The pit is 2 ft. deep; gravel lower down is too coarse for use; most of the pebbles are of sil. lime.
80		85	15	0							No pit; 2 to 3 ft. bouldery gravel on the surface.
81	3	60	20	20	Abundant $CaCO_3$.	Subangular.	90	10			Pit has been abandoned; lies on outcrop.

82	2+	45	50	5	Traces of $CaCO_3$ and Fe_2O_3; loam abundant.	Angular.	95+				Pit walls 2 ft. high on average; gravel lies on bedrock.
83							High				High proportion of boulders, almost all boulders and pebbles are of limestone.
84	2–2·5	5	70	35	Moderate $CaCO_3$.	Round.	95				Shells present, coarser in east bank.
85		50	30	30	Moderate $CaCO_3$, plenty of clay.		90				Boulders up to 2 ft. estimate in road cut 5 ft. deep.
86	3·5	65	35	0	Moderate $CaCO_3$.	Subangular.	85	10	5	0	Bank 5 ft. high.
87	2–2·5	75	25	0	Abundant $CaCO_3$.	Angular.	97		3	0	Bank 5 ft. high.
88		10	55	35	$CaCO_3$ lots of clay and dirt.	Subangular.					Bank 2 ft. high, material weathered to this depth; nearly all pebbles are of limestone.
89		15	60	25	Moderate $CaCO_3$ and Fe_2O_3.						Bank 2 ft. nearly all limestone.
					OSGOODE TOWNSHIP.						
90		10	55	35	Coating of $CaCO_3$.	Flat to sub-angular.	16	23	13	48	Shells occur in the gravel.
91	1										No estimates obtained; gravel is very sandy from lot 15 northward; it is better in lot 18, con. iii.
92	1	10	50	40		Rounded to subangular.	22	17	8	53	
93	½	25	40	35	Considerable clay.	Flat, angular.	40		55	5	Some shells in sand underlying the gravel.
94	½			100							4 ft. of white to brown sand exposed; to the s.w. the sand runs into boulders.
94a		60	25	15	Moderate amount of $CaCO_3$.	Angular.					95% of pebbles and boulders are sil. lime.; only weathered gravel is exposed, remainder talus covered. See also Mountain township.
95	1½	10	55	35	Traces of $CaCO_3$ and Fe_2O_3.	Flat and rounded to subangular.	39	17	13	31	Leda and Saxicava shells occur in gravel.
96	1½	15	60	25	Traces of $CaCO_3$.	Flat, subangular.	26	38	14	22	Six estimates were made in the pit which showed a variation of from 10 to 15% of lime. hard and soft; pit walls are about 10 ft. high; plenty of marine shells, well stratified.

Table VI.—Character of the Sands and Gravels—Continued.

OSGOODE TOWNSHIP.—(Cont.)

Map No.	Depth of weathering in ft.	Percentage of			Impurities	Shape of pebbles	Pebble composition, percentage of				Remarks.
		Boulders 3 in. and over	Gravel ¼ to 3 in.	Sand ¼ in. and under			Limestone	Silty limestone	Hard	Soft	
97		40	25	35	Traces of $CaCO_3$.	Round.	36		20	44	Estimates were made on 1 ft. of the bank which was not talus covered; some shells occur in the gravel.
98	2	5	40	55	Traces of $CaCO_3$ and Fe_2O_3.	Round.	45	20	15	20	Shells occur in the gravel; gravel is stratified.
99		30	40	30	Considerable amounts of $CaCO_3$ and traces of Fe_2O_3.	Round.		50	20	30	Estimate was made on south bank; north and east banks are coarse white sand; walls are mostly talus covered; pit floor is clay.
100											No pit.
101	3–4	5	50	45	Traces of $CaCO_3$ also Fe_2O_3 and clay in some layers.		27	30	13	30	Broken shells occur in the gravel; well stratified gravel said to go down 13 ft.; iron oxide and blue clay in an 8-in. bed 9 ft. from the surface.
102		40	35	25	Considerable $CaCO_3$.	Round.	36	19	16	29	The walls are talus covered; estimates were made in the weathered gravel; some shells occur.
103						Angular.					No pit, largely lime. with clay.
104											No pit, gravel very bouldery.
105		Rare	40	60	$CaCO_3$ abundant, traces of Fe_2O_3.	Rounded and subangular.	30	25	10	35	Some boulders occur in the south bank; gravel is stratified with layers dipping to the east.
106	2–3	20	45	35	Moderate amount of $CaCO_3$, traces of Fe_2O_3.	Round.	25	20	15	40	Size estimates were made on the south and west banks.
107	1½	5	15	80	Moderate amounts of $CaCO_3$.	Subangular.	19	24	17	40	Size estimates made on east and west banks.

108											Pit walls entirely covered; the gravel is over 75% sand; s.s. forms high per cent of the pebbles.
109											No pit, gravel consists of lime. boulders mixed with clay.

MOUNTAIN TOWNSHIP.

110	2+	50+			Some $CaCO_3$.	Angular.					Only weathered portion exposed in the pit to a depth of 2 ft.; shells are present.
111						Angular.		High		High	Opened in weathered part only, very bouldery gravel exposed along the road.
112						Angular to rounded.					Gravel with high per cent of fine sand pebbles of sil. dol.; road cut in weathered part only.
113						Angular to rounded.					Shallow pit in the weathered portion of the gravel; shells present; pebbles largely lime. and soft.
114	1–2	20	30	50	Abundance of $CaCO_3$.	Rounded to subangular.	29	32	2	37	4 to 5 ft. exposed gravel; size estimates made on south and north faces of pit.
115	1–2	45	30	25	Abundance of $CaCO_3$ and some loam.	Angular to subangular.	28	30	2	40	This estimate on a 3 ft. face on n.e. side of road.
116	1	5	55	40	Moderate amount $CaCO_3$.	Angular to subangular.	54	6	8	32	5½-ft. face exposed.
117	1–1½	10	55	35	Moderate amount $CaCO_3$.	Rounded to subangular.	17	50	6	27	4-ft. face exposed.
118	1–2	10	60	30	Moderate amounts $CaCO_3$ and clay.	Rounded to subangular.	20	39	7	34	4 ft. of gravel exposed.
119	1–2	10	35	55	Moderate amount $CaCO_3$.	Flat to subangular.	28	42	5	25	About 3 ft. of gravel exposed.
120	3–4	5 10	60 50	35 40	Traces of $CaCO_3$.	Rounded to subangular.	40–45 65	25–30 15	10–15 10	15–20 10	The first estimate was made in the pit, the last in camp; plenty of shells present; fine sharp and clean sand in bottom of pit; pit walls fall down.

Table VI.—Character of the Sands and Gravels—Continued.

OXFORD TOWNSHIP.

Map No.	Depth of weathering in ft.	Percentage of			Impurities	Shape of pebbles	Pebble composition, percentage of				Remarks.
		Boulders 3 in. and over	Gravel ¼ to 3 in.	Sand ¼ in. and under			Limestone	Silty limestone	Hard	Soft	
121	2–3	30	35	35	Traces of $CaCO_3$, walls stand up firmly.	Rounded to subangular.	75	20	2	3	1 yd. gravel exposed; sand is very fine silt or rock flour; lime. is really dol. and silty lime. is altered dol.; broken shells present.
122	3½	25	55	20	Moderate amount of $CaCO_3$; traces of clay.	Angular.	49	10	1	40	Exposed face of 3-3½, 2-2½ ft. gravel layer; a few broken shells occur in top layers; estimates of composition made in weathered gravel.
123	2	25	60	15	Traces of $CaCO_3$.	Rounded to subangular.	87	5	1	7	Estimates made on east face, the other faces are sand; at east end of pit 3 ft. gravel exposed in 8-ft. face. Plate VI B.
124	2	10	15	75	Traces of $CaCO_3$.	Rounded to subangular	81	9	2	8	Estimates of sizes were made at south end of pit. Pit walls are about 10 ft. high and show a gravel layer of 2-4 ft. gravel underlain by sand; sand is coarse and white; pit more sandy toward the north end.
125	1–1½			100							Sand pit; sand is weathered to a bright golden yellow for 1 ft. from surface; beneath is a fine grey sand; sand is clean and free from impurities; a very few shells occur.
126		30	40	30	Traces of $CaCO_3$.	Rounded to subangular.	93	6	rare.	rare.	Sand a fine dirty silt.
127	1–2	25	55	20	Slight amount of $CaCO_3$.	Angular.	50	25	2	23	6 ft. gravel exposed; sand is chiefly rock flour; broken shells occur.
128	4	20–30	30–40	40–50	Traces of $CaCO_3$ and Fe_2O_3.	Rounded to subangular.	50	30	5	15	Gravel is weathered practically to the full depth of the deposit; bedrock at 4 ft.

129		0	20	80	Clay.	Rounded to subangular.					Abandoned pit with faces covered; Nos. 129 to 133 are in one long narrow deposit which is well stratified and seems to have more sand on the sides than along the centre.
130	4										The walls are talus covered.
131	3–4	25	35	40	Traces of $CaCO_3$ fine silt and clay in seams.	Rounded to subangular.	95	5			Deposit is stratified; broken shells occur in the gravel, while at the south end of the ridge in the sand unbroken Leda shells are found.
132					Slight traces of $CaCO_3$; clay in thin seam.	Rounded to subangular.					Bouldery near top, sandy toward bottom; marine shells 6 ft. from surface; well stratified, sands cross-bedded and certain seams made up of very fine grains.
133	3–5				Abundance of $CaCO_3$ in places.	Rounded to subangular.	96	1	1	2	Pit extends across the gravel ridge from e. to w.; it runs into sand at both ends; an estimate in the south face gave 35% boulders, in a hole in floor there was 60% gravel, and 40% sand; gravel well stratified in places with pronounced dips.
134	3+	50	25	25	Traces of $CaCO_3$.		100				Gravel exposed in a road cut to depth of 3 ft. Weathering extends to the bottom of the cut.
135	2–3½	Rare.	20	80	Traces of $CaCO_3$.	Round.	87	10	3		Gravel layer of 1 to 2 ft. underlain by sand; the gravel layer is weathered; clay in the bottom of the pit.
136						Angular.					Gravel exposed in a road cut; gravel is very bouldery; boulders and pebbles are mostly sil. dol.
137	3+	60	25	15	Abundant $CaCO_3$.	Subangular.					No pit; greatest depth of gravel exposed 3 ft., weathered to full depth; pebbles and boulders are all sil. dol.
138	2–5	Rare.	25	75	Traces of $CaCO_3$ and Fe_2O_3.	Round.	74	15	6	5	Deposit consists of alternate layers of sand and gravel dipping to east; overburden of 1-5 ft. sand; average height of bank is 6 ft. consisting of 4 ft. sand and 2 ft. gravel.
139											Where opened in ditch pebbles are angular, are mostly of lime., and lie on rock bottom.

Table VI.—Character of the Sands and Gravels—Continued.

OXFORD TOWNSHIP.—(Cont.)

Map No.	Depth of weathering in ft.	Percentage of			Impurities	Shape of pebbles	Pebble composition, percentage of				Remarks.
		Boulders 3 in. and over	Gravel ¼ to 3 in.	Sand ¼ in. and under			Limestone	Silty limestone	Hard	Soft	
140						Subangular.					Excavation in old cellar, pebbles all lime.
141	2+	10	60	30	Traces of $CaCO_3$ and Fe_2O_3.	Subangular.	55	21	9	15	2 ft. weathered gravel exposed in road cut.
142	2+				Slight amount of $CaCO_3$.	Rounded to subangular.					Pit has been opened to depth of 2 ft. all of which is in weathered gravel; pebbles consist mostly of lime.; the whole deposit is probably very bouldery.
143	3–5	30	35	35	Traces of $CaCO_3$.	Rounded to subangular.	35	50	10	5	Very little evidence of stratification, sand clean, some unbroken Leda shells; bottom of pit is down to bedrock; lies west of a boulder clay hill.
144	3–4	20	20	60	Traces of $CaCO_3$ and Fe_2O_3.	Subangular.	60	25	10	5	Bank 2 to 6 ft. high; lime. pebbles fairly hard.
145		15	55	30		Angular.					Estimates made in cut 3½ ft. deep in old house foundation; all material seen was weathered; high percentage of limestone.
146		10	60	30		Angular to flat.	100±				All material is weathered.
147	2	30	50	20	Some $CaCO_3$, clay in north bank.	Angular to subangular.	High	High			Height of bank 7 ft., 4 ft. covered, boulders less toward bottom; bottom of south end of pit on bedrock; large proportion of lime. amongst pebbles.
148	2–3	15–20	50–60	20–25		Rounded to subangular.	70–80		10–15	10–15	Excavation is in weathered gravel; indication of stratification; gravel pebbles are mostly coarse (1¼ to 3 in.); clay and $CaCO_3$ in weathered part.
149		45	30	25		Flat with rounded edges.	80–90		2–5	5–10	Gravel is weathered to full depth; clay and $CaCO_3$ present.

150	5	25	30–35	40–45		Rounded to subangular.	40	53	5	2	Pit opened to depth of 10 ft.; indefinite indications of stratification; pebbles appear cleaner and more worn than usual, sand fairly coarse; lies 15 ft. over swamp to west and lower than boulder clay hill to s.e.
151						Flat to rounded.	High	High	Low		3 ft. of gravel has been exposed not enough to reveal the character of the gravel; boulder content is high and pebbles and boulders are mostly sil. limestone.

SOUTH GOWER TOWNSHIP.

152					Plenty of clay.						No pit; gravel is very bouldery; the pebbles and boulders are all of limestone.
153					Clay abundant.						No pit; gravel is full of clay and bouldery.
154	½	30	45	25	Moderate amounts of $CaCO_3$.	Angular.	70	22	4	4	6 ft. gravel exposed; the sand is very fine, like rock flour; shells present some unbroken.
155	1½–3	30	55	15	Traces of $CaCO_3$, considerable amounts of clay.	Hard pebbles rounded, lime. pebbles angular to subangular.	90		5	5	Some shells occur in the gravel; it lies in a deposit of boulder clay.
156		Rare	20	80	$CaCO_3$ and Fe_2O_3.	Rounded to subangular.	30	57	7	6	These estimates were made at point on s. face of the pit; nearly all of the walls are talus covered.
157		20	55	25	Very little $CaCO_3$.	Angular to subangular.	40	25	10	25	Shells present.
158											Pit walls completely talus covered; high per cent of boulders, gravel and boulders are practically all limestone.
159	1	5	60	35	Traces of $CaCO_3$, large quantities of clay.	Flat and angular.	50	20	7	23	2 to 3 ft. gravel layer exposed underlain by sand; shells occur.
160	2				Moderate amount of $CaCO_3$.	Rounded to subangular.	65	25	2	8	Percentage of boulders varies; sand content is fairly low.
161		30	50	20	Traces of $CaCO_3$.	Flat to angular and subangular.	55	20	5	20	The gravel is underlain by clean grey sand; the sand in the gravel is very fine like rock flour; broken shells occur.

See also the gravel deposits described from Mountain tp.

Table VI.—Character of the Sands and Gravels—Continued.

EDWARDSBURGH TOWNSHIP.

Map No.	Depth of weathering in ft.	Percentage of			Impurities	Shape of pebbles	Pebble composition, percentage of				Remarks.
		Boulders 3 in. and over	Gravel ¼ to 3 in.	Sand ¼ in. and under			Limestone	Silty limestone	Hard	Soft	
162	1–4			100							Sand is dark coloured, is fairly sharp and contains a moderate per cent of quartz grains; marine shells occur; walls are talus covered.
163	2–3	2–5	30–35	60–65		Rounded to subangular.	90		5	5	Sand is coarse; the finer sand is brownish weathered to full depth of 3 ft.; deposit is slightly stratified; lies west boulder clay ridge; $CaCO_3$ in weathered part.
164	3–5	30	45	25	Some $CaCO_3$, nodules of Fe_2O_3; sand contains considerable clay.	Rounded to subangular.	60–65		15–20	20–25	Pit walls are talus covered; indications point to great variation in the character of the gravel; estimates made in n. wall, west end; pit opened to depth of 12 ft.; deposit is stratified; in con. viii, lot 24, just south of road is a small deposit on which no information was obtained except that it lies on bedrock.
165											No information; road cut through deposit is talus covered.
166		40	40	20	Moderate amounts of $CaCO_3$, clay abundant.	Flat angular to rounded.	85		5	10	Pit has, not been used for some time; walls are talus covered.
167		High			Clay abundant.	Flat angular to rounded.					Pit has been opened to depth of 5 ft.; pebbles and boulders mostly sil. lime. lies west side hill of boulder clay.
168	3+	High									Gravel on west side of boulder clay hill opened up to a depth of 3 ft.
169	3	5–10	35–40	50–55	Walls stand up poorly.	Rounded to subangular.	75	15	5	5	Sand is fairly coarse and dirty looking; some indication of stratification; a few broken shells occur; $CaCO_3$ in weathered part.

170	3½–4	30	40	30	Moderate amount of $CaCO_3$.	Rounded to subangular.	70–75	15–20	2–5	5–10	Finer part of sand is silt and gives gravel a dirty appearance; south end of pit runs into sand; pit walls talus covered; some indication of stratification.
171		10	30	60	Some $CaCO_3$.	Flat, round to subangular.	85	5	5	5	Council pit on east side of road; 13-ft. deposit exposed, 1 ft. sandy overburden, 6 ft. boulders, gravel, and sand, 6 ft. gravel; estimate made in gravel bed.
		0	40	60	Traces of $CaCO_3$.	Round to subangular.	85	5	5	5	Council pit on west side of road; 15-ft. deposit exposed, 1 ft. sandy weathered loam, 3 ft. sand, gravel, and boulders, 11 ft. gravel; estimates made in gravel bed.
											Pit owned by Spencer has same character as council pits; top layer is not quite so bouldery and under gravel finer, becoming very fine at bottom.
172		40	20	40	Abundance of clay.	Angular.	75	25			Cut along road; the sand contains yellow silt and clay.
173		40	30	30		Rounded to subangular.					Pit has been abandoned, walls are talus covered.
174											Pit 2 ft. deep, boulders not very numerous.
175											Small pit in same deposit as the above walls are talus covered; material appears to be sandy.
176	2–3	15	50	35		Rounded to subangular.	87	6	2	5	Test pit opened to depth of 8 ft., some indications of stratification; sand fairly clean and coarse.
177											Indications of coarse gravel and plenty lime. pebbles on the surface.
178	2	0	60	40	Slight amounts of $CaCO_3$.	Round to subangular.	57	28	2	13	Pit is opened to depth of 5½ ft., small quantities of shells occur.
179	3–4	40	20	20	Traces of $CaCO_3$ seams of $CaCO_3$ in pit at north end of deposit.	Subangular.	50	35	10	5	Pit bank 15 ft. high, 7 ft. covered; beds dip in the same plane as the surface of the ridge; estimates made in north bank; at north end of the deposit a pit 8 ft. deep of gravel and sand contains a few marine shells.
180											No pit; gravel seen in post holes; pebbles angular, mostly sil. dol.

Table VI.—Character of the Sands and Gravels—Continued.

EDWARDSBURGH TOWNSHIP.—(Cont.)

Map No.	Depth of weathering in ft.	Percentage of			Impurities	Shape of pebbles	Pebble composition, percentage of				Remarks.
		Boulders 3 in. and over	Gravel ¼ to 3 in.	Sand ¼ in. and under			Limestone	Silty limestone	Hard	Soft	
181	4	20	55	25	Traces of $CaCO_3$ and Fe_2O_3.	Round to subangular.	82	9	3	6	Deposit is distinctly stratified, tumultuous cross bedding. 9-ft. face exposed; sand varies greatly in character; it is not sharp; lime. pebbles are for most part not hard; deposit is in contact with rock outcrop.
182											No face of gravel now exposed; gravel probably very bouldery.
183		Small				Round to subangular.					Small pit with talus covered walls; appears to be a fair per cent of hard pebbles; sand is yellowish.
184			45	55	Small amounts of clay.	Subangular.	40	20	10	30	Small cut in road; estimates made in partly weathered gravel.
185	2–3	10	50	40	Slight amount of $CaCO_3$.	Flat to subangular.	58	28	3	11	Pit face 9 ft. high 2 to 3 ft. of sandy weathered overburden, some coarse gravel and 6 ft. of good gravel; southern end of pit is much finer than northern and the gravel runs out into sand; marine shells present; lies to west of rock outcrop.
186	2	10	30	60	Small amount of $CaCO_3$ and traces of Fe_2O_3.	Round to subangular.	70	13	7	10	Gravel is decidedly stratified; 18 ft. of gravel exposed.
187											Pit walls talus covered; gravel is evidently coarse; boulders in the pit have avg. comp., lime. 70%, hard 20%, soft 10%.

188		15	55	30	Traces of $CaCO_3$.	Round to subangular.					Pit filled in with sand, gravel exposed in road cut; pebbles are mostly sil. lime., gravel looks clean and of good quality.
189	2–3	5	60	35	Traces of $CaCO_3$.	Subangular.	67	23	5	3	Estimates made in south bank (9 ft. high) other walls are covered; deposit shows stratification; gravel is clean.
190	4	1	19	80	Lumps of clay occur in lower part of gravel in west and north banks.	Subangular.	60	27	8	5	Estimates made in west bank (7½ ft. high); east bank consists of fine yellow sand; in north bank there are irregular layers of fine yellow sand, coarse sand, and gravel.
191	4	30	45	25	Traces of $CaCO_3$.	Subangular.	55	20	15	10	Estimates made in east bank (6 ft. high); other walls nearly all covered.
192											No information.
193						Subangular.	High				Pit walls are entirely covered; pit is 4 ft. deep and down to clay.
194				60+		Subangular.	90				Small pit with walls covered; pebbles mostly all of sil. lime., estimates in weathered part.
195	2½	5	65	30	Traces of $CaCO_3$ and Fe_2O_3.	Subangular.	60	25	10	5	Estimates were made in south bank.
196		30	45	25		Flat and angular.					Pit walls entirely covered; all gravel seen appears weathered; pebbles are nearly all of sil. lime.
197											No pit; surface indications suggest coarse gravel, angular pebbles.
198											No pit; gravel appears coarse from surface indications; deposit lies in flat low ridge.
199						Boulders flat, pebbles flat. angular.	90+				Pit walls entirely covered; gravel looks very coarse; all pebbles look weathered.
200	1½–3½	1	66	33	$CaCO_3$ in certain beds.	Subangular.	56	28	10	6	Estimates made in s.w. bank (7 ft. high); composition is fairly uniform throughout pit; deposit is somewhat stratified the layers lying in places parallel to surface deposit; gravel is clean.

Table VI.—Character of the Sands and Gravels—Continued.

AUGUSTA TOWNSHIP.—(Cont.)

Map No.	Depth of weathering in ft.	Percentage of			Impurities	Shape of pebbles	Pebble composition, percentage of				Remarks.
		Boulders 3 in. and over	Gravel ¼ to 3 in.	Sand ¼ in. and under			Limestone	Silty limestone	Hard	Soft	
201	2–2½	10	75	15	Moderate amounts of $CaCO_3$.	Round.	55	28	10	7	Estimates made in south bank, other banks entirely covered; deposit is stratified, coarse layers at top, getting finer toward the bottom; gravel has a clean appearance.
202	2½–3½	3	57	40	Moderate amount of $CaCO_3$, traces Fe_2O_3.	Subangular.	62	20	11	7	Deposit is irregularly stratified; at east bank of the deposit there is a layer of fine sand and silt over the gravel and separated from it by thin layer of brown loam and organic matter; estimates on material below overlying sand.
203	2½–4	5	60	35	Traces of $CaCO_3$ and Fe_2O_3.	Subangular.	63	18	12	7	Pit extends along road side; bank 10 ft. high, 2-6 ft. being covered; a few shells occur in the gravel.
204		10–15	45–50	30–40	Moderate amount of $CaCO_3$; abundance of clay.	Round to subangular.	77	5	10	8	Gravel is exposed to depth of 10 ft.; deposit is indistinctly stratified; sand is very dirty with clay and silt, upper 6 ft. of gravel contains more boulders than that below; all lime. pebbles are dolomitic.
205	3–5	5	50	45	Moderate amount of $CaCO_3$; some clay.	Round to subangular.	45	30	10	15	Deposit contains bands of fairly clean sand.
206											No pit; surface indicates fine gravel mixed with sand.
207											No pit.
208	2	15	50	35	Traces of $CaCO_3$; gravel face stands up very firmly.	Subangular to angular.	50	13	20	17	Deposit is stratified; gravel uniform laterally but varies in vertical direction being high in boulder content at top and free from them below; strata dip to north.

209	2	15	50	35	Moderate quantities of $CaCO_3$; pit walls stand up very firmly.	Subangular.	57	14	7	22	
210											Gravel nearly exhausted, what remains is sandy; it lies up against a rock outcrop to the west.
211	1–7				Moderate amount of $CaCO_3$; faces stand up very firmly.	Subangular.	70		5	25	Deposit is stratified, in places the layers lie flat and in others they form concave beds with sharp curvature; great variation in sizes from bed to bed.
212	2–4	20	40	40	Moderate amount of $CaCO_3$; faces stand up firmly.	Round.	70		10	20	Face visible at s.w. corner only; more boulders in the north end; soft pebbles are weathered limestone.
213	1–2	5–20	25–60	20–70	Moderate amount of $CaCO_3$; face stands up firmly.		65	15	10	10	The estimates were made on the north face; gravel in well sorted beds; rock outcrop at higher elevation to east; the whole deposit is not in one well defined ridge.
214	2	50	20	30	Moderate amount of $CaCO_3$; face stands up firmly.	Subangular.	50	10	10	30	Gravel appears quite uniform throughout the pit; no indication of stratification; Rock outcrop to the east.

Table VII.—Commercial Development of Sands and Gravels.

NEPEAN TOWNSHIP.

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
1	Con. i, lot 20, Ottawa front.	W. N. Bell, Britannia Bay.	150,000 to 200,000.	The gravel has been largely used by the C.P.R. as ballast.	Small amount south Carp road.	Deposit worked out north Carp road; south road amount difficult to estimate largely built on; sold in 1915 at $1.35 per 2 cu. yds.
2	Con. ii, lot 17, Ottawa front.	Ottawa Electric Co., Ottawa.	8	Gravel used for concrete.	Deposit is about 50 yds. long and 30 to 60 yds. wide.	
3	Con. iii, lots 20, 21, Ottawa front.		9		Deposit lies in a hill 60 yds. wide and extends for about 70 yds.	The deposit lies parallel to the G.T.R.; it runs into sand to the north.
4	Con. ii, lots 20, 21, Ottawa front.	Watson and Hanawell, Bells Corners.		Used with tarvia as top dressing on Richmond road.		This deposit is chiefly coarse sand.
5	Con. A, lot 32.	R. Mulvaugh, City View.	1,700	The River road was built of this gravel 14 yrs. ago.	The deposit extends over an area of 3,000 sq. yds.; it is a yard or more deep on the bedrock and 6 yds. to s.e. off the rock.	The high boulder content would necessitate crushing before the gravel could be used for road metal; the pit is 300 yds. from the road and at a higher elevation; drainage good; gravel sold at 60 cents per load in pit.
6	Con. ii, lot 2, Ottawa front.		170	Gravel from Nos. 7 and 9 used by Nepean council on roads in Nepean tp. and that from 8 and from a pit across the road from 7 on roads in March tp.; roads where seen are very rough due to large pieces of limestone.	Greatest depth 3 to 4 yds.; average extent 1,000 × 60 × 2 = 120,000 cu. yds.	The deposit is weathered to the bottom and lies on lime. beds; there is no sign of water anywhere; a crusher is necessary to render the gravel deposit useful as road metal.
7	Con. vi, lot 35.	Nepean council.	(17 × 14 × ½) = 2,500 + 1,300. across road 30 × 6 × 1½ = 300.			
8	Con. vi, lot 35.	Addison Hand.				
9	Con. vi, lot 35.		300 to 400.	See numbers 6 to 8.	9,000 cu. yds.	Weathered to bedrock.
10	Con. iii, lot 33.	Robt. Stapledon, City View, R.R.I.	12 × 14 × 1½ = 280.	Locally in concrete work.		This is practically a coarse sand deposit and of no use as a road metal.

11	Con. v, lot 25.	Robt. Wallace, Fallowfield.	26 x 34 x 2½ = 2,210.	The gravel has been satisfactorily used in concrete work; it was also used on the road in front of the owner's property; this road is in good condition.	The deposit is about 100 yds. by 130 yds. in surficial extent.	The gravel is sold at 25 cents a double load f.o.b. pit; good drainage.
12	Con. v, lot 24.	Wesley Caldwell, Fallowfield.	37 x 28 x 1½ = 1,380.	Gravel has been used locally for concrete work.		The gravel sells at 25 cents a double load in the pit; good drainage.
13	Con. iv, lot 24.	Thos. Patterson, Fallowfield.	30 x 40 x 1 = 1,200.	Was used by the Nepean council for road construction.	Extent about 5,000 sq. yds. greatest depth 3 yds.	The gravel lies in a flat ridge about 3 yds. high; drainage good.
14	Con. iii, lot 23.	John Walters.	30 x 20 x 1½ = 1,000.	The gravel was used on the first side road south of the deposit between con. ii and iv some years ago; the road in rather poor condition now.	The deposit extends over an area of 90,000 sq. yds. and varies in depth from 1 to 2 yds.	The deposit extends down to bedrock.
15	Con. v, lot 21.	Chas. Smith, Fallowfield.	25 x 25 x 1½ = 1,037.	Used on forced road s.e. of Fallowfield by Nepean council in 1910; road in fair shape.	The deposit lies in a small hill; the top of the hill which probably represents the best part of the gravel has been excavated.	The deposit is covered with bush; the pit is 100 yds. from the con. road and accessible by means of a private road; pit is dry; the gravel sells at 50 cents per load.
16	Con. ii, lot 12.	Miss Mary Lynch.	600	Used on roads by Nepean council.	750 x 250; depth pit 1½ yds.; 250 yds. north, 9 yds. in well.	Pit is situated on top of a hill 70 yds. from the road.
17	Con. i, lot 12.	Mr. Mansfield.	100	Locally for concrete work.	Areal extent 200,000 sq. yds.; depth unknown.	Pit is at the top of a hill 80 yds. north of the road.
18	Con. v, lots 16, 17.	Canadian Northern ry.	520 yds. by 6 to 80 yds. by 6 to 10 yds. on north side.	Ballast on C.N.R.		The deposit appears to diminish in depth to south.
19	Con. v, lot 12.	Wm. Little, Fallowfield.	5 x 6 x 3½ = 100.	Locally for concrete work.		Pit is near top of a ridge; drainage is good; pit is 250 yds. from the road ¼ mile from the C.N.R.; the deposit is covered with bush.
20	Con. iv, lot 12.	Conn. Clark.	97 x 30 x 2 = 5,820.	Placed by Nepean council on adjoining con. road which is in poor condition; the road foundation is soft sand.	These pits occur in a large gravel area which extends in s.e. direction across con. iv for 2 miles through lots 7 to 14; the width varies from 500 to 1,200 yds.; the depth for the most part is unknown; on lot 12 a well was dug to a depth of 15 yds. in the gravel.	
21	Con. iv, lot 13.	Andrew Todd.		Ballast on the C.N.R. and for concrete in bridge over the Jock river.		There are two pits close to each other and about 350 yds. from the road; sold to contractor for $300.
22	Con. iv, lot 13.	Andrew Todd.	17 x 12 x 2 = 408.			
23	Con. iv, lot 19.	Jas. Birtch.	$\frac{21 \times 22 \times 11}{2}$ = 2,541.	Concrete.		Sold at 25 cents per load.
24	Con. iv, lot 9.	Jas. Birtch.				

Table VII.—Commercial Development of Sands and Gravels—Continued.

NEPEAN TOWNSHIP.—(Cont.)

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
25	Con. iii, lot 8.	N. Todd.	About 40.		This deposit extends for over 2½ miles in s.e. direction into North Gower; for a mile at the northern end the deposit is 700 to 800 yds. wide but then narrows to a ridge from 150 to 500 yds. wide; at pit 175 and south there is a depth of from 5 to 7 yds. of gravel.	Sold at 10 cts. per load; top layer only removed.
26	Con. iii, lot 4.	Michael Hawley, Kars.	1,100.	Resurfaced road between lots 5, 6, con. ii, in 1913; road rough; locally for concrete work; 1 to 5 mix. 2 yrs. old in stable foundation, good condition.		The pit is wet and holds water in the spring; the Nepean council has a 10-yr. lease on ½ acre of the deposit; owner sold gravel for 50 cts. per load.
27	Con. i, lot 2, North Gower.	Jas. Tobin, Kars.	18 × 11 × 3½ = 639.	Used by council on forced road through con. ii, lots 3, 4, 5 in autumn of 1914; in spring the road was levelled, the coarse stones being removed; the gravel is too coarse and remains loose between the tracks.		North Gower and Nepean councils have a 10-yr. lease on ½ acre of Tobin's gravel for which they paid $50; gravel sells for 40 cts. a load; overburden 1 ft. sand and gravel; pit opened in 1914.
28	Con. A, lot 2, North Gower.	Robt. Scharf, R.R. No. 2, Kars.	10 × 11 × 3 = 330	Gravel used in concrete work, mix 1 to 5 and 1 to 7, work 1 yr. old and satisfactory; gravel was put on crossroad between con. i and ii on lots 4 and 5; road is 6 yrs. old and in poor condition, the gravel apparently having no binding qualities.		The gravel used on the roads was taken from a road cut about 30 yds. away from the pit.
29	Con. i, lot 2, North Gower.	Howard Potter, R.R. No. 2, Kars.	400	Local concrete work and for sidewalks in Manotick; the concrete is in good condition.		The drainage is good; pit floor is clay; pit is 65 yds. from the road.
30	Con. i, lot 4, North Gower.	David Brown— R.R. No. 2, Kars.	12 × 20 × 2 = 480.	Concrete 14 yrs. old in barn foundation, poor condition.		Overburden of 4 ft. loam and coarse sand; the pit is halfway up the slope of the ridge; according to owner the gravel is 14 ft. in places and overlies clay.
31	Con. ii, lot 6.	Bernard Kennedy, Kars.	12 × 13 × 1 = 156.	Placed on road between lots 5, 6, con. ii about 1908; see preceding pit.	Extent 113,000 sq. yds. depth 2 yds.	Good drainage, deposit in flat ridge 12 ft. high; 10 years. lease sold to Nepean council in 1905 for $75.

31a	Rockcliffe Park, Ottawa.	C. H. Keefer, Rockcliffe.	90,000	Gravel and sand are sold in the city for building purposes.		Excavation is done by hand; the pit is dry; at the western end of the pit the water stands 25 ft. below the surface; sand sells for 45 cts. per yd. in pit, $1 delivered in upper Ottawa; gravel sells for 70 cts. per yd. in pit, $1.25 delivered to upper town.
32	Con. iii, lots 6, 7.		20 × 10 × 1 = 200.		1,000,000 cu. yds. in the area west of creek.	Test pits were put down 20 ft.; well near con. road to s.e. sunk in deposit is said to have penetrated 50 ft. of gravel and then sand to a total depth of 105 ft.; the large per cent of boulders would probably necessitate screening and crushing; the deposit is accessible from the C.P.R.
33	Con. iv, lot 7.	Gloucester council.	30 × 33 × 6⅔ = 6,600.	In 1910 on road between con. iv and v about 1½ miles south from Walkley road; road in fair condition in 1915 under light traffic.	The deposit in which 33, 34, and 35 occur lies in a ridge extending north of east for 2,700 yds. and varying in width from 250 to 500 yds.; the deposit appears to consist of a bed of gravel about 8 ft. thick underlain by sharp clean sand to a depth of about 30 ft.	Water level is about 35 ft. below surface.
34	Con. iv, lot 8.	J. H. Spratt, Billings Bridge.	5,000	Used in concrete work by the Dominion Government, also in C.N.R. bridge over Rideau river.		Pit is dry; equipment consists of small stationary screen and small shaking screen; prices $1 per load in pit; owner says 10,000 cu. yds. have been excavated.
35	Con. iv, lot 7.	Mr. Eccles, Billings Bridge.	33 × 20 × 2½ = 1,540.	Concrete work locally and in Ottawa.		Pit is dry; the deposit is well above the natural drainage.
36	Con. ii, lot 8.	John Davy, Bowesville.	50		The deposit is very small.	Overburden ½ to 1 ft. of yellow sand at pit deeper elsewhere.
37	Con. ii, lots 8, 9, pit in lot 8.	Michael Nolan, Bowesville.	36 × 6½ × 1½ = 312.	Concrete in bridge and foundation work; locally on roads.	The depth of gravel is from 7 ft. to 9 ft. and extends over an area of about 90,000 sq. yds.	Drainage is good; the deposit is underlain by clay; gravel sold at 50 cts. per load (1·5 cu. yds.)
38	Con. i, lot 6.	Rideau Canal Supply Co. own 4 pits; silica Brick Co. own the 5th pit.	160,000.	The sand is used in Ottawa for building purposes.	The deposit is about 15 yds. in depth and extends back from the river at least as far as the Manotick rd. (250 yds.).	Overburden of 2 to 3 ft. of weathered yellow sandy soil; there are five pits but only the north one is being worked, the rest being dug back too far for quick loading of the barges; the pit is operated by Ely Bros., Ottawa; equipment consists of a tug, barge, 50 ft. trestle and chute at the pit and two cars working on the gravity system from the sand face to the chute which delivers the sand to the barge 50 ft. below.

Table VII.—Commercial Development of Sands and Gravels—Continued.

GLOUCESTER TOWNSHIP.

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
39	Con. ii, lot 11.	S. side of road. Mr. McCarthy.	5,800		The deposit extends over an area of a little less than 300 acres; said to be 40 ft. deep in places.	The pit is dry; the deposit occurs in a flat-topped ridge; overburden 1-3 ft.
40	Con. iii, lots 11, 12.	C.N. ry.	128,000	Probably ballast.	The deposit extends over an area of a little less than 1 sq. mile, and to a depth of 10 yds. at least in places.	The deposit lies in a flat-topped ridge; overburden 1-5 to 3 ft., the C.N.R. have tracks laid in the pit; the east end of the pit is close to the C.P.R.; pits Nos. 40 and 41 are in the same deposit.
41	Con. ii, lot 13.	L. L. Lecuyer, Bowesville.	530	Concrete work; some used in 1904 on the road near Bowesville.		Drainage good; sold at 50 cts. per load in the bank.
42	Con. iii, lots 17, 18.	Road allowance.	Small.		Deposit consists of a ridge about ¼ mile wide running south.	To the north of this pit hills of wind blown sand from 5 to 10 ft. high lie over the deposit in places.
43	Con. iv, lot 26.	Allen Johnson, R. R. No. 2, Billings Bridge.	3,500	Gravel has been used for concrete work.	The general deposit runs from Bowesville southeastward to Greeley for a distance of about 6 miles; at Bowesville the ridge is about 650 yds. wide, narrowing to 200 yds. at Johnston Corners, then getting wider again; at the tp. boundary it is 1,300 yds. wide and then narrows and plays out in an indefinite way south of Greeley; the depth of the deposit is from 30 to 40 ft. in certain places.	Drainage is good; the pit is 200 ft. from the con. road; gravel sold at 50 cts. per load; depth about 40 ft.
44	Con. iv, lot 30.	J. R. Mackelvoy, R. R. No. 2, Billings Bridge.	30 × 30 × 1½ = 1,500	Gravel used locally for concrete work.		Overburden 2 to 3 ft.; the pit is on the tp. line road.
45	Con. iii, lot 24.	N. A. Spratt, Billings Bridge.	23	Locally on roads.	Approx. dimensions, 650 × 70 × 2 = 91,000.	The pit is on the road side.
46	Con. ii, lot 27.	Robt. Gamble, Manotick Stn.	42 × 34 × 1 = 1,428	On roads 4 to 5 yrs. ago.		Gravel is too coarse and the deposit has been abandoned; sold at 25 cts. per 2 cu. yds.

47		Wm. Nolan, R. R. No. 1, Billings Bridge.	5		Areal extent about 5 acres.	Drainage good; gravel occurs in a small ridge and has been laid down against a lime. deposit.

NORTH GOWER TOWNSHIP.

48	Con. i, lot 6,	T. Craig, R.R. No. 2, North Gower.	15 x 24 x 1½ = 480.	Locally for concrete with fair results; 1,500 ft. of the river road south of road between lots 5 and 6, con. A was surfaced with it in 1914; under soil clayey loam; road is dusty but in fair condition.	60 x 1,000 x 5 = 300,000 cu. yds. appr.	Drainage good; the deposit lies in a ridge about 60 yds. wide and 5 yds. above water-level; a well is said to have been dug through 33 ft. of gravel.
49	Con. i, lot 10.	C. G. Armstrong, R.R. No. 2, Kars.	10 x 25 x 1 = 250.		Small.	Drainage good; abandoned on account of boulders; the deposit lies in a ridge 8 yds. high; crushing necessary.
50	Con. iv, lot 13.	J. R. Beckett, R.R. No. 3, Richmond.	20 x 16 x 2 = 640.	On roads in Marlborough tp. in June 1914; one road shows shallow longitudinal ruts and some holes; surface is rough due to the boulders.	Deposit contains about 100,000 cu.yds.; another similar ridge nearby may contain gravel.	In wet weather there is 1 to 1½ ft. water in the pit; price 15 cts. per load in pit; overburden 1 ft. sandy gravelly loam.
51	Con. iv, lot 13.					Pit is abandoned on account of high boulder content of the gravel.
52	Con. iii, lot 15.		25 x 30 x 1 = 750			Abandoned and overgrown.
53	Con. iii, lot 15.	W. J. Graham, North Gower.	60 x 30 x 2 = 3,600.	Used on roads 40 yrs. ago and with gravel from 55 now forms the foundation of the roads in vicinity; was used on road between lots 15, 16, con. iii; road rough in 1915, due to boulders and longitudinal ruts 1 to 4 in. deep; also used on forced road in con. ii, lots 11 to 15; road is muddy in lower spots, has ruts 1 to 3 in. deep and some holes; looks as though the road had been graded from the side up over the gravel.	The gravel lies in a narrow ridge 40 to 80 yds. wide and 400 yds. long which itself occurs on a larger boulder ridge; the gravel ridge is 3 to 10 ft. high.	Pit is not in use; drainage good; sells at 10 cts. per load in pit.
54	Con. iii, lot 17.	R. A. Craig, North Gower.	450	Used on roads.	100,000 cu. yds. at least.	Drainage good.

Table VII.—Commercial Development of Sands and Gravels—Continued.

NORTH GOWER TOWNSHIP.—(Cont.)

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
55	Con. iii, lot 17.	Nixon Craig, North Gower.	64 x 30 x 1 = 1,920.	Used on roads but now forms part of the foundation; it forms the surface of the forced road in con. iii and on road between con. iii and iv, lots 16-20; this road shows ruts 1 to 2 in. deep and a few bad holes where drainage is poor.	Gravel lies in a narrow ridge about 800 yds. long and 60 yds. wide; this ridge lies from 1 to 2 yds. and on west side of drift hill.	Drainage good; pit has not been used for 4 yrs.; opened 40 yrs. ago; gravel sells at 15 cts. per load in the pit.
56	Con. iii, lot 20.	R. A. Craig, North Gower.	25 x 10 x 2 = 500.	Local concrete work.	Deposit lies in a ridge of about 100 x 30 x 3 = 10,000 cu. yds.	Drainage good; overburden 1 to 2 ft. sandy loam; gravel ridge rises 5 yds. above a creek.
57	Con. i, lot 12.	J. Lewis, R.R. No. 2, Kars.	40 x 24 x 2½ = 2,560.	Used on roads; road built in 1912 rough in 1915. 1913-14 roads show that gravel does not cement; they are rough from the boulders and heavy from the sand.	The deposit extends in north-south direction for 1,100 yds. and is about 150 yds. wide; the ridge is about 6 yds. high.	Drainage good; the gravel is too bouldery for road material; the walls do not stand up well.
58	Con. 1, lot 20.	Mr. Wallace, Kars.	100	Locally in concrete barn foundations.	These pits occur in a gravel ridge running n.w. from Kars for 2½ miles; the width of the ridge varies from 500 to 1,500 ft.	
59	Con. i, lot 21.	Mr. Pettapiece, Kars.	15	Concrete work in Kars.		
60	Con. iii, lots 23, 24	Robt. Clark, North Gower.	None.		Probably about 800,000 cu. yds.	Overburden ½ ft. of loamy clay; the deposit lies in a flat-topped hill; a pit is soon to be opened.
61	Rideau front, lot 26.		None.		Deposit extends over an area of about 50 acres.	Overburden ½ ft. of loam.
62	Con. ii, lot 26.		None.		Deposit is of small extent.	Overburden of ½ ft. black loam.
63	Con. i, lot 24.	Lawson Greer Kars.	100	Gravel and sand used for concrete work.	This deposit extends north-westward along the river road for 1,000 yds. and with an average width of 200 yds.; depth of gravel unknown; at the two pits depth of gravel is about 4 ft.	
64	Con. i, lot 25.	E. Lindsay, Kars.	50 x 12 x 2, = 1,200 also 200 sand pit.	Concrete sidewalks in Kars and the sand for making plaster.		

65	Rideau front, lot 25.			Concrete.		Gravel from a cut along the road; overburden of 3 ft. of yellow sand over 1 ft. of loam.
66	Con. iv, lot 27.	Hugh Wallace, R. R. No. 1, North Gower.	26 x 35 x 1 = 900.		The deposit occurs in a ridge and extends n.e. for about 500 yds. with average width of 200 yds., depth unknown.	Drainage good; sold at 10 cts. per yd.
67	Con. ii, lot 28.	W. J. Johnson, R. R. No. 1, Kars.		Placed on road passing through deposit 35 yrs. ago; road rough.	Roughly estimated at 86,000 cu. yds.	Gravel is exposed in a cut in the road.
68					Estimated at 20,000 cu. yds.	
69	Con. iii, lot 30.		Small.	On roads.	Estimated at 19,000 cu. yds.	Use of gravel has been abandoned on account of its poor quality.
70	Rideau front, lot 28.	E. Whelan, R.R. No. 1, Kars.	Small.	Locally for concrete.	Estimated at 160,000 cu. yds.	Cut in road allowance; gravel in a round hill.
71	Rideau front, lot 32.		None.		Deposit is very small.	

A number of deposits have been mapped from surface indications only and no numbers have been given them.

MARLBOROUGH TOWNSHIP.

72	Con. ix, lot 4.	P. B. Bowrin, R. R. No. 3, Richmond.	40 x 40 x 1¾ = 2,670.	On roads; road surfaces one year old under light traffic not well cemented, older surfaces, long ruts 1 to 3 in. deep.	200 x 50 x 3 = 30,000 cu. yds.	Overburden 6 ft. gravelly loam; drainage good; gravel sold at 25 cts. per load; to council at 15 cts. per load; gravel said to be 25 ft. deep, but bouldery below 10 ft. Estimate includes material down to 9 ft.
73	Con. ix, lot 4.	J. Hill, R. R. No. 3, Richmond.	24 x 6 x 1 = 144.	Road use; ruts developed in one year.	75,000 to 100,000 cu. yds. A well dug in the deposit shows 10 yds. of gravel.	Sells at 15 cts. per load.
74	Con. vii, lot 8.	G. Morrison, R.R. No. 3, Richmond.	150	Gravel used on road between lots 6 and 7, con. viii, June 1915; road is smooth in wheel tracks but loose and rough (due to boulders) between the tracks and has ruts ½ to 1 in.; traffic light, side drainage fair; road built with same gravel in 1913 still loose between tracks and shows ruts 1 to 2 in. deep.	The deposit extends northeastward from pit 75 for 1¼ miles; it is in form of a narrow ridge 50 to 70 yds. wide but widening somewhat at either end; the ridge is 1 to 2 yds. high.	Overburden ½ ft.; gravel lies in a ridge which forms part of a larger ridge; deposit is shallow; pit is rather difficult to reach; price 10 cts. per load.

Table VII.—Commercial Development of Sands and Gravels—Continued.

MARLBOROUGH TOWNSHIP.—(Cont.)

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
75	Con. vii, lot 11.	J. McCurdy, Malakoff.	1,600	Gravel has been used extensively on roads in vicinity with fairly good results; the gravel has a tendency to remain loose.		Overburden ½ to 2 ft. gravelly and somewhat clayey loam; pit lies 400 ft. from a good gravel road; some water at west end of pit; price 25 cts. per cu. yd.
76	Con. vii, lot 9.	Mr. McCurdy, Malakoff.	45 × 20 × ½ = 675.	Locally on roads.	This deposit extends over an area of about 100 acres; depth unknown.	½ to 1½ ft. overburden of clayey gravelly loam; top of hill removed; gravel sells at 25 cts. per cu. yd.
77	Con. vi, lot 10.	J. H. Taylor, Malakoff.				Overburden up to 1 ft.
78	Con. v, lot 3.	W. H. Pratt, R. R. No. 2, North Gower.		Locally for roads and concrete.		Overburden 1½ to 2 ft. of clayey loam containing many boulders; deposit is confined to top of hill; it has practically been abandoned.
79	Con. v, lot 1.	J. W. McCordick, R. R. No. 2. North Gower.		Locally for roads and concrete.		Overburden of ½ to 1 ft. clayey loam; deposit is very small and has practically been abandoned.
80	Con. iv, lot 1.		None.			
81	Con. iii, lot 10.		100	Locally for roads.	Deposit very small.	Overburden 2 ft. clay.
82	Con. ii, lot 13.	Jas. Wilson, Kemptville.	170		4,500	Drainage poor but could be remedied; overburden 1 ft. loam.
83	Con. iv, lot 1.	W. J. Brown, R. R. No. 1, North Gower.	None.		Covers about 7 acres.	
84	Con. iii lot 4.	Frank W. Moffatt, R. R. No. 1, North Gower.	5,400	On roads.	About 160,000 cu. yds. assuming average depth of 1 yd.	
85	Con. ii, lot 3.		Few loads.		Small.	Road cut only.

86	Con. i, lot 2.	Alfred Erskine, R. R. No. 4, Kemptville.	60	Locally for roads, too bouldery.	Small.	Drainage good; gravel sells at 10 cts. per load.
87	Con. i, lot 4.	Angus Crawford, R. R. No. 4. Kemptville.	108	Locally for roads.	Small.	Drainage good; gravel sells at 10 cts. per load.
88	Con. i, lot 16.	Wm. Riddick, R. R. No. 4, Kemptville.	3,800	Roads and concrete.	About 90,000 cu. yds.	Top gravel sells at 10 cts., bottom at 20 cts. per load; drainage good.
89	Con. i, lot 12.	David Ross, R. R. No. 4, Kemptville.	840	Used on roads some time ago.	16,000 cu. yds.	Ridge 7 ft. high.

OSGOODE TOWNSHIP.

90	Con. iv, lot 9.	Osgoode tp.	30	Locally on road surfaces.	The deposit extends n.w. from lot 11, con. iv, for 1½ miles; it is 500 to 600 yds. wide; depth unknown.	
91	Con. iv, lot 14.	Eddie McEvoy, R. R. No. 2, Manotick Stn.	25	Concrete work.	The deposit extends from lot 20, con. iii, northward for 3½ miles; at the centre it has a width of 1½ miles but tapers off at each end; depth unknown but 7 yds. and over in places.	At lot 18, con. iii, the surface shows more gravel than elsewhere on this deposit.
92	Con. iii, lot 21.	Osgoode tp.	20	Patch work on local roads.	The deposit is small in extent and lies immediately to the west of the large gravel area running northward through the tp.	Opening cut in road surface more gravelly to the east.
93	Con. iii, lot 26.	Robt. Saunders, C/o J. E. Blanchfield. R. R. No. 1. Osgoode.	100	Locally for road surfacing and concrete work.	The deposit extends southward from lot 22, con. iii, for 2½ miles and with a width of about 900 yds.; it is really a continuation of the one described under 91.	
94	Con. ii, lot 26.	J. E. Blanchfield, R. R. No. 1, Osgoode	50 × 40 × ½ = 1,000.			Sold at 50 cts. per yd.
94a	Con. ii, lot 27.	Pat Dewan, R. R. No. 1, Osgoode Stn.	80	Unknown.		Drainage good; overburden 1 ft. black loam and sand.

See also Mountain tp.

Table VII.—Commercial Development of Sands and Gravels—Continued.

OSGOODE TOWNSHIP.—(Cont.)

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
95	Con. ii, lot 25.	R. J. Cleland, Osgoode Stn.	75	Concrete in building foundations.	Deposit extends northwestward from lot 29, con. ii, for 2 miles; average width is 500 yds. and the average depth is said to be 4 yds.	
96	Con. ii, lot 26.	C. P. ry.	500,000	Used for road ballast and concrete work.		C. P. R. paid $11,000 for 50 acres; they have installed a plant in pit for making concrete culverts, etc.; water stands to a depth of 6 in. in places.
97	Con. ii, lot 27.	Harry Boyd. Osgoode Stn.	40	Placed 2 yrs. ago on forced road from the pit to Osgoode Station; road in good condition.		Overburden of 1 to 2 ft. sandy loam was removed over an area of 400 sq. yds.; drainage is good; gravel sold at 50 cts. per load.
98	Con. ii, lot 27.	Harry Boyd, Osgoode Stn.	12 × 9 × 3 = 325.	Concrete only.		Drainage good; overburden of 1½ to 2 ft. sandy and gravelly loam.
99	Con. ii, lot 27.	Harry Boyd, Osgoode Stn.	18 × 19 × 2⅔ = 912.	Concrete only.		Water level in dry weather 6 in. below pit bottom.
100	Con. ii, lots 28, 29.				Covers an area of about 200 by 530 yds., greatest depth about 4 yds.	
101	Con. i, lot 36.	Michael Murdock, R. R. No. 2, Osgoode Stn.	12 × 15 × 2 = 360.	Placed in 1914 on road between con. i and Rideau front, lots 36 and 37; road in good condition; summer 1915 same road, lots 34 and 35 and road near pit; road poor, gravel loose, too much sand.	The deposit is irregular in shape and extends over about 80 to 100 acres.	Drainage poor, water stands in pit in the spring; gravel sells at 25 cts. per load; overburden 1 ft. sandy loam.
102	Con. i, lot 35.	Edmore Moses, R. R. No. 4, Osgoode Station.	15 × 2 × 18 = 540.			Overburden 1 ft. loam and sand; gravel sold for 50 cts. per load.
103	Con. i, lot 36.				Extent 15 to 20 acres, ridge about 3 yds. high.	Overburden of a few in. clayey loam; depth of gravel was taken as 1½ yds. on half the height of the ridge.

104	Con. ii, lots 38, 39.				Extent about 35 acres, ridge 4 yds. high.	Overburden of 1 to 2 ft. sand.
105	Lot 30, Rideau front.	Allan Mussell, Osgoode Stn.	40 x 11 x 2 = 880.	Gravel used in 1914 for repairing roads with good results.	If the gravel is assumed to be 2 yds. deep there is about 300,000 cu. yds. available.	Drainage good; overburden ½ to 1½ ft. sand and loam.
106	Lot 31, Rideau front.	John Brownlee, Osgoode Stn.	5,500	Gravel used for concrete work.		Drainage is bad, water stands in pit.
107	Lot 31, Rideau front.	John Brownlee, Osgoode Stn.	30 x 15 x 2⅔ = 1,200.	Concrete building blocks.		Drainage poor, water stands in pit; gravel sold at 50 cts. load.
108	Lot 31, Rideau front.	John Brownlee, Osgoode Stn.	15 x 16 x 1 = 240.	Concrete building blocks.		Drainage good; the deposit is largely sand.
109	Con. i, lot 39.				Deposit extends over an area of about 45 acres.	Overburden varies and becomes very thick in places.

MOUNTAIN TOWNSHIP.

110	Con. ii, lot 39, Osgoode.	Archie Buckels, Osgoode Stn.	10			Drainage good; overburden 1 ft. sandy loam.
111	Con. xii, lot 7, Osgoode.	Mountain tp.	40		The deposit is very irregular in outline; it covers about 300 acres and lies in ridges about 3 yds. high; it lies in both Osgoode and Mountain tps.	Drainage good; overburden about 1 ft. of sand and loam.
112	Con. xii, lot 7, Mountain.	Mountain tp.	120			Drainage good; overburden about 1 ft. of yellow sand.
113	Con. xii, lot 7, Mountain.	Mountain tp.	54			Drainage good; overburden of 1 to 1½ ft. of gravelly sand.
114	Con. x, lot 6, Mountain.	E. Lancan, R. R. No. 2, Mountain.	21 x 8 x 2 = 336.	Gravel used locally for concrete.	It lies in both South Gower and Mountain tps.	The gravel is running into sand to the east; sold for 50 cts. per cu. yd.
115	Con. x, lot 5, Mountain.	Mountain tp.	Small.		The deposit is about 4½ miles long and varies from about 150 to 500 yds. in width; the pits are not much over 2 yds. in depth the deposit may be 4 yds. in places; estimates 7,000 x 200 x 2 = 2,800,000 cu. yds.	Cut along the road.
116	Con. x, lot 4, Mountain.	Mr. Laughlin, R. R. No. 4, Kemptville.	17 x 8 x 1⅔ = 225.	Gravel used locally for concrete work.		Pit is on the southern limit of the deposit; the gravel is coarse to the north; gravel sells for 50 cts. per yard.
117	Con. x, lot 1, Mountain.	Mountain tp.		Gravel used for repairing Prescott road; packs well but wears poorly.		Gravel cut along road.
118	Con. x, lot 1, Mountain.	Mountain tp.		Gravel has been used to repair Prescott road.		
119	Con. vii, lot 3, South Gower.	South Gower tp.				Gravel cut along road.
120	Con. vii, lot 6, South Gower.	John Coleman, R. R. No. 3, Kemptville.	30 x 100 x 2 = 6,000.	Local concrete and road work; gravel appears to take a long time to bind but wears well.		Overburden 2 ft. of gravelly soil.

Table VII.—Commercial Development of Sands and Gravels—Continued.

OXFORD TOWNSHIP.

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
121	Con. ii, lot 18.	J. J. Dolan, R. R. No. 5, Kemptville.	25	Locally on road.	300 × 100 × 3 = 90,000 cu. yds.	Drainage good; gravel sells at 10 cts. yd.; overburden of ½ ft. gravelly soil.
122	Con. ii, lot 24.	W. A. Somerville, R. R. No. 3, Kemptville.	80	Used locally on roads; packs well but wears poorly; concrete work.		Overburden of 1 ft. sand; gravel is exposed in cut along road; owner intends to open pit to the north; gravel costs 10 cts. yd.
123	Con. ii, lot 24.	W. A. Somerville, R. R. No. 3, Kemptville.	8 × 20 × 2 = 320.	Gravel has been used for road patching; it binds well but apparently wears poorly; used in concrete work on farm buildings.	2,000 × 66⅔ × 1½ = 178,000 cu. yds. app.	Gravel and sand sells at 10 cts. per yd.; overburden 2 ft. sandy soil.
124	Con. ii, lot 25.	Dominion Concrete Co., Kemptville.	14,300	Used for concrete roadway in Kemptville; mixtures were 8 to 1 for foundation and 3 to 1 for surface; 7 in. thickness of concrete in road cost $1.35 per sq. yd. of pavement.		Drainage bad, water stands in pit; gravel has been exhausted except to the south where a little more is available; price 15 cts. per yd. in pit.
125	Con. ii, lot 30.	Chester Bank estate, C/o Miss Adeline Pratt, Mr. Langstaff, Kemptville.	56 × 43 × 4 = 9,632.	Used for plaster work.	The deposit extends for miles to the north and west.	Sold at 25 cts. per yd.
126	Con. iv, lot 24.	R. J. Somerville and A. Somerville, Kemptville.	540 × 80 × 3 = 129,600.	Ballast on the C.P.R.; now used for concrete work.	250 × 100 × 10 = 250,000 cu. yds.; there is 40 ft. of gravel in a nearby well.	Sold at 15 cts. per load; overburden 1 ft. of gravelly bouldery soil; crushing and screening necessary.
127	Con. v, lot 27.	Oxford council.	88 × 20 × 1½ = 2,640.	To a small extent for road repairing, mostly for concrete work.	The deposit extends over an area of about 700,000 sq. yds.; gravel is 7 yds. deep in places.	Pit may be extended farther north where from surface indications the gravel becomes finer; drainage poor.
128	Con. ii, lot 16.	H. Acton, R. R. No. 5 Kemptville.	535 × 30 × 1 = 1,150.	Used for patching road; not very durable.	Deposit extends over an area of about 25 acres; at the pit there is a depth of gravel of 4 ft. lying over bedrock.	Overburden of ½ to 1 ft. gravelly soil; water stands in the pit and might be difficult to drain away.

	Con. iv, lot 18.		None.			Surface indications suggest a gravel deposit; there has been no development.
129	Con. iv, lot 22.	B. F. Dangerfield, Kemptville.	1,560	Locally for concrete and plaster.	Deposit extends over an area of about 335,000 sq. yds.; at 62 the gravel is 40 ft. deep.	Overburden ½ to 1 ft. sandy soil.
130	Con. iv, lot 22.	B. F. Dangerfield, Kemptville.	7 x 24 x 1½ = 280.			
131	Con. iii, lot 22.	N. Seymour, Kemptville.	85 x 37 x 7 = 22,000.	Used for concrete work; it was used for the cement road in Kemptville 1913 which was in good condition in 1916; sidewalks 6 yrs. old are in good shape.		Overburden ½ to 1 ft. gravelly soil; drainage good; gravel is exposed to depth of 24 ft.; two abandoned pits to north; concrete gravel sold at 25 cts., coarser gravel at 10 to 15 cents per load.
	Con. iv, lots 22, 23.		None.			Surface indications suggest a gravel deposit in the area outlined; no development.
132	Con. iv, lot 21.	Oxford council.	6,000	Used for concrete; said to be unsatisfactory, perhaps due to presence of fine silt or clay.	This deposit is really a continuation of the above 129 ,130, and 131; this part of the deposit extends over an area of about 90 acres; near C.P.R. pit a well shows gravel to depth of 11 yds.	Overburden ½ ft. gravelly soil; pit has been opened to depth of 16 ft.; sand only is now being taken out.
133	Con. iv, lot 21.	C.P.R., present operator, J. S. Sloan	190 x 3 x 325 = 185,000 app.	Ballast on C. P. R., in concrete work it is not very satisfactory; on the roads it does not bind the first year but eventually makes a good road; roads constructed from this gravel are in excellent condition.		Overburden ½ to 1 ft. sandy soil The large pit was worked to depth of 20 ft. by steam shovel; water stands at depth of 26 ft. from surface after rains; sold at 10 cts. per load.
134	Con. v, lot 23.	John O. Dair, Kemptville.			Deposit is of small extent; the ridge is 4 yds. high in places.	Overburden of ¾ ft. sandy loam.
135	Con. v, lot 18.	Sam Harris, Oxford Mills.	10½ x 40 x 2 = 840.	Used locally on roads with satisfactory results.	Deposit extends over an area of about 60 acres.	Overburden 1 to 1½ ft. sand and loam; drainage rather poor; pit is used as a source of sand.
136	Con. v, lot 21.			Used years ago on road between con. v and vi with good results; gravel was taken from road cut.	Unknown.	Road cut; overburden 3 to 15 in. loam and sandy loam; there is a ridge of less bouldery gravel along western limit of the deposit; ridge is on the property of W. H. Bolton, Smiths Falls.
137	Con. v, lot 22.				Roughly estimated at 400,000 cu. yds.; the gravel is shallow.	No pit and overburden of 8 in. loam.

Table VII.—Commercial Development of Sands and Gravels—Continued.

OXFORD TOWNSHIP.—(Cont.)

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
138	Con. vii, lot 16.	Oxford council.	13½ × 45 × 2 = 1,215.	Placed in 1914 on forced road in con. vii to Oxford Mills over the swampy part of the road; work is in fair condition, but foundations not sufficiently strong.	Deposit extends over an area of about 25,000 sq. yds.	Overburden 1 to 5 ft. sand; no water in pit although it is dug lower than surrounding country.
139	Con. vi, lots 25, 26	John Flannigan, Kemptville.	None.		There are three narrow parallel ridges near together; depth unknown.	
140	Con. vi, lot 24.		None.		About 9,000 cu. yds.	Large deposits to the east and n.e. mapped from surface indications only.
141	Con. vii, lot 20.	Oxford council.	55 × 4 × ⅔ = 147.	Placed on north end of the road between lots 20 and 21, con. vii, under soil swampy; road is in poor condition probably due to poor foundation.	Deposit extends over an area of about 180 acres; depth unknown.	Overburden 1 to 2 ft. sandy gravelly loam; drainage good.
142	Con. x, lot 14.			Put on road June 1915, when seen Oct. 9, 1915, road was soft due to sand; gravel was still uncemented; road formation sandy gravelly loam.	Unknown.	Not enough development has been done to reveal much of the character of the deposit; the ridge to the east of the pit may be of value.
143	Con. ix, lot 21.	Oxford council.	21 × 67 × 2⅔ = 3,752.	This gravel forms most of the foundation of the macadam road near Oxford Stn.; road from pit to near Oxford Stn. constructed with this gravel in June 1915; when seen in Oct. 1915 was in good condition; smooth in tracks though otherwise rough due to boulders and loose between tracks; undersoil loam, side drainage fair, traffic medium.	300 × 50 × 5 = 75,000 cu. yds. app.; top of ridge 7 yds. over bedrock in pit bottom.	Overburden ½ ft. sandy gravelly soil; drainage good.
144	Con. viii, lot 21.	C.P.R.	8½ × 19¼ × 1 = 210.	On road between lots 20, 21, con. ix, satisfactory after few months use.	Covers about 12 acres.	Overburden 1 to 3 ft. sand and loam.

145	Con. viii, lot 23.	Pat McGinty, Oxford Stn.	None.	None.	Covers about 12 acres.	
146	Con. viii, lot 26.	Wm. H. Simzer, Kemptville.	50	Patchwork on roads.	Covers about 5 acres.	Overburden less than 1 ft.
147	Con. vi, lot 27.	Phil. Finley, Kemptville.	1,450	Used locally on roads with fair results.	Very small; lies on bedrock.	Overburden about 1 ft. of loam.
148	Con. x, lot 22.	R. J. McGovern, R. R. No. 1, Oxford Stn.	9 × 5 × 1 = 45.	Used for concrete in barn floor in 1912, mix 2 to 7, finishing coat 3 to 7, floor in good condition.	Small.	Overburden ½ to 1 ft. gravelly sandy soil; pit bottom is 6 ft. above swampy ground.
149	Con. x, lot 24.	W. J. Coulthart, R. R. No. 1, Oxford Stn.	20	Used in making concrete barn floor in 1914; mix 1 to 8 and 1 to 5 for finish; floor is pitted.	About 2,000 cu. yds.	Overburden ½ ft. gravelly loam.
150	Con. x, lot 27.	Oxford and Edwardsburgh councils.	25 × 20 × 1⅔ = 833. + 3,400.	This gravel has been used for years on the Prescott road but no information about its wearing qualities could be secured.	Extent of deposit is unknown; it is small, however.	Overburden 1-3 ft. of yellow sand; deposit lies about 15 ft. above swampy ground to north and west.
151	Con. x, lot 30.	A. Barton, R. R. No. 1, Oxford Stn.	30 × 7 × 1 = 210.		The deposit extends in a narrow ridge about 60 yds. wide northward for about 1,000 yds.; depth unknown.	

A number of areas are mapped as gravel deposits in Oxford county regarding which there is no other information available than that they are gravelly near the surface.

SOUTH GOWER TOWNSHIP.

152	Lot 35, Rideau front, partly in Osgoode.				Extent of gravel unknown.	Deposit lies on west side of a bouldery hill; its area as sketched on the map includes this hill.
153	Lots 38, 39, Rideau front.				Extent unknown; said to be 40 ft. deep in places.	The deposit lies on the west side of a boulder clay hill.
154	Con. viii, lot 12.	Frank La Plante, R. R. No. 1, Kemptville.	8 × 10 × 1⅔ = 133.	Locally for concrete work.	Deposit extends over an area of more than 20 acres; depth unknown.	
155	Con. v, lot 13.	W. H. Buchanan, Kemptville.	65	Locally on roads.	Extent small.	Drainage good; overburden ½ ft. gravelly soil; deposit hard to work because of boulders.

Table VII.—Commercial Development of Sands and Gravels—Continued.

SOUTH GOWER TOWNSHIP.—(Cont.)

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
156	Con. v, lot 6.	C.P. ry.	300,000	Ballast and for concrete work.	These pits occur in a very irregularly shaped gravel area which extends through con. iv and v, lots 1 to 6; it covers over 400 acres; at the s.w. end it is about 4 yds. deep.	Pit drained by system of trenches; gravel was worked by steam shovel; C. P. R. bought 26 acres at $100 per acre; deposit in this neighbourhood is about 12 ft. deep; there is an overburden of 2 ft. of sand with good gravel below to the n.w.
157	Con. v, lot 5.	S. Gower tp.	23 × 9 × 1½ = 310.	Used for patching the road near the pit and appears to wear well.		Overburden 2 to 3½ ft.; pit could be worked to s.w. and also opened across the road to advantage.
158	Con. vi, lot 1, Mountain tp.	Mountain tp.	21 × 26 × 1½ = 728.	Used on roads, proved too coarse and was abandoned.		
159	Con. iv, lot 1.	Samuel Gower, R. R. No. 3, Kemptville and S. Gower tp.	10 × 50 × 1 = 500. 12 × 40 × 1 = 480.	Locally on roads; wearing qualities poor.	The deposit covers about 80 acres, at pit it is not over 1 yd. deep.	Pit can be extended to n.e. and n.w. C. P. R. tracks are close to the north; gravel is 2 to 3 ft. thick at the pit.
160	Con. ii, lot 9.	Geo. Bennett, R. R. No. 2, Kemptville.	20 × 13 × 2 = 520.	Used for concrete work with good results, it has also been used for road repairing; gravel packs well and wears fair considering that overburden was used.	Deposit extends over an area of about 150 acres.	Pit could profitably be enlarged to the north and n.e.; gravel sells for 40 cts. per yd. in pit.
161	Con. iii, lot 5.	Wm. Sloan, R. R. No. 3, Kemptville.	12 × 7 × 2 = 168.	Used for road repair.	Deposit extends over an area of about 30 acres; depth of gravel at the pit is 2 yds.	Overburden 1 ft. sandy loam; gravel sells at 10 cts. per yard; screening necessary.

See also the gravel deposits described from Mountain tp.

EDWARDSBURGH TOWNSHIP.

162	Con. x, lot 35.	R. J. Porter, R. R. No. 2, Oxford Stn.	216	Locally for plaster work.	Extent unknown.	Sand deposit, mapped from surface indications.
163	Con. ix, lot 36.		30 × 5 × 1 = 150.	Used on road going north through swamp; ruts 1 to 6 in. deep; traffic very light.	Extent unknown but probably small.	Overburden ½ ft. sandy loam; deposit is low lying being 6 ft. above swampy ground; no water in pit.

164	Con. ix, lots 23, 24.	T. Kane, R. R. No. 3, Spencerville.	25 x 7 x 3 = 525.	Used in patching roads.	Deposit extends over an area of about 5 acres.	Overburden about 1 ft. gravelly soil; tp. council bought 1 acre for $200; drainage good; a small deposit lies just south of road in lot 24, con. viii.
165	Con. ix, lot 20.	L. Grue, Spencerville.		Used on Prescott road many years ago.		No information; old cut in Prescott road.
166	Con. ix, lot 12.		21 x 7 x 1 = 147.	Used on roads; gravel now covered by more recent surfacing.	About 4,500 cu. yds.	No water in pit; on rock outcrop.
167	Con. ix, lot 11.	A. A. Campbell, Ventnor.	18 x 25 x 1⅔ = 750.	Used on roads; the gravel now under newer surfacing.	Deposit is of small extent.	No water in pit.
168	Con. viii, lot 29.					Opened to a depth of 3 ft.
169	Con. viii, lot 31.	W. T. Peterson, R. R. No. 2, Spencerville.	50	Used locally for concrete and with good results.	Deposit extends north in a narrow (150 to 250 ft.) bow-shaped ridge for about a mile; ridge 5 to 7 yds. high.	Overburden 1 ft. reddish brown, sandy gravelly soil; ridge to east is of boulder clay.
170	Con. viii, lot 24.	Edwardsburgh council; Mrs. F. Whitley, Spencerville, R. R. No. 3.	2,500		Deposit extends over an area of about 65,000 sq. yds.	Overburden 1 ft. of sandy gravelly loam.
171	Con. vii, lot 12.	John Spencer, Ventnor. Two pits owned by Edwardsburgh council.	100 x 27 x 3 = 8,100. 60 x 20 x 4 = 4,800. 22 x 20 x 3 = 1,320.	Used on roads; gravel from east pit is coarse but wears well; gravel from west pit is rather fine, it packs well, however, and wears fairly well. From Spencer's pit for concrete work in Spencerville; dams, culverts, etc., are made of it.	Deposit extends over an area of about 20 acres and is at least 5 yds. deep.	Spencer's gravel sells for 30 cts. per yd.
172	Con. vi, lot 32.			Used on road near the cut but was found to be too coarse.	Extent unknown.	Overburden 1 ft. gravelly loam.
173	Con. vii, lot 29.	Wm. Robinson, Spencerville.	20 x 24 x 1⅔ = 800.	Formerly used on roads; council now using crushed stone; gravel was also used for cement sidewalks in Spencerville; work 6 yrs. old and still in good condition.	Deposit lies in a ridge 1 mile long and about 300 ft. wide running north from road between con. vi and vii; gravel is said to be 50 ft. deep near the south end.	Overburden 1 to 1½ ft. sandy gravelly soil; no water in pit; gravel sells at 25 cts. a load; rock outcrop to the east.
174	Con. vii, lot 29.		90 x 30 x ⅔ = 1,800.			
175	Con. vii, lot 30.		Small.			
176	Con. vii, lot 30.	James Black, Spencerville.				This is a test pit 8 ft. deep.

Table VII.—Commercial Development of Sands and Gravels—Continued.

EDWARDSBURGH TOWNSHIP.—(Cont.)

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
177	Con. vii, lots 17, 18.	Edwardsburgh tp.				No development; for extent see map.
178	Con. vii, lot 10.	Edwardsburgh tp. Joel Adams, R. R. No. 4. Spencerville.	170	Used locally for concrete in farm buildings.	Approx. extent of deposit is 300 × 100 × 6 = 180,000 cu. yds.; well near pit shows 6 yds. of gravel.	
179	Con. vi, lot 35.	Henry Keeler, R. R. No. 2, Spencerville.	30 × 50 × 2½ = 1,875.	Used years ago on Prescott road and side roads; these roads have since been stoned; used more recently as foundation for stone roads.	Deposit extends northward from pit for about 900 yds. in narrow ridge 80 yds. wide.	Overburden 1 ft. sandy loam with a few boulders; drainage good; owner sold ¼ acre to council in 1882 for $80.
180	Con. vi, lots 33, 34.		None.		Extent unknown.	Gravel hill no development.
181	Con. v, lot 24.	P. A. McIntosh, Spencerville.	45 × 10 × 1⅔ = 750.	Used on nearby roads, appears to cement quickly but is not very durable.	The deposit extends over an area of about 25 acres.	Overburden ½ to 1 ft. sandy gravelly soil; drainage good; gravel sells at 25 cts. per load.
182	Con. v, lot 24.	Edwardsburgh tp.		Gravel was used on roads but was found too coarse.		
183	Con. v, lot 28.	J. Dempsey, R. R. No. 2, Domville.	5 × 10 × 1 = 50.	Locally for concrete work.	Deposit is of small extent.	Overburden 1 to 2 ft. of sand; drainage good.
184	Con. iii, lot 28.	Edwardsburgh tp.	20	Weathered gravel was put on road nearby, does not wear well.	Deposit extends over about 20 acres.	Overburden 1 ft. of sandy loam; the gravel could be worked to south.
185	Con. iii, lot 25.	Harvy Riddell, R. R. No. 5, Spencerville.	780	Used on roads.	80,000 cu. yds. app.	Overburden 2 to 2½ ft. sandy gravel; the coarse top gravel along with the overburden was sold to council at 15 cts. a yd.; the better gravel underneath sells at 25 cts. a yd. and is used for concrete.

186	Con. i, lot 22.	T. Adams, R. R. No. 3, Prescott.	20 x 15 x 5 = 1,500	Used for years on the river front road; a piece of road gravelled in May 1915 showed a firm surface in October and was apparently wearing well under medium heavy traffic.	120,000 cu. yds app.	Overburden 2 ft. sandy gravel; coarser gravel and overburden was sold for road work at 15 cts. a yd.; the better gravel sells for 15-20 cts. per yd.
187	Con. i, lot 33.	W. W. Bradley, R. R. No. 3, Prescott.		Gravel was used on river front road before road was stoned, also for concrete.	Deposit extends over about 10 acres.	Pit has been abandoned, no demand for the gravel.

AUGUSTA TOWNSHIP.

188	Con. viii, lot 3.	Mrs. Wm. Cotton, Roebuck.		Road on which gravel was used is covered with drifting sand.	Deposit extends over an area of over 20 acres.	Overburden 1 ft. loam; deposit is partly covered with drifting sand.
189	Con. vi, lot 3.	Mrs. Mary Johnson, Roebuck.	14 x 2 x 70 = 1,960.	Placed on top of crushed stone 4 or 5 yrs. ago on Roebuck road between con. vi and vii; road is in good condition; gravel also used for concrete blocks for new church in Roebuck.	Deposit extends over an area of about 70 acres; depth of gravel unknown; rock 10 ft. from surface at pit 190.	Overburden 1 ft. gravelly loam; drainage good, gravel sells for 30 cts. per double load.
190	Con. vi, lot 3.	Wm. McKinley, Roebuck.	27 x 13 x 1⅛ = 600.	Gravel used for concrete.		Overburden 2 to 4½ ft. loam and silt; gravel is underlain by rock at depth of about 10 ft.; drainage of pit is poor.
191	Con. vi, lot 7.	Ben Throop, R. R. No. 2, Roebuck.	6 x 100 x 1⅛ = 1,100.	Used on roads but these have since been stoned; owner used gravel for concrete foundation; the concrete does not look in good condition.	Deposit extends s.e. for 1 mile from the last deposit 189 to 190; average width is 500 ft. but widening to 1,500 ft. at south end.	Overburden 1 ft. sandy loam; drainage good, gravel sells 25 cts. per load.
192	Con. v, vi, lot 17.					Lies west of hill of rock outcrop.
193	Con. iv, lot 2.	Jas. Bradley, Domville.	30 x 27 x 1 = 810.	Used years ago for road work, but the roads have been covered with stone since.	Deposit is small and low lying.	Overburden ½ to 1 ft. sandy loam; water standing in pit.
194	Con. iv, lot 1.	Bowman Wright, Domville.	30	Concrete work.	Deposit is of small extent.	Overburden 1 ft. sandy loam.
195	Con. iii, lot 5.		15 x 5 x 2 = 450.		Deposit extends northward from pit for 1,000 yds. with average width of 170 yds.; depth unknown but probably small.	Overburden 1 to 2½ ft. loam and sand; drainage good.
196	Con. v, lot 23.	Wm. Bishop, R. R. No. 1, Algonquin.	5 x 1½ x 30 = 250.		Deposit is of small extent.	Overburden of few in. sandy loam; drainage good.

Table VII.—Commercial Development of Sands and Gravels—Continued.

AUGUSTA TOWNSHIP.—(Cont.)

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
197	Con. v, lots 21, 22.				The ridge which probably contains gravel extends northwestward for 1 mile and has width of about 170 yds.	Deposit mapped from surface indications.
198	Con. iv, lot 11.				Deposit extends over about 15 acres.	Overburden ½ to 1 ft. sandy gravelly loam.
199	Con. iii, lot 23.		100		About 50,000 cu. yds.	Overburden 3 to 5in. loam; drainage good; ridge is about 6 ft. high.
200	Con. iii, lot 21.	Leonard Conklin, R. R. No. 2, Prescott.	24	Used in concrete stable floor, mix 1 to 8 gravel with top of 1 to 4 of sand; good condition.	Deposit lies in an east-west ridge and extends over an area nearly 40 acres; depth unknown.	Overburden ½ to 1 ft. sandy gravelly loam.
201	Con. iii, lot 20.	Augusta council, Wm. and Leonard Conklin.	33 x 50 x 3½ = 5,775.	Most of the gravel has been used on roads; much of the work has been since covered with stone.		Overburden 1 to 2½ ft. loam and sand; drainage good; council bought ½ acre from Wm. Conklin 40 yrs. ago for $150; council sells gravel at 10 cts. load.
202	Con. iii, lot 9.	Geo. Conklin, Prescott.	46 x 28 x 2½ = 3,200.		Deposit extends northwestward from road between con. ii and iii for 1,000 yds. with a width of about 670 yds.; depth of gravel unknown.	Overburden 1 to 3 ft. sand and loam; drainage good; gravel sells for 20 cts. load; east edge of deposit is covered with drifting sand; drifting sand also occurs in north part of deposit; gravel occurs in flat hill.
203	Con. iii, lot 8.	Wm. Robinson, R. R. No. 2, Prescott.	870	Used for concrete; was used on roads years ago but work has been covered with broken stone.		Overburden 1 to 2½ ft. sandy loam; drainage good; gravel sells for from 10 cts. to 20 cts. per load.

204	Con. ii, lot 9.	G. W. Robinson, R. R. No. 2, Prescott.	27 x 28 x 3 = 2,268.	1,100 loads of the gravel was put on 1½ miles of road between con. ii and iii just west of Prescott road in 1913; under soil sandy gravelly loam; in 1915 road soft, fairly smooth but uneven in wheel tracks; some ruts ½ to 1 in. in depth and some holes; side drainage poor; traffic medium to light; gravel seems to have poor cementing properties.	Deposit extends northward from pit 205 for over a mile in a ridge 170 yds. wide but widening out at the north to ½ mile; the deposit covers an area of about 450,000 sq. yds.; depth of gravel unknown but 10 ft. of deposit is exposed in two of the pits.	Overburden ½ to 1 ft. sandy gravelly soil; drainage good; gravel sells for 10 cts. per load.
205	Con. ii, lot 9.	D. Sterrett, Prescott.	18 x 18 x 2 = 648.	Gravel was used in construction of concrete sidewalks in Prescott from fair grounds to railway track; good condition.		Overburden 1 to 1½ ft. gravelly sandy soil; drainage good; gravel sells for 25 cts. load; pit bottom smoothly polished bedrock, of Beekmantown lime. with glacial striæ trending in the same direction as the ridge that is north and south.
206	Con. iii, lot 6.				Deposit lies in a very low ridge on top of a rocky hill; approx. extent of deposit 10 acres.	
207	Con. ii, lots 16, 17, 18.					Deposit mapped from surface indications.
208	Con. i, lot 24.	Jas. Rockey, Maitland.	28 x 12 x 1½ = 560.	Used locally for concrete.	The deposit extends over an area of about 60 acres; depth of gravel at pit is 7 ft. but probably increases farther back in the ridge.	Overburden 1 to 2 ft. sandy gravel; drainage good; the whole deposit lies above the general level of the country; deposit in lots 23 to 24.
209	Con. i, lot 22.	Harold Jones, Maitland.	30 x 30 x 2 = 1,800.	Used for years in repairing the river road; the road in the neighbourhood of the pit is in good condition, being hard and smooth.	Deposit extends over about 120 acres; depth of gravel at pit is 7 ft.	Overburden 2 ft. sandy soil; drainage good; deposit in lots 19 to 23.
210	Con. i, lot 15.	Ed. Bradley, Prescott.	30 x 10 x 2 = 600.	Used to build the road between con. i and ii up above the swampy ground to the south of the road and west of the pit; the road is in good condition.	None.	Deposit is exhausted.

Table VII.—Commercial Development of Sands and Gravels—Continued.

AUGUSTA TOWNSHIP—(Cont.)

Map No.	Concession and lot.	Owners and address.	Amount excavated in cu. yds.	Uses.	Amount of sand and gravel available.	Remarks.
211	Con. i, lot 14.	C. W. Beaven, Prescott.	1,400	Used on front road which in Nov. 1915 was in poor condition partly through lack of maintenance.	The deposit extends northward from the river over 1 mile and with a width of from 500 to 800 yds.; in the south of the deposit the gravel is from 7 to 10 yds. deep; at pit 213 in the north of the deposit, 3 yds. gravel is exposed.	Overburden 1 to 7 ft. gravelly soil; gravel sells for 25 cts. yd.; drainage good; deposit in lots 12, 13, 14.
212	Con. i, lots 13, 14	G. T. Ry. Co.	300,000	Used in ballasting the G. T. R. double track.		Overburden varies from 1 to 3 ft. gravelly soil; pit is provided with tracks which are now out of commission.
213	Con. i, lot 13.	Jas. Patterson, Prescott.	33 x 45 x 2 = 2,970.			Overburden of 1 ft. sandy soil; drainage good; pit is old and much of it is overgrown with sod; this edge of the deposit lies up against rock outcrop.
214	Con. i, lot 8.	Town of Prescott.	33 x 3 x 40 = 3,960	Used for concrete sidewalks in Prescott.	Deposit extends for 1,000 yds. along the road between con. i and ii with average width of about 200 yds.; depth of gravel at pit is 3 yds.	Overburden 2 ft. sandy soil; drainage good; deposit in lots 7, 8, 9.

PART II.

ROAD MATERIALS AVAILABLE FOR A HIGHWAY BETWEEN HULL AND GRENVILLE, QUEBEC.

PART II.

Road Materials Available for a Highway between Hull and Grenville, Quebec.

CHAPTER I.

INTRODUCTION.

This report is based on field work done on the north side of Ottawa river between Gatineau river and the eastern edge of Grenville township in the county of Argenteuil, Quebec. The purpose of the work was to find stone suitable for the making of a highway from Hull to Montreal and this was accomplished for one-half of the distance. The route of the proposed highway lies close to the north shore of the river nearly all the way from Hull to Grenville. All outcrops lying within 2 miles north of the river between the points indicated were examined and mapped and, where good stone was scarce, within this 2-mile belt search was made for suitable stone to the maximum practicable hauling distance north of the road, that is from 4 to 5 miles. The belt surveyed is 60 miles long and over 200 square miles in extent. Thirty-two deposits of stone and two of gravel lying near the proposed road were tested for the Geological Survey in the laboratories of Columbia university, New York.

A number of deposits of diabase and other first grade macadam material were found close to the proposed highway. Diabase deposits lie between Papineauville and Calumet at intervals of a few miles, many of them singly, containing enough material to pave the whole road (Plates I, XC). Deposits of diabase, kersantite, and augite-syenite, of good road-making qualities, lie close to the village of Buckingham, and at East Templeton, Thurso, and a point a few miles east of Plaisance there are deposits of dolomite and magnesian limestone of Beekmantown age of excellent road-making qualities. The study of all the stone directly near the road has also made possible some discrimination between the numerous types of gneisses. Gravel deposits are not numerous nor are many of them of large extent. Two gravel deposits were tested with fair results.

The writer was assisted by K. A. Clark, H. Gauthier, and R. S. Adams. The work done by Mr. Clark and Mr. Gauthier was especially effective. The outcrops west of Lièvre river as far as the Gatineau were mapped by M. E. Wilson of the Geological Survey in con-

nexion with areal work done under his direction. The writer is indebted to Mr. Wilson for much information regarding deposits of stone within that portion of the area reported on.

TOPOGRAPHY.

The country examined lies adjacent to and north of the Ottawa river. The greater part of it forms a portion of the immediate valley trough of the river, but the northern edge touches and laps over the frontal ridges of the Laurentian plateau. The valley bottom rises toward the Laurentian hills in a series of flat clay terraces. The terraces have steep fronts facing the river and their surfaces are broken by small hills of rock and by narrow valleys cut by tributaries of the Ottawa. The Laurentian plateau front forms a well-defined escarpment to the north from Papineauville east; west of Papineauville the change from plateau to river bottom is not so abrupt. The hills within the plateau have nearly flat, gently rounded, tops and are steep sided; they rise to elevations of several hundred feet above clay flats of irregular shape (Plate VIIIA). The mean elevation of the water of the Ottawa varies from 132 feet at Gatineau point to 131 in the neighbourhood of Calumet, a distance of nearly 60 miles. Close to the southern edge of the plateau overlooking the river the elevations of the plateau remnants that now exist as hill tops are over 700 feet.

The clay terraces in the river valley and the clay flats on the hills are fertile and for the most part under cultivation. The hills are rocky and covered with bush. Lumbering has been the principal industry of the villages scattered along the river front, but the timber supply is lessening and there is less lumber sawn to-day than formerly.

The formations found within the belt of country traversed in the course of this survey are tabulated below. They are arranged in chronological order with the most recently formed at the top of the table.

Table of Formations.

Eras.	System or formation	Lithological characters
Quaternary.	Glacial.	*Unconsolidated materials.* Partly stratified yellow sand and sandy gravel Stratified blue to grey clay carrying marine fossils. Unstratified boulder clay.
Palæozoic.	Chazy.	*Consolidated bedded sediments.* Sandstones and shales.
	Beekmantown.	Sandstones, calcareous sandstones, magnesian limestones, dolomites.
	Potsdam	Sandstone
Cambrian.	Late Pre-Cambrian.	Quartz syenite porphyry, quartz syenite, diabase, kersantite, hypersthene gabbro.
	Early Pre-Cambrian.	Pegmatites. *Gneisses of igneous origin:* (1) Granite gneisses: gneisses free from pyroxene, granites to diorites in composition. (2) Augite syenite gneisses: pyroxene-bearing gneisses from granite to gabbro in composition. *Grenville series.* Crystalline limestone, quartzite, and garnet gneiss.

Grenville Series.

The Grenville series comprises a group of altered sediments, namely, crystalline limestones, quartzites, and garnet gneisses. These are the oldest rocks in the area and they outcrop in many places. The crystalline limestones are generally white, coarse-grained crystalline rocks made up very largely of calcite. They are massive in the majority of cases, but in many instances the rock is foliated. The amount of magnesium carbonate in these rocks varies from place to place and in many cases the percentage is high enough to allow of the stone being quarried for magnesite. In places there is also a great deal of garnet, diopside, and other calcium silicates present.

The quartzites are white, hard, rather coarse crystalline rocks made up almost wholly of quartz. They are generally unfoliated. The

garnet gneisses are fine, even-grained crystalline rocks containing garnets. They are in most cases well foliated and cleave easily in parallel planes in one direction. They resemble the finer-grained varieties of the gneisses of igneous origin described in the next section.

Gneisses of Igneous Origin.

There are many outcrops of gneiss close to the proposed road, the majority of which were originally igneous rocks but others were derived from sediments. They have been changed by pressure and heat from rocks of granitic texture to rocks of foliated texture. The altered or metamorphosed sediments with gneissic texture are in general derived from what were originally clay-bearing rocks. They are usually fine-grained, have a well developed parallel cleavage, and belong to the Grenville series described above. In general the grains of the igneous gneisses vary in size from one-hundredth to about one-twentieth of an inch. The larger grains are from one-fiftieth to about one-tenth of an inch in size. The igneous gneisses vary in texture from well foliated varieties to those in which the foliation is not apparent to the naked eye. Their colour varies from light pinkish grey to black greenish grey.

Microscopic examination has shown that these rocks vary in mineral composition from granites carrying large proportions of alkalic feldspars and quartz and few dark ferromagnesian minerals, through a great many intermediate variations, to dark-coloured peridotites and pyroxenites in which the greater part of the rock is made up of augite, olivine, and other dark minerals. In the Buckingham district M. E. Wilson[1] has been able to distinguish between a series of pyroxene gneisses, and younger series of gneisses of the composition of granite or syenite. The geology of these gneisses is, however, complicated. The different types resemble each other closely in the field and are often intimately intermixed, that is a comparatively small rock outcrop may contain gneisses varying widely in composition and in age. In these circumstances it was not found practicable to distinguish the various gneisses in the survey for road materials. In the descriptions of rock outcrops given in Appendix B the gneisses are divided into two main classes, granite gneisses and augite syenite gneisses. The term granite gneiss as used in this report refers to light-coloured holocrystalline rocks, with a granular mosaic to foliated texture. Quartz is, in many places, a prominent constituent of the rocks referred to as granite gneisses, but no augite was discovered in the granite gneisses with the hand lens. Gneisses with a rather dark grey appearance were generally classed as "augite syenite gneiss" in the field, and in the majority of cases the mineral augite could be seen on the

[1] Wilson, M. E., "Southwestern portion of the Buckingham map-area, Quebec," Geol. Surv., Can., Sum. Rept., 1915, p. 158.

fresh rock surface with the aid of a hand lens. Their texture varies in the same way as that of the granite gneisses. Microscopic examination made after the field work was done proved, however, that certain augite-bearing gneisses were of a light grey green colour and others carry large percentages of quartz. It is possible that certain outcrops described in Appendix B as granite gneiss may, therefore, be augite-bearing gneiss, but in the majority of cases the field classification is doubtless correct.

In the following table the mineral compositions of a number of the gneisses are placed together for comparison. The results of the tests for percentage of wear, toughness, and cementing value are also included. The first five on the list are pyroxene free gneisses, the last five carry augite except in one specimen in which certain areas of calcite and chlorite are thought to be alteration products after augite. The table gives some idea of the variation in the mineral composition of the gneisses, for the samples represent the average types met with in the area examined. The rocks are as a rule of rather an acid type carrying a large percentage of the white minerals feldspar and quartz; some of them are of an intermediate type and very few are basic with high percentages of dark minerals.

Pegmatite.

A number of coarse-grained pegmatites consisting nearly wholly of feldspar and quartz intrude the gneisses in many places. They occur in dyke and vein-like form and are of no value in road work.

Kersantite.

Deposits of kersantite are found directly east of the town of Buckingham and also about 2 miles to the south and southwest of it.

There are two varieties of kersantite which are found to grade into one another in the field; one is a black, dense and the other a reddish grey, dense to medium-grained rock. The stone sampled 2 miles southwest of Buckingham is of the reddish grey type and in it reddish feldspar, augite, and biotite can be detected with a hand lens. The dense black variety is found on Belters farm northeast of Buckingham and in it a few shiny lath-shaped feldspar phenocrysts can be seen embedded in a fine-grained matrix. There is also a coarser-grained black variation which does not show the reddish feldspar. Microscopic examination shows that the rock is made up of magnetite, apatite, titanite, augite, biotite, plagioclase, quartz with secondary chlorite, epidote, iron oxide, muscovite, and kaolin. Microscopic examination of a specimen from southwest of Buckingham showed about 40 per cent labradorite feldspar, 23 per cent albite feldspar, 9 per cent quartz, 7 per cent biotite, 7 per cent augite, 6 per cent magnetite, and the remainder of the products of secondary alteration, epidote and chlorite.

Mineral Composition and Physical Properties of Certain Igneous Gneisses.

Map No.	Rock variety	Percentage of												Physical properties			Remarks
		Plagioclase	Orthoclase	Quartz	Augite	Hornblende	Magnetite, titanite, apatite	Biotite	Kaolin	Sericite	Calcite	Epidote	Chlorite	Toughness	Per cent of wear	Cementing value	
127	Granite gneiss	31	27	22		7	3	10						4·4	9	44	Medium-grained not intensely foliated.
131	Granite gneiss		+	+		+	+	+						4·9	10	48	
167	Pink granite gneiss													4·4	6	65	
118	Biotite-quartz syenite gneiss	+	+	+			+	+						4·6	6	80	Intensely foliated varying in size of the grains.
161	Quartz diorite gneiss	55		14			4·0	0·3	1·0				26·0	7·4	4	127	Rock badly fractured and granulated, fracture planes within 0·03 m.m. of each other.
51	Augite-quartz monzonite gneiss	31·6	18·3	36·4	3·6		2·3			4·8		2·9		3·8	7	91	Rather fine-grained and partially granulated quartz and feldspar showing strain shadows.
	Biotite augite diorite gneiss	+			+	+	+	+			+		+	3·3	12	81	
35b	Augite granite gneiss	7·8	26·7	24·1	26·3		0·4	5·6	2·9 incl. calc. and sericite.			3·4	2·7	3·6	17	80	High percentage augite; quartz and feldspar partially granulated.
68	Quartz syenite gneiss	18	54	10	?		2·0	1·0		6·0		2·0	7·0	4·5	16	35	Certain masses of calcite and chlorite are probably alteration products after augite.
35c	Augite syenite gneiss	+	+		+		+							3·5	25	59	Some of quartz and feldspar is granulated.

+ indicates that the mineral mentioned at the head of the column is present in the rock.

Hypersthene Gabbro.

Gabbro occurs chiefly on the west side of Charette lake north of Montebello. It is a greenish grey stone in which biotite, augite, and feldspar are generally visible. The augites are in many cases large and conspicuous and hold the other minerals as inclusions.

The specimen tested consisted of 39 per cent andesine feldspar, 8 per cent hypersthene, 38 per cent hornblende, 11 per cent biotite, and 4 per cent quartz.

Diabase.

The diabases are dark grey to greenish grey rocks, even-grained and crystalline, the size of the grains ranging from about one-twenty-fifth of an inch to that in which they are hardly visible to the naked eye. The stone breaks with a rough fracture and differs in that respect from the majority of the surrounding Pre-Cambrian rocks which are foliated and cleave with more or less ease in certain directions with resulting smooth surfaces. Small white feldspars lie in all directions through the rock and scattered among them are black augites. The greenish tint in the stone is due in large measure to secondary chlorite. The rough fracture of the diabase and the crisscross manner in which the white minerals lie in the stone are characteristic features (Plate VIIIB).

Microscopically the stone is made up of magnetite, augite, and plagioclase; in a number of samples olivine and perthite were present and at the end of one dyke north of Calumet contained biotite and green hornblende. Sericite, chlorite, epidote, iron oxide, and some serpentine, kaolin, and quartz are found as alteration products. The plagioclase is generally a basic labradorite about Ab_{25} An_{75}; in one slide oligoclase was also present. Perthite is an intergrowth of alkali feldspar and quartz. An estimation of the quantitative composition was made upon seven of the sections examined and is given in the table, page 136.

Quartz-Syenite or Granite.

This rock occurs over a large area to the northeast of Calumet and north of Grenville. It is pinkish red rock with greenish black minerals scattered through it. The mass of the stone is red feldspar, perthite, and soda-lime feldspars near albite in composition. The black minerals are probably hornblende although too badly altered to determine. There is from 5 to 10 per cent of quartz present in the slide examined. The pink granites found northwest of Pointe au Chene and near Calumet may be related to this syenite in age and origin, for the two rocks are similar in appearance and the pink granite is less foliated than the gneisses, and is, therefore, probably a younger rock.

Mineral Composition of Physical Properties of Certain Rocks of the Pre-Cambrian.

Map No	Name of stone	Percentage of													Physical properties			Remarks
		Plagioclase	Orthoclase	Quartz	Augite	Hornblende	Magnetite, titanite, apatite	Biotite	Olivine	Kaolin	Calcite and sericite	Epidote	Chlorite	Average size of mineral constituents	Per cent of wear	Toughness	Cementing value	
	Diabase	50	2		33		2						13	0·5 mm.	4	10	157	Part I, page 38.
138	Diabase	57	1·0	0·2	13	5	5				18	3	2	0·7 mm.	3·7	16	120	
156	Diabase	42			40		6·0			2	1		9	0·8 mm.	3·0	17	55	
164	Diabase	46	12		19		4·0			0·3	9	0·5	9	10 max. 3·5 min.	3·2	10	100	There is a certain amount of quartz present included with orthoclase.
183	Diabase	82	0·3		12		2·0				2·0	0·2	2·0	0·5 mm.	3·2	14	182	
172	Diabase	53	1·0		36		4		1·0			4	1	0·3 mm.	3·0	16	35	Quartz included in the percentage of orthoclase.
191	Diabase	44			3	25	8	2	18					0·3 mm.	3·4	11	91	
193	Quartz syenite porphyry		+	+		+	+							3	3·0	35	53	12% of the rock is of large crystals the rest very fine-gr. but crystalline.
41	Kersantite.	64		9	7		7	6				5	2	0·5 mm.	2·8	15	131	38% of feldspar labradorite, 25% albite.
62	Kersantite porphyry	+		+			+	+							2·8	17	234	Quartz accessory, very fine groundmass.

+ indicates that the mineral mentioned at the head of the column is present in the rock.

Quartz-Syenite Porphyry.

This stone is found on the farm of Mr. Lowe, north of Grenville, Que. Pink to brown feldspars with an occasional crystal of quartz are embedded in a fine-grained closely interlocking groundmass of feldspar, quartz, and blue amphibole (Plate VIIIC). The feldspar is apparently nearly all untwinned and is probably, therefore, alkalic. The porphyry is, according to Logan[1], intrusive into the quartz-syenite mentioned above.

Potsdam Sandstone.

The Potsdam outcrops in the neighbourhood of East Templeton and in an area lying several miles to the north of Gatineau point. The rock is white to greyish white and composed nearly wholly of rounded quartz grains.

Beekmantown Formation.

Outcrops of the Beekmantown are found in and east of the village of East Templeton, at Thurso, between Thurso and Plaisance, and in one or two small outcrops between Fassett and Pointe au Chene.

The Beekmantown beds in this area resemble those outcropping on the plain to the south of the city of Ottawa. They consist of sandstones, calcareous sandstones, dolomites, and magnesian limestones. The sandstones contain more or less lime and magnesium carbonate which cements the grains together. They are of a whitish grey colour. Sandstones with little or no calcareous cement are soft and break easily under the hammer. When rounded sand grains are plainly visible in the body of the rock and there is enough calcareous cement to form a tough firm stone the rock is called calcareous sandstone in this report. These rocks are generally light to dark grey with a blotchy look. The dolomites are very fine, even-grained rocks of a steel to buff grey colour. The magnesian limestones are coarser grained, uneven in their texture, and in most cases light grey in colour.

Unconsolidated Materials.

The unconsolidated materials consist of boulder clay, marine clay, gravel and sand. No boulder clay deposits were looked for or studied in the field. Such deposits are probably present in certain parts of the area worked over, but are certainly not extensive close to the river.

Marine clay is exposed on the flat terraces near Ottawa river and in the low flat places among the hills far to the north of it. The clay is grey to blue in colour, very plastic, and carries fish and shell remains of marine origin. It is well stratified and the beds lie flat or nearly so

[1] Logan, W. E., "The geology of Canada," Geol. Surv., Can., 1863, p. 39.

in nearly all the occurrences examined. It was deposited in an arm of the sea during the Champlain epoch.

Deposits of yellow sand in places stratified, and sandy gravel are of frequent occurrence. They lie in many cases upon small elevations rising above the general level of the clay terraces and also on the flanks of the hills which rise to the north of the river. At East Templeton and elsewhere there are, moreover, extensive sand deposits lying on the flat terraces. The greater part of the sand deposits were doubtlessly laid down as beaches and bars near the shores of the old Champlain sea. The gravels which occur with the sand carry a high percentage of well rounded Pre-Cambrian pebbles.

STRUCTURAL GEOLOGY.

The rocks of the Pre-Cambrian are either massive or foliated. The sediments of this division have been recrystallized and they have become mashed, banded, and foliated under intense earth stresses. Their original bedded structure disappeared in the process and in recrystallizing new minerals like garnet and diopside have been formed.

The igneous rocks of the early Pre-Cambrian are in most cases foliated or gneissic (Plate XA). In many masses where the banded structure is not evident the individual grains of feldspar and quartz have been partially granulated and a microscopic examination of the stone reveals other evidences of the strain to which the rock has been subjected (Plate XB). The degree of foliation of the igneous gneisses varies greatly over a short distance in some of the outcrops, so that it becomes difficult to locate an unbanded deposit of any size, even on an extensive outcrop.

The greater part of late Pre-Cambrian rock masses are unfoliated. Certain of the masses are sheared and fractured in some of their outcrops but they are as a whole much stronger and more massive than the earlier rocks. The diabase occurring in dykes is characterized by well developed fracture planes at right angles to the strike of the dyke (Plates I and IXB). These are regular smooth planes; less regular planes of fracture lie parallel to the strike of the dyke. The action of frost breaks the diabase along these fracture planes with comparative ease. The diabase outcrops are, therefore, often partly covered with loose blocks (Plate IX A). These blocks are in turn more easily removed by erosion than even soft bedrock in place and the result is that the site of a diabase dyke is in most cases a valley, though rock on both sides of it, in many cases much softer but not so easily broken into blocks, stands up in little hills above the diabase.

The Beekmantown and Potsdam beds are bedded and unmetamorphosed. They lie nearly flat or dip gently to the south.

RELATIONS OF THE FORMATIONS TO EACH OTHER.

The igneous gneisses have been found intruded into the crystalline limestones, quartzites, and garnet gneisses of the Grenville series in a number of places, proving that the Grenville series is older than the gneisses. Certain rocks of the granite gneisses are for the same reason considered younger than the augite syenite gneisses. Pegmatites are found intruded into the Grenville series and all the igneous gneisses. There is evidence of a great interval between the formation of the foliated rocks of the early and the unfoliated massive rocks of the late Pre-Cambrian. Of the late Pre-Cambrian rocks diabase was found cutting across bodies of kersantite and hypersthene gabbro and the diabase is, therefore, younger than the kersantite and gabbro. Logan states that the pink quartz syenite north of Grenville cuts across dykes of diabase. At the one contact seen by the writer the evidence of the relative age of the two rocks was not clear. Quartz-syenite porphyry is intruded into the quartz-syenite, and is, therefore, the younger rock.

CHAPTER II.

MATERIAL SUITABLE FOR ROAD-MAKING.

A trunk highway such as that contemplated between Montreal and Ottawa will in all probability eventually be subjected to traffic of more than 200 vehicles a day. For such a highway a surface of gravel macadam is unsuitable, although some of the gravel along the road has a high resistance to abrasion and if bound with bitumen might wear well under this traffic. The field stone found in the hills north of the road is generally weathered and its resistance weakened. It should not be used except for foundation work.

BEDROCK.

The results of laboratory tests upon the various classes of rocks found along the highway are given on pages 149 to 151. The results for per cent of wear and for toughness are shown graphically in Figure 5, and are compared with limiting values for bituminous and water bound macadam as explained on page 13.

Of the various kinds of bedrock, quartz-syenite porphyry, kersantite, diabase, certain of the igneous gneisses, and the Beekmantown dolomites, magnesian limestones, and calcareous sandstones are, in most of the deposits, suitable for use in water-bound macadam, on roads subjected to traffic up to say 150 vehicles per day. The porphyry, kersantite, and some of the augite bearing gneisses and diabases should prove durable in water-bound construction under traffic of over 200 vehicles per day. The porphyry, kersantite, augite-syenite gneiss, diabase, and firm unweathered dolomites, magnesian limestones, and calcareous sandstones of the Beekmantown should wear well, if bitumen bound, under a traffic of 200 vehicles per day and over. The kersantite is found near Buckingham only, the porphyry north of Grenville only and at some distance from the proposed road, so that their use can be only local. The augite bearing igneous gneisses give good values on testing, but their strength varies greatly, and their variation is apt to cause poor patches if any great length of road is surfaced from one deposit. Large deposits of diabase lie in places close to the proposed road, near Papineauville, Montebello, Pointe au Chene, and Calumet. North of Fassett they lie on a railway line (Plate XC), from which the road material can be distributed along the road from Calumet to Hull. The plentiful supply of stone of uniform quality to be obtained from these diabase deposits is their chief recommendation. Beekmantown dolomite is found adjacent to or within a few hundred yards of the pro-

posed road at East Templeton, Thurso, and the line road of the Gore of Lochaber. Fresh dolomite, magnesian limestone, and calcareous sandstone from these deposits are the best local material for use on the trunk road for several miles on either side of the localities at which they occur.

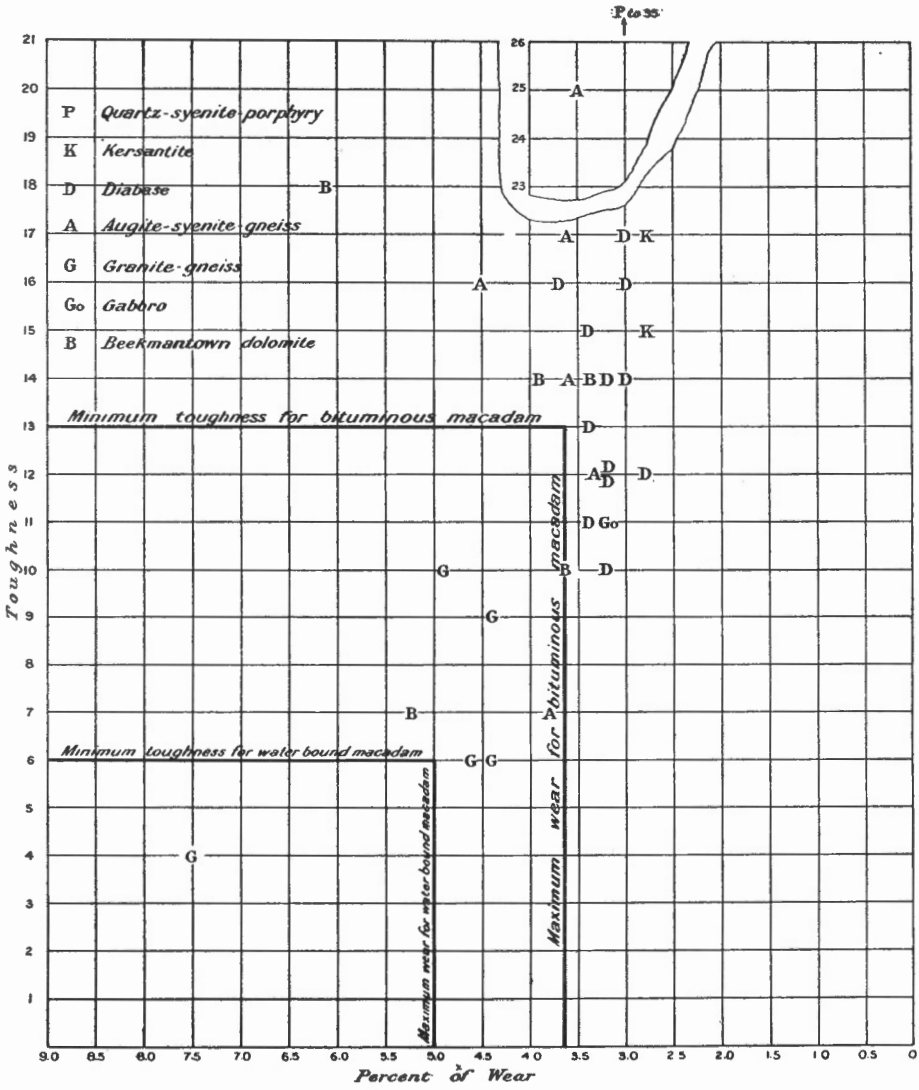


Figure 5. Relative toughness and per cent of wear of the better classes of bedrock near the Hull-Grenville road. The limits set for waterbound and bituminous macadam are explained on page 13.

A detailed discussion of the value of the different types of bedrock follows.

Types of Bedrock.

Grenville Series. The crystalline limestones and garnet gneisses of the Grenville are either too soft or too easily cleavable for use on roads. The quartzites if unbanded should be suitable for road foundations. It is not advisable to use quartzite in water-bound macadam, however, if better stone is available, because it is usually brittle and has little or no cementing value.

Igneous Gneisses. The igneous gneisses have been divided into those carrying augite, which are for convenience referred to as "augite-syenite gneiss," and those without augite called "granite gneiss" in this report. They differ in their physical properties as well as in their mineralogical make up. Five samples of granite gneiss were tested; four of these ranged from 4·4 to 4·9 in percentage of wear, from 6 to 10 in toughness, and from 44 to 80 in cementing value; average per cent of wear 4·6, toughness 8, cementing value 59, page 134; one excessively altered and chloritized sample had a per cent of wear of 7·4, toughness 4, and cementing value 127, page 134 (Plate XB). The tests indicate that the granite gneisses when fairly fresh are suitable for use on roads subjected to light traffic, but not for traffic ranging much over 150 vehicles per day. The excessively altered material is useless. Granite gneiss mixed with other types of rock was used on the macadam road running north from Papineauville for about one mile. This road and part of the streets in the village were constructed under proper engineering supervision in 1913 and 1914. They were in good condition at the end of August 1915 with the surface breaking slightly in the horse tracks. The traffic over the part just north of the village is probably not in excess of 150 vehicles a day and may average less than 100. The river road through the village of Montebello was surfaced with granite gneiss in 1913; other streets in the village were made in 1914. In September 1915 the surface of the river road was beginning to break. The traffic on this stretch is heavier than on the Papineauville road, for it forms the main street of the village of Montebello.

The five samples of augite-bearing gneisses which were tested varied from 3·3 to 4·5 per cent of wear, 7 to 25 in toughness, 35 to 91 in cementing value, page 134. The average values are: per cent of wear 3·7, toughness 15, cementing value 69. The average values of toughness and per cent of wear are nearly equivalent to those of diabase but the variation in values is much greater. To judge of the relative strengths of igneous gneisses at their outcrops is very difficult. The variation in strength is probably caused by differences in the intensity of earth stresses upon the various masses of rock. The effects of such stresses manifest them-

selves in the granulation of the quartz and feldspar minerals, the slipping of others along cleavage planes, the bending and distortion of others, and finally the recrystallization of the minerals with their longer dimensions in the same direction or in the same plane, giving rise to a foliated or gneissic texture (Plate XA). Granulation and distortion of the minerals is not, however, easily recognizable in the hand specimen or outcrop and certain foliated augite syenites have given tests as satisfactory as the more massive. The per cent of wear of the rocks varies as the quality of soft alteration products, such as calcite and chlorite; and rocks with large percentages of the dark mineral augite and yellowish green mineral epidote are apt to be high in toughness value. As a general rule, unfoliated material is tougher than foliated material that cleaves easily along the planes of bedding, but gneisses without the large percentage of mica or those that carry augite and hornblende may be extremely tough and durable.

Unfortunately the strength of the igneous gneisses as determined by the character or degree of their foliation, their alteration to soft minerals, and their granulation varies very greatly over short distances in nearly all the outcrops examined by us. There is, therefore, every chance that if a deposit of augite syenite were developed on a fairly large scale, say an output of 10,000 cubic yards and up, the resulting crushed stone would vary greatly in its road-making qualities.

The road from Buckingham to Masson was first macadamized in 1903. In 1914 about 2 miles of old macadam was scarified and about 8 inches of 2 and 1-inch augite syenite from quarry No. 35c with a binder of tarvia X was placed on it. This road has fairly heavy traffic but was in excellent condition in November 1915.

Kersantite. There are two or three areas of kersantite near Buckingham. The rock varies from dense to fine or medium-grained crystalline material. Samples of the dense and of the fine-grained material were tested, the resulting per cent of wear was 2·8, toughness 17 and 15, cementing value 234 and 131. The tests indicate that the kersantite will make excellent road material under nearly all traffic conditions. As far as we know, none of the kersantite near Buckingham has been used in macadam construction.

Hypersthene Gabbro. The test made upon the hypersthene gabbro near Charette lake indicates that it will bear from light to medium traffic under water-bound macadam conditions; but there is so much diabase of better quality in the same place that it would hardly be of advantage to develop this deposit.

Diabase. Tests upon the diabase deposits show fairly uniform results. Twelve samples were tested varying in toughness from 10 to 17 with an average of 14, in per cent of wear from 2·8 to 3·7 with an average of 3·2,

and in cementing value from 35 to 182 with an average of 115, pages 149 to 151 and Figure 5. The diabases are of poorer wearing quality and toughness than the average rock of the type, those from lake Huron for example, and this may be ascribed to the freshness of the rocks and lack of secondary hornblende, epidote, etc., which serve to strengthen the stone. Their cementing value is invariably good. The two samples of excessively coarse-grain (one millimetre) material have toughness values below the average, but their percentage of wear is better than the average. It is difficult to judge as to what should be considered the causes of such variations in toughness and wear as do exist. An excessive percentage of the secondary minerals chlorite, calcite, and sericite undoubtedly tends to decrease the resistance of the stone to abrasion, and diabase with a grain of one millimetre or over must be expected to have a lower toughness value than the average. As opposed to the igneous gneisses, however, the diabase deposits maintain a fair degree of uniformity in toughness values and percentages of wear. The average values as given for the diabase samples indicate that they are suitable for use in water-bound macadam subjected to a traffic of about 250 vehicles per day; and, if bitumen bound, they can be used under much heavier traffic conditions. Diabase from the quarry of the Ottawa Improvement Commission, lots 10, 11, range V, Hull township, with per cent of wear 2·8, and toughness 8, page 38, has been used with a bitumen binder on Clemow avenue and the causeway over Dow lake in Ottawa, with excellent results.

Quartz-Syenite Porphyry. The porphyry found on Lowe's farm north of Grenville has, according to the test, a very high toughness value. The per cent of wear is 3·0, toughness 35, and cementing value 53. It should make excellent road material under heavy traffic conditions (Plate VIIIC).

Potsdam. The Potsdam sandstone may be considered useless for any but foundation work. The same stone from the neighbourhood of Ottawa was tested: its per cent of wear was high and toughness very low.

Beekmantown. Five samples of Beekmantown stone were tested and they varied greatly in their physical characters. The per cent of wear ranges from 3·4 to 6·1, toughness 7 to 18, cementing value 40 to 120. Three of the samples which are of fresh magnesian limestone dolomite and firm calcareous sandstone range from 3·4 to 3·9 in per cent of wear, 10 to 14 in toughness, and 40 to 67 in cementing value. One of the others which is made up largely of calcareous sandstone has a per cent of wear of 6·1 and toughness 18. The poor resistance to abrasion is probably accounted for by the presence of a partly weathered or poorly cemented layer of sandstone in the beds sampled. Rather friable sandstone beds should always be carefully excluded from the crusher. A weathered dolomite from East Templeton gave per cent of

wear 5·2 and toughness 7, although fresh stone, partly from the same beds a few hundred yards away, gave per cent of wear 3·4 and toughness 14.

From the work done on the Beekmantown stone here and elsewhere it is certain that if friable sandstones and all weathered stone are excluded, the Beekmantown dolomites, magnesian limestones, and calcareous sandstones will furnish an excellent crushed stone suitable for light traffic, if water bound, and traffic up to 250 or 300 vehicles a day if bitumen bound.

Deposits of the Better Grades of Bedrock.

The following is a list of the map numbers of the better class of deposits found within practicable hauling distance of the proposed road. Further information regarding them is to be obtained from Appendix B, where they are described in detail.

Between Gatineau and Lièvre Rivers. Nos. 23a[1], 21a, 21b, 30, 35b[1], 35c,[1·2], 36, 41,[1] and 51[1].

From Lièvre River to Papineauville. Nos. 62,[1] 63, 68,[1] 80, 90, 92,[1·2] 93, 103,[1] 104, 127,[1] 133.

From Papineauville to Grenville. Nos. 138,[1] 146, 155, 156,[1] 157, 158,[1] 164,[1] 170b,[1] 172,[1] 177,[1] 178, 183,[1] 184, 187,[1] 188,[1] 191,[1] 193.[1]

Commercial Development of Bedrock.

Small quarries have been opened in the Beekmantown deposits at East Templeton, Thurso, and the line road of the gore of Lochaber. Augite-syenite gneiss has been quarried on Cameron's lot and the property of the Buckingham Electric Reduction Company's works at Buckingham. Most of the product has been crushed, but some of the East Templeton stone has doubtlessly been used for building and dimension work. The deposits mentioned in the preceding paragraph are for the most part of large enough size to pave several miles of road. In nearly all cases they can be worked to depths of 1 to 3 yards with little trouble with drainage, and many of the diabase deposits can be excavated to depths of 10 yards and more without getting below the ground water level (Plates I and XC, Figures 6, 8, 9). In the case of the Beekmantown formation, joint and bedding planes would be of assistance in blasting the rock, but the joint planes enlarged by the solution of the ground waters have caused trouble in drilling. The cross joints in the diabase dykes should also be of great help in blasting (Plates I, IXB). In the gneisses and other varieties of good stone fracture planes are more irregular. Nearly all of the deposits of stone recommended in this report will be found hard

[1] A sample from this deposit has been tested.
[2] Stone from this deposit has been used in macadam work.

enough to cause rapid wear of drilling and crushing tools. It is considered that the extra expense involved will be more than offset by increased length of service of the crushed stone in the road bed.

The better classes of stone lie at varying distances and seldom as much as 4 miles from the proposed road. The diabase at Maholey junction north of Fassett (Plate XC) is 7 miles away (Figure 7) but the product can be delivered directly on railway cars and shipped to points on the north shore branch of the Canadian Pacific railway which lies within one-half mile of the proposed road for the greater part of the distance between Gatineau river and Grenville.

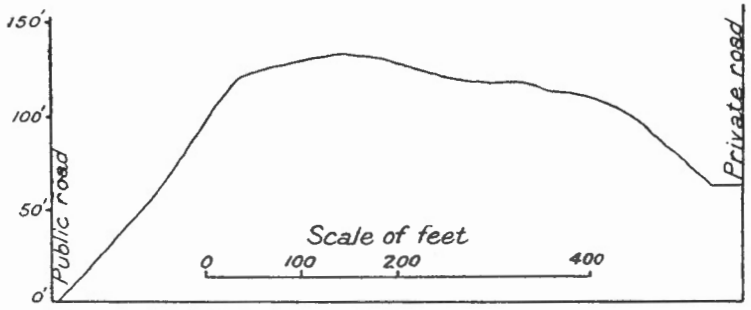


Figure 6. Profile of the crest of a portion of the diabase dyke west of Charette lake. Outcrop 157. Width of dyke 110 to 123 feet.

FIELD STONE.

By field stone is meant the loose more or less rounded boulders found scattered through the fields or on the hill slopes. They may have been transported from their original source for some distance or they may have been broken off from the parent outcrop within 100 yards of where they lie. Stone of this kind has invariably become somewhat weathered on all sides and is not so firm or tough in this district as fresh stone of the same kind quarried from the outcrop. A great many boulders occur in the Laurentian hills and they can be used to advantage in road foundations, but only those of durable rock species should be used for surfacing.

GRAVEL.

Gravel is found in places within a few miles of the river for the greater part of the distance from Lièvre river east to Grenville. The deposits are in most cases small and excessively sandy. Some of the larger deposits east of Papineauville have been mapped and two samples tested.

The gravel contains more or less sand which is invariably yellow and in many cases carries much iron oxide. It is stratified in certain

deposits. Practically all of the pebbles are of Pre-Cambrian age and from 80 to 100 per cent of them of good durable stone. The percentage of wear of one sample tested is 4·4 and the other 1·6, their respective cementing values 71 and 217. Both should make excellent roads for light traffic, the better of the two should wear well under heavy traffic if it is properly constructed.

MATERIALS TO BE AVOIDED.

With so much rock at hand from which a durable road can be made it is wise to avoid putting soft material or stone of doubtful quality into the surface of this trunk road. The following varieties of stone should not be used: crystalline limestones and garnet gneisses of the Grenville series, mica schists with much mica, gneisses which split with ease along the planes of foliation, coarse-grained pegmatites, sandstones of the Potsdam, friable sandstones of the Beekmantown, sandstones, and shales of the Chazy (outcropping at Grenville), stone carrying much of the alteration products chlorite and calcite, badly sheared, granulated or weathered stone. Rock varieties of doubtful value in the surface course, but probably suited for the foundation, are quartzites of the Grenville series, extremely coarse-grained granites, the granite gneisses, hypersthene gabbro, coarse-grained pink quartz syenite near Grenville. Certain granite gneisses and the gabbro should, however, do well in the surface for parts of the road where the traffic is light.

SOILS AND OTHER MATERIALS ON THE PRESENT ROAD SURFACES.

Except for a distance of a mile or two at Gatineau Point and another in Montebello, the Kings road along Ottawa river is not metalled and the road surface is the underlying native soil. Along the greater part of the road blue marine clay comes to the surface. This is a very plastic clay which becomes soft and very sticky and heavy in wet weather, but makes a smooth firm road after it is thoroughly dry and pounded down by traffic.

Along certain stretches of the river road such as that east of East Templeton near Plaisance and Papineauville, there are stretches of yellowish rather fine sand, and sand mixed with gravel and boulders occurs along the river road in both sides of Pointe au Chene. In the hills along the northern part of the belt surveyed, sand covers a far larger part of the surfaces of the roads than near the river. In places the sand is up to 10 feet deep, in others it is not more than a few inches. Sand is especially prevalent over areas of rock outcrop but a great part of the sand is underlain by blue clay.

Where there is a thin layer of sand overlying clay the road surface is in places firm, but where the sand layer is more than a foot or two

deep the surface becomes deeply rutted and hauling over it is very heavy. Short stretches of the road pass over a natural mixture of clay and sand which may overlie clay or in some places bedrock. Such clay-sand or sand-clay surfaces apparently stand up better under the light traffic that prevails along the Kings road than any of the other native soils.

Black clay loam or muck is of infrequent occurrence and does not cover a long stretch of the front road at any one place. The black muck patches are apt to be wet and have to be adequately drained before they can be considered as foundations for a broken stone road. For details see Appendix D.

Appendix A.

Tests Made upon Stone.

Map No.	Location.	Owner.	Rock species[1]	Formation or age.	Specific gravity.	Water absorbed, pounds per cu. ft.	Per cent wear.	French coef-ficient of wear.	Hard-ness.	Tough-ness.	Cement-ing value.
20a	Old quarry s. of main road and w. of wharf road in village of East Templeton.		Impure magn. lime and dol somewhat weathered	Beekmantown.	2·77	0·63	5·2	7·7	17·3	7	120
20a	New quarry e. of wharf road, East Templeton.		Same, fresh rock.	Beekmantown.	2·78	0·88	3·6	11·1	15·5	10	61
35b	Hill directly w. of Buckingham.		[2]Coarse foliated augite syenite gneiss.	Early Pre-Cambrian.	2·93	0·14	3·6	11·1	18·9	17	80
35c	At Buckingham Electric Reduction Co.'s works, Buckingham, Que	Buckingham Electric Reduction Co.	Massive augite syenite gneiss.	Early Pre-Cambrian.	2·84	0·01	3·5	11·4	18·9	25	59
41	Two miles s.w. of Buckingham just n. of road between ranges ii and iii, $\frac{7}{10}$ mile w. of Lièvre river.		Kersantite	Late Pre-Cambrian.	2 76	0·11	2·8	14·3	18·9	15	131
51	Two miles n.w. of Bassin du Lièvre, lot 19a, range ii, Buckingham.	Thos. Trudel.	Fine-gr. augite, syenite gneiss.	Early Pre-Cambrian.	2·78	0·06	3·8	10·3	19	7	91
62	North of e.-w. road and 1 mile e. of Buckingham near farm-house.	J. E. Belter, Buckingham.	Diabase.	Late Pre-Cambrian.	3·02	0·11	3·2	12·5	18·9	12	166
62	Immediately n. of diabase on Belter's farm.	J. E. Belter, Buckingham.	Fine-gr. kersantite.	Late Pre-Cambrian.	2·87	0·03	2·8	14·3	18·4	17	234
68	Lot 20, range v, Lochaber, 3 miles n. of Lochaber Bay, Que.		Fine-gr. augite, syenite gneiss, fairly massive.	Early Pre-Cambrian.	2·70	0·14	4·5	8·9	18·7	16	35
92	Quarry e. of n.-s. road in village of Thurso.	Thurso village.	Impure magn. lime. and dol.	Beekmantown	2·71	0·08	3·4	11·8	18·5	14	67

[1] gr. = grained, ry. = railway, sil. = siliceous, magn. = magnesian, lime. = limestone, dol. = dolomite.

[2] The term augite syenite gneiss was applied in the field to a series of augite bearing gneissic rocks of igneous origin varying in composition from granites to gabbro and is used in that sense here. Similarly the term granite gneiss is applied to a set of augite free gneiss varying in composition from granite to diorite. The petrographic names for these gneisses are given in the table on page 134.

Tests Made upon Stone.—Continued.

Map No.	Location.	Owner.	Rock species	Formation or age.	Specific gravity.	Water absorbed, pounds per cu. ft.	Per cent wear.	French coefficient of wear.	Hardness.	Toughness.	Cementing value.
103	Quarry at forks of Kings road and tp. line roads, 2½ miles w. of Plaisance, Que., lower beds in section.		Sil. magn. lime.	Beekmantown.	2·80	0·21	6·1	6·6	18·9	18	63
103	Quarry at forks of Kings road and tp. line roads, 2½ miles w. of Plaisance, Que., upper 12 ft. in sec.		Sil. magn. lime. and dol.	Beekmantown.	2·83	0·34	3·9	10·3	17·1	14	40
118	Railway cut, 1 mile w. Plaisance, Que.	Jos. King, Plaisance.	Fine-gr. foliated granite gneiss.	Early Pre-Cambrian.	2·89	0·08	4·6	8·7	18·2	6	80
127	Two miles w. of Papineauville, ½ n. of Kings road, and w. of mountain road.		Granite gneiss coarse-gr. fairly massive.	Early Pre-Cambrian.	2·77	0·28	4·4	9·2	18·7	9	44
131	Two miles n. Papineauville, ½ w. of St. Andre Avelin road.		Largely foliated granite gneiss.	Early Pre-Cambrian.	2·83	0·30	4·9	8·2	17·0	10	48
138	Lot 84, Ste. Angelique parish, 1 mile n.e. of Papineauville.	Antoine Robitaille, Papineauville.	Diabase.	Late Pre-Cambrian.	3·03	0·13	3·7	10·8	18·5	16	120
156	Two miles n. of Montebello, ½ mile w. of Charette lake, n. of e.-w. road		Diabase.	Late Pre-Cambrian.	3·03	0·16	3·0	13·3	18·7	17	55
158	Two miles n.e. of Montebello, ½ mile s. of Charette lake.	Mr. Charette, Montebello.	Diabase.	Late Pre-Cambrian.	3·05	0·11	3·4	11·8	18·7	15	123
159	On w. side Charette lake, Montebello.	Mr. Kemp, Montebello.	Gabbro.	Late Pre-Cambrian.	2·96	0·18	3·2	12·5	18	11	90
164	Maholey junction, 7 miles n. of Fassett, immediately w. of ry.	Fassett Lumber Co.	Diabase, coarse-gr. and badly altered.	Late Pre-Cambrian.	3·03	0·18	3·2	12·5	18·6	10	100
164	Same from railway cut.	Fassett Lumber Co.	Diabase, coarse-gr. fresher than preceding.	Late Pre-Cambrian.	3·06	0·07	2·8	14·3	18·8	12	86
165	On mountain road 3 miles w. of Fassett, ½ mile n. of Kings road.		Grey granite gneiss much altered.	Early Pre-Cambrian.	2·68	0·17	7·4	5·4	18·3	4	127

167	At foot mountain 1½ miles w. of Pointe au Chene, ½ mile n. of Kings road.		[2]Pink granite gneiss, sheared, not intensely foliated.	Early Pre-Cambrian.	2·62	0·67	4·4	9·0	18·7		
170b	East of mountain road, 500 ft. n. of Pointe au Chene.		Augite syenite gneiss, fine-gr. foliated.	Early Pre-Cambrian.	2·98	0·00	3·6	11·1	18·8	14	45
172	Lot 2, range ii, augmentation de Grenville 1 mile n. of Pointe au Chene on mountain road.	James Young, Pointe au chene.	Diabase.	Late Pre-Cambrian.	3·05	0·25	3·0	13·3	18·8	16	35
177	Lot 2, range iv, augmentation de Grenville tp., 3 miles n. of Pointe au Chene, Que., e. of mountain road.	Thos. Garland, Pointe au Chene.	Diabase.	Late Pre-Cambrian.	3·04	0·13	3·2	12·5	18·5	12	97
183	1,000 ft. n. of Kings road and just e. of Rouge river, 2 miles w. of Calumet.	Riordan Paper Co., Ltd., Hawkesbury.	Diabase.	Late Pre-Cambrian.	3·01	0·08	3·2	12·5	18·6	14	182
187	Lot 13, range iv, Grenville, about 1 mile n. of Kings road on mountain road e. of Calumet.	A. McKay, Calumet.	Diabase.	Late Pre-Cambrian.	3·01	0·09	3·4	11·8	18·7	13	164
188	West of Calumet creek and first mountain road e. of Calumet, 2½ miles n. of Kings road.	E. Brown, Calumet.	Diabase.	Late Pre-Cambrian.	3·04	0·08	3·0	13·3	18·6	14	162
191	On Scotch road about 4 miles n. of Grenville.		Basic diabase.	Late Pre-Cambrian.	3·01	0·04	3·4	11·8	18·5	11	91
193	Just w. of Rawcliffe, n. Grenville.		Quartz syenite porphyry.	Late Pre-Cambrian.	2·69	0·12	3·0	13·3	19·4	35	53
	Cameron's lot, n. of Alexandra Hotel, Buckingham, Que.		[1]Augite syenite gneiss, fairly massive.	Early Pre-Cambrian.	2·78	0·05	3·3	12·1	17·1	12	81

[1]See footnote 2 on page 149.

Appendix B.

Deposits of Bedrock.

The detailed information obtained regarding deposits of stone has been assembled in this Appendix. Each area referred to in the list is designated by a number on the map, in certain cases parts of an area have different numbers, and one number occasionally refers to more than one area. The rocks referred to as altered sediments are of the Grenville series, see page 131. For the sake of brevity all igneous gneisses containing pyroxene are referred to in this Appendix as augite-syenite gneiss and all igneous gneisses which do not carry pyroxene as granite gneiss. Both varieties of gneiss vary in their composition (see the table on page 134) and the terms augite syenite and granite gneiss as used in this table each represent a number of varieties varying from granite to gabbro in composition.

No. 1. Lots 6, 7, range IX, Hull. Augite syenite and garnet.

No. 2. Lots 5, 6, range X, Hull. Vitreous quartzite and garnet gneiss with patches of granite, quartz syenite, and crystalline limestone.

No. 3. Lot 4, range X, Hull. Largely quartzite and garnet gneiss.

No. 4. Lot 4, range X, Hull. Vitreous quartzite and garnet gneiss (Grenville series).

No. 5. Lot 3, range X, Hull. Largely granite with pegmatite and rocks of the Grenville series.

No. 6. Lots 1 to 5, range XI, Hull. Vitreous quartzite and garnet gneiss.

No. 7. Lot 4, range IX, Hull. Crystalline limestone.

No. 8. Lot 2, range VIII, Hull. Crystalline limestone.

No. 9. Lots 27, 28, range III, Templeton. Vitreous quartzite, garnet gneiss with some granite gneiss, and pegmatite.

No. 10. Lots 23, 24, range III, Templeton. Potsdam sandstone outcrops in the northwestern half of the area and in isolated outcrops to the west. Along the eastern edge there are outcrops of sandstone with thin beds of conglomerate and a 1-foot bed of calcareous sandstone. This must be at the base of the Beekmantown.

No. 11. Lots 25, 26, between ranges IV and V, Templeton. Vitreous quartzite and garnet gneiss with granitic intrusions. Small outcrop of Potsdam to southeast.

No. 12. Lot 25, range V, Templeton. Rather fine-grained augite syenite gneiss.

No. 13. Lots 23 to 28, range V, Templeton. Syenite gneiss and augite syenite gneiss with some pegmatite. The same outcrops to the east past the cemetery and church. The best looking stone, amounting to several thousand cubic yards, lies north and west of the corner of the township and east-west roads; south on the township road the outcrops are badly foliated.

No. 14. Lots 26, 27, range V, Templeton. Vitreous quartzite and garnet gneiss.

No. 15. Lots 21, 22, range V, Templeton. Altered sediments of the Grenville series and augite syenite gneiss to the northwest of the area. Along the southeastern side there are outcrops of garnet gneiss and quartzite. Isolated outcrops of Potsdam and garnet gneiss to the southeast.

No. 16. Lots 17 to 25, range VI, Templeton. Mostly granite gneiss with vitreous quartzite and garnet gneiss along the southeast edge.

No. 17. Lots 17, 18, range II, Templeton. Vitreous quartzite and garnet gneiss.

No. 18. Lots 14 to 17, range II, Templeton. 18a, mostly augite syenite gneiss with subordinate crystalline limestone. North of the road the stone looks promising. No. 18b, vitreous quartzite and garnet gneiss.

No. 19. Lots 13 to 15, range II, Templeton. 19a, Potsdam sandstone. No. 19b, Beekmantown formation. Ten feet of calcareous sandstone lying over about 3 feet of sandstone.

No. 20. Lot 13, range II, Templeton. No. 20a, Beekmantown formation. Southwest of the road forks there is 7½ feet of magnesian limestone and dolomite in an old quarry and across the road a thickness of 5 feet of these beds is exposed. Tests have been made on the stone from both quarries. There is sandy material on east edge of outcrop. There is about 30,000 cubic yards of fairly good dolomite lying above water level south and the same amount north of the main road. No. 20b, outcrops of Potsdam sandstone with some conglomerate material.

No. 21. Lot 11, range II, Templeton. No. 21a, Beekmantown dolomite and magnesian limestone. A 7-foot escarpment on the west offers quarrying facilities, the stone lies flat. There is an outcrop of the same kind to the south. No. 21b, Beekmantown dolomite, etc.

No. 22. Lots 16, 17, range II, Templeton. Potsdam sandstone.

No. 23. Lots 16, 17, range VII, Templeton. Crystalline limestone with quartzite and garnet gneiss to the north.

No. 24. Lots 14, 15, range VII, Templeton. Vitreous quartzite, garnet gneiss, etc. Rocks are foliated.

No. 25. Lots 5 to 12, range VII, Templeton. Vitreous quartzite and garnet gneiss with some pegmatite and augite syenite gneiss.

No. 26. Lots 12, 13, range VI. Augite syenite gneiss with quartzite and crystalline limestone.

No. 27. Lots 13, 14, range VI. Vitreous quartzite and garnet gneiss. The same material in a number of detached outcrops to south.

No. 28. Lots 4 to 12, ranges V, VI, Templeton. Very gneissic augite syenite and also rocks of the Grenville series.

No. 29. Lots 1 to 5, range VI, Templeton. Augite syenite gneisses of varying composition.

No. 30. Lot 1, range VI, Templeton. Augite syenite gneiss. There is about 90,000 cubic yards available of a somewhat coarse and acid but otherwise promising looking stone. No. 31a. Lots 22 to 28, range IV, Buckingham. Augite syenite gneisses with patches of crystalline limestone. No. 31b. Lots 20, 21, range IV, Buckingham, crystalline limestone.

No. 32. Lot 24, range II, Buckingham. Augite syenite gneiss with some quartzite. Small outcrop pegmatite across road to the south.

No. 33. Lots 18, 19, range IV, Buckingham. North part crystalline limestone, south part augite syenite gneiss. At western edge along road there is some fine-grained, massive material to the amount of several hundred cubic yards.

No. 34. Lots 12 to 18, range IV, Buckingham. Largely augite syenite gneiss except at western tip which is of crystalline limestone.

No. 35. Lot 15, range IV, Buckingham. No. 35a, several thousand cubic yards of fine-grained, massive feldspathic augite syenite gneiss, good stone. No. 35b, coarse foliated augite syenite gneiss of type found through greater part of this hill. Sample tested. This is technically an augite granite gneiss. No. 35c, fairly massive, rather coarse augite syenite gneiss. Sample tested.

No. 36. Lot 21, range III, Buckingham. Diabase dyke. About 250 cubic yards diabase available. Owner, D. Laframboise.

No. 37. Lots 14 to 22, ranges IV, V, Buckingham. Augite syenite gneisses.

No. 38. Lot 20, range III, Buckingham. Augite syenite gneiss, fine to medium-grained and somewhat foliated.

No. 39. Lots 18, 19, 20, ranges II, III, Buckingham. Augite syenite gneiss. Eastern part of outcrop consists of medium-grained, foliated rock with some dense tough material towards the northeast corner. Some good material occurs where the line of the road crosses the hill shown on map.

No. 40. Lot 16, range III, Buckingham. Augite syenite, much being coarse-grained and foliated. At the east and west ends there is considerable fine-grained, massive material. Outcrops to southwest of the same material.

No. 41. Lots 13, 14, range III, Buckingham. This outcrop contains a good deal of fine to medium-grained kersantite and fairly massive augite syenite. Where road crosses east edge of outcrop, kersantite and augite syenite occur with an overburden of sand. Under house to north there is 3 by 33 by 10, about 1,000 cubic yards, dense and massive kersantite. A sample of kersantite east of house, was tested; 900 feet north of the house there is a dense dyke with 600 cubic yards of kersantite. South of road several hundred yards of dense brecciated kersantite in outcrops 3 to 5 feet high occurs

(fractures 2 inches and less apart). Along east edge of outcrop north of road are two patches of about 1,000 cubic yards massive, fine-grained rather acid augite syenite and 4,800 cubic yards augite syenite becoming foliated to west.

No. 42. Lot 13, range III, Buckingham. Crystalline limestone, pegmatite, and augite syenite gneiss.

No. 43. Lot 12, range III, Buckingham. Crystalline limestone with some kersantite.

No. 44. Lot 11, range III, Buckingham. Crystalline limestone.

No. 45. Lot 11, range III, Buckingham. Kersantite, medium to fine-grained, much sheared. The stone lies in the bed of the Lièvre river, the banks are steep, over 50 feet high in places, and the material is, therefore, not available.

No. 46. On river banks, ranges I and II, Buckingham. No. 46a, crystalline limestone and Potsdam sandstone. No. 46b, Potsdam sandstone. No. 46c, crystalline limestone north of railway, Potsdam sandstone south of railway.

No. 47. Lot 21, range III, Buckingham. Altered and foliated augite syenite.

No. 48. Lot 22, range II, Buckingham. Altered and foliated augite syenite.

No. 49. Lot 20, range II, Buckingham. Altered, coarse-grained and acid augite syenite. South end of outcrop contains 900 cubic yards of more basic material.

No. 50. Lot 19, range II, Buckingham. Coarse-grained acid augite syenite.

No. 51. Lot 19, range II, Buckingham. Augite syenite gneiss mostly altered acid and coarse-grained. Technically augite quartz monzonite gneiss. Southeast part of outcrop is fairly massive, medium-grained augite syenite. Rock occurs in outcrops 5 to 6 feet high. Several thousand cubic yards available. Owner, Thos. Trudel. The stone from just east of house was sampled and tested.

No. 52. Lots 16, 17, 18, range II, Buckingham. Augite syenite gneiss mostly altered and foliated, acid, etc.

No. 53. Lot 15, range II, Buckingham. Rather basic, fine-grained, foliated augite syenite gneiss. Only small quantity available.

No. 54. Lots 14, 15, range II, Buckingham. Potsdam sandstone.

No. 55. Lots 15, 16, 17, range II, Buckingham. Potsdam sandstone.

No. 56. Lot 18, range II, Buckingham. Potsdam sandstone.

No. 57. Lots 19, 20, 21, range II, Buckingham. Altered acid augite syenite gneiss with crystalline limestone near creek. Several small outcrops.

No. 58. Northeast from village of Buckingham. Crystalline limestone and sediments. At north end of outcrop at the village dump heap there are the remains of a diabase dyke. Few hundred cubic yards still remain in place on side hill.

No. 59. South of 58. Crystalline limestone.

No. 60. South part of large rocky area east of Buckingham. Foliated acidic rock, with a strip of crystalline limestone extending north and south through the middle of the area. The area is covered with brush with outcrops of rock occurring here and there. Rock is poor in quality and mostly inaccessible.

No. 61. That part of area 60 along the south side of road running east from northeast corner of Buckingham. Dense and much brecciated kersantite. Outcrops occur in form of little bluffs in isolated places in the bush.

No. 62. Lot 6, range V, Buckingham. Dense to medium-grained, massive kersantite cut by diabase dyke. There are crystalline limestone outcrops along the northern edge of the area. About 14,000 cubic yards diabase and 120,000 cubic yards kersantite. Owner, J. E. Belter. Both the diabase and kersantite could be readily quarried. Kersantite is in a hill with a continuous face for 600 feet on the west side. The kersantite at the face is dense and brecciated, but becomes massive and fine-grained in a short distance toward the centre of the deposit. Samples of the kersantite and diabase were tested. The kersantite to the south toward the road is much coarser-grained and is poor compared to above-mentioned material. About 22,000 cubic yards more diabase outcrops on the farms to the east, owned by Thos. McNamara, Fred. Kennedy, and Michael Gleason. In each patch the diabase stands by itself and could be easily worked.

No. 63. Bell Graphite mine. Diabase. Two dykes of diabase are exposed on the face of the hill overlooking McNaughton creek. One dyke cuts through a mine excavation and the other is about 900 feet northwest along the hill. About 10,000 cubic yards material available at each place. Country across the creek is cleared and roads for hauling are accessible.

No. 64. Range II, Buckingham. Massive quartzite. The outcrop is very small

No. 65. Range II, Lochaber. Crystalline limestone and altered sediments. Two small outcrops along the road.

No. 66. Range II, Lochaber. Fine to medium-grained granite, acid on the west side of outcrop but more basic on the east side. Outcrop is in form of a hog's back 200 feet wide extending 1,300 feet north and south across the road. Middle of deposit is about 10 feet high at the road, becoming gradually lower to south. The rock is not very good road material although the best looking in the neighbourhood.

No. 67. Ranges II and III, Lochaber. Southern part of outcrop crystalline limestone and altered sediments, northern part acidic granite gneiss. Altered sediments extend from southern limit to about 1,500 feet north of road.

No. 68. Range V, Lochaber. Very acidic and foliated granite gneiss, but including two patches of medium-grained dark green to reddish augite syenite gneiss. The augite syenite is much altered and no augites were positively identified under the microscope. The deposits of augite syenite lie northeast of a house which is on the south side of road and are at the south and north limits of the outcrop. The deposit at the south limit contains about 145,000 cubic yards and that at the north about 100,000 cubic yards of stone suitable for road material. Sample tested from the southern of the two deposits.

Nos. 69 to 73. Range V, Lochaber. Fairly massive, coarse-grained augite syenite gneiss, granite gneiss, and quartzite. No good road material occurs in these areas.

No. 74. Range VI, Lochaber. Acid, foliated, red granite gneiss varying toward the north to a massive basic, rather coarse-grained augite syenite. About 120,000 cubic yards of fairly good augite syenite gneiss occurs in the outcrop. The stone is quite accessible from the neighbouring road.

No. 75. Between ranges V and VI, Lochaber. Altered coarse-grained, acid augite syenite gneiss and reddish to whitish granite gneiss. On property of Mr. Thibeaudeau, range VI, there is a deposit of 100,000 cubic yards medium-grained to greenish to light grey augite syenite, massive to slightly foliated. Deposit is in form of hill 30 feet high.

No. 76. Range V, Lochaber. Foliated red granite gneiss with strips of dark, fine-grained gneiss.

Nos. 77 to 79, 81 to 84. Along bank of Blanche river. Foliated red granite gneiss intruded by dark, fine-grained gneiss.

No. 80. Blanche Mills. Diabase. Present in small quantity in the river bed, inaccessible for practical purposes.

No. 85. Range V, Lochaber. Foliated granite gneiss.

No. 86. Range V, Lochaber. Foliated granite gneiss and mica schists.

Nos. 87, 88. Range V, Lochaber. Foliated granite gneiss and schists.

No. 89. Range IV, Lochaber. Altered sediments and acidic granite gneiss.

No. 90. Range IV, Lochaber. Beekmantown formation. Deposit on property of H. Sutherland, Thurso, Que. Strata vary from calcareous sandstone to dolomite. At north side of deposit there is a bare face of 15 feet high where quarrying could be easily started. Overburden over deposit varies widely. Deposit is about 40,000 square yards in extent.

No. 91. Village of Thurso. Outcrop in the village acid granitic gneiss with some altered sediments. Outcrop of a massive and binary granite gneiss on east side of village. The latter is suitable for road foundation, the rest is worthless.

No. 92. Village of Thurso. Quarry east of main north-south street. Beekmantown formation. There is about 20 feet of siliceous magnesian limestone and 3 feet of calcareous sandstone exposed lying over Pre-Cambrian quartzite. Quarry owned by Mr. Dole, operated by Edward Lefebvre. About 8,000 cubic yards have been excavated and used in macadam roads in the streets and north from the village. Available material 140,000 cubic yards. Municipality of Lochaber and Gore have lease on quarry for ten years starting 1913. Have bought 10 by 16 inch jaw crusher, steam engine, 2 steam drills, steam roller, and grader. Road construction was done in 1914 and 1915. This stone has been tested.

No. 93. Village of Thurso, west of 92. Beekmantown dolomite, etc. Small quarry owned by Mr. Beauchamp. Excavation, 160 cubic yards. Rock exposed on a knoll of 5,000 square yards extent. To the north are outcrops of conglomerate with pebbles of quartzite in a magnesian limestone matrix.

No. 94. Range IV, Lochaber. Granite gneiss. On east side of outcrop along a low face extending for about 100 feet, dense, hard basic looking rock occurs. Overburden of soil and underbrush hides extent of material. A large part of the outcrop is massive and hard but very acidic.

Nos. 95, 96, 97, 98. Range IV, Lochaber. Foliated granite gneiss. None of the rock in these outcrops looks like good road material.

Nos. 99, 100, 101. Range IV, Lochaber. Foliated granite gneiss with some altered sediments. Unsuitable for road work.

No. 102. Range IV, Lochaber. Mostly medium-grained, foliated, grey granite gneiss. At north of outcrop there is some medium-grained, foliated augite syenite. At north extremity of outcrop by the road, 1,900 cubic yards fairly good, medium-grained augite syenite occurs.

No. 103. Range IV, Lochaber, south Kings road. Beekmantown calcareous andstone, siliceous magnesian limestone, and dolomite. Outcrop rises steeply on east side on two terraces to height of 15 feet. Lower terrace is more siliceous than upper. Good opportunity for quarrying. Outcrop owned by Albert Leduc, Thurso, Que. Extent about 40,000 square yards. Two samples were tested one from lower, the other from upper beds exposed.

No. 104. Range IV, Lochaber, next railway track. Beekmantown formation. There is about 11 feet of siliceous dolomite and magnesian limestone exposed. Quarry of about 7,000 cubic yards owned by Albert Leduc, Thurso, Que. About 12 feet strata exposed. Quarry is beside Canadian Pacific railway.

No. 105. Range IV, Lochaber. Beekmantown, steel grey, fine-grained dolomite in a railway cut; 3 to 4 feet strata exposed.

No. 106. Range III, Lochaber. Beekmantown dolomite beds come to surface in several places south of the front road and along Black bay.

No. 107. Range VII, Lochaber. Altered sediments, foliated and fine-grained.

No. 108. Range VII, Lochaber. Binary granite.

No. 109. Range VII, Lochaber. Acidic granite gneiss and schist.

No. 110. Range VI, Lochaber. Granite gneiss intruded into very much foliated rock with a few patches of augite syenite gneiss.

Nos. 111, 112, 113, 114, 115, 116. Range V, gore of Lochaber. Coarser grained granite with gneissic structure and containing much black basic looking mineral. The rocks throughout these areas are of the same type. They are coarse, black and white, with the constituents tending to form in parallel planes in varying degrees. The rocks are of loose texture.

No. 117. Range VII, gore of Lochaber. Foliated granite gneiss and a little foliated augite syenite gneiss.

No. 118. La Petite Nation. On the northwest side coarse-grained, acid granite lies in a steep hill. Along the south of the Canadian Pacific railway, fine to medium-grained, foliated, basic granite gneiss; along Black bay, schistose rocks; west part and part north of railway track, altered sediments of the Grenville. The stone near the railway is rather foliated, although fairly basic and hard. A sample of some of this has been tested. A bare ridge runs south from the track, and could be easily quarried. Owner, Joe King, Plaisance, Que.

No. 119. La Petite Nation. Altered sediments of the Grenville series. The high cliff facing the river is all sedimentary.

No. 120. Where the Canadian Pacific railway crosses the Nation river. Schistose rock containing secondary mica. No good road material.

No. 121. La Petite Nation, west of the Nation river. Medium to coarse-grained, grey granite gneiss, fairly massive, varying to decidedly foliated rock with plenty of secondary mica. At southern end of outcrop there are a few ridges of fairly massive, medium-grained, hard granite gneiss, often quite dark in colour. Toward the north, the rock becomes foliated and poor.

Nos. 122, 123. La Petite Nation. Very foliated and crumpled possibly altered sediment.

No. 124. La Petite Nation. Foliated red and grey granite gneiss.

No. 125. La Petite Nation. Altered sediments of the Grenville series.

No. 126. La Petite Nation. Mostly coarse-grained, foliated, grey granite gneiss. Granite becomes more massive in places, and at northwest edge there is an area of pink granite gneiss.

No. 127. La Petite Nation, east of Plaisance. Massive to lightly foliated, coarse-grained, acid granite gneiss, with dykes of very acid material. The outcrop is a little more basic on south side. Small outcrops to south of main outcrop are same in character. The east end of the outcrop near the road was sampled and tested.

No. 128. La Petite Nation, east of North Nation Mills, west of the montée road. Coarse-grained, acidic, foliated granite gneiss.

No. 129. La Petite Nation, north of 128. Foliated granite gneiss and schistose rocks with some altered sediment.

No. 130. La Petite Nation, east of No. 128, and of the montée road. Fine-grained, slightly foliated, grey granite gneiss, and fine to medium-grained, pink granite gneiss.

No. 131. La Petite Nation between St. Andre Avelin road and creek to west. Crystalline limestone and schists in places, but mostly granite and augite syenite gneiss. Granite, acid and coarse, in outcrop near road, altered limestone farther north. Some granite gneiss occurs in this area, and was used in the village of Papineauville for a macadam road. A sample was collected, where stone for road was taken out, and tested.

No. 132. La Petite Nation, west of Papineauville. Medium-grained, fairly massive, pink granite.

No. 133. La Petite Nation, west of Papineauville. Fairly massive, medium-grained, pink and grey granite gneiss. Part of this outcrop on the railway one-half mile west of town, of a dark grey, basic, massive to schistose igneous gneiss. These outcrops are close to the river road and contain a large amount of dark granite gneiss. The macadam road at Papineauville was built of somewhat similar rock.

No. 134. La Petite Nation, northwest of Papineauville. Medium-grained, fairly massive, grey granite gneiss.

No. 135. La Petite Nation. Fine to medium-grained, foliated granite, with some altered sediment and schistose rock.

No. 136. La Petite Nation, in Papineauville on river bank. Crystalline limestone. Crumpled crystalline limestone in small outcrops at ferry dock to the east.

No. 137. La Petite Nation. Foliated granite gneisses and altered sediments.

No. 138. La Petite Nation, northeast of Papineauville. Foliated, grey granite gneiss with an intrusion of diabase. Diabase owned by Antoine Robitaille, lot 84, parish of Ste. Angelique, Papineauville, Que. About 5,700 cubic yards in diabase deposit. Farm road runs from deposit to main road. This stone has been tested.

No. 139. La Petite Nation, east of Papineauville. Coarse-grained, acid, foliated granite gneiss.

No. 140. La Petite Nation, between Papineauville and Montebello. Fine to coarse-grained, somewhat foliated, pink granite gneiss forms the main mass of this hill. Directly north of the crossing of the railway and the Kings road there are outcrops of grey granite gneiss, crystalline limestone, and a basic lamprophyric dyke; grey granite gneiss is at the eastern foot near creek.

No. 141. La Petite Nation. Foliated, grey granite gneiss with pink granite gneiss toward east forms the main mass of the northern part of the same hill as No. 140.

No. 142. La Petite Nation, 2½ miles west of Montebello, in the hills. Fine-grained, fairly massive augite syenite gneiss. To the west there are altered Grenville sedimentaries and badly foliated igneous gneisses. Massive, grey granite gneiss to the east. The deposit, 30,000 cubic yards in extent, occurs on side hill on north side of a well marked and cleared valley. A road runs westward from near the deposit probably to the Papineauville road.

No. 143. La Petite Nation, northwest of Montebello. Fine to medium-grained, fairly massive, grey and pink granite gneisses.

No. 144. La Petite Nation, west of Montebello. Foliated, fine to medium-grained, grey granite with mica-schist and some black schistose rock occurring in the western part of the outcrop.

No. 145. La Petite Nation, south of Arcand bay. Potsdam sandstone. The sandstone is white to grey white, even grained and banded. Beds have been quarried in two places, about 150 and 800 cubic yards being excavated. Stone is fairly even grained throughout and banding is developed all through. Has been quarried for building stone.

No. 146. La Petite Nation, south of Arcand bay. Beekmantown formation. About 8 feet of dolomite and magnesian limestone outcrops on the shore of Arcand bay, 1,000 feet east of number 145. Deposit is about 2,000 cubic yards in extent. The strata are exposed in a face 5 feet high next to the shore.

No. 147. La Petite Nation, on the grounds of Papineau manor. Crystalline limestones and other altered sediments with quartz bearing and foliated granite gneisses.

No. 148. La Petite Nation, Ste. Rosalie island. Dark coloured, fine to medium-grained, foliated mica granite gneiss. There is also a large mass of pegmatite. Under the lighthouse is a small patch of fine-grained, fairly massive augite syenite gneiss.

No. 150. La Petite Nation in Montebello. Altered sediments of the Grenville series.

No. 151. La Petite Nation, north of railway northeast of Montebello. Altered sediments and badly foliated acidic granite gneiss.

No. 152. La Petite Nation, north of Montebello. Fine to medium-grained, acid, foliated granite gneiss. They occur in a series of small outcrops.

No. 153. La Petite Nation, north of Montebello. Foliated, acidic granite gneiss in several outcrops.

No. 154. La Petite Nation, north of Montebello. Foliated, acidic granite gneisses.

No. 155. La Petite Nation, north of Montebello. Diabase. Diabase dyke is exposed at road corner as a smooth face on a side hill. There is about 2,800 cubic yards present. Soil in neighbourhood is clay, and ground water runs out between clay and diabase.

No. 156. La Petite Nation, 200 feet north of crossroad, 2 miles north of Montebello. Rather fine-grained, dark grey diabase. There are two deposits totalling about 3,700 cubic yards, situated 200 feet north of crossroad, 2 miles north of Montebello. Deposits are at foot of a hill of foliated granite and schistose rock. Sample tested.

No. 157. La Petite Nation, on farms of Joe Blais and Mr. Kemp, 2½ miles northeast of Montebello. Diabase, fine to medium-grained. Deposit lies as a dyke in a high hill above a montée road. Dyke rises abruptly to 120 feet in a distance of 240 feet, and reaches a maximum of 165 feet above the road (Figure 6). Another road passes the intrusion at the east end, and is 55 feet higher than the west road. The diabase could be quarried to the level of the lower road without trouble from water. Extent about 288,000 cubic yards. Deposit is 2½ miles from front road with down hill grade and open road practically all the way. The above intrusion comes to view again to the east on the shore of Charette lake. Extent about 12,000 cubic yards. This part of dyke cuts through gabbro. This deposit is more inaccessible than the other. More diabase occurs east of Charette lake, but it is inaccessible.

No. 158. La Petite Nation, near farmhouse of Mr. Charette, 12 miles northeast of Montebello. Fine to medium-grained diabase. Two dykes end on west at the clearings of the farm and are quite accessible from the road. The third lies to the east at the west end of a lake, and is not so easily reached. The first two total 90,000 cubic yards in extent, and the third, 13,000 cubic yards. A good face can be obtained in quarrying at the west end of the main mass (Plate I). There should be no trouble from drainage in an excavation at this point. Sample tested.

No. 159. La Petite Nation, west shore of Charette lake. Dense to fine-grained, massive, dark grey to black hypersthene gabbro. Large quantities of gabbro occur on the west shore of Charette lake. The material can be quarried from the south end of the lake without any great difficulty.

No. 160. La Petite Nation, northeast of Montebello. Fine to coarse-grained, pink and grey granite gneiss forms the main part of the mass lying between the depression of Charette lake and the Kinonge river.

No. 161. La Petite Nation. Diabase dyke with crystalline limestone in the hills both north and south of it. To the east across a valley there is grey granite gneiss. The diabase occurs 2½ miles north of Fassett and east of the Fassett Lumber Company's railway. It is small in extent (few thousand cubic yards) and is high up on the limestone hill, one part 175 feet and the other 300 to 350 feet above the track. The diabase is soft and breaks up readily.

No. 162. La Petite Nation west of the Kinonge (Salmon) river about 3½ miles north of Fassett. Diabase. Deposit is about 120 feet above track and along an old lumber road. Remnant of a dyke coming to view in a draw. About 2,000 to 3,000 cubic yards in sight.

No. 163. La Petite Nation east of No. 162 and on Kinonge river in a steep sided gulch. Fine-grained diabase. Deposit about 500 feet long, 40 to 100 feet wide, height up to 35 feet in cross profile with cliff faces on north. Lowest outcrop perhaps 100 feet above railway. Diabase is much sheared and breaks easily under the hammer.

No. 164. La Petite Nation lying immediately adjacent to track of Salmon River and Northern railway at Maholey junction 7 miles north of Fassett, Quebec (Figure 7). Coarse-grained diabase. Two large hills of diabase west of track can be worked with ease from the north (Figure 8 and Plate XC). Switch can be run to this site which is 50 yards or so from track. East of the main track and along a branch of the railway is a portion of the remainder of the diabase dyke. There is a great deal of diabase in this portion but the larger part lies below the level of the track. About 350,000 cubic yards can be obtained above ground water level. The stone and the railway are owned by the Fassett Lumber Company of Fassett, Que. The railway is connected with the Canadian Pacific railway at Fassett and also with a wharf on the Ottawa river. Two samples of the stone were tested, but they were not of as good quality as in the finer-grained deposits.

No. 165. La Petite Nation northeast of Fassett. Fine to medium-grained, foliated, grey granite gneiss with some pink granite gneiss. Some of this grey gneiss is very badly mashed and altered (Plate XB). A sample of the latter type has been tested and is of very poor quality. Near where wagon road leaves the La Petite Nation

land line to go up Little Salmon creek there are outcrops of thin-bedded, shaly Beekmantown magnesian limestone or dolomite.

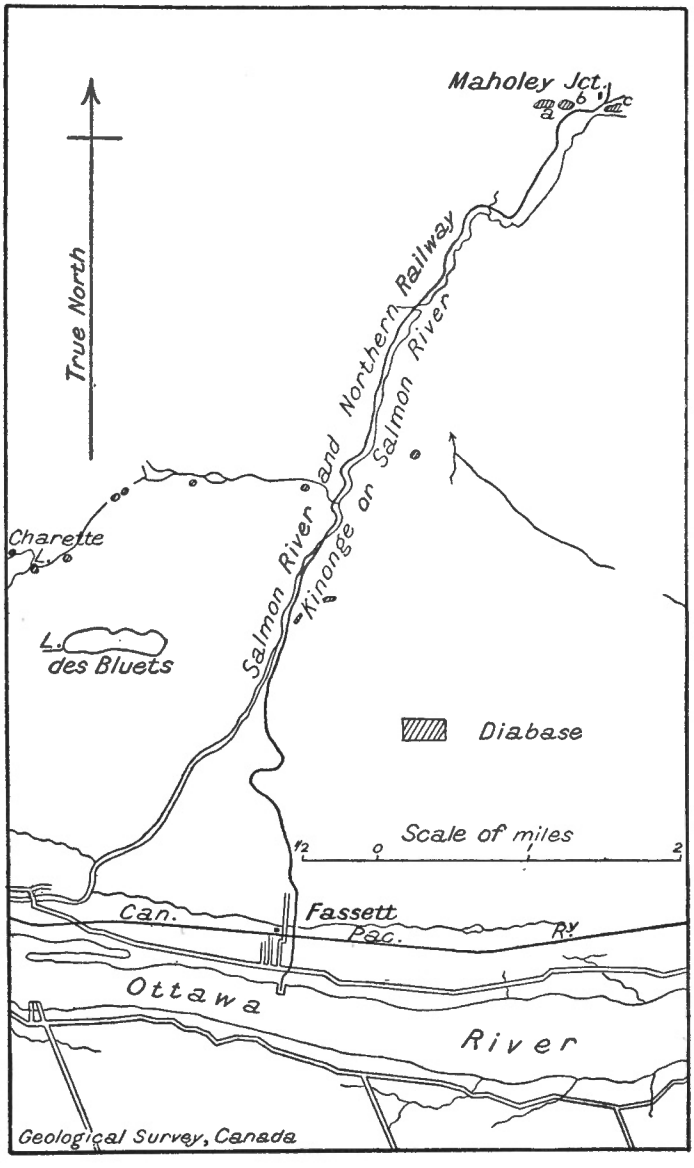


Figure 7. Diabase deposits lying near the Salmon River and Northern railway, between Fassett and Maholey Junction, Que.

No. 166. La Petite Nation and Grenville, Little Salmon creek. Fine to medium-grained, fairly massive to foliated grey and pink granite gneiss.

No. 167. Grenville tp., northwest of Pointe au Chene. Pink and grey granite gneiss. Sample of the pink gneiss tested.

No. 168. Grenville tp., northwest of Pointe au Chene. Coarse-grained, foliated granite gneiss and schistose rock.

No. 169. Grenville tp., northwest of Pointe au Chene. Coarse-grained, rather soft, foliated granite gneiss with some massive red glassy quartz.

No. 170a. Grenville tp., north Pointe au Chene west of road. Granite gneiss and schistose rocks.

No. 170b. Grenville tp., north and near Pointe au Chene east of road. A hill of augite syenite gneiss lies close to the road. The material is foliated, but according to a sample which was tested some of it is good road material. There is more than 300,000 cubic yards available.

No. 171. Grenville tp., one-half mile north of Pointe au Chene. Schistose rock with coarse-grained, binary granite pegmatite and quartzose material in a big hill.

No. 172. Lot 2, range II, Augmentation, Grenville, on road one mile north of Pointe au Chene. Diabase dyke with crystalline limestone to north and gneissic granite and altered sediment to south. The deposit is owned by Jas. Young. Creek runs along south contact. Diabase rises 30 feet above creek at east end. Extent approximately 18,000 cubic yards. Sample tested (Plate VIIIB).

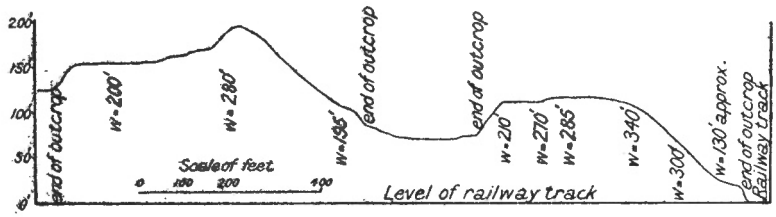


Figure 8. Profile of the crest of that portion of the diabase at Maholey Junction lying west of the railway track. Outcrop 164. W = width of diabase outcrop at point indicated.

No. 173. Grenville tp., north of Pointe au Chene. Altered limestone.

No. 174. Grenville tp., north of Pointe au Chene. Altered limestone and sediments.

No. 175. Grenville tp., north of Pointe au Chene. Altered limestone and sediments, schist.

No. 176. Grenville tp., north of Pointe au Chene. Grey, foliated, altered gneiss.

No. 177. Grenville. Lot 2, range IV, north of Pointe au Chene. Diabase dyke cutting through altered sediments. To south of intrusion there is a large deposit of serpentine, also an old asbestos mine. The sedimentary rock has been used for manufacture of plaster. Diabase deposit owned by Thos. Garland. At east end dyke is 75 feet wide and 35 feet high. About 13,000 cubic yards available. Deposit lies in a draw (Plate IXA). West of first outcrop, the deposit is covered with swamp but again comes to view at west end of draw. Deposit is 1,000 feet east of Avoca road and 3 miles from front road. The material has been tested.

No. 178. Grenville. Lot IB, range IV. Diabase intruded through grey pink granite gneiss. Owner, André Deslauriers, Pte. au Chene. Material available, 450,000 cubic yards, assuming that 50-foot face would be worked. From west to east, the dyke rises 200 feet in 2,000 feet. Outcrops are visible over this distance in the bush which covers the deposit. A creek runs along south edge of dyke. East of main deposit there is a 1,000-foot stretch of swamp and then about 25,000 cubic yards more diabase, with swamp to the east again. A little diabase occurs in draw south of main dyke. Its amount is insignificant. This deposit is about 3½ miles from the main road.

No. 179. Grenville tp., north of 178. Rusty-coloured, foliated gneiss.

No. 180. Grenville tp., west of 179 and of the road. Altered sedimentary rocks with a small outcrop of diabase in a low place.

No. 181. Grenville tp., hill between Pointe au Chene creek and first montée road to the east. Fine to coarse-grained, fairly massive to foliated, grey and pink granite gneiss.

No. 182. Grenville tp., on Rouge river. Diabase. About 3,500 cubic yards diabase on west bank Rouge river. Material quite inaccessible.

No. 183. Grenville tp., just east and near mouth of Rouge river. Rather fine-grained diabase. Deposit owned by Riordan Paper Company, Hawkesbury, Ont. West end of deposit is about 1,000 feet north of river road and at about 150 feet higher elevation. The grade is even and a road could easily be picked out. The deposit presents plenty of good faces for quarrying and in distance of 500 feet reaches height of 100 feet above the lowest point (Figure 9). Over 300,000 cubic yards are available. Material tested.

No. 184. Grenville. Diabase intruded into granite. Dyke is on line between farms of E. Wilman and E. Bigelow. The diabase is nearly all covered but 1,000 cubic yards or so of material could be obtained. It is 1,500 feet west of the montée road and 2,500 feet north of the main road.

No. 185. Grenville tp., east of montée road northeast of Calumet. Fine to medium-grained, massive granite gneiss. This material lies in a craggy hill. It is dark coloured and has a texture resembling to some degree that of diabase. The rock extends about 150 feet along the road, rises abruptly for 50 feet, and extends back from the top at least 150 feet. It looks as though it might do for road metal. The rest of the rock in the neighbourhood is altered sediment.

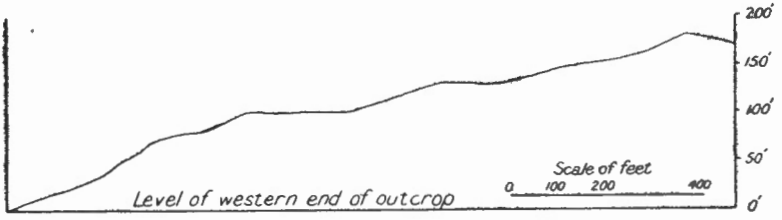


Figure 9. Profile of the crest of a diabase dyke directly east of Rouge river. Outcrop 183. Width of dyke 90 to 100 feet.

No. 186. Grenville tp., north of Calumet. Fine-grained, massive to foliated, pink granite gneiss.

No. 187. Grenville. Lot 13, range IV. Diabase cutting through altered sediments. Deposit owned by A. McKay. At least 50,000 cubic yards available. Diabase is immediately east of a montée road and is 1⅛ miles north of Canadian Pacific Railway tracks and river road. The material is exposed on a side hill where it is easily accessible. Sample tested. The dyke extends to west of road where two low outcrops of about 1,800 cubic yards occur; 3,000 feet southwest of the road and in line with the direction of the dyke another diabase outcrop occurs on the north ridge of a crystalline limestone hill of about 13,000 cubic yards. The prevalent type of rock through the neighbourhood is crystalline limestone.

No. 188. Grenville tp., about 3 miles northeast of Calumet, farm of E. Brown. About 2½ miles by wagon to the river road. Diabase standing out in humps in the open by itself (Plate IXB). 3,000 cubic yards material is available without going below the surface of the ground, and as much more at least could be quarried out of face of hill next to the montée road. All of the deposit is accessible from the road. Sample tested.

No. 189. Grenville tp., west of 188. Granite gneiss varying in colour and texture,

No. 190. Grenville tp. Crystalline limestones.

No. 191. Lots 8 to 11, range IV, Grenville. Diabase. At eastern end, the dyke apparently ends abruptly in contact with red granite or quartz syenite. The diabase at the east end is more basic than the average and carries a large amount of magnetite. It is fine-grained throughout the dyke. Diabase on lots 10 and 11 owned by Jas. Carson, Calumet, and by Mr. Garland, merchant, Ottawa. Near, and west of, the Scotch road 4,800 cubic yards are available, with practically no overburden or other serious difficulties for quarrying. There is an easy grade for 500 feet through bush to Scotch road. Across a swamp, 1,000 feet farther west, there is 1,800 cubic yards more in a hill. Three outcrops occur in the 3,000 feet west of the Scotch road and they are separated by swampy areas. At this distance the western end of the dyke commences and continues for about

800 feet. It contains approximately 98,000 cubic yards of material. A winter road connects this part of dyke with farm of Jas. Carson on flat north of main road.

No. 192. Grenville tp. Coarse-grained, massive, pink granite or quartz syenite.

No. 193. Lot 3, range V, Grenville tp., West Rawcliffe. Quartz syenite porphyry. Groundmass dense and grey with brown crystals of feldspar (Plate VIIIC). The stone lies in a hill on the farm of Martin Lowe (Figure 10), and several million cubic yards of good stone can be obtained. Sample tested. The middle of the area contains the most promising material.

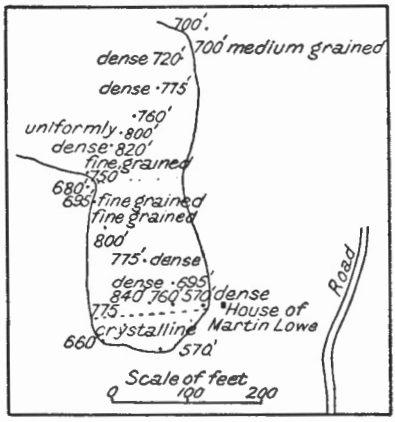


Figure 10. Area of syenite porphyry on the farm of Martin Lowe, near Rawcliffe, Quebec. Outcrop 193. Dense, fine-grained, etc., refer to texture of stone at dotted points; numbers refer to elevation in feet above sea-level.

No. 194. Grenville tp., East Rawcliffe. Coarse-grained, massive, reddish quartz syenite or granite porphyry.

No. 195. Grenville tp., at Grenville village. Beekmantown and Chazy formations. In village of Grenville and on the canal and river nearby, are outcrops of Chazy shales and sandstones. North of the town are outcrops of shaly limestones or dolomites resembling Beekmantown beds.

Appendix C.

DEPOSITS OF GRAVEL.

A few fairly large deposits of gravel are referred to in the following section. They all lie east of Papineauville. There are other gravelly deposits to the west, of which no account has been taken in this work. They are not numbered on the map.

No. 1. About 1 mile east of Papineauville and 1,500 feet north of the Kings road, there is a gravel deposit on the side of a hill. The pebbles are nearly all under 3 inches in size. They are of Pre-Cambrian rock types, about 88 per cent of firm durable stone, the rest rather soft. The gravel is sandy, the sand yellow and carrying much iron oxide. The deposit covers about 14 acres, and is fairly deep. It has not been developed, but a test made upon a sample from the deposit indicates that the gravel is suitable for gravel macadam under light traffic conditions.

No. 2. About 1¾ miles west of Montebello on the farm of Theodore Le Blanc, there are two gravel deposits, one next the railway, the other one-quarter of a mile to the north. The latter covers about 8 acres to a depth which may average about 2 yards. The deposit near the railway is small. The gravel contains a great deal of yellow sand. Over 90 per cent of the pebbles are of hard firm stone.

No. 3. Deposits of gravel lie at the foot of the ridge on the farms of Messrs. Charette and Thomas, northeast of Montebello. The gravel is very sandy and boulders are scarce. The amount of sand varies from place to place. The material is not deeply weathered, and the unweathered part is comparatively free from impurities. About 90 per cent of the pebbles are of hard firm stone. Some of the material from Thomas' farm has been used in concrete work. There is considerable sandy gravel available.

No. 4. Directly west of where Pointe au Chene creek enters the Ottawa, a bar of gravel lies on the shore of the river. The material is quite clean, but somewhat bouldery.

No. 5. On lot 12, range III, Grenville, about 1 mile northeast of Calumet, and one-half mile from the Kings road, there is a large gravel deposit carrying 20 per cent of boulders 3 to 4 inches in size, 40 per cent of gravel ¼ to 2 inches in size, and 40 per cent of sand. The pebbles are rounded, and nearly 100 per cent of them are of hard durable stone. Outside of a little organic matter, the gravel is clean. It is covered by from 1 to 2 feet of dark weathered material. A pit about 5,600 square yards in surface area and 1½ yards in depth has been opened on the farm of J. F. Morrow, and a small excavation has been made on the farm of G. Whinfield to the west. The large pit was opened fourteen years ago, and the material sells at from 10 to 20 cents per cubic yard. A test made upon this gravel indicates that it is of very excellent wearing quality, and has a high cementing value. It has been used in concrete construction in Calumet and Grenville, and for road work in Hawkesbury.

Tests Made upon Gravel.

Location	Composition			Physical character				
	Hard pebbles.	Soft pebbles.	Sp. gr.	Per cent wear.	French co-efficient wear.	Cementing value.	Per cent voids, material loose.	Per cent voids, material compacted.
1 mile east of Papineauville, ½ mile north of Kings road.....	88	12	2·69	4·4	9·1	71	34·0	27·0
Lot 12, range III, Grenville, 1 mile east of Calumet, ¼ mile north of Kings road.	99	1	2·64	1·6	25	217	34·1	24·5

Appendix D.

Soils and other Materials Forming Present Road Surfaces.

In Appendix D the information obtained regarding the materials forming road surfaces in this area is compiled. The numbers refer to stretches of road with corresponding numbers on the map.

No. 1. Top soil, blue plastic clay. On the river road sand has been placed on this clay to a depth of about 4 inches, making a good firm surface. West of No. 1 to Gatineau point, the road is macadamized.

No. 2. Top soil of sand to a depth of 4 feet in places west of the creek. East of the creek there is a mixture of clay and sand on the top.

No. 3. Heavy top soil of sand. Ruts in the road to a depth of 6 inches.

No. 4. A sand top soil up to 2 feet thick lies over clay.

No. 5. Clay from No. 4 east to the outcrop of Potsdam sandstone and north as far as indicated.

No. 6. Clay with boulders and sand mixed on top.

No. 7. Sand on top carrying clay or silt lies from the creek eastward to the village, the sand is 4 feet deep in places west of the creek. There is a stretch of clay at the creek. On the bedrock area to the west is a brown sand with clay in it.

No. 8. Heavy sand and rock outcrop in the village of East Templeton, and from there north to Ste. Rose de Lima.

No. 9. Sand on top of clay to east, clay to a point across bridge.

No. 10. Sand and brown clay loam running into clay to north.

No. 11. 1 to 3 feet sand overlying clay. Clay to the south to a point near road forks. To north for several miles sand and clay have been mixed with good results.

No. 12. Sand and loam overlying bedrock east to point indicated on the map. The two east-west roads to south of No. 12 have a surface of heavy clay. Directly west on McLaurin's road there are sand and boulders overlying outcrops of rock.

No. 13. Clay on the road going west from this point. There is a small patch of sand 1 foot thick from the Canadian Pacific Railway track north to the east-west road. Clay from the track south.

No. 14. Sand very thick in places for 2 miles east of East Templeton. From there east the road surface is of blue clay to a point past Anger. The division between sand and clay is only approximately placed on the map.

No. 15. Heavy clay from Anger to near the bridge at Bassin du Lièvre, where there are a few rock outcrops in the road. From one-half mile to 1 mile east of Anger there is also a thin patch of sand, a few hundred feet long, over the clay.

No. 16. Sandy top soil underlain by clay at east end and bedrock at western end. Farther west there is clay, with thin sand in places.

No. 17. Top soil of clayey sand.

No. 18. Top soil of yellow sand underlain by clay.

No. 19. Bedrock at the surface in many places; in others, covered with sand.

No. 20. Top soil sandy dark clay loam or muck, drainage poor.

No. 21. One foot yellow sand overlying clay west to small creek. From road forks north to Buckingham the road is macadamized.

No. 22. Clay soil with a layer of sand and some boulders on top in certain places. The sand varies in thickness from a few inches to 1 foot. This condition continues north to No. 21 and west to No. 16.

No. 23. Sand overlying clay, the sand becoming thicker towards the river. North to the railway, at Masson, there is heavy clay on the surface. From Masson to Buckingham the road is macadamized.

No. 24. Heavy clay from bridge west of Masson to No. 25.

No. 25. Small knoll where road cuts through at least 3 feet of sand for distance of 15 to 20 yards.

No. 26. Top soil of few inches of sandy clay underlain by clay. Clay south of railway.

No. 27. Top soil of sand from a few inches to 2 feet thick underlain by clay.

No. 28. Top soil of few inches of loam underlain by clay.

No. 29. Top soil of sand increasing from a few inches to 5 to 6 feet.

No. 30. Top soil of sand from 1 to 5 feet in depth and underlain by clay from the metalled road east to point indicated on the map. East of where the road turns to the south for about 600 feet the road bed has been cut down to clay. Farther east the top soil is heavy clay all the way to No. 31.

No. 31. Rock outcrop for 200 feet. For a few hundred feet west the top soil is clayey sand. From here east to No. 32 the top soil is a sandy clay or clayey sand with rock outcrops in places.

No. 32. Top soil of 1 foot sand with bedrock underlying and coming to surface in places. East to road crossing and river road top soil of clay and clayey sand.

No. 33. Top soil of sandy clay and clayey sand to depth of 5 feet in places. At the south end at least 2 feet of sand on top. From No. 33 to No. 34 clay.

No. 34. On this stretch there is a top soil of from one-half to 1½ feet of sandy clay over blue plastic clay. Blue clay to both the west and east along the river road as far as Thurso.

No. 35. Top soil sand to a depth of at least 3 feet in places. Clay from No. 33 to No. 35.

No. 36. Top soil one-half foot sandy clay underlain by clay.

No. 37. Clayey sand with one patch of heavy sand over clay east to road crossing.

No. 38. Small knoll where top soil is 1 foot of sand underlain by clay. Clay to the north as indicated with heavy sand and gravel near north end of road. South to road crossing there is clay.

No. 39. Top soil of sand, from 1 to 1½ feet at two ends of the stretch to 4 to 5 feet in the middle. Between Nos. 38 and 39 on the east-west road there are alternations of sand and clay top soils, first stretch of clay in river bottom, second east of road crossing at 38. Clay to the north of 39. Clay to east as far as Thurso.

No. 40. North-south road through Thurso with macadam surface from Ottawa river north as far as Blanche river. Small rock outcrop on river road in Thurso; from there west to No. 41 heavy clay top soil.

No. 41. Surface soil of at least 2 feet sand at top of hill where road comes up out of draw. Top soil changes to clayey sand, sandy clay, and finally clay within about 600 feet. From there east to near the Gore road the top soil is heavy clay.

No. 42. Sand and gravel over bedrock, clay west as far as road forks, and from there north to first rock outcrop. There is a short sandy stretch west of road forks and from there to No. 43 there is clay on the surface. East and south to Blanche Mills, heavy clay.

No. 43. Top soil mostly sand or gravel over rock outcrop or clay.

No. 44. From Blanche Mills north on east side of river, the road is of clay with gravelly spots on the hills. On the road going west 2 miles above the mills stretches of clay, sand, and rock outcrop occur alternately on the road surface. The sand generally lies on small hills, often over bedrock.

No. 45. Sandy gravelly top soil containing some clay. Clay on the surface both to east and west along this road.

No. 46. Series of sandy hills with rock outcrops coming to the surface on the tops. Clay on the surface to the west of this stretch and east to near first road going south.

No. 47. Top soil of 6 to 9 inches sand underlain by clay. Top soil is alternately sand and clay east to the Gore road, the last stretch being clay. South on the short montée it is alternately clay and sand to the river road, the last stretch being clay.

No. 48. Yellow gravelly sand varying up to 2 feet, underlain by clay. Clay top soil along this road to the north and south.

No. 49. From railway north to the first west road there are alternate stretches of clay and of ½ to 2 feet of sand over clay. There is clay at the railway, in the middle, and up at the crossroad.

No. 50. Rock outcrops in the road bed. Clay along the front road to the west.

No. 51. Stone is exposed at junction of Gore and Lochaber roads. Sandy clay top soil extends east from junction of roads for 1,500 feet, and includes one patch of sand at least 2 feet thick.

No. 52. Clay from Nos. 51 to 53, except for one stretch of about 650 feet east of township road along which a layer of sandy clay and sand lies over clay.

No. 53. At the railway crossing there is a stretch of sandy clay. To the east the road goes over bedrock, which is covered with sand with the bare rock exposed in places.

No. 54. Clay.

No. 55. Surface soil varies from sand and sandy clay to clay with subsoil of clay or solid rock.

No. 56. Top soil of 1 foot to 4 feet sand underlain by clay. The sand continues north through Plaisance and south along river. The road from the North Nation river east of Presqu'ile Ennuyeuse is on clay all the way. Heavy clay top soil along river road from No. 56 east to railway crossing where No. 60 begins.

No. 57. Thick top soil of sand here and on road to northeast as far as No. 58, clay to the south on this road, clay on the roads to the west between the montée and North Nation mills.

No. 58. Top soil of gravelly sand here and along road to the south. The montée between No. 57 and No. 59 consists of stretches of clay and sand as marked off; beginning with clay at the south end.

No. 59. From a few inches to 2 feet of sand underlain by clay or rock. A patch of clay at bend of road to north.

No. 60. Top soil of sand with bedrock underlying it in places west of Papineauville. The sand continues to the east of the village to point marked and is in places very thick.

No. 61. Water-bound macadam. The street going north from the wharf is water-bound macadam with a stretch of tar macadam on a steep grade.

No. 62. Black muck and red loam top soil to depth of 1 foot; stratified fine sand subsoil clayey in places with occasional rock outcrop.

No. 63. Top soil of yellow sand over bedrock.

No. 64. Top soil of 3 feet black muck underlain by clay; this extends for a few hundred feet to the north. The top soil is black loam turning to sand farther north. Bedrock below.

No. 65. Top soil of sand increasing from 1½ to 4 feet toward the north. Sand is underlain by clay.

No. 66. Heavy blue clay top soil.

No. 67. Macadam surface here and eastward through the village of Montebello.

No. 68. Plastic clay top soil.

No. 69. Top soil of sand with gravel mixed in at places.

No. 70. Top soil black clay loam underlain by bedrock.

No. 71. Top soil of sand as far as it was visible.

No. 72. Top soil of sandy clay underlain by clay.

No. 73. Top soil of yellow gravelly sand for a short stretch over a hill.

No. 74. Top soil of yellow gravelly sand for a short stretch over a hill.

No. 75. Top soil of sand with some gravel mixed in on the face of hill at the crook in the road; clay south of railway.

No. 76. Top soil of sand which for the most part is fairly firm.

No. 77. Patch of black muck.

No. 78. Top soil of sand of varying depth. South from No. 78 to No. 79 there is a heavy clay top soil.

No. 79. Top soil of sand. Clay south of railway.

No. 80. Top soil of sandy clay. Top soil of clay along river road to the east and west for several miles.

No. 81. Top soil at least 1 foot thick at east end of patch, and 4 feet near the creek lies first on one then other side of road. West of creek sand is at least two feet thick, and is very fine and partly stratified. Sand continues for 300 feet west, and then in streaks for 200 feet farther. Clay top soil along river road from Nos. 80 to 81 and Nos. 81 to 82.

No. 82. Deep sand on both sides of the creek. Clay in creek bottom. Clay top soil from Nos. 82 to 83.

No. 83. Top soil containing more or less gravel and plenty of boulders. This stretch of sand contains one patch of black soft clay loam 50 feet long.

No. 84. Top soil of black muck containing large stones. In some places it contains a considerable amount of clay, and in other places it is sandy.

No. 85. Top soil of gravelly sand underlain by clay, from No. 84 east through Pointe au Chene.

No. 86. Top soil of gravelly sand with a few hundred feet of clay near creek south of rock outcrop No. 172.

No. 87. Top soil of sand containing a little clay and gravel, underlying soil clay.

No. 88. Thick top soil of sand.

No. 89. Top soil of sand varying in thickness from 1 foot to over 5 feet. Sand becomes gravelly on some of the hills.

No. 90. Top soil of gravelly sand, in places alternating with sandy patches; in other places bouldery and rough.

No. 91. Road has been blasted out over an outcrop of granite.

No. 92. Top soil of a clayey sand, sandy top soil east from Nos. 91 and 92. Clay content varying.

No. 93. Top soil of sand containing a considerable amount of gravel and in places clay.

No. 94. Top soil near the front road is a sandy gravel underlain by clay; farther north it is more sandy.

No. 95. Soil is swampy black muck, kept wet by a spring.

No. 96. Top soil of sand getting more clayey toward the north.

No. 97. Top soil sandy clay.

No. 98. Top soil sand, containing gravel in places. A few patches of black muck occur.

No. 99. Top soil from montée west of Calumet; east through the village is sandy. The west part of this stretch is fairly firm and probably contains clay or silt. Toward the eastern end of the stretch the sand becomes heavier. From the east end of Calumet to the cemetery the top soil is yellow sand becoming thick toward the east.

No. 100. Top soil of about 1 foot, clayey sand underlain by clay.

No. 101. Top soil of thick, soft, fine yellow sand; top soil of dark loam in low places in the fields which are at lower level than the road.

No. 102. Top soil of 1 foot clayey sand underlain by clay.

No. 103. Top soil of sand, getting heavier toward the east. It ends in a patch of clay at the bottom of a hill.

No. 104. Top soil of clayey sand. Top soil becomes heavy fine sand where road cuts through some knolls.

No. 105. Top soil of clayey sand becoming more sandy toward the east; undersoil clay.

No. 106. Top soil of 5 to 6 feet sand, which gets thinner toward the creek, where there is some clay.

No. 107. Top soil of sandy clay few inches thick and becoming more clayey toward the east; underlying soil is clay.

No. 108. Top soil of few inches sandy clay underlain by clay.

No. 109. Top soil of sand on road going up the hill.

No. 110. Top soil of sand containing some dark loam which holds it solid. There is a considerable amount of gravel in patches where the road turns eastward along the face of the hill, and again where it turns north.

No. 111. Waterbound macadam roads.

No. 112. Top soil of a dark loam carrying a little sand.

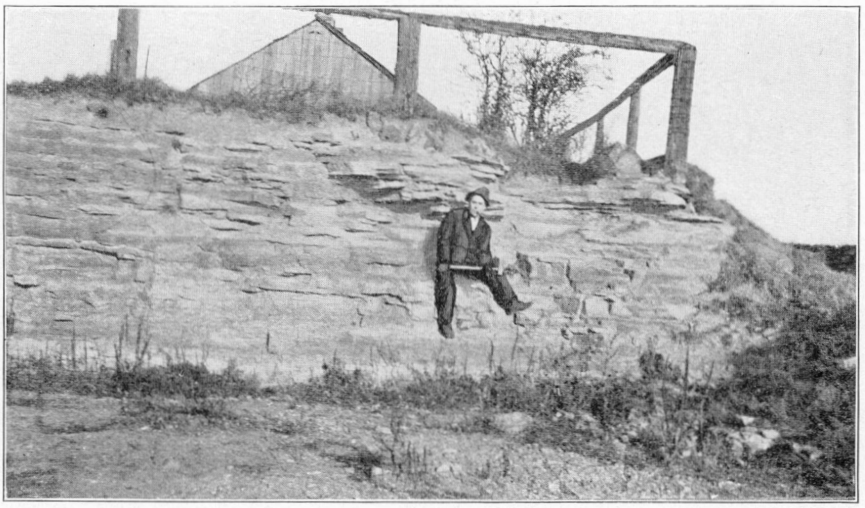
No. 113. Top soil of sand 4 to 5 feet thick at least in cuts along the road.

No. 114. Top soil of from few inches to 1 foot clayey sand underlain by clay.

No. 115. Thick sand.

PLATE II.

A. Conglomerates and dolomites of the Beekmantown north of Millar, Ont., Part I, outcrop 116a. Outcrops of Pre-Cambrian quartzites are found to the left of the view and at the level of the bottom of the picture. The pebbles in the conglomerate are of quartzite.



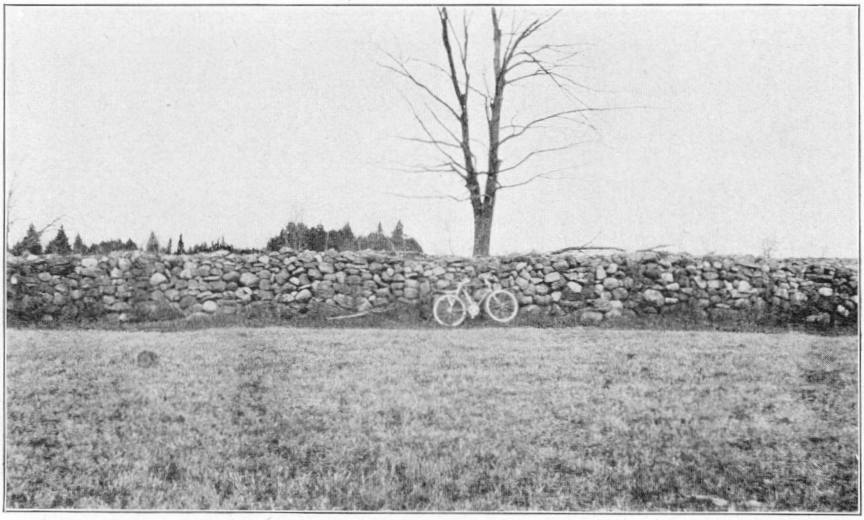
B. Flat-lying Beekmantown dolomites and magnesian limestones, Wood street, Prescott. Outcrop 191.

PLATE III.

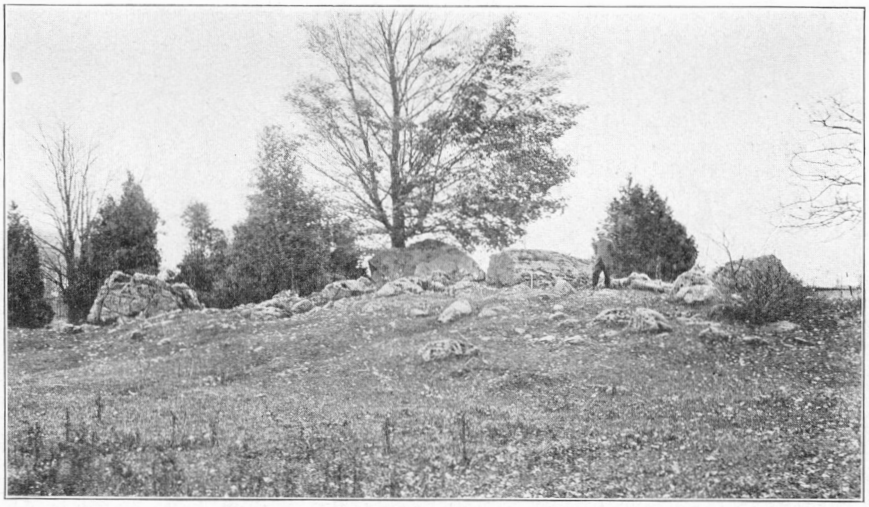
A. Prescott road south of Kemptville surfaced with field stone. Scale in rut $6\frac{1}{2}$ inches long.

B. Fences of field stone 4 miles southeast of Kemptville, Ont. Over 90 per cent of the boulders are of durable Pre-Cambrian stone.

PLATE IV.

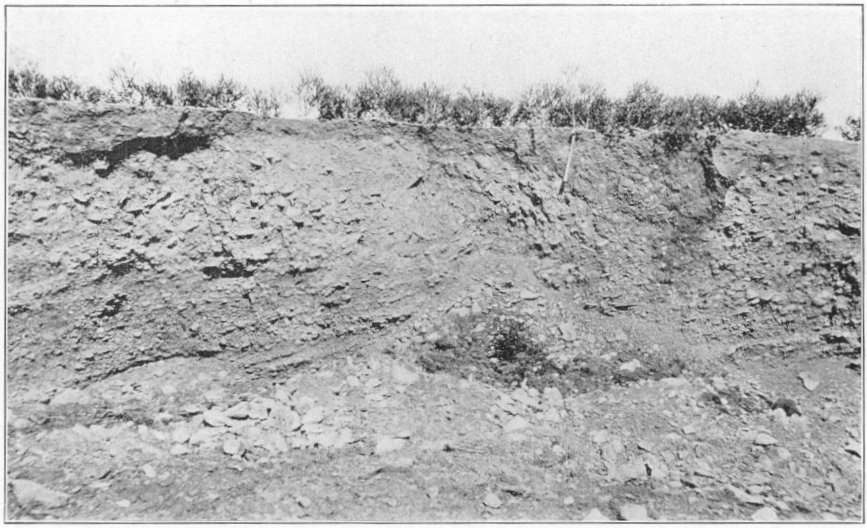


A. Fences of field stone near the Prescott road between Groveton and Spencerville, Ont. From 70 to 80 per cent of the boulders are of Beekmantown dolomite and magnesian limestone.

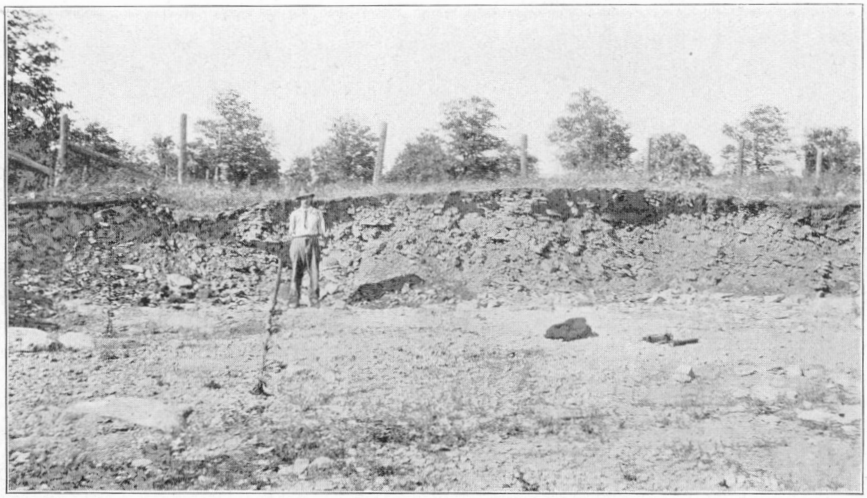


B. Boulder hill near Rideau river in North Gower township.

PLATE V.



A. Irregularities in the depth of weathering, of gravel deposits, Lecuyer's pit near Bowesville, Ont. Part I, pit 41. The weathered material at the surface is darker than the rest of the deposit. The hammer is 15 inches long. This is presumably a fluvio-glacial gravel.



B. Slab gravel lying upon bedrock northeast of Fallowfield, Ontario. Part I, pit 14. The pebbles are flat and angular and all of the same character as the bedrock. There are boulders up to 3 feet in diameter among them.

PLATE VI.

A. Wall of gravel pit near Fallowfield. Part I, pit 15. Illustrates sharp variations from sand to gravel in horizontal directions.

B. Boulder forced into gravel from above. Part I, pit 123. West of Kemptville. The gravel carried marine shells near surface. The main deposit is fluvioglacial in origin.

PLATE VII.

A. Microphotograph of Beekmantown dolomite. Part I, quarry 79. Enlarged 100 times. Illustrates the close packing and even sizes of the individual grains of dolomite, and their angularity.

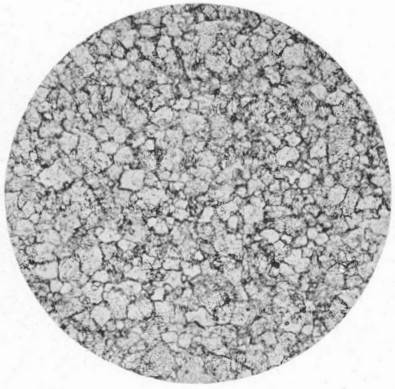
B. Microphotograph of Black River limestone. Part I, quarry 24. Enlarged 142 times. The dark-coloured grains are carbonates with clay and other impurities. They are nearly the same size but not as closely packed as the grains in Plate VIIA.

C. Microphotograph of Trenton limestone. Part I, quarry 12. Enlarged 50 times.

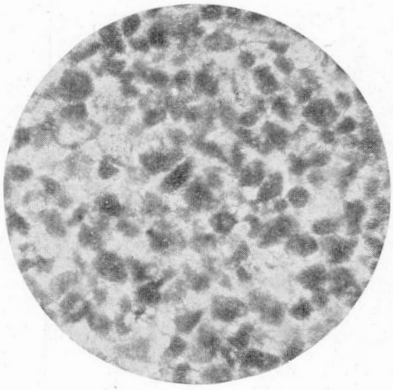
D. Microphotograph of Trenton limestone. Part I, quarry 38. Enlarged 11 times. A coarse-grained, loosely packed aggregation of calcite grains with a resulting low toughness value. The dark grains and those with dark rims are aggregates of carbonates and are mostly rounded; some of them are undoubtedly fossil remains that were evidently a loose aggregate cemented together later by the clear carbonate between.

E. Beekmantown calcareous sandstone. Enlarged 50 times, crossed nicols. Part I, quarry 19. o = original quartz, s = secondary quartz, c = calcium magnesium carbonate cement in the interstices between grains and cracks within grains. Illustrates the strengthening of sandstone by secondary siliceous growth and calcareous cement.

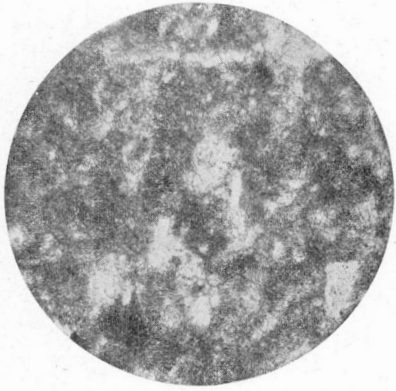
PLATE VII.



A



B



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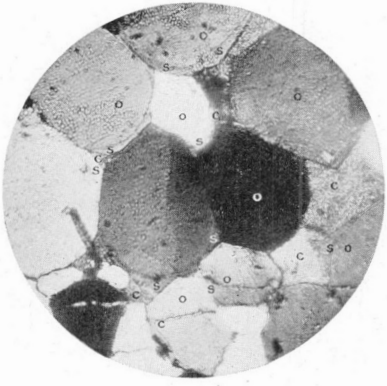
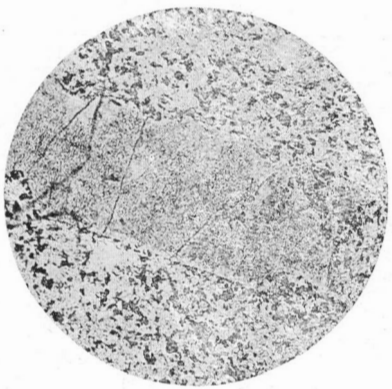
D



E

A. Topography in the Laurentian plateau near Calumet, Que. There is a broad, cultivated, clay flat in the foreground with wooded hills surrounding it. Rock outcrops are plentiful in the hills.

B

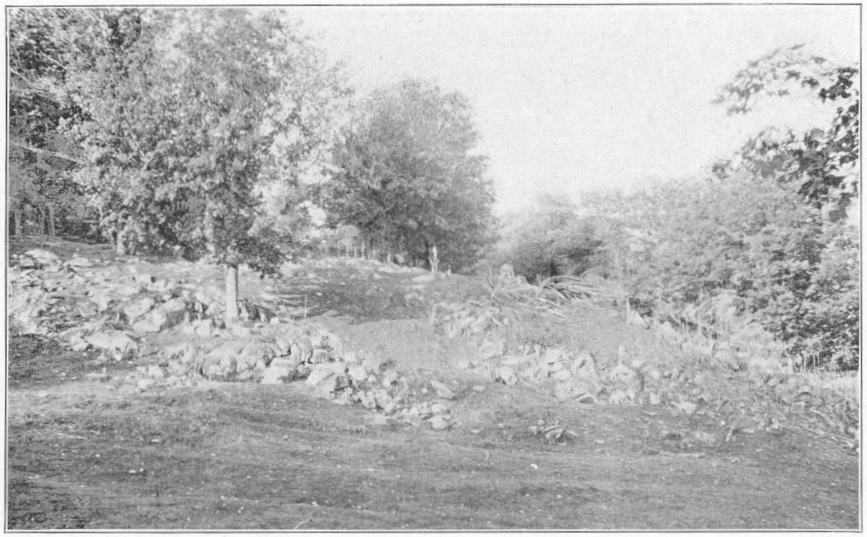


C

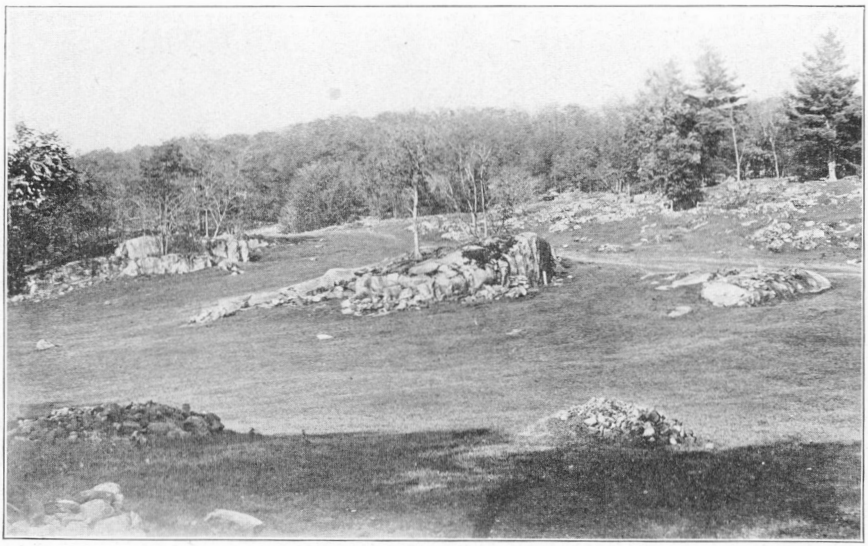
B. Microphotograph of diabase from Part II, outcrop 172. Enlarged 50 times, crossed nicols. Shows the interpenetration of feldspars *f*, into augite *a*. The dark speckled material is augite.

C. Microphotograph of quartz-syenite porphyry. Part II, outcrop 193. The large crystal in the middle is a feldspar phenocryst, the small black individuals in the groundmass are blue amphiboles.

PLATE IX.



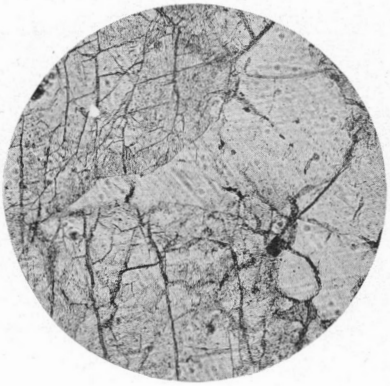
A. Outcrops illustrating the weathering of diabase into angular blocks. Part II, outcrop 177.



B. Three outcrops of diabase to illustrate cross fracturing. Part II, pit 188. The three outcrops in the middle foreground are of the same diabase dyke; each ends in a smooth, nearly vertical, fractured plane at right angles to the direction of the dyke.

PLATE X.

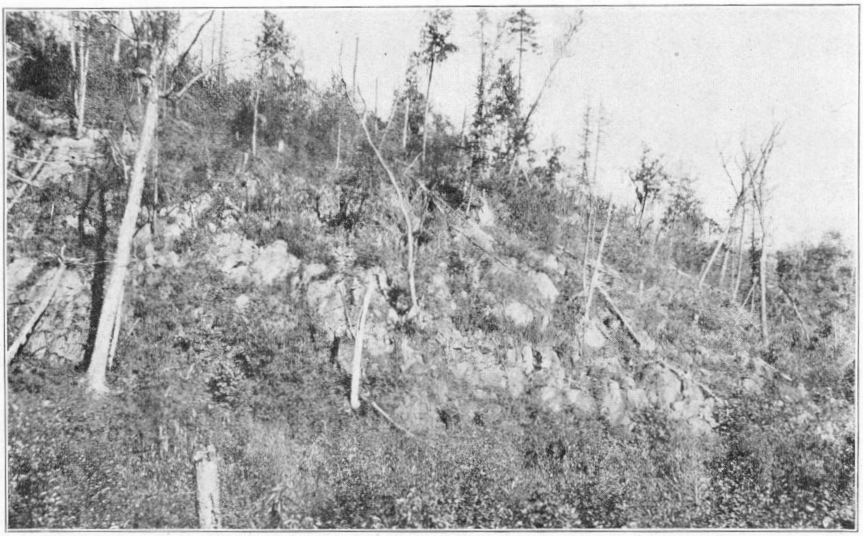
A



B

A. Microphotograph of a slightly foliated augite diorite gneiss. Enlarged 50 times, crossed nicols. f = feldspar; a = augite; h = hornblende; m = magnetite. The larger dimensions of the hornblendes are arranged in parallel directions.

B. Microphotograph of a granite gneiss very finely fractured and much altered. Enlarged 100 times. Illustrates the close spacing of fractures.



C. Hill of diabase at Maholey Junction north of Fassett, Que. The hill rises 120 feet above the railway which is hidden by the shrubs in the foreground.

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