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SENNETERRE MAP-AREA, ABITIBI DISTRICT

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PROVINCE OF QUEBEC, CANADA

BUREAU OF MINES

Honourable J. E. PERRAULT, Minister of Mines

J. L. BOULANGER, Deputy-Minister A. O. DUFRESNE, Director

ANNUAL REPORT

OF THE

QUEBEC BUREAU OF MINES

FOR THE CALENDAR YEAR

1933

JOHN A. DRESSER, Directing Geologist

PART B

Senneterre Map-Area, Abitibi District,

by

L. V. Bell and A. M. Bell

QUEBEC

PRINTED BY R. PARADIS

PRINTER TO HIS MAJESTY THE KING

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SENNETERRE MAP-AREA

ABITIBI DISTRICT

by L. V. Bell and A. M. Bell

INTRODUCTION

General Statement

The field season of 1933 was devoted to a continuation of the geological mapping of the easterly part of the Abitibi mineral belt. The progress of this work, begun in 1931, is recorded in the annual reports of the Bureau for that and the following year, entitled respectively *Bell River Headwaters Area* and *Assup River Area*. Discoveries of gold in substantial quantity in the northern part of Tiblemont township in 1932 made it desirable to map an area immediately north of the map-sheet of 1931.

The *Senneterre Map-Area* includes the town and also the township of that name. It lies between longitudes 77°00′ and 77°35′ and latitudes 48°10′ and 48°35′, and comprises approximately 650 square miles.

The area is underlain by a complex of igneous rocks of pre-Cambrian age. Broadly described, there is a wide belt of rocks of Keewatin age, principally volcanics, which extends in a northwesterly direction throughout the area mapped. The southwestern part of the map-area is largely occupied by granite and related rocks of the Pascalis-Tiblemont intrusive, although Keewatin rocks reappear beyond the southwestern margin of this mass. The major band of Keewatin rocks is cut off on the northeast by granite and gneiss, which form part of a very large area of these rocks. The Keewatin is also intruded in many places by granitic rocks, chiefly in the form of stocks or as small batholiths, which collectively have a very considerable volume. Témiscamian sediments are not found within the borders of the present map-sheet. They occur, however, in the adjacent district, the southern border of the map lying approximately twelve miles north of the principal belt of such rocks. It is with this sedimentary belt that so many of the gold deposits of western Quebec are associated.

The preparation of the map and report, and the field work upon which they are based, have been carried out jointly by the writers. That portion of the area lying to the east of the Bell river, and also the northern half of Montgay and Carpentier townships, were examined by A. M. Bell. The remainder of the area, lying to the west of the Bell river, was mapped by L. V. Bell. A close co-operation in the work was, however, maintained to ensure the use of like terms for the various rock types and structures, and to obtain a comprehensive knowledge of the field as a whole.

Location and Access

The boundaries of the map-sheet are defined on the north by the north boundaries of Carpentier, Montgay, and Brassier townships, or approximately latitude 48°34′; on the south, by an east and west medial line through Pascalis, Tiblemont, and Tavernier townships, or approximately latitude 48°13′; on the east, by a north and south line a short distance to the east of the central line through Brassier, Dollard, and Tavernier townships and corresponding to longitude 77°00′; and on the west, by the western boundaries of Pascalis, Courville, and Carpentier townships, corresponding closely to longitude 77°34′. Included within these boundaries are the following townships and part townships; Carpentier, Courville, Montgay, and Senneterre; the northern halves of Pascalis and Tiblemont; the western halves of Brassier and Dollard; and the northwestern quarter of Tavernier. The map-sheet is nearly square and has an area of 645 square miles.

The map-area is well situated as regards access and transportation facilities. It is traversed in a westerly direction by the Quebec-Cochrane branch of the Canadian National railways and in a northerly direction by the Bell and Mégiscane rivers. West of the town of Senneterre, an automobile highway more or less closely parallels the railway, and is connected with a series of branch roads for colonization purposes. Ready means of transportation is thus afforded throughout much of the area, and more particularly the central part, including most of Senneterre, northern Courville, and the southern parts of Carpentier, Montgay, and Dollard townships..

The western part of northern Montgay and the eastern part of northern Carpentier may be reached by descending the Taschereau (Coffee) river from Belcourt village; northwestern Carpentier can

be reached from roads in Barraute township; and eastern Montgay and western Brassier, from lake Parent (or Shabogama). Northern Dollard township is traversed on the west by the Mégiscane river, which affords the best means of entry.

South of the railway, southern Courville and northern Pascalis may be reached through lakes Roquetaillade, Pascalis, and Tiblemont with their connecting streams that drain into the Bell river. Numerous rapids in the Bell river between the foot of lake Tiblemont and the town of Senneterre make it preferable to utilize, for this part, the automobile roads on either side of the river; a truck and taxi service from Senneterre is now maintained for this purpose. The road on the west side of the river forms the northern part of the projected Senneterre-Mont Laurier highway and is at present gravelled as far south as the Pascalis river. It skirts the western shore of lake Tiblemont and thus traverses northeastern Pascalis township. Northwestern Tiblemont township is easily reached by Tiblemont lake and by a winter road connecting the Wood-Etcheverry property with the road leading to Senneterre. The northeastern part of this township is more difficult of access, although a winter road extends for a mile east of the Wood-Etcheverry camp buildings. The southeastern part of Senneterre township is similarly lacking in roads or water routes. Here the only transport is by 'back packing'. Northwestern Tavernier township may be entered by ascending the Mégiscane river from the railway at Mégiscane station to the point where the river bends back to the east. Two portages are necessitated in this stretch of the river. An alternative route to the central part of Tavernier township, except during periods of very low water, is provided by the Tavernier river from its junction with the Mégiscane.

The aerial base for commercial flying, which was established at Senneterre by Canadian Airways, Limited, in 1932, was in continued operation during the field season of 1933. A means of quick transportation was thus provided in any part of the area in which there are suitable lakes on which to land and take-off. Rouyn and Amos are the bases for a number of commercial flying organizations which also serve the area.

Method and Scope of Work

The area was systematically traversed, at intervals generally of half a mile or less. In the southern part, because of the presence of the northern margin of the Pascalis-Tiblemont intrusive, with its important economic possibilities, the examination was made in more detail; whereas in the northeastern section, which was found to be underlain by granite and gneiss, the work was less detailed. The country was examined by pace-and-compass methods, the traverses usually having been carried in a north and south direction in order to cross the trend of the formations.

The excellent topographical map prepared from aerial photographs by the Topographical Survey of Canada, and furnished on a scale of 40 chains to the inch, was used as a base for the plotting of the geological information. This map, however, does not extend far enough north to include northern Carpentier, Montgay, and Brassier townships, so that here the township surveys and plans of the Department of Lands and Forests of Quebec were utilized. Stereoscopic study of the aerial photographs of the district permitted of locating a great many of the rock exposures and other elevated areas of similar appearance, as well as delimiting their size and shape. Field examination was then modified in such a manner as to traverse those areas in which rock outcrops, and presumed rock outcrops, were indicated.

The immediate vicinity of the actual gold discoveries has, of course, been made the object of a special study, and detailed maps have been prepared to illustrate the mode of occurrence of a number of the deposits.

Several deposits lying to the south of the map-area (and hence within the 1931 sheet) are described in the present report. They are associated with the Pascalis-Tiblemont intrusive and are closely allied to deposits occurring under similar conditions in the southern part of the present map-area. They were discovered subsequently to the field work of 1931.

Topography and Drainage

The Bell river marks approximately the eastern limit of the glacial lake basin known as the 'Clay Belt', but is frequently a few miles within it. Consequently, with the exception of a narrow por-

tion on the east, the map-area is characterized by the topography of the clay belt, or, more specifically, is a flat or gently rolling plain interrupted at some points by projections of the underlying rock rising above the general level, and by elevated areas and ridges composed of surficial deposits of glacial derivation. The extreme eastern part of the area is, on the other hand, characterized by heavy glacial deposits of sand and boulders, and, in general, by somewhat higher elevations. Where crossed by the railway, the mean elevation of the area above sea-level varies between 1,102 feet, at Mégiscane station near the eastern boundary of the sheet, and a minimum of 990 feet at Shabogama lake, *i.e.*, the level of the lake at Senneterre. Farther west, the ground-level again rises to 1,091 feet at Coffee siding. Uniacke station, which is not far from the western boundary of the area, has an elevation of 1,058 feet. The lake-level at Senneterre is probably close to the minimum for the area as a whole, but, of course, none of the railway elevations represent the maximum elevation of the country. Some of the more prominent topographical features, such as the granite hills in southern Montgay and the diabase ridges in Senneterre township, have, for example, an altitude considerably higher than that of the surrounding territory. The mean elevation of the map-area as a whole is about 1,050 feet above sea-level, and, generally speaking, the country to the north of the railway is somewhat lower than that to the south. It has been noted that lake clays are found for the most part below an elevation of 1,060 feet. At levels higher than this, deposits of sand and boulders are more common.

The map-area is situated a short distance to the north of the height-of-land and is drained principally by streams of the Bell River system, the chief of which are the Bell river itself, the Mégiscane, the Taschereau, and the Brassier. The western portion of the area includes, in part, the divide between the waters of the Bell and Harricana river systems. In consequence, it is rather poorly drained and contains some large swamps. The rivers of the Harricana system are the Courville, and the headwaters of the Senneville, to which the Courville is tributary. Both of these are, of course, small. Of the streams of the Bell River system the largest is the Mégiscane, which flows into lake Shabogama in the northern part of the area and thus becomes a part of the Bell. For the greater part of its course it has a strong current with numerous rapids—between the

western railway crossing and lake Shabogama it drops 81 feet. Along this stretch it has deeply entrenched itself in the glacial débris that forms its banks. One of several sections of the Bell river connects lake Tiblemont, and indirectly lake Pascalis, with lake Shabogama. This portion of the river has a total fall of 37 feet through a series of six rapids that separate quiet stretches. The Taschereau river is a small, winding stream flowing chiefly through a flat, clay country; only near the northern boundary of the map-sheet are there rapids along its course.

Soil, Agriculture, Timber

With the exception of its eastern margin, the greater part of the area is in some measure suited to agriculture. The arable soil is essentially clay and loam, which can be cultivated only where it is sufficiently drained. Thus, owing to its swampy nature, much of the western part of the area, although underlain by clay, is useless until it can be drained. Certain sections, also, that are occupied by deposits of sand, gravel, and boulders, and usually standing above the level of the clays, are unsuited to agriculture. Although such glacial deposits occur at numerous points throughout most of the map-area, they are particularly frequent in that portion lying to the east of lake Shabogama and the Senneterre river. Consequently, agricultural settlement does not extend eastward beyond this line. Elevated rocky areas, such as in northern Tiblemont, northeastern Pascalis, and certain sections in southern Montgay township, are likewise unfavourable for agricultural uses. The favourable sections for farming purposes, that is, the clay areas, are to be found in northern Carpentier township, in certain sections of northern and southwestern Courville, in western Senneterre, in the more southerly part of Montgay, and in northwestern Pascalis.

Settlement has taken place chiefly on the better tracts of land, along the roads and water routes. Thus, within the map-area, farming is very largely confined to a strip of land about four miles in width on either side of the railway or highway, and to the vicinity of the roads which parallel the Bell river.

Much of the timber of the district has been destroyed by forest fires. In the vicinity of the railway or roads, a considerable amount of timber has been cut in logging operations, and a good deal has also

been removed by the farmers in clearing their land. The principal areas of good timber remaining are to be found in northwestern Pascalis township (block *A*), southwestern Courville, and northern Tiblemont. The better stands of timber are chiefly black spruce, with a fairly high proportion of white spruce in the better drained areas. Birch is common in the upland type of country, and jack pine in the sandy areas. It has been noted that in certain sandy areas now largely devoid of forest growth, as for example in parts of southern Carpentier township, the trees are confined chiefly to the vicinity of streams.

Population

Practically the entire permanent population of the district is engaged in agricultural occupations, very largely in and about the villages of Senneterre, Belcourt, and Uniacke, and on the farm-lands in their immediate vicinity. Figures supplied by the Department of Colonization, Game and Fisheries indicate that the population of the parish of Senneterre in the year 1932 was 946. Belcourt parish had a population of 660, this figure including the small settlement near Uniacke station. The permanent population of the map-area for the year 1932 would thus total slightly more than 1,600 persons. During recent years, mining and prospecting activity have added considerably to these numbers, although as yet this addition is largely of a seasonal nature.

Previous Work and Bibliography

The earliest geological exploration of the region was conducted during the fall of 1887 by A. S. Cochrane, assistant to Dr. Robert Bell, of the Geological Survey of Canada. Cochrane crossed the height-of-land from Grand Lake Victoria and descended the river, later known as the Bell, for nearly ten miles below lake Shabogama. He established the presence of 'Huronian' rocks in the region, the significance of which was early appreciated. Much more extensive geological exploration was carried out during the years 1895 and 1896 by Robert Bell and his assistant, R. W. Brock. In 1895, the Bell river was descended to Mattagami lake, and from thence the Nottaway river was followed to its mouth in Rupert bay. In 1896, several of the tributaries to the Nottaway, and to the river which in that year was named in honour of Robert Bell, were explored. Among

these was the Mégiscane river, which was surveyed by Brock. The first geological map of the region which includes the present map-area was prepared by Robert Bell, and is based on the field work for the years mentioned. It accompanies his final report on the district, entitled *The Easin of the Nottaway River*①.

W. J. Wilson who, in 1906 and 1907, carried out a geological reconnaissance in the vicinity of the National Transcontinental (Canadian National) railway in western Quebec, examined the geology along several of the lakes and water-routes within the present map-area, including the Bell river and its connecting lakes, Mégiscane river, Pascalis lake, and Senneville river.

An extensive geological examination in the vicinity of the Bell river was conducted by M. E. Wilson in 1912. The geological map accompanying his report for that year, and a composite map issued with a later memoir, include in a general way the geology of the present map-area. His work, however, was necessarily of a reconnaissance nature and was confined largely to the water routes and to the vicinity of the railway.

During 1924, G. W. Bain made a reconnaissance study of the geology of a large portion of the area to the south of the railway and drained by the Bell and Harricana rivers.

The systematic and more detailed geological mapping of the mineral belt of western Quebec, instituted in 1922 by the officers of the Geological Survey of Canada, was carried from the Ontario-Quebec boundary as far east as longitude 77°30′. The most easterly of their series of map-sheets are known as the Fiedmont and Dubuisson sheets. Although these were overlapped somewhat to permit of better correlation, the Fiedmont sheet, together with the northern part of the Dubuisson sheet, form the western boundary of the present (Senneterre) map-sheet.

The area adjoining the Senneterre map-sheet on the south was examined by the present authors during 1931, and that to the south-east was mapped by A. M. Bell during the following year; the work in each case being carried out on behalf of the Quebec Bureau of Mines.

① Geol. Surv. Can., Ann. Rept., Vol. XIII, 1900.

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The writers take this opportunity of expressing their appreciation of the kindly assistance rendered them by many persons in the district. Thanks are due in particular to the prospectors, mining engineers, and employees of the several mining companies working within the area. The authors are especially indebted to Mr. W. P. Murdoch, engineer of the Hollinger Consolidated Gold Mines, Limited, and to the original owners of the Wood-Etcheverry holdings, for maps and plans of that property. Messrs. W. Blair, J. C. Carroll, E. Croteau, Jos. Norrie, Jacob Smith, and G. E. Metcalfe all facilitated the examination of the mining properties with which they severally were associated. The writers were shown the greatest hospitality by the staffs at the principal mining properties in Pascalis, Louvicourt, Bourlamaque, Varsan, and Dubuisson townships, which were visited during the fall of 1933.

The aerial map and photographs provided through the courtesy of the Topographical Survey of Canada proved to be very valuable in the field work and in the preparation of the accompanying geological map No. 261. The writers acknowledge with pleasure the close cooperation of this Department. The aerial map is in turn based on the ground surveys of the Department of Lands and Forests of Quebec.

Capable assistance in the field-mapping was rendered by the following student assistants: R. Grimes-Graeme, F. T. Denis, H. A. Belloc, N. L. Wilson, F. Morisset, A. Côté, A. Dugas, and P. Jacques. An accurate survey of the projected roads leading to several mining properties in the eastern part of the Abitibi belt was carried out by F. Morisset.

GENERAL GEOLOGY

Exclusive of surficial deposits of Recent and Pleistocene time, the area is underlain entirely by pre-Cambrian rocks. Although these are of somewhat diverse nature, they embrace three general types distinguished by difference in age and composition. The predominantly volcanic and in large part more basic Keewatin series is extensively intruded by younger and essentially granitic rocks herein classed as pre-Cobalt. Of very small volume as compared with either of these, and intrusive into both, is a third type consisting of dykes of quartz diabase.

TABLE OF FORMATIONS

RECENT and PLEISTOCENE	Lake-clays, alluvium, ground moraine, sand, gravel, eskers
Great unconformity	
	Quartz diabase (later gabbro)
	Intrusive contact
PRE-COBALT (?) INTRUSIVES	Soda-granite, diorite, gabbro, rhyolite, feldspar porphyry, aplite, lamprophyre Granite, quartz and feldspar porphyry, pegmatite, aplite, hornblendite Granite gneiss Rhyolite porphyry, dacite porphyry Diorite, quartz diorite, hornblendite
Intrusive contact	
KEEWATIN	Intrusives: diorite, hornblendite, rhyolite, felsite; altered equivalents of all these Volcanics: basalt, andesite, trachyte, rhyolite, tuff, volcanic breccia; altered equivalents of the above rocks, chiefly chloritic schists

KEEWATIN

Keewatin rocks are somewhat more widespread within the area than the younger, granitic rocks. They are to be found chiefly in Carpentier, western Montgay, northern and eastern Courville, western and southern Senneterre, northern Tiblemont and Tavernier, and to a small extent in northwestern Pascalis township. As is the case elsewhere, they consist very largely of volcanic rocks of intermediate to basic composition, although more acidic types, such as rhyolite, are represented.

ANDESITE, BASALT, TRACHYTE:

Of the several types of Keewatin volcanics present in the area, andesite is probably the most widely distributed. On the map, however, differentiation has not been attempted between the various intermediate to basic lavas, to which the general term 'greenstone' might be applied. In many of their occurrences, these rocks are so intensely altered that their original nature cannot be determined. Many such rocks are now chloritic and hornblendic schists. Carbonate alteration is likewise a common feature and is especially pronounced in the vicinity of granitic intrusions. Doubtless on account of their composition, the basic lavas are invariably more altered than are the acidic types.

The lavas of intermediate to basic composition are almost invariably schistose, and they are commonly characterized also by pillow and amygdular structures. Where such structures are lacking, however, and especially where the rock is of relatively coarse grain, it is difficult to decide whether it is a lava or an intrusive. For example, the relatively massive, fine to medium-grained hornblendic rocks which are associated with normal pillow lavas near the eastern boundary of Carpentier township, in ranges III and IV, may well be dioritic intrusives.

It was noted that pillow lavas commonly occur in close association with much of the volcanic tuff of the area.

RHYOLITE, FELSITE:

Since, in this area, it is difficult, if not impossible, to distinguish between rhyolites of intrusive and extrusive origin, they are here discussed together. A rock of similar texture and closely related genetically, but of somewhat more basic composition, has been designated felsite. As indicated on the accompanying map, rhyolite of Keewatin age is but sparsely represented within the area. There is, however, an extensive occurrence of rhyolitic rocks in Carpentier township, but here they are porphyritic, and, for reasons that will appear later, they have been classed as post-Keewatin.

In range VI, central Courville township, is a relatively small area underlain largely by rhyolite and rhyolite breccia. These rocks are assumed to be extrusives, and they are apparently related to acidic tuffs which are exposed in their vicinity. There is a minor occurrence of rhyolite also near the boundary between Tiblemont and Senneterre townships, a mile east of lake Tiblemont. More extensive exposures of dense, rhyolitic rocks are to be found in western Carpentier township, near the borders of the intrusive mass termed dacite porphyry. In each of these occurrences, the rhyolite is assumed to be a lava.

Rhyolite with features that are strongly suggestive of an intrusive origin occurs near the northern margin of the Pascalis-Tiblemont granitic mass, in Courville township. With the exception of a small, isolated exposure in lot 27, range III, this rhyolite is intimately associated with felsite, commonly fine grained. The principal outcrops are in the southern halves of lots 34 to 38 in range IV and the northern halves of the lots bearing the same numbers in range III, or in what were formerly the Springer claims. Massive rhyolite is also exposed in the bed of the Senneville river, at the point where it is reached by the portage leading from lake Pascalis. This is a small outcrop, in which coarse rhyolite is cut by a narrow dyke of felsite. It is immediately south of several outcrops of a porphyritic phase of the soda-granite and is thus assumed to lie within the Pascalis-Tiblemont intrusive. But although it has been mapped as an inclusion of Keewatin material, it might well connect on the west with the similar rocks in the Springer claims, which, as already stated, have rather the features of intrusive rocks. Small outcrops of a rock assumed to be a somewhat coarse variety of the felsite were seen in lots 33 and 34,

range V, but with no associated rhyolite. This occurrence is separated from the principal one (in the Springer claims) by a drift-covered interval of a mile and a quarter. If the rocks of the four localities cited are parts of one and the same mass, which is not improbable, it would occupy a triangular area with minimum dimensions of three miles northeast by two and a half miles east and west.

It is difficult to determine whether rhyolite or felsite predominates, so intimately are they intermingled. In the rhyolite, quartz usually occurs in finely granular aggregates and occasionally in phenocrysts, and both plagioclase and orthoclase are common as phenocrysts. In hand specimen, the felsite may be distinguished from the rhyolite by its darker and more basic appearance. Under the microscope, it is seen to differ in containing less quartz, a higher proportion of secondary minerals indicative of its more intense alteration, and only rare phenocrysts. The abundance of epidote and certain other secondary minerals in the felsite suggests an originally feldspathic rock.

The intimate association and similar texture of the two rock types would indicate a like origin. The felsite is intrusive into the rhyolite and would appear to represent a somewhat more basic differentiate of the same magma. Although, in some specimens, the rock is massive, it commonly exhibits a definite, but not strong, foliation, in a direction corresponding to that typical of the region. While, therefore, the rhyolite and felsite have been tentatively classed as Keewatin and are indicated as such on the map, it is not improbable that they are phases of a younger intrusive mass. Some support for the latter view is found in the fact that these rocks occur near the margin of the Pascalis-Tiblemont intrusive, which is known to assume, in places, a fine, rhyolitic texture.

TUFF, VOLCANIC BRECCIA:

Tuffs are much more common in the area than volcanic breccias of either extrusive or intrusive origin. They were seen in association with breccias only in a few places, but they frequently occur with lava flows, with which they may be intimately interbanded. The tuffaceous nature of the rock may or may not be very evident and is best displayed in a fine banding.

Within the Keewatin rocks, there is a persistent horizon, up to two miles in width, which contains a high proportion of tuffaceous

material. From the most easterly exposures of the Keewatin rocks in Jurie township, the zone may be traced westward, in intermittent exposures, through northern Tavernier and into southern Senneterre township ①. To the west of the Senneterre river, it swings sharply to the north into range VI, where its course is interrupted by granitic intrusions; but it continues westward across the Bell river, through ranges VI and VII of Senneterre, and as far as range VI in central Courville township. Rocks that have been indicated on the map as tuffs occur also in Montgay township, where they seem to form a somewhat discontinuous band extending diagonally from range I, near the centre line, to the west boundary of the township in range VII. Here, however, the tuffaceous character of the rock is not so evident, and the continuity of the band is somewhat doubtful, partly in consequence of interruptions by granitic intrusions. A third, but somewhat isolated, occurrence of rock believed to be tuff is exposed in central Courville township.

In the main zone referred to above, the tuffs are for the most part finely banded rocks. Beds in which the banding is particularly evident are exposed two miles southeast of the town of Senneterre, and also to the west of the Bell river in ranges VI and VII of Senneterre township and in ranges V, VI, and VII of Courville. Iron formation, in minor proportion, is interbedded with the tuffs, as in the large exposure in lots 14 to 18, range VII, Senneterre. The pronounced banding of the folded and crumpled iron formation here is well shown in the photograph, Plate II-A.

Although in some places, as in range I of Montgay township, the tuffaceous character of the rock is obvious, many of the rocks, both in this township and elsewhere, which are provisionally assumed to represent tuffs are of somewhat doubtful origin. These include biotite schists and crenulated schists which consist largely of chlorite.

A banded rock, which forms a bare ridge in lots 28 to 31, range IV, of Carpentier township, is unique in this area and there has been much speculation concerning its nature. Dense, finely banded rock, uniformly light-grey in colour, alternates with coarser, granular rock of darker colour which shows no evidence of fine banding. The more massive rock, which is in much lesser amount than the other, occurs

① Bell, A. M. *Assup River Area;* Que. Bur. Mines, Ann. Rept., 1932, Part B.

in bands from five to ten feet in width. Included in these rocks are occasional, more or less spherical, lumps of more basic, chloritic rock. The uniformity and persistence of the laminae of the finely banded rock is a striking feature (see Plate II-B). The rock has a pronounced schistosity, which parallels the banding. Its banded appearance is emphasized by veins and veinlets of quartz, which, in part, have been injected in *lit par lit* fashion. Quartz also occurs more irregularly, and in the more granular rock is common in transverse lenses, probably occupying tension fractures.

Although, mineralogically, the laminated and granular bands are alike, they differ markedly in the relative proportions of the constituent minerals. The finely banded rock is made up principally of quartz, with some epidote, sericite, and talc, whereas quartz is far less abundant in the more massive bands, in which, also, the constituent minerals are more coarsely crystalline. The rock as a whole is exceptionally high in silica.

The rock is assumed to have originated as a water-lain deposit of an acidic volcanic ash. The alternating bands of finely laminated and massive material probably represent recurrent changes in the composition of the volcanic ejectamenta, and the somewhat rare, rounded inclusions are thought to be bombs. The supposition of a tuffaceous origin is supported by a related occurrence of siliceous agglomerate a short distance to the south of the high, rocky ridge that forms the principal exposure of the banded rock.

Occurrences of volcanic breccia within the area are relatively small, and reference has already been made to most of them. Besides the agglomerate mentioned in the foregoing paragraph, rhyolite breccia is exposed in range VI of central Courville township.

DIORITE, HORNBLENDITE:

Certain coarse grained, dark-coloured rocks of basic composition, which in most cases are known to be intrusive into the lavas and tuffs, have been assigned to the Keewatin. They are very much less abundant in the area than the Keewatin extrusive rocks. In large part they would appear to represent a later, intrusive phase of Keewatin volcanic activity. Some of these rocks, however, have the appearance of very thick flows, and in several occurrences dioritic rocks of this nature grade into fine-grained types similar in appearance to

the lavas. Collectively, most of these rocks may be classed broadly as diorite and hornblendite, although, as the result of intense alteration, their original nature is obscure. On the map, they have not been differentiated from other members of the Keewatin.

The largest occurrence of such rocks is along a well-defined zone in the Keewatin lavas which extends through northern Tiblemont and into Tavernier township and is believed to represent an anticlinal fold. Several stocks of later intrusive rocks also follow this zone and are indicated on the map. Certain other dioritic rocks occurring to the east of the main granite mass in the northern half of Tiblemont township have been similarly grouped with the Keewatin. They may, however, belong to the group of later dioritic intrusives indicated on the map by the symbol '*4*'. An altered diorite, which is so foliated as to appear banded, is to be found to the west of the Bell river, in range II of Senneterre township. It is exposed principally on the Chiasson farm and along the western shore at the lower end of Tiblemont lake. Farther south, it becomes fine in grain and passes transitionally into a lava.

Altered hornblendite irregularly intrudes the lavas and tuffs of northern Montgay and western Carpentier township, and occurs in lesser volume elsewhere. It is a dark-coloured rock of medium grain consisting essentially of hornblende.

Somewhat distinct from the hornblendite and diorite is an altered rock which is intrusive into highly schistose Keewatin lavas at Belcourt village. Under the microscope, it is seen to have a diabasic texture and to contain fibrous amphibole as its ferromagnesian constituent.

It should be noted that the distinction between the diorites classed as Keewatin and those, to be described below, which are classed as post-Keewatin, is based largely on their composition and the extent of their alteration. In some instances, therefore, there may be some question as to their proper classification. Since, in adjacent areas, altered post-Keewatin dioritic rocks have been found in association with mineral deposits ①, this factor of uncertainty of age classification should not be overlooked in a consideration of the diorites here classed as Keewatin. The Keewatin hornblendites, on the other hand, do not suggest the likelihood of related mineralization.

① Que. Bur. Mines, Ann. Rept., 1932, Part B, pp. 6, 52, 76.

Pre-Cobalt (?) Intrusives

In this division are grouped the great bulk of the intrusive rocks of the area. In composition they are mainly granitic, but they include also certain older dioritic intrusives, rhyolite and dacite porphyry, and a basic facies of the granite. The rocks are of various ages, and both massive and gneissic types are represented. Generally speaking, granitic rocks occupy the southern and northeastern parts of the area and are widely distributed elsewhere in the form of small stocks and masses. In a broad way, gneissic rocks are more common in the northeastern section. The smaller intrusive masses are typically massive.

Dioritic Intrusives:

Intruding the Keewatin lavas at several places within the map-area are bodies of massive rock ranging in composition from quartz diorite to hornblendite. These have been distinguished on the map by the symbol '*4*'. The two larger masses that have been indicated in Tavernier and Tiblemont townships, and possibly a third in northern Carpentier, have been intruded along what appears to be an anticline, in the Keewatin rocks. While the age of these rocks can only be inferred, they are thought to be younger than the Keewatin and to correspond to a series of intrusives that preceded, and were more basic than, the granitic intrusives. The more acidic types resemble the quartz diorite of Louvicourt township① and also certain intrusive masses in southeastern Tavernier and central Haig. Normal diorite and hornblendite, however, are more abundant than quartz diorite. The fact that somewhat similar rocks in adjacent areas are the probable source of gold deposition gives to these rocks, and particularly their more siliceous members, a potential economic significance.

The composition of the dioritic intrusive rock of northeastern Tiblemont township varies in the one mass from quartz diorite, with opalescent eyes of quartz, to a rock made up almost entirely of hornblende. The acidic phases intrude the more basic ones, but a complete gradational series between the two end members may be traced.

① Que. Bur. Mines, Ann. Rept., 1931, Part B, pp. 77-78.

In this vicinity there are, in addition, somewhat similar rocks which, although mapped as Keewatin, may belong to the group under discussion.

Examined under the microscope, the quartz diorites are seen to consist of albite, quartz, hornblende, and chlorite, the quartz and albite being characteristically in micrographic intergrowth. In the more basic types, all gradations may be seen, from those which, containing little or no quartz, are composed of very coarse (up to $\frac{3}{4}$ in.) hornblende enclosing laths of altered feldspar, to rocks that are made up entirely of hornblende, now partially altered to chlorite. Some of this more basic rock weathers a striking brick-red colour, and under the microscope is seen to consist of fibrous chlorite and serpentine, with accessory magnetite, and with some remnants of hornblende crystals.

RHYOLITE PORPHYRY, DACITE PORPHYRY:

An acidic intrusive extends in a northwesterly direction from northeastern Courville to and beyond the western boundary of the map-sheet, in range VI of Carpentier township. The rock in the southern portion of this mass (in northern Courville and southern Carpentier) has been termed rhyolite porphyry, whereas the term dacite porphyry has been applied to that in its presumed northerly continuation in ranges V and VI of Carpentier township. In the map, a further subdivision has been made of the rhyolite porphyry on the basis of foliation; for, although uniform mineralogically, this rock, in its southerly exposures, exhibits a strong and uniform foliation, and is rather coarse grained, whereas in its more northerly exposures it is a relatively massive rock. This more massive phase is very light in colour, and although for the most part fine-grained, it commonly has a porphyritic texture. Ferromagnesian minerals are present in negligible amount or are lacking. This rock has been designated granite on the map issued by the Geological Survey of Canada①. The foliation of the sheared rock is such as to suggest that it was involved in the folding that has affected the rocks of Keewatin age. This foliated type of the rhyolite porphyry, that might thus be interpreted as the older of the two, is separated from the more massive rock by a drift-covered interval of about two miles.

① Geol. Surv. Can., Fiedmont Sheet (Map 206A), 1929.

Owing to their petrographical similarity and to their relation in position, however, they are regarded as parts of the same mass; the shearing is assumed to have decreased in intensity towards the north.

The rhyolite porphyry is composed of phenocrysts of quartz, plagioclase, and orthoclase, in a groundmass of the same minerals. Some secondary sericite and carbonate are present, but in general the rock is fresh or but little altered.

The dacite porphyry, as exposed in range V, Carpentier township, is a massive, fine-grained rock composed of phenocrysts of albite in a fine groundmass. It is closely associated with rhyolite, which, although provisionally classed as Keewatin, may represent an intrusive rock related to the dacite porphyry.

GRANITE, GRANITE GNEISS, HORNBLENDITE, PEGMATITE, QUARTZ- AND FELDSPAR-PORPHYRY:

In this division are grouped the granitic rocks of the area exclusive of, and for the most part lying to the north of, the Pascalis-Tiblemont granitic intrusive; the latter is discussed on a subsequent page. Included are rocks which differ in age, and to some extent in composition, but which bear intrusive relationships to one another. Both massive and gneissic, pink and grey, granites are represented. Generally speaking, the older types are grey and gneissic, whereas the later ones are both grey and pink, but generally, if not always, massive. On the other hand, it is recognized that both types might be represented in the same intrusive mass—the gneissic as a border phase and the massive in the interior. On the map, an attempt has been made to distinguish between the massive and gneissic granites, which, in some measure, serves also to delimit the younger and older granites. Whether their age difference is such that they might be classed as Laurentian and Algoman, for example, is not known, but this is considered probable. It is worthy of note that there are rather extensive occurrences of massive, and presumably younger, granite north of, and for a short distance to the east of, the Pascalis-Tiblemont intrusion ①, whereas few such masses have been noted ② in the predom-

① Bell, A. M., *Assup River Area*; Que. Bur. Mines, Ann. Rept., Part B, 1932, p. 72.

② Bancroft, J. A., *Geological Reconnaissance between Hervey Junction and Doucet*; Que. Bur. Mines, Ann. Rept., 1916, p. 152.
Bell, L. V., *Granitic Gneisses in the Foch Area*; Que. Bur. Mines, Ann. Rept., 1932, Part B, p. 102.

inantly gneissic rocks of granitic composition that extend for many miles farther east and southeast of that body. It would seem that this factor may be of some economic significance for the area under discussion.

Some phases of the granite are relatively basic and might properly be termed hornblendite. They occur only in small volume.

Grey, biotite gneisses are the oldest of these granitic rocks. Closely allied to them are gneissic, grey, hornblendic granites, which were noted more particularly in Montgay township. For the most part, the banding of the gneisses is fine and uniform, although it appears to have been affected in some measure by inclusions of altered Keewatin rocks, which are rather numerous. Little or no garnet was observed in the gneisses here, contrasting with the frequent occurrence of this mineral in the gneissic rocks remote from this area and lying to the east and south of the Keewatin belt.

The more massive granites form a series which may represent either successive phases of a single intrusion, or two or more distinct periods of injection. Grey, biotite and hornblende granites, intrusive in their relationship to the gneissic types, are in turn cut by pink granites. Later pegmatite also occurs in the form of small, lenticular dykes, but these are not abundant. Where granite is intrusive into greenstone, hornblendite, apparently due to assimilation, is common, especially in smaller stocks and in certain parts of the borders of larger intrusions.

Chemical analyses of the granites under discussion, and also of the Pascalis-Tiblemont granite, indicate that the soda content is sufficiently high to warrant classification of all of them as soda-granite (*see* Table 1). The ratio of soda to potash is, however, somewhat higher in the Pascalis-Tiblemont granite than in the others, and the term soda-granite is herein confined to it. The high soda content common to the Pascalis-Tiblemont mass and to these other granitic masses (to the north of that body) within the present map-area would suggest that they all belong to the same petrographic province. On the other hand, it may be noted that, in respect of this high percentage of soda, these granites stand in strong contrast to the large La Corne granite mass (*see* analysis, column VI), the eastern border of which is but a short distance from the Pascalis-Tiblemont intrusion.

Table 1, columns I to IV, gives the results of analyses of a number of these soda-granites. For comparison, the average of thirty-six analyses of typical soda-granites from various localities is given in column V, and an analysis of the LaCorne granite is reproduced in column VI.

TABLE 1

Analyses of Various Granites

	I	II	III	IV	V	VI
SiO_2	67.09	66.85	74.61	76.11	71.67	67.30
Al_2O_3	15.65	16.19	13.03	12.07	14.51	15.95
Fe_2O_3	0.66	1.14	1.50	0.81	1.52	1.75
FeO	2.27	1.04	1.51	2.32	1.29	1.30
MgO	2.11	1.07	0.30	0.35	0.85	0.70
CaO	4.27	3.03	1.42	1.57	2.34	3.68
Na_2O	4.90	6.90	4.84	4.40	4.17	2.88
K_2O	2.10	2.60	1.56	1.17	2.29	4.08
H_2O (hygroscopic)	0.16	0.39	0.04	0.10	0.79	.....
H_2O (combined)	0.18	0.48	0.20	0.41	.....	.....
TiO_2	0.43	0.30	0.12	0.21	0.30	.....
CO_2	0.05	0.04	0.89	1.01	.....	.....
P_2O_5	0.15	0.11	trace	trace	0.15	.....
$S(FeS_2)$	trace	trace	0.05	trace	.....	.....
SO_3	.....	.....	.....	.....	.....	.....
Cl	.....	.....	.....	.....	.....	.....
MnO	trace	0.05	0.02	0.03	0.12	.....

I.—Composite sample of granites from Senneterre, Dollard, and Montgay townships.

II.—Massive pink granite from ranges III, IV, V, Montgay township.

III.—Siliceous type of soda-granite from Pascalis-Tiblemont mass, northern Tiblemont township.

IV.—Siliceous type of soda-granite from Roquetaillade lake, Pascalis township.

V.—Average composition of 36 soda-granites, as given (in note) by N. L. Winchell (from data of Washington and Clarke).

VI.—Granite from LaCorne township. Analysis by W. Gerrie (Geol. Surv. Can., Mem. 166, 1931, p. 137).

(Analyses I, II, III, and IV by M. Archambault, Bureau of Mines, Quebec).

An example of one of the better defined and more uniform intrusions of massive granite is to be found in southern Montgay township, where it is in part expressed in two adjacent hills in range IV. This batholith occupies an area extending at least from lot 14 to lot 44. Although best exposed in range IV, it also outcrops in ranges III and V. On the south and west it intrudes grey, gneissic granite and Keewatin

rocks; the relationships on the north and east are obscured by cover of drift. The rock is characterised by a uniform pink colour, commonly flecked with greenish epidote. It is fine to medium in grain and (except very locally) is massive. Lenses and stringers of barren-looking quartz cut the granite. It is apparent that this mass is one of the younger of the granitic intrusives of the area. An analysis of the rock is given in column II, Table 1.

Dykes of quartz- and feldspar-porphyry are not uncommon cutting the Keewatin rocks of the area. Such dykes, however, are for the most part small. They would appear to be genetically related to the smaller intrusions of massive granite. These porphyritic intrusives are usually grey in colour, massive, and little altered. Those parts of the area underlain by Keewatin rocks that are intruded by porphyritic dykes are indicated on the map by the symbol '*1*^{p}'.

PASCALIS-TIBLEMONT INTRUSIVE:

The southern part of the map-area is in large part underlain by the northern portion of a granitic batholith that has been termed the Pascalis-Tiblemont intrusion. On the west, it extends beyond the border of the map-sheet. This intrusive is of particular economic interest, in view of the fact that mineral deposits have been located at certain points within it and along its borders. Its southern portion is included in the map-area of 1931 and is described in the report for that year①, the rock being there referred to as quartz-monzonite. While this term is probably acceptable for the several phases of the intrusive taken collectively, further work has shown that certain basic phases of the mass are more sharply defined than was suspected previously. In the present report, therefore, a differentiation is made between the more distinctive of the various phases of the intrusive, and these have been separately indicated on the map. They indicate differentiation in the magma with development of widely varying rock types. None the less, probably 85 per cent of the intrusive as exposed may be referred to soda-granite, and there is thus considerable justification for applying this term to the mass as a whole. The soda-granite itself shows variation in composition, due largely to differences in the relative proportions of quartz and feldspar in the rock. Generally speaking, however, the more siliceous varieties predominate.

① Que. Bur. Mines, Ann. Rept., 1931, Part B, p. 77.

The several phases of the mass range from basic to acidic, or from gabbro and diorite① to siliceous granite, as the end product of differentiation. The granite and diorite are intermingled in a highly irregular manner, so that mapping them separately was difficult, and in most cases boundaries had to be drawn arbitrarily. The sequence of the several phases, beginning with the earliest, appears to be as follows: (1) highly altered and sheared diorite or quartz diorite; (2) massive diorite, in some cases preceding, but nearly contemporaneous with, the soda-granite; (3) soda-granite, intrusive into the altered basic rocks; (4) lamprophyre dykes; (5) feldspar-porphyry and aplite dykes.

Although, in the field, no difficulty was experienced in distinguishing between 'diorite' of divisions (1) and (2), for mapping purposes they have been grouped together and both are shown by one colour. The widespread distribution and similarity in original composition of the two dioritic types favours the view that they are an early, basic differentiate of the general intrusion. The sharper contacts made by the granite with the more altered diorites, taken to indicate that they occur in the granite as inclusions, and their greater alteration near such contacts, suggests that, in general, the altered diorite is earlier in age than the massive variety. However, the difference between the two types is largely one of alteration, and it may be found that they grade into one another. A more important distinction between them is an economic one, based on the fact that certain mineral deposits are related to the sheared and altered phase of the diorite, whereas none have as yet been observed in association with the massive diorite. The altered phase, insofar as it has been revealed, lies almost exclusively to the east of the Bell river. An estimate based on the results of mapping of outcrops indicates that these basic dioritic differentiates make up roughly 7 per cent of the exposed rock within the Pascalis-Tiblemont intrusion. Since, however, they tend to occupy the low ground, in contrast to the granite, which often forms hills, these basic phases are not so well exposed as the granite, and the estimate given is probably somewhat low.

The altered diorite is a coarse-grained, highly altered, chloritic rock. It is distributed in an intimate and irregular manner through-

① Here, and in the descriptions that follow, the term 'diorite' is used in a broad sense. Chemical analyses show that much of this so-called diorite is, more properly speaking, gabbro (see Table 2).

out the central and southeastern parts of the intrusive mass, and everywhere it is intruded by the soda-granite; but where present near the margin of the batholith, it is intrusive into the adjacent Keewatin rocks. Under the microscope, the rock is seen to consist of chlorite, quartz, altered plagioclase (albite), carbonate, and sericite. The platy minerals, in all sections examined, show a marked parallelism.

The massive diorite (or gabbro) is dark in colour and often mottled, the hornblende contrasting with the light coloured feldspar. The rock varies in texture from place to place, but for the most part is of medium grain, and, as seen in the field, it has a fresh appearance. It occurs in irregular masses rather than dykes.

Analyses of specimens from two localities are given in Table 2, columns I and II. As may be seen by comparison with the figures in column III, which represent the average composition of twenty-four typical normal gabbros, these rocks have the composition of gabbro. Some varieties, however, may be less basic than the specimens analysed.

Examined under the microscope, the rock is seen to be composed essentially of hornblende and plagioclase, but minor amounts of quartz are present. The plagioclase is intensely altered to epidote. The least-altered occurrence of this rock seen by the writer is just south of the east bay of Tiblemont lake. It is interesting to note that the gabbro here has a fine-grained border, suggesting that it is intrusive into the soda-granite with which it is associated.

Field evidence has shown that, almost invariably, the massive phase of the diorite (or gabbro) is intruded by the soda-granite. As noted in the last paragraph, however, this condition appears to be reversed in the occurrence at Tiblemont bay, and the same is true in some other localities①. Thus it would appear that, although they differ so widely in composition, the diorite and granite are closely related genetically and are mutually intrusive. In nearly every instance observed, the contact between them is sharp, without evidence of intermediate or transitional types. Selected specimens from different localities do, however, show varieties more or less intermediate between granite and diorite. In general, the relationships are such as to suggest differentiation at depth, with injection of the magma after differentiation was complete.

① Que. Bur. Mines, Ann. Rept., 1931, Part B, p. 77, also Plate I-A.

TABLE 2

Analyses of Massive Diorite or Gabbro

	I	II	III
SiO_2	49.54	49.01	49.50
Al_2O_3	18.35	16.01	18.00
Fe_2O_3	2.32	6.92	2.80
FeO	7.87	7.31	5.80
MgO	7.06	4.99	6.62
CaO	10.15	11.64	10.64
Na_2O	2.68	2.70	2.82
K_2O	0.28	0.30	0.98
H_2O (hygroscopic)	0.09	0.10	1.60
H_2O (combined)	0.31	0.33	
TiO_2	0.89	0.52	0.84
CO_2	0.02	0.03	.....
P_2O_5	0.26	0.10	0.28
$S(FeS_2)$	0.04	0.09	.....
MnO	0.15	0.12	0.12

I.—Gabbro from south point of Tiblemont island.

II.—Gabbro from south shore of Pascalis lake.

III.—Average composition of 24 gabbros, excluding olivine gabbro, reproduced from *Igneous Rocks and their Origin*, by R. A. Daly, p. 28.

(Analyses I and II by M. Archambault, Bureau of Mines, Quebec).

The soda-granite is of two general types, although variation in composition is such that they cannot be closely defined. One, a highly siliceous phase, in which the quartz commonly appears as opalescent 'eyes', is characteristic of the northeastern part of the batholith and is common elsewhere within the intrusive. With decrease in quartz and a corresponding increase in feldspar and biotite, this passes into the second type, which is more typical of the northwestern part of the batholith.

Analyses of representative specimens of the siliceous type are given in columns III and IV of Table 1. A Rosiwal determination gave the mineral composition as follows: quartz, 44%; albite, 33.5%; orthoclase, 20%; magnetite, 1%; chlorite, 1%; and carbonate, 0.5%. In some of the thin sections examined, the soda-granite was found to contain also microcline, biotite, and hornblende; secondary epidote, kaolin, and sericite; and a little accessory magnetite and pyrite.

A number of dark-coloured lamprophyric dykes intrude the granite. The larger ones are shown on the accompanying map. They range in composition from hornblende diorite, in which the chief essential constituent, other than hornblende, is basic plagioclase, to more acidic types in which biotite takes the place of hornblende, and there is a high proportion of orthoclase and albite feldspar with variable amounts of quartz. The lamprophyre dykes as a whole are highly altered, and contain much secondary chlorite, carbonate, and epidote. Dark-coloured dyke-like material consisting of quartz with carbonate, feldspar, and chlorite is frequently associated with quartz veins in the granite. This may be an extreme, siliceous phase of the lamprophyre. These dykes are most prevalent in northeastern Tiblemont township. They occupy two sets of fractures, which strike northeast and northwest, respectively, and they range in width from a few feet to over a hundred feet.

Dykes of fine grained aplite and coarse feldspar-porphyry cut both the granitic and dioritic phases of the batholith. They are composed essentially of quartz and albite. Such dykes are most abundant in Tiblemont township, where their strike is either northeast or northwest, as with the lamprophyre dykes. Besides occurring in well defined dykes, aplite is also found in large, irregular bodies within the granite.

In addition to the various rock types described above, fine-grained, rhyolitic phases of the soda-granite are not uncommon near the margin of the intrusive, and in some instances it is a problem of some difficulty to distinguish them from the rhyolites of Keewatin age. An example of the rhyolitic phase may be seen in exposures on the east side of the large island in Tiblemont lake.

QUARTZ DIABASE (LATER GABBRO):

The youngest intrusive rocks of the area are dykes of quartz diabase. This rock is fairly well represented within the area, but chiefly in one large north and south dyke, or series of dykes, near, and more or less parallelling, the Bell river. The topographic relief afforded by this dyke, or zone, and the manner in which it truncates the formations, may be seen in Plate III. It has been traced in intermittent outcrops from the southern point of the large island in

Tiblemont lake to range V of Montgay township, a distance of 18 miles. Quartz diabase also occurs on Wigwam island and on the western shore of Shabogama lake ①, twelve miles north of the northern boundary of the map-sheet, where it forms a probable continuation of the same dyke. If so, the dyke would have a length of at least 35 miles. Several other dykes of quartz diabase are shown on the map. Most of them strike northeasterly.

The principal dyke has an average width of about 250 feet. It appears to be somewhat discontinuous, unless—as is not improbable—it has been offset by faulting. There is, indeed, some evidence for the off-setting by faulting of the southern part of the dyke, on the east side of the Bell river. The principal breaks in continuity are where the dyke is assumed to cross the Bell river, a short distance north of the town of Senneterre, and again in range III of Senneterre township. It is, of course, possible that such discontinuities may be due to there being really several dykes, nearly parallel and arranged *en échelon* within a comparatively narrow zone of early fractures. Thus, in Senneterre and Montgay townships, the several exposed sections of the dyke strike slightly east of north, whereas the dyke as a whole strikes in a more northerly direction. There is also a possibility that the several exposures are parts of one continuous, but somewhat crooked, dyke.

These quartz-diabase dykes correspond to dykes which, in this general region, have been termed 'later gabbro' by the officers of the Geological Survey. They have applied this term to both quartz- and olivine-gabbro dykes, but within the present map-sheet only quartz-gabbro, or quartz-diabase, dykes have been recognized. The excellent petrographic description of the quartz-gabbro given in Memoir 166 of the Geological Survey of Canada makes unnecessary any further description of this well defined and uniform petrographic type.

Recent and Pleistocene

The glacial deposits of the area are principally lake-clays, sand, gravel, boulders, and ground moraine or boulder clay. Lake-clays,

① Geol. Surv. Can., Memoir 103, 1918, p. 112; also Map. No. 145A.

characterized by the usual flat topography, are typical of the western and central parts of the area, but they do not extend quite to the eastern border of this map-sheet. They terminate at a north and south line which extends from lake Shabogama parallel to, but a mile east of, the Senneterre river and continues south to the rocky upland composed of granitic rocks in Tiblemont township. This line is presumed to be the eastern shore-line of post-Glacial lake Ojibway①, which formerly extended for many miles to the west over what is known as the 'clay belt'. The ancient shore-line is defined over the greater part of the distance mentioned by a high ridge of sand and boulders, which may represent a broad esker. East of this boundary, the terrain is in large part sand and boulders, with some boulder clay to be seen along the lower Mégiscane river.

As already mentioned, lake-clay deposits predominate throughout the greater part of the area, but amidst these, also, the higher elevations are plains or ridges composed of boulders or sand, or they are solid rock. The sand plains are in general only slightly higher than the clay terrain, the lower-lying parts of which are swamp-covered. The material of the sand plains is usually of fine grain, as for example in certain parts of southeastern Carpentier and extending into range X of eastern Courville. The sand areas are the source of exceptionally good water. The filtering action of the sand is such that the water flowing from them is fresh and clear, in sharp contrast to the muddy waters of the area, which have given to some streams such names as Coffee and Clay rivers.

The sand plains are in many places interrupted by sand ridges, which usually have an east-west trend. Of particular interest are several very well defined ridges which rise about 50 feet above the level of the surrounding country. Their strike is in general slightly west of south, roughly parallel to the direction of ice movement as indicated by glacial striæ on rock exposures. The ridges are in large part composed of fine sand, but there is also some gravel. Huge boulders, or erratics, may be seen in places resting upon the fine sand of these ridges. Their presence in such a position is difficult of explanation. The ridges are often bordered and parallelled by areas of swamp.

① Coleman, A. P., Ont. Bur. Mines, Vol. XVIII, 1909, pp. 284-293.

The best defined of these ridges is in the western part of the area. It has been traced with only minor interruptions from northern Pascalis township to the northern border of the map-sheet, a distance of more than 21 miles, and it is known to continue beyond this. Its width varies from a few hundred feet to more than a mile, with average about half a mile.

The sand ridges are an expression of the retreat of the ice. They suggest the sites of water courses confined by the ice, in which case they are of the nature of esker ridges. The large erratics occasionally found on the sand ridges, on the other hand, could have been carried and deposited only through the agency of ice.

STRUCTURAL GEOLOGY

The structural features of the area are of two types: those resulting from the folding of the Keewatin rocks, and those connected with a later fracturing and faulting.

Folding in Keewatin Rocks

The lavas have been folded into a series of tightly compressed anticlines and synclines. The normal strike of the axes of the folds and of the schistosity is in general N.75°W. in the eastern part of the area, while to the west of the Bell river it is N.45°W. These generalized strikes are influenced locally by granite intrusives. The schistosity, as in the adjacent areas, tends to dip steeply to the north.

Both the schistosity and the formations themselves have been bent around by the intrusions of granite, so that they have a marked parallelism to the contacts of the granite masses. It is inferred that the Pascalis-Tiblemont batholith was intruded after the Keewatin had been folded. Along the northeast margin of the batholith, the lavas, little metamorphosed or schisted, are in contact with massive granite. The parallelism in the strike of the schistosity in the greenstones to the outlines of the intrusive shows that the schistosity has been produced by the granite. The fact that this schistosity dips steeply away from the granite mass is strong evidence that the intrusive has the shape of a batholith rather than that of a shallow laccolith or sill.

A limited number of observations on the tops and bottoms of lava flows suggests that the axis of an anticlinal fold, which would lie about two miles north of the granite intrusion, extends east through Tiblemont township and then continues in a more southeasterly direction through the northwestern part of Tavernier. A small stock of granite and several dioritic intrusions occur along the presumed axis of the anticline.

If the tuffaceous rocks found in Senneterre, northern Tavernier, and again to the east of the map-area in Jurie township, all belong to one general horizon, this affords a key to the broad structure of the Keewatin formations. In that case, this horizon indicates a general trend of the formations in a direction N.65°W. from Jurie township across Tavernier and into Senneterre township as far as the Senneterre river in range II. At this point, the formation bends sharply north into range VI of the same township. To the west of the Bell river, the band continues westerly into ranges V and VI of Courville township, whereas another band extends northwesterly into Montgay township. The presumed junction or parting of the bands would be in the vicinity of the town of Senneterre. An extensive mass of granite lies between the bands. The relationships might be interpreted as indicating the existence of an anticlinal fold in the Keewatin rocks extending northwest from near the town of Senneterre.

Fracturing and Faulting

The existence of a system of faults which divide the country into angular blocks is strikingly brought out by aeroplane photographs of the granite areas to the east of lake Parent (*see* Plate IV). The faults fall into three sets, one striking north and south, and the other two northeast and northwest, respectively. Of these, the north and south faults are the most prominent. A diabase dyke in Brassier township appears to be displaced along a well-defined north and south depression that is in part occupied by the Brassier river. A fault which lines-up with this depression is seen ten miles to the south, in Dollard township. The existence of such block-faulting near the borders of the greenstone belt suggests that the greenstone areas may have been in part preserved from erosion by down-faulting. The diabase dykes in the vicinity of the Bell river strike either north and south or northeast, and thus occupy fissures parallel to two of the sets of faults described above.

The Pascalis-Tiblemont granite mass has been fractured by faults and joints in a way very similar to those described in the granite of the northeastern part of the area. The major fractures fall into three dominant sets, which strike in a north and south, a northeast, and a northwest direction. The fractures in the granite that are occupied by dykes of lamprophyre and porphyry all strike in one of these three directions and dip vertically. The quartz veins also occupy similar sets of fractures, though they favour the north and south set more than do the dykes. The prevailing strikes of the major joints are in the same three directions and, in addition, a few strike roughly east and west. The dip of all these joints is steep.

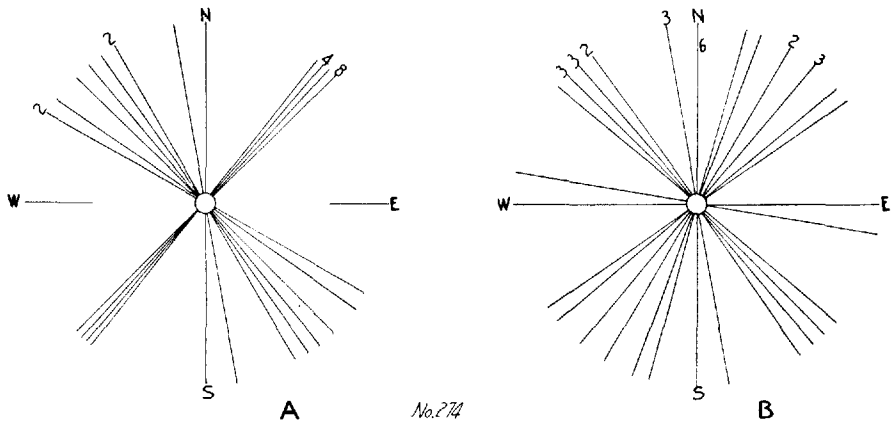


Figure 1.—A.—Strikes of aplite and lamprophyre dykes cutting the soda-granite in northern Tiblemont township, plotted through a single point.

B.—Strikes of quartz veins in the soda-granite of northern Tiblemont township, away from contacts with other rocks, as plotted through a single point.

The north-south set is believed to represent tension fractures, and compression is implied in a north and south direction. Figures 1A and 1B show the strikes, plotted through a single point, of the dykes and of the quartz veins in the massive granite of northern Tiblemont township. The numerals indicate the number of each that were plotted in the direction concerned. Plotting of the strikes of the joints in the granite of this vicinity and near lake Pascalis, gives essentially similar figures. The fracturing connected with many of the chief mineral deposits is less regular, since it is due to differential movement along the contacts between different rock types.

Topographic Modifications

The geological history of the area is in large part reflected in its topographic features. Three of the more important geological factors may be summarized as follows: firstly, the nature of the underlying rocks; secondly, the deformation of these rocks; and lastly and more important than all, the glacial history of the district. Most of the topographic features resulting from these different factors have been mentioned earlier in the report, so they are merely assembled here.

Rocky elevations or ridges rising above the general level of the surrounding territory as the result of the relatively greater resistance to erosion of the rocks composing them, are well exemplified in certain granitic rocks and in the diabase dykes that form ridges near the Bell river. Those portions of the dykes which show the least jointing have proved the most resistant to erosion. Where such dykes occur in ridges, they appear to have also protected rocks adjacent to them, so that the ridges are often composed of rocks of more than one type. It seems probable that the large island in lake Tiblemont may be accounted for in this way, since a diabase dyke forms the core of the island. Two conspicuous hills in range IV of Montgay township are composed of massive granite which seems to have withstood erosion better than the greenstone and gneissic granite which it intrudes. This massive granite is expressed in part, however, in low outcrops. The quartzose soda-granite of the Fascalis-Tiblemont intrusion commonly forms hills, whereas the dioritic phases of the same mass tend to occupy the low areas, including lake beds.

From a structural standpoint, a relationship may in some cases be established between the fault pattern of the rocks and the drainage system. Thus, certain depressions that are followed in part by streams —such as the Brassier, Bell, and Senneterre rivers— are assumed to mark the location of faults. The stream courses, however, are determined for the most part by the glacial deposits rather than by the structure of the underlying rocks.

In its final development, the topography of the map-area has been largely controlled by its glacial history: The flat, clay areas in the central and western parts of the area were the site of a post-glacial lake. The relatively higher, sandy terrain on the east represents shore and land deposits of glacial derivation. The southerly trending,

sandy ridges of glacial nature, described on an earlier page, are topographic features related to the retreat of the ice. Protruding through the glacial deposits are the rocky elevations, which remained as islands above glacial lake Ojibway, much as they stand above the 'clay belt' to-day.

ECONOMIC GEOLOGY

The mineral deposits of the region are of two general types, namely, those occurring within the granitic rocks of the Pascalis-Tiblemont batholith and those found in the Keewatin rocks. The deposits of the former type have so far proved the more important.

Those deposits which are located to the west of Tiblemont lake and the Bell river were examined and are described by L. V. Bell, and those east of this by A. M. Bell.

I.—DEPOSITS ASSOCIATED WITH PASCALIS-TIBLEMONT INTRUSIVE

General Considerations

General Features:

The occurrence of gold deposits in the interior, as well as near the margin, of a large granitic mass such as the Pascalis-Tiblemont batholith, which has an area of nearly 8 by 20 miles, presents a type of ore deposit new to Canadian mining experience. Since the nature of these deposits, and the geological features which determine their location, differ somewhat from those found elsewhere, they will be discussed as fully as possible. Those deposits examined in southern Tiblemont township, as well as those lying within the area mapped during the past season, will be described together.

Gold was first discovered in this granite in 1931, on the east side of Tiblemont lake①. The discovery of other gold-bearing veins on the Wood-Etcheverry property in the fall of 1932 was followed by considerable activity in the district and led to the finding of visible gold in numerous places throughout the eastern part of the intrusion. At the time of writing, the majority of the gold discoveries have been made in Tiblemont township, but gold has also been found

① Que. Bur. Mines, Ann. Rept., Part B, 1931, p. 123.

along the north margin of the same granite mass in Courville township. Prospecting is aided by the fact that more rock is exposed in these districts than is usual in the prospecting territory of western Quebec. Most of the discoveries have been of gold-bearing quartz stringers that are too small and scattered to form workable deposits. However, a sufficient concentration of gold-bearing quartz has been found to suggest that mineable deposits may be developed in several places.

In the area southwest of the present map-sheet, important gold deposits have been found in and near the Bourlamaque granodiorite batholith and in satellitic intrusives associated with it①. These deposits occur either as fissure-veins or as quartz lenses within shear-zones. The more important lie within the intrusive rock, but are within half a mile of its margin. In the Pascalis-Tiblemont intrusion, however, persistent fissure-veins have not as yet been found, the known deposits being generally stock-works or zones of parallel stringers which occur not only near the margin, but also within the central portion, of the batholith. This more widespread distribution is due to strong fracturing through the granite, in part localized along the contacts of widely different rock types which have resulted from the differentiation of the same parent magma.

The various rock types included within this batholith have been described in an earlier section of this report. The extreme differentiates are a soda-granite high in quartz, and a basic rock which ranges in composition between gabbro and quartz-diorite. The basic rock is, in part, of approximately the same age as the acidic phase, but some is distinctly older and has been highly altered and sheared.

Mineralogy of the Deposits:

The only mineral of economic importance known to occur in the granitic rock is gold. In the great majority of cases, the gold is in minute specks, or it may be quite coarse in veins or stringers of rather glassy quartz, which, as a rule, contain but little sulphide. The sulphides, when present, are usually pyrite and chalcopyrite, and occasionally there is tetradymite also. Since the quartz of some pegmatites found in the region is similar in appearance to that of the

① Que. Bur. Mines, Ann. Rept., Part B, 1930, 1931.

veins, it is judged that these deposits are of high-temperature origin. The deposits in the vicinity of Fish lake, however, appear to be a lower temperature type. On the property of the South Tiblemont Mining Company, minor amounts of sphalerite are seen in the veins, and on the Martyn-Sweet discovery, a mile farther north, the gold is associated with galena. Unlike the gold occurrences of the Louvicourt-Pascalis district, important gold values here are not typically associated with coarse pyrite, and the presence of tourmaline and carbonates in the veins is rare.

The deposits found in the small related granite stock on the east side of Tiblemont lake have somewhat different characteristics. In one vein, gold is seen in a sugary yellow quartz, while nearby, values are contained in a fine, granular, white quartz, and in coarse pyrite associated with it.

STRUCTURAL RELATIONS:

The occurrence of most of the vein deposits in the granitic rocks of western Quebec can be explained by the same structural principle, namely, that where a relatively brittle, massive rock is adjacent to a rock which has been deformed by schisting, the massive unschisted rock has adjusted itself to the movement in the schisted rock by fracturing. Veins have then filled the fractures in the massive rock. In detail, the application of this process, and the nature of the fractures and mineral deposits resulting, are varied. The most common example of its application is where the granitic intrusives are in contact with easily sheared Keewatin greenstones.

The deposits connected with the Pascalis-Tiblemont granite can be classified according to their structural relations under the following types:

1.—Quartz veins filling fractures in siliceous granite near the margin of the intrusive rock or near inclusions of greenstone. Examples are the gold-bearing veins on the Wood-Etcheverry property, on the large island in Tiblemont lake, and on the northeast group of claims of the Blairmont Mining Company.

2.—Quartz veins filling fractures in siliceous granite near masses of an older sheared diorite. In this category may be listed occurrences in southeast Tiblemont, on the claims held by the South Tible-

mont Mining Company, and by Martyn and Sweet; and, in northern Tiblemont, occurrences on the Reeve claims, some of the veins on Tiblemont island, the south zone on the Wood-Etcheverry claims, and numerous unimportant showings.

3.—Quartz veins and sulphides associated with dykes of sheared porphyry, or lamprophyre, within the granitic intrusive. The veins may be either within the sheared dyke or in tension fractures along its walls. Examples of this are provided by numerous showings carrying a little gold and often some chalcopyrite. The original Springer showing on the Wood-Etcheverry claims, and that on the west group of the Blairmont claims, are representative. In addition, a more important occurrence on the Blair-McDonald claims, in Vauquelin township, might be included here.

4.—Quartz veins in shears or fractures in the siliceous granite which have no apparent association with other rock types. Here are included numerous veins throughout the intrusive, few of which are known to carry gold. However, gold-bearing veins on claims of the Quebec Eureka Gold Syndicate in southeast Tiblemont township, which were not visited by the writer, may come under this classification.

5.—Sulphide replacement deposits. Deposits in which pyrite replaces dyke rocks or basic phases of the intrusive occur on the claims prospected by the Mecca Mines, in southern Tiblemont, and in minor occurrences elsewhere. Occasionally, wall-rock alteration may accompany veins and carry low gold values. Disseminated molybdenite is also found in the altered granite.

6.—Deposits in intrusives related to, but beyond the margin of, the main batholith. Examples of these are the veins on the Jacob Smith property, and a gold occurrence in a rhyolite dyke on a small island in the east bay of Tiblemont lake, held by Alfred Reeve.

Deposits near the margins of the granite, near sheared diorite, or in satellitic masses (groups 1, 2 and 6) have so far proved to be the most important. In all these, the fractures filled by the veins occur in a massive, brittle rock, which, owing to its texture and composition, will not flow under pressure by the rearrangement of its minerals. In each case, the deposits are located not far from a contact with a more basic rock, such as greenstone or altered diorite,

which can flow more readily, by the recrystallization of its minerals, to form a chlorite schist. This results in a change in shape in the basic rock, causing the massive granite to adjust itself to the deformation by fracturing in the vicinity of the contact. The most suitable fractures for vein filling are often along a zone within the granite at a short distance from the contact. This seems to be especially true in cases where a steeply dipping contact makes a large angle with the direction of shearing in the more basic intruded rock. Observations suggest that where such a condition obtains, a relatively more important concentration of quartz may result.

The nature of the deformation in the north part of the batholith was described in an earlier section, in which the structure of the district was discussed. The same type of deformation seems to extend throughout the granitic mass. In addition, a series of northeasterly striking faults are indicated in the eastern part of the intrusive. The approximate position of one of these is shown on the geological map for 1931 (Map No. 167). Study of the known faulting and fracturing leads to the belief that the general deformation and movement along faults and schisted zones has been greater in the horizontal than in the vertical plane. This has an important bearing on the dip of the vein fractures and on their location with respect to bodies of chloritic rock.

CONSIDERATIONS IN PROSPECTING:

The possibilities of finding ore are best in those sections of the intrusive where there has been the most movement. In general, such sections are in zones not too far removed from the granite-greenstone contact, or where chloritic diorite or greenstone inclusions are abundant in the intrusive. Favourable ground for ore deposition would appear to be in a general zone, ten to thirty chains in width, which extends westward from the showing on the Wood-Etcheverry property to the gold discoveries on Tiblemont island. This zone is in the granite between the main Keewatin-granite contact on the north and a series of Keewatin inclusions on the south. Unfortunately, part of this area is under the lake, and part is covered by heavy overburden. It is worthy of note that little movement has taken place along the northeast granite-greenstone contact, and that no promising deposits have as yet been found there. Localities

away from the margins, where deformation has been concentrated, are to be found east of Fish lake and also along the east side of Tiblemont lake.

That part of the interior of the intrusion in northern Tiblemont township which lies away from the lake has been traversed in sufficient detail to show that here there are no large areas of chloritic rock. Hence it would appear that this area is less favourable for prospecting. In the southern part of the township, the country occupied by the batholith has not been examined in detail, but the work done has been sufficient to disclose a very complex association of granite and dioritic rocks. Besides the basic rock to the east of Fish lake, already mentioned, presence of similar rock distributed along a belt trending northwest from this lake is indicated. If the gold has not been too widely scattered in this section, search may reveal the presence of workable deposits. Unfortunately, the rock near the southern contact, and near margins in the western part of the intrusive, is largely drift-covered. All outcrops near these contacts, however, should be carefully prospected.

Any satellitic intrusives of the soda-granite type, such as those in the northwest corner of Tiblemont township, would seem to be especially favourable places for mineral deposition.

In the following pages, the principal known mineral deposits that are associated with the Pascalis-Tiblemont intrusive are described, dealing first with properties situated within the map-area, and then with others in the adjacent (Bell River Headwaters) area.

A.—PROPERTIES WITHIN THE MAP-AREA

Wood-Etcheverry Property

(Tiblemont township)

In October, 1933, this property comprised claims A-41602 to 41622, inclusive, held in the name of J. M. Wood, and located in northwestern Tiblemont township. Gold was discovered on claim A-41606 in the fall of 1932, and Hollinger Consolidated Gold Mines, Limited, having taken an option on the property, did a considerable amount of work during the winter of that year and in the following

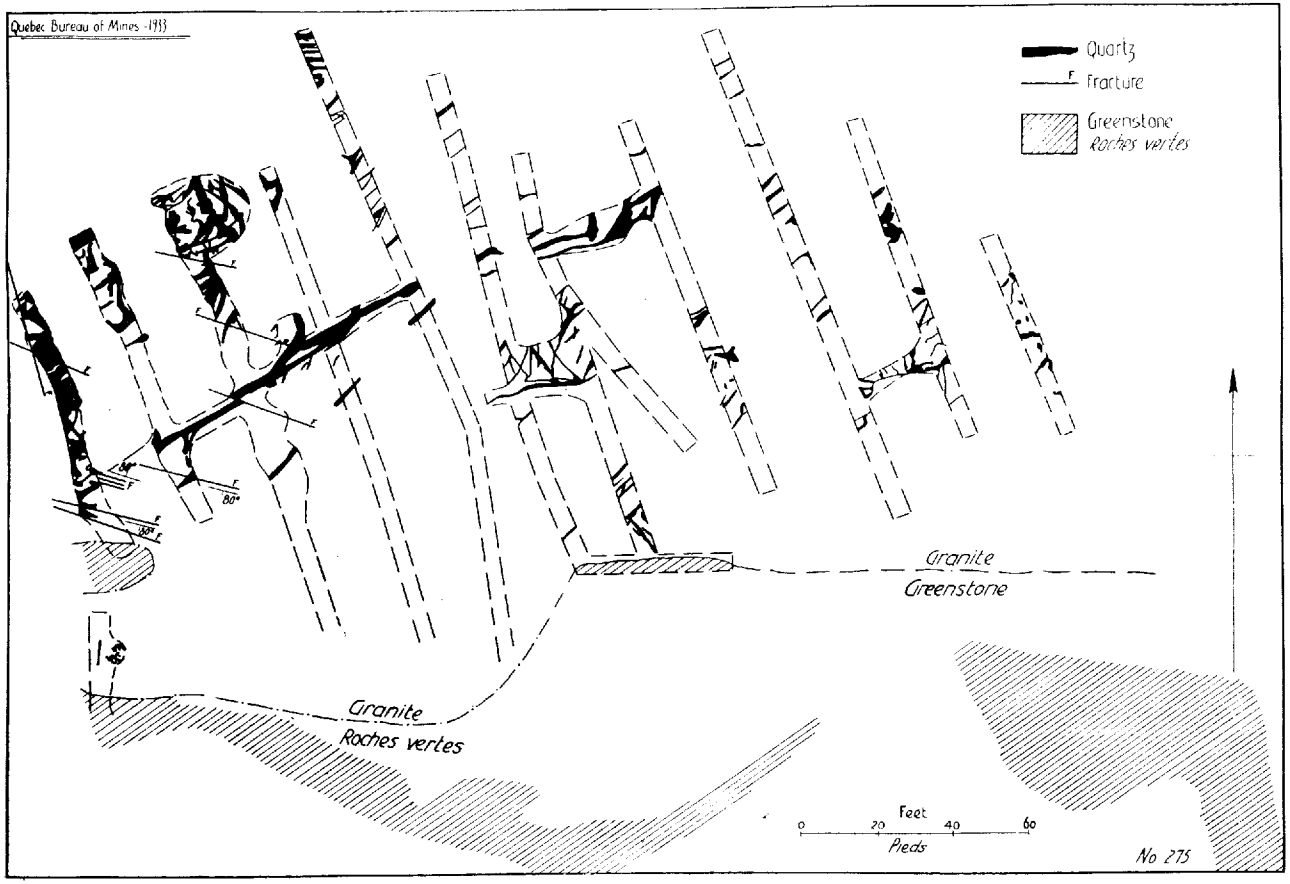


Figure 2.—Vein-zone of Wood-Etcheverry property, Tiblemont township.

spring, in the course of which the original surface discovery was thoroughly trenched, sampled, and tested by fourteen shallow drill-holes. After the completion of this work, the option was relinquished.

In the discovery zone, on which most of the work has been done, gold is found in a stockwork of quartz veins in siliceous granite. A sketch of this zone is given in Figure 2. The showing is located on the north side of a large inclusion of Keewatin greenstone, and is approximately 25 chains south of the main Keewatin granite contact. The proximity of this greenstone inclusion appears to have a very definite connection with the fracturing of the granite and, consequently, with the quartz veins which fill the fractures. The Keewatin lava on the south side of the main showing appears from drilling to be a fairly shallow roof-pendant, which, before being eroded, probably extended over the gold deposit. The granite in which the veins occur is a light-coloured rock characterized by a high content of bluish, opalescent quartz, and low in ferromagnesian minerals. Nearby is a dioritic phase of the intrusive, but for the most part this rock is so highly altered that, where fine grained, it is difficult to distinguish it from the Keewatin greenstone. Drilling beneath the showing and to the west of it revealed the presence of numerous bands of such altered diorite which did not appear at all on the surface directly above. The mode of occurrence of some of this rock suggests it may be in the form of dykes which are later than the granite. There is a possibility that the presence of this altered diorite was a factor in localizing gold deposition, since deformation would be concentrated in it in the same manner as in the greenstone, and this would result in fracturing of the adjacent granite.

The surface work on the discovery zone consisted in blasting eleven deep trenches into the rock to explore a mineralized area 300 feet east and west by 160 feet north and south. The contact between the granite and the greenstone inclusion at this place has a general east-west trend, and the explored area lies adjacent to the greenstone and to the north of it. The quartz has filled an intersecting system of steeply dipping fractures in the granite.

The most prominent directions of fracturing are N.60°E. and N.45°E., but there are also veins that strike N.-S., N.20°E., N.20°W. to N.60°W., and E.-W. Near the western end of the exposure, four strong fractures, which are not filled by quartz, strike N.75°W. and

offset some of the quartz veins. The quartz not only fills fissures, but, near the intersections of fractures in particular, it has replaced the granite walls to a considerable degree. Where two fractures dipping in opposite directions intersect, the quartz is seen replacing the granite beneath the intersection, due, apparently, to the damming of ascending solutions. A sectional view of intersecting veins in one of the westerly trenches is shown in Plate V-A.

Sampling by Hollinger interests showed that gold values are confined to the quartz. The bulk of the quartz is white and rather glassy, although gold also occurs in a darker quartz. Metallic minerals in the veins are pyrite, pyrrhotite, chalcopyrite, and visible gold. The gold is frequently in small octahedral crystals.

The coarse nature of the gold and the irregular distribution of the quartz makes sampling very difficult. Assays of a large number of channel and small bulk-samples taken from what is known as the 'base-line' zone showed that the bulk samples, after washing, gave values roughly 50 per cent higher than did the channel samples. If not washed, bulk samples gave even higher values. From the channel sampling of the entire zone, W. P. Murdoch, engineer in charge, calculated that the quartz carries an average value of $6.74 per ton at the standard price of gold.

Surface work on the main showing exposed two zones, sampling of which gave encouraging values. An irregular northeast-trending zone of quartz, having an exposed length of 120 feet and a width of 60 feet, was encountered in the five trenches on the west. This zone contains some 40 per cent of quartz, and may have a sufficient gold content to make low-grade ore. The percentage of quartz encountered in four drill holes beneath this zone at an average depth of approximately 60 feet was not nearly as high as in the surface exposures. This might suggest that the quartz had been concentrated in a flat body lying immediately beneath a capping of greenstone, which has now been removed. If such is the case, the quartz in this zone might continue with a shallow plunge beneath the greenstone inclusion.

What is known as the 'base-line' zone joins the body described above at the west end of the outcrop. Quartz from two to five feet in width has been exposed for a distance of 180 feet along a strongly

fractured zone which strikes N.60°E. Sampling indicates that this would make a medium-grade ore. This vein has a vertical dip and was intersected by drilling at a depth of some 75 feet.

Gold can be seen in numerous stringers and veins of quartz throughout the remainder of the trenched area, but in none of these trenches do the quartz veins make up as much as 10 per cent of the rock exposed.

It has been mentioned that drilling revealed the presence of bodies of medium-grained, chloritic rock to the west and north of the surface showings. The writer considers that these are, in part, basic phases of the granitic intrusive. A drill hole 350 feet west of the surface exposure, after passing through one of these bodies, is reported to have intersected gold-bearing quartz on the south side. This suggests the possibility of other gold-bearing zones being found adjacent to such bodies of chloritic rock.

The chances of locating ore on the property are not necessarily confined to this one locality. The ground is drift-covered for some distance both to the east and west of the main showing. Work in a number of other places revealed the presence of irregular bodies of quartz which carried no important gold values. On what is known as the south zone, situated some 50 chains west and south of the main showing, quartz veins occur near two bodies of sheared diorite. A little gold had previously been found a mile west of here, on the former Springer claims (*see* Ann. Rept., Part B., 1931, p. 123) where it occurs in quartz stringers adjacent to sheared porphyritic dykes. In the fall of 1933, also, free gold was discovered in some partially exposed quartz stringers in the granite close to the main contact with the Keewatin lavas at a point a quarter of a mile northwest of the Hollinger camps. The ground on the west side of this discovery is low and drift-covered, but may be underlain by an embayment of the greenstone.

From the results of the drilling and surface work carried out on this property to date, the main ore-zone, which has a known length of 320 feet and an average width of 150 feet, would seem to fall below ore grade, if taken as a whole; but over two sections the gold content is higher than elsewhere. The fact that all the gold is confined to the quartz would permit the sorting-out of much of the waste rock in mining.

Tiblemont Island Mining Company

(Tiblemont township)

The holdings of this Company in October, 1933, comprised claims A-37593 to 37601, and A-37803, on the large island in Tiblemont lake. In the winter of 1932-33, coarse free gold was discovered in quartz stringers in a ridge of rock on claim A-37599. The gold-bearing stringers have been exposed by stripping the rock near the east side of the island, and are known to occur scattered over an area measuring some 1,800 feet in a northeast direction and about 400 feet in a northwest direction. At the time the property was visited, in the fall of 1933, this was the extent of the exploratory work, but the favourable area, with rocks well exposed, extends for some 50 chains in a north and south direction and 25 chains in the east and west direction.

The veins occur in altered soda-granite which contains numerous irregular inclusions of highly altered and sheared basic (chloritic) rock. Some of these may be inclusions of Keewatin lava; many appear to have been diorite or quartz diorite, corresponding to similar rocks found in other parts of the batholith, of which they are considered to be an early differentiate. A less altered diorite occurs at the south end of the island. The granite is rather fine-grained and has been altered by the development of secondary silica, albite, and sericite. Near its northern contact with the Keewatin rocks, it passes into a fine, fresh quartz-diorite. The most southerly discovery of gold lies some 50 chains south of this contact. In addition to the rocks mentioned, a dyke of quartz diabase, later in age than the mineralization, parallels the long axis of the island.

A close relation between the altered, chloritic inclusions and the gold-bearing stringers is evident. A large mass of these chloritic rocks occurs west of the wharf. The principal gold-bearing veins lie in the granite to the south of this and off the east end of it. The fractures carrying the gold tend to occur close to small chloritic inclusions and, in general, do not extend into them. The direction of shearing in the chloritic rock is between S.65°-80°E. and the dip is vertical. The veins in the granite usually strike somewhere between

N.75°E. and E.-W., and dip from 60° to 80° north. A few minor stringers strike north and south; others are flat lying. The individual veins are lenticular and they vary from six inches to one foot in width.

Fine and coarse gold may be seen in the quartz in a great many different places, and particularly near the intersections of veins. Pyrite, chalcopyrite, and a little tetradymite are also found in the quartz. The wall-rock bordering some of the veins is bleached for an inch or two, due to silicification and albitization, and, as already stated, the granite as a whole has been subjected to a similar, but less intense, alteration. Pyrite, chalcopyrite, and a very little molybdenite occur in the wall-rock, but up to the present, no appreciable gold values have been noted. One sample of pyritized wall-rock taken by the writer from between gold-bearing stringers assayed $1.16 in gold. Another, of pyritized rock remote from stringers, gave a negative result. The sulphides in some of the quartz veins, however, carry gold values.

Trenching did not reveal any zones containing a high percentage of quartz. Since the property was visited, a tunnel has been driven northward from the lake to pass under a section previously exposed by a trench. One of the best sections seen on surface was a little east of the entrance to this tunnel, where the granite is well fractured. Nine gold-bearing stringers up to ten inches in width occur here across a width of 23 feet.

So far, work on the property has been confined to the section lying near the east side of the island. The probability of finding deposits in the unexplored portions of the granitic outcrop appears to be quite favourable. For example, quartz was noticed some 30 chains northeast of the present workings, in an area where sheared chloritic inclusions again occur in the granite.

Ventures, Limited

(Tiblemont township)

This property consists of three 'water' claims, A-42124, A-42125 and A-42129 (Oct. 1933) situated in Tiblemont lake, near the large island. In the lake, about fifty feet east of a small point on the east shore of the island, a mass of quartz may be seen which is just below

the surface of the water when the lake level is low, as it was in the fall of 1933. The discovery is on the boundary between the two claims A-42125 and A-42129. The quartz extends approximately 40 feet north and south, and 20 feet east and west, with no wall-rock to be seen on either side. A hole blasted in the quartz showed it to be at least two feet thick. On the nearby shore are many large blocks of quartz, containing coarse 'cube' pyrite, which no doubt were shoved up from this vein by ice. The writer took a sample of this float, which included some coarse pyrite, and obtained an assay of $2.83 in gold at the standard price.

Jacob Smith and Associates

(Tiblemont township)

This property is located in the northwest corner of Tiblemont township. In October, 1933, it included ten claims, numbered A-42802 to 42811. During the summer, extensive trenching resulted in the discovery of veins of gold-bearing quartz, with associated sulphides, also carrying gold, in the southwest corner of claim A-42808.

The discovery was made in a small stock of soda-granite which lies about one mile north of the northern margin of the main batholith. This stock is on or near the axis of an anticlinal fold in the Keewatin lavas. The soda-granite of which it is composed is similar to that in which the gold is found in the larger intrusion to the south. The only other rock seen in the vicinity is lamprophyre, of which there are numerous dykes filling a very regular and persistent system of fractures in the granite. Since the quartz veins occupy similar fractures, a study of the dyke fracture-system should throw some light on the nature of the vein system.

All the known dykes and veins occupy vertical fractures which strike in one of two directions (see Figure 3). One set strikes S.70°E., which direction is roughly parallel to the folding in the adjacent Keewatin rocks. These fractures, which seem to be the dominant set, are very regular and extend for hundreds of feet. The other set, whose direction is not quite so constant, strikes S.40°-60°E. Movement has occurred along all the fractures subsequent to the injection of the dykes or veins. In every case, the movement has been of the northeast side to the northwest.

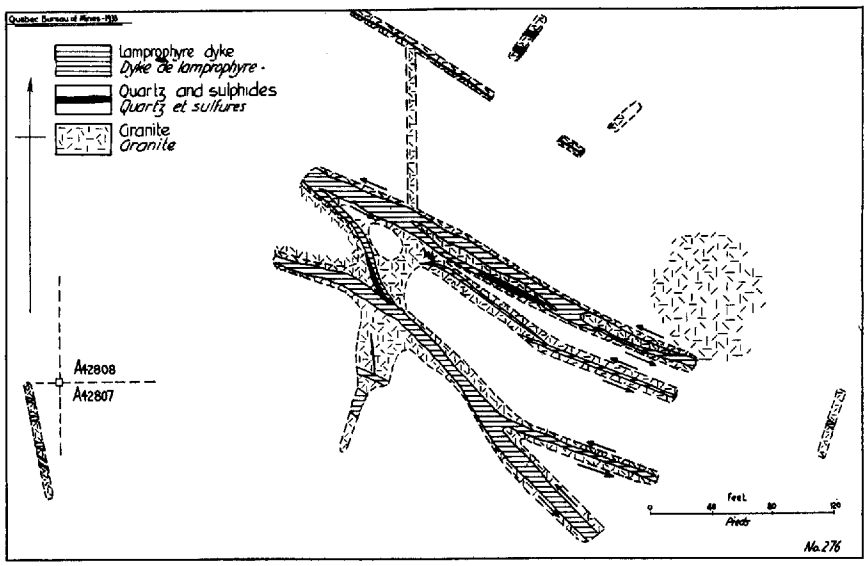


Figure 3.—Geology in vicinity of Jacob Smith discovery, Tiblemont township.

Gold is found on this property both free and in association with pyrite. The two principal discoveries resulted from trenching in the heavy overburden, and very little can now be seen of them. To the north of the principal rock outcrop, the first showing encountered is a vein of sugary yellow quartz, two to six inches in width, which occurs in the centre of a three-foot shear-zone in the granite. The vein and shear strike S.57°E. and have a vertical dip. They have been traced for 175 feet but disappear beneath drift at both ends. In the most easterly trench, the quartz attains a maximum width of ten inches and the shear is three and a half feet wide. Free gold occurs abundantly in the quartz. A sample of the sheared wall-rock, taken by the writer, did not show appreciable gold values when assayed.

In a deep trench some 25 feet northeast of this vein, two zones of quartz and sulphide were revealed. The first of these consists of approximately one foot of quartz with one and a half feet of heavy sulphide on either side. It appears to strike S.60°E., nearly parallel to the vein described in the last paragraph. Encouraging

gold values are said to have been obtained from this zone. The trench could not be properly examined owing to water, but a grab sample of the quartz and sulphide, taken by the writer, gave 1.2 ounces gold to the ton. Ten feet northeast of this is a similar zone consisting of one foot of quartz with one foot of pyritized wall-rock on each side. This strikes S.70°E. and thus belongs to the other set of fractures. The mineralization here is not so intense, and gold values are lower than in the adjacent zone.

In addition to these occurrences, gold is found in small quartz stringers and in patches of sulphide in the wall-rock of the lamprophyre dykes exposed on the main outcrop to the south. Two deep trenches have revealed numerous bands of carbonated lamprophyre, or of greenstone, in granite near the No. 3 post of the claim. Following one of these altered bands is a two-foot vein of quartz and albite carrying pyrite and chalcopyrite. A sample of this, taken by the writer, assayed $0.75 in gold per ton. Disseminated pyrite and chalcopyrite are seen elsewhere in these trenches.

Ten chains northeast of the principal showings is a low outcrop of sheared granite. Elsewhere, a heavy blanket of clay overlies the rock and makes exploration difficult, except by diamond-drilling. The extent and nature of the mineralization in the small section which has been explored by trenching is such as to encourage further work, more particularly on the northeast of the present discoveries.

Blairmont Mining Company and Associates

(Tiblemont township)

Work was carried out in 1933 on three groups of claims held in part by this Company. One group is located southwest of the Wood-Etcheverry holdings and in June, 1933, embraced claims A-41722 to 41729, and A-41890 to 41893. On claim A-41723, trenching 300 feet northwest of the No. 2 post has exposed quartz lenses and stringers throughout a 20-foot dyke of sheared and altered porphyry which cuts massive, siliceous granite. The dyke strikes S.60°E., and has been traced for over 200 feet. The quartz of the lenses and stringers carries chalcopyrite and pyrite accompanied by calcite and vein chlorite. The management reports only erratic gold values. On

the boundary between claims A-41728 and A-41890, irregular quartz bodies have been exposed in the acidic granite near its contact with a mass of diorite.

Another of the groups held, A-41730 to 41737, is on the east side of the Wood-Etcheverry ground. The rock on these claims is well exposed. Quartz veins occur in granite along a greenstone contact, striking normally to the latter, but although fairly numerous they are narrow and widely spaced. They frequently contain pyrite, but are not known to carry gold. Numerous veins of a similar nature occur in the granite more remote from its contact with the greenstone. A vein reported to carry gold was found on claim A-41735 close to a small greenstone inclusion in the granite. It has a length of 125 feet, is one foot to 16 inches in width, and strikes S.20°E. In claim A-41734 is a vein up to six feet in width and 150 feet long which carries coarse pyrite. It is in granite, near the greenstone contact. On claim A-41889, in the greenstone, just north of its contact with the granite, is a two-foot vein of quartz, mineralized with pyrrhotite and chalcopyrite, following an east and west shear-zone.

A third group of claims, A-41894 to 41899, and A-41900 to 41909 (June 1933) lies to the south of the group last described. These claims are entirely within the main granite batholith. Trenching has been done in numerous places to explore irregular quartz veins in the granite at its contact with some large dykes of diorite and lamprophyre. So far as observed, however, the quartz carries but little metallic mineral. Quartz occurs also as lenses in sheared porphyry dykes which cut the granite, and along the margin of a greenstone inclusion.

Alfred Reeve Claims

(Tiblemont township)

Visible gold has been found on the north shore of the most easterly island in the east bay of Tiblemont lake, on claim A-45374 as numbered in October, 1933. A narrow dyke of fine rhyolite intrudes altered lavas and the gold occurs as visible specks in a flat-lying veinlet of quartz which caps the outcrop. The occurrence could be of importance only if a closely-spaced series of such veinlets were found.

Two miles southwest of this island, on the rocky point of the mainland, covered in October, 1933, by claims A-41823 and A-41824, a number of interesting showings have been exposed. On the point, a number of quartz veins carrying pyrite are associated with basic dykes in the granite. In the low ground south of this, on claim A-41823, is a wide shear-zone along the contact of granite with altered diorite. It is known to contain quartz and sulphides but has not yet been explored. On the same claim, farther to the southwest, are bodies of sheared diorite alternating with granite, and quartz is found in the granite adjacent to the diorite. Molybdenite, also, was noted in a small exposure of granite in this vicinity. Where it occurs, the granite has been silicified and albitized, and the molybdenite is present as veinlets and disseminated flakes, the latter closely associated with secondary white mica. The occurrence of molybdenite under such conditions is unusual, but suggests the possibility that work might somewhere reveal larger deposits.

Northern Aerial Canada Gold

(Tiblemont township)

A block of 22 claims covering a part of the eastern margin of the Pascalis-Tiblemont intrusive is held in the name of J. E. Hammell (Northern Aerial Canada Gold). The claims, in October, 1933, included A-37887 to 37891, A-38622 to 38636, A-41879, and A-41880. Some surface work was done here in 1932 and 1933. Although rock is well exposed in the northern claims, no important discoveries are known to have been made. One large quartz vein follows along the greenstone-granite contact on claim A-37888, but it is poorly mineralized. Elsewhere in the granite, numerous small quartz veins are seen, which carry pyrite and occasionally tourmaline.

Coniagas Mines, Limited

(Tiblemont township)

Some work was done by Coniagas Mines, Limited, in the winter of 1932-33 on claims which at that time were numbered A-41740 to 41742, and A-41746. These claims are located south of the Wood-

Etcheverry holdings. The first three claims mentioned are held in the name of M. O. Inglis. On the south boundary of claim A-41742, a zone of quartz lenses five to ten feet wide, having a southeast strike, has been exposed in the granite for a length of 125 feet. The quartz carries some pyrite. To the west, on claim A-41741, are other southeasterly striking quartz veins and subsidiary stringers. West of No. 1 post on claim A-41746 is a third vein of quartz, ten to twenty feet in width, which has been traced for 200 feet in a southeasterly direction. This vein is in granite adjacent to dykes or inclusions of altered diorite, and, in its southerly part, the quartz contains pyrite. Gold values are not known to have been found in any of these veins.

Claim A-41719

(Tiblemont township)

This claim is located a short distance south of the large bay in the eastern shore of lake Tiblemont and is in northwestern Tiblemont township. Some trenching was done here on irregular quartz lenses in a shear which follows both a narrow greenstone inclusion in the granite and an aplite dyke along the south side of the inclusion. The quartz is accompanied by chlorite and a little chalcopyrite.

Claims A-43524 to 43532

(Pascalis township)

These claims are located on the prominent point on the western shore of Tiblemont lake, a short distance north of the centre-line of the township. Some development work has been done on a showing which is 1,100 feet in a northwesterly direction (N.25°W.) from the southern extremity of the point. The rock, a small outcrop, is massive soda-granite exhibiting hornblendic and aplitic phases, the latter cutting the former. In this granite are a series of parallel quartz stringers, striking N.70°E. and dipping 70° to the northwest. They average about two inches in thickness. The quartz of the stringers is vitreous and somewhat bluish in colour. No metallic minerals were observed by the writer. The claims have been allowed to lapse.

Byck Claims

(Pascalis township)

These claims are in block *A* of Pascalis township, slightly over one and three-quarter miles due south of lot 19, on the south boundary of Courville township. Rock exposures are rare, but the claims are probably within the Pascalis-Tiblemont intrusive though not far from its western border. On the claims is an outcrop of massive, quartzose soda-granite, which is bordered on the south by a rock approaching granodiorite in composition. Within the granite is a narrow quartz vein, which strikes N.75°E. and dips vertically. It has been traced over a length of 115 feet, throughout which distance it would average eight inches or less in thickness. At either end, it appears to fray out. The quartz is white and vitreous, and is accompanied by a little carbonate, together with sericite and chlorite. No metallic minerals were observed. A sample of the quartz, taken by the writer from a test pit on the vein, yielded no values in gold.

Lots 42 and 43, Range IX

(Pascalis township)

These claims are near the eastern shore of Pascalis lake, in the northeastern part of the township. They are underlain by rocks of the Pascalis-Tiblemont intrusion, which is here represented in a rather extensive exposure in which soda-granite and diorite are thoroughly intermingled. Prospecting by G. Metcalfe and R. Talbot during the summer of 1933 resulted in the discovery of two mineralized quartz veins of substantial size, in addition to several smaller ones. The larger of the two veins is in diorite and attains a maximum width of about six feet. It has a strike of N.45°E. and a vertical dip. Vein matter is granular quartz, well mineralized with pyrite and chalcopyrite, which often take the form of bands parallel to the vein walls. A short distance to the east is the second, somewhat narrower, vein, which is of similar character, but not quite as heavily mineralized. It lies along the contact of a felsitic dyke, much altered to epidote, which cuts the coarser diorite. The strike is N.70°E. and the dip vertical. Gold values in the well mineralized vein matter from both veins are understood to be low. Visible gold has been reported in one place.

Lots 42-49, Range II (P. Swanson)

(Courville township)

In the northern part of lots 42 to 45 is a prominent outcrop consisting chiefly of soda-granite, together with some diorite. Near its eastern border, the rock is intruded by a lamprophyre dyke which is altered and closely resembles greenstone. Greenstone inclusions are, indeed, believed to be present in several places in the exposure. A gold discovery is reported to have been made here by P. Swanson after the close of the field season of 1933. Geologically, the claims are well situated, being near the northern margin of the Pascalis-Tiblemont intrusive. The vicinity merits careful prospecting.

B—PROPERTIES IN THE ADJACENT (BELL RIVER HEADWATERS) MAP-AREA

Tiblemont Township

Gold was found during the summer and fall of 1931 on several properties on the east side of Fish lake, in the south and central parts of Tiblemont township. These occurrences are noteworthy in that they are more than two miles within the borders of the granite batholith. All the deposits in this vicinity are of a similar type and their mode of occurrence appears to be controlled by the same factors.

Three of these properties—the South Tiblemont, Martyn-Sweet, and Croteau—are described below, as well as the property of Mecca Gold Mines, Limited, which also is in the south part of Tiblemont township, but to the west of Fish lake.

South Tiblemont Mining Company:

The claims of this Company include surveyed claims numbered A-43388 to 43407. During the summer of 1933, gold was found near the northwest corner of claim A-43399. Figure 4 shows the geology in the vicinity of the showing.

The gold occurs in quartz stringers within lenticular sheared zones in granite. These zones strike northeast and southwest, into schistose diorite on the west and sheared aplite on the east. In both direc-

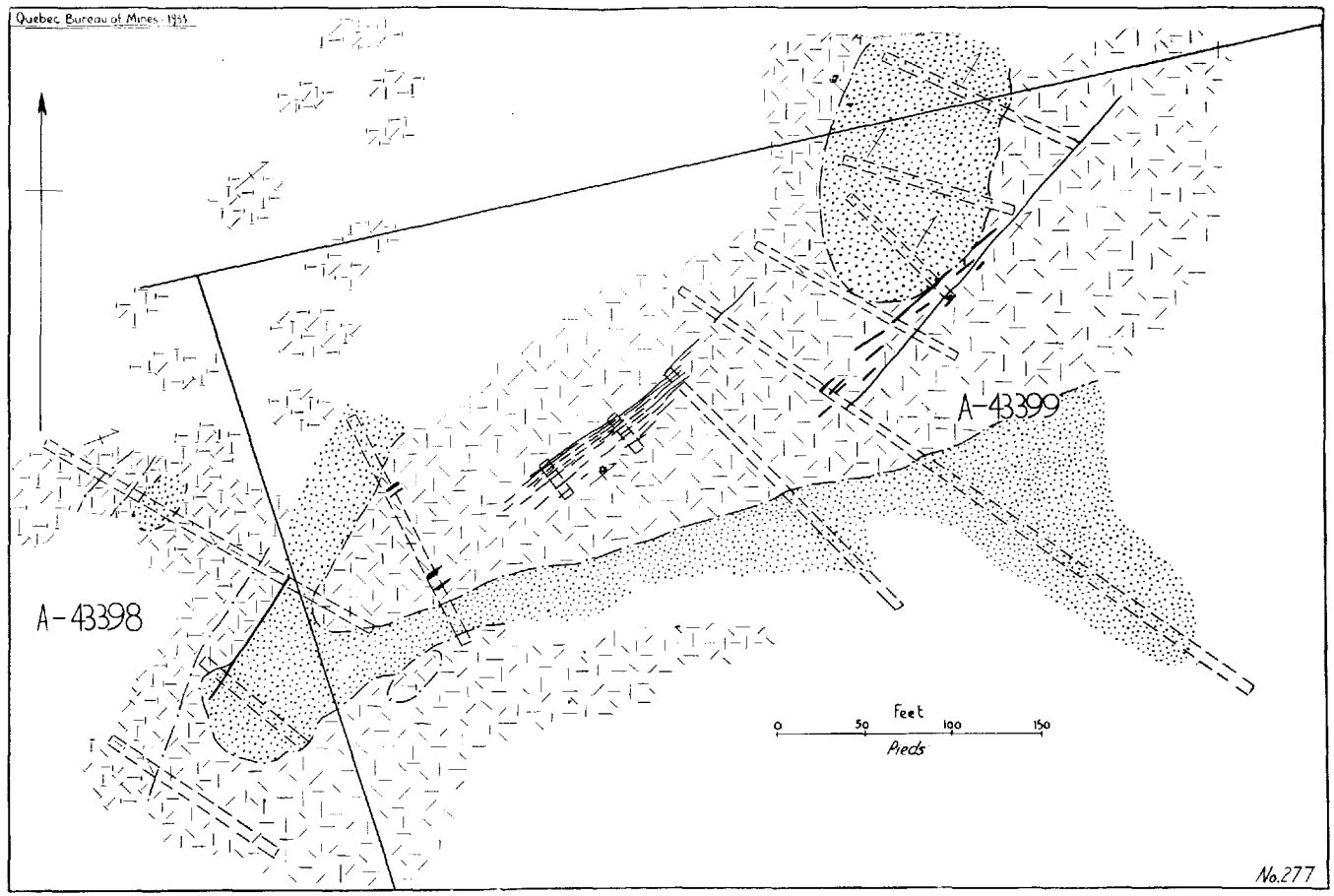


Figure 4.—Main showing of South Tiblemont Mining Company, Tiblemont township.

LEGEND:—Irregular black lines, *quartz*. Dot stippling, *aplite*. Irregular dashes, *granite*. Irregular T's, *altered diorite*. One-barb arrows, strike of schistosity with vertical dip. Twelve trenches indicated.

tions, the quartz stringers disappear from the granite before the other rock is reached. The gold is both fine and coarse. The only other minerals present in the quartz are a very little pyrite, sphalerite, and tetradymite (bismuth telluride).

Zone No. 1 consists of a series of stringers and lenticular veins, up to 15 inches in width, which occur in sheared granite over a width of 10 to 15 feet. Free gold can be seen in a number of these veins. They can be traced over a length of 175 feet, the best section having a length of 120 feet. Two trenches had been blasted across this zone to a depth of six feet. For a distance of ten feet in the westerly part of the southern trench, veins up to ten inches in width are revealed. They dip 70° west and strike N.55°E. In the other trench, 50 feet to the northeast, there is a one-foot vein at the west side and a number of stringers across the remaining 17 feet.

Zone No. 2 lies 70 feet east of the north end of zone No. 1 and has a parallel strike. A quartz vein, three to fifteen inches in width, has been traced for 240 feet. Other stringers occur near it. Coarse gold was seen in some dozen places along this zone.

The gold-bearing quartz veins would not appear of sufficiently high gold content to yield more than low-grade ore over mining widths in either of these zones.

Since the property was visited by the writer, in the fall of 1933, it is understood that additional veins have been located to the south of those described, and that underground development of the property is proposed.

MARTYN-SWEET CLAIMS:

Gold was found on these claims during the month of October, 1933, but owing to the lateness of the season the writer had no opportunity to visit the property. A sketch-map kindly supplied by Mr. W. P. Murdoch shows that the occurrence is on claim A-44368, 600 feet north of the No. 3 post of the claim, and about 700 feet northwest of the fault shown on the geological map for 1931 (Map No. 167). The showing occurs in granite on the west side of a mass of altered diorite. Specimens of the quartz show the presence of considerable galena associated with free gold.

CROTEAU CLAIMS:

This group, which lies between the property of the South Tiblemont Mining Company, and the Martyn-Sweet claims, included, in October, 1933, claims A-46104 to 46112. Little work had been done at the time of the writer's visit. Some gold is reported by the owner not far south of the Martyn-Sweet occurrence. Geological conditions are similar to those on the two adjacent properties.

MECCA GOLD MINES, LIMITED:

A block of claims which in October, 1933, were numbered A-42445 to 42460, and A-42462 to 42463, held in the name of Paul Croteau and located south of the centre-line in western Tiblemont township, have been prospected by the Mecca Mines, Limited. The rock on these claims is soda-granite with large masses of an older, altered diorite distributed through it in an irregular manner.

Near the northwest corner of claim A-42458, an east and west trench has exposed sulphides in a siliceous replacement of a fine-grained dyke, or inclusion, in the granite. The full extent of this rusty zone in any direction is not known, but it continues for more than 300 feet in an easterly direction. In the granite, and lying a short distance to the west, several stringers of quartz, averaging six inches in width, are exposed, and in one of these gold was seen.

Half a mile to the west, in the southwestern part of claim A-42452, is an irregular pyrite zone having an approximate width of 35 feet. In this zone pyrite, quartz, and albite selectively replace an irregular dioritic inclusion in the granite. Assays of a few samples of the sulphide taken by the management, and one of the albitized rock taken by the writer, did not show any substantial gold values. Another body of sulphides has been partially exposed a short distance west of this.

VAUQUELIN TOWNSHIP

BLAIR-MCDONALD DISCOVERY:

A discovery commonly referred to as the Blair-McDonald was made during the winter of 1932-33 at a point several hundred feet south of plate 7 on the Vauquelin-Tiblemont township line. Claims A-38573 to 38577, which include the Blair-McDonald discovery,

were held in the name of K. Roberts during 1933. The country rock is siliceous soda-granite, the property being not far north of the presumed location of the granite-greenstone contact. A pit at the base of a rock-face exposes a band of granite some two feet wide lying between a five-foot dyke of carbonated rock above and a two-foot quartz vein below. Both dyke and vein strike N.-S. and dip 35° west, and they are again exposed 50 feet to the north. The granitic band is composed of quartz and albite, and some pyrite and quartz stringers traverse the rock. Visible gold in the granite has been reported by several observers, and Mr. Blair states that some encouraging assays have been obtained. Owing to the fact that the pit was partially filled with water, the examination on the part of the writer was not complete.

II.—DEPOSITS ASSOCIATED MAINLY WITH KEEWATIN VOLCANICS

Carpentier Township

Lot 20, Range V:

On this lot, a number of short lenses and stringers of quartz with an easterly strike occur at intervals in rhyolite porphyry near its probable contact with Keewatin greenstones to the east. Little, if any, mineralization was seen, although it has been reported that some colours of gold may be panned from the quartz. Values, however, are undoubtedly low. Heavily pyritized material occurs in lower ground a short distance to the north of the zone of quartz lenses. Prospecting here and in this vicinity has been carried out by Coniagas interests, and more recently by the late H. Cave-Browne-Cave and associates.

Lot 31, Range V:

Near the boundary between ranges IV and V, about 400 feet west of the centre-line of the township, a small quartz lens cuts across the northwesterly schistosity of the acidic tuff which is exposed here. The quartz carries pyrite, and it is reported that gold may be panned from the crushed material. As at present known, however, the showing is too small to be of economic interest.

LOTS 31 TO 34, RANGE IV:

A sheared, carbonated zone has been traced in a northwesterly direction across the north and south centre-line of the township, in range IV, for a total distance of about 4,500 feet. The country rocks are Keewatin lavas and siliceous tuffs, which outcrop only at intervals. The intensely carbonatized and highly sheared zone parallels the schistosity of the enclosing rock, which, as an average, strikes N.35°W. and dips steeply to the northeast. Within this zone are quartz lenses and stringers, some of which follow the shearing while others occupy transverse fractures. The quartz appears barren, notwithstanding the fact that tourmaline has been noted in it. A little pyrite may occasionally be seen in the adjacent rock. The zone was prospected during the latter part of the 1933 season.

LOTS 31 TO 34, RANGE I:

Light-weathering, schistose rhyolite-porphyry outcrops in the northern part of these lots. In many places, the rock is much altered to carbonate and it then has a rusty weathering. The schistosity, which is quite uniform, strikes N.50°W. and dips steeply to the northeast. Locally, zones of more intense shearing, but with a similar strike, have been developed. Intrusive into a number of these zones and parallel to them are several narrow dykes. Some of these are aplite, but others, while of similar texture, are more basic, containing abundant carbonate and chlorite, both of which are fresh and appear to be primary. These basic dykes are intruded by the more acidic ones. They would seem to be analogous to the so-called 'andesite' dykes which are associated with certain mineralized veins in Pascalis and Louvicourt townships①. It is probable that the carbonatization of the rhyolite-porphyry country rock is connected with the injection of these dykes.

The principal mineral occurrence on this property consists of a series of gold-bearing veinlets in aplitic dykes (*see* Plate V-B). One of these dykes has been traced for a distance of 150 feet, and a second which appears 550 feet to the northwest, but slightly offset to the northeast of the projected strike of the first, has been followed for 200 feet. Both are five feet wide. In each of these dykes is a series of

① Que. Bur. Mines, Ann. Rept., 1931, Part B, p. 79.

'ladder' veinlets cutting the dyke transversely. These strike approximately N.65°E. and dip at 70°, more or less, to the southeast. Their thickness averages about two inches, and they constitute some 5 per cent of the volume of the dykes. The white quartz of the veinlets is only sparsely mineralized, chiefly with pyrite. A representative sample of the quartz from veinlets in the more southerly of the two dykes was taken by the writer for assay and yielded $6.61 in gold per ton. If this is to be regarded as representative of the gold values in the quartz, then the tenor of the dykes as a whole must be quite low.

Farther west, in the same rhyolite-porphyry outcrop, and near the centre-line of the township, is a ten-inch quartz vein which occupies a fracture cutting the schistosity of the rock in a direction N.15°W. and dipping 40° to the west. It has been traced for forty feet and is terminated at either end by zones of intense shearing, which appear to have given rise to the vein-fracture. The quartz is white and granular, and in places is heavily mineralized with pyrite and chalcopyrite. Mineralization is, however, quite patchy. A sample of the best looking vein matter, taken by the writer, yielded $22.45 in gold per ton. This, of course, is not to be taken as representing the value of the vein matter as a whole. A short distance to the south of this vein is a second one, structurally identical with it, but barren of sulphide mineralization.

These claims were staked and prospected by the late B. Parker, who optioned them to the Dubuisson Mines, Limited. Surface work, consisting chiefly of trenching and sampling, was carried out for the Company during the summer of 1932 under the direction of J. Perry. The option has been allowed to lapse.

Lots 60 to 62, Range I (A. Baril):

In lot 60, a sheared, carbonated zone in pillow lavas is penetrated by quartz-tourmaline stringers. A little pyrite and chalcopyrite are to be seen here. A short distance to the northwest are some small, irregular quartz lenses and silicified zones, accompanied by sparse mineralization, in finely banded tuffs. Tuffs of cherty appearance occur near the western border of the outcrop. In places, they have been subjected to strong shearing, and graphitic material has formed on the shear planes. Porphyry dykes occur in this vicinity.

Montgay Township

Lot 14, Range VIII:

Close to the range line in the southern part of this lot, a trench has been blasted in a mineralized quartz vein in gneissic hornblende-granite. The granite at this point is within three quarters of a mile of Keewatin rocks. The vein really consists of a series of lenses, which follow a sheared east and west dyke of aplite, 8 to 15 feet in width. The quartz is irregularly distributed over a zone 2 to 15 feet in width and has been exposed for a length of 250 feet. Near the south of the same outcrop, a trench has exposed a dyke of aplite which is bordered, both on its north and its south wall, by quartz veins, two and three feet in width, respectively. Quartz also occurs as stringers within the sheared dyke. The quartz is mineralized with chalcopyrite and pyrite. The owners report values of $1.60 in gold per ton over a width of eight feet of the mineralized material in the northern part of the trench.

Lots 5 and 6, Ranges V and VI:

A prominent outcrop of banded tuff is traversed by the boundaries separating lots 5 and 6 and also ranges V and VI. The banding and schistosity of the rock strike about N.45°W. and dip steeply to the northeast. Parallel to the schistosity is a sulphide zone, 25 feet in width, which has been traced for 200 feet. Gossan marks the surface expression of the zone. Pyrite is the predominant sulphide; locally, it is concentrated in zones corresponding in direction to the schistosity of the rock, so that the mineralized rock is banded rather than massive. In the vicinity are a number of quartz stringers, most of which are barren. A typical specimen of the mineralized rock was taken by the writer and submitted for assay. The results were negative.

Courville Township

Lot 43, Range X (H. Bush):

Lots 42 and 43 are the property of H. Bush. In the southern part of lot 43, a sulphide zone has been found in schistose Keewatin lava a short distance east of its contact with foliated rhyolite-por-

phyry. Some of the lavas here have a well-defined pillow structure. Intense shearing in the rock may be noted just south of the mineralized zone and would appear to define the contact of the two rock types at this point.

Mineralization follows a direction more or less parallel to the schistosity of the enclosing rock, namely, N.60°W. It varies in type from pyritized rock to massive pyrite, the sulphide concentration being for the most part high. Development to date shows heavy sulphide mineralization over an area approximately 50 feet by 50 feet.

A selected sample of the most highly mineralized material, taken by the writer, gave $0.35 in gold per ton and a trace of copper. A pit sunk in the zone to a reported depth of 60 feet was filled with water at the time of the examination.

N.½ Lot 16, Range IX (H. Gilligan):

The northern halves of lots 15 to 18, in range IX, have been staked and prospected by H. Gilligan. An outcrop of Keewatin lava, much of which shows pillow and other flow structures, extends southwesterly across the north-central part of lot 16. The rock is schistose, with strike N.60°W., and there are several shear-zones in the outcrop, especially in its western part, one of which is related to the mineralization.

The deposit consists of several narrow, irregular lenses and stringers of white, granular quartz, exposed at intervals in a shear-zone with maximum width of 15 to 20 feet. The shearing, which is somewhat *en échelon*, strikes N.65°W. and dips 65° to the east. The zone has been traced for 120 feet. The quartz appears barren, but the adjacent rock is highly carbonated and in places pyritized. Visible gold has, however, been reported in quartz stringers. A sample of the intensely rusted, carbonated rock impregnated with pyrite was taken by the writer and upon assay yielded $0.70 in gold per ton.

Lots 31 and 32, Range VII:

A ridge of rock is traversed by the boundary between ranges VI and VII and by the north and south centre-line of the township. On a narrow quartz vein close to the northern edge of the outcrop, in range

VII near the centre-line, a shallow test-pit has been sunk. The rock is a fine-grained lava of intermediate composition which in some places exhibits a brecciated structure. The brecciated zones strike N.35°W., paralleling the normal schistosity of the rock, which dips steeply to the northeast. The rock is in part carbonatized, and at some points is cut by irregular networks of quartz stringers.

The quartz vein as exposed in the pit occupies a narrow fracture striking east-west and dipping vertically. It has been traced for only about twenty feet, but on the west it is obscured by cover of drift. The walls of the vein are heavily carbonatized with the development of much rusty-weathering material. The milky quartz of the vein is rather sparsely mineralized with pyrite. The vein averages only about eight inches in thickness. A selected sample of the mineralized quartz was taken by the writer and submitted for assay. It gave $4.82 in gold per ton.

N. ½ Lots 49 to 52, Range V; S. ½ Lots 49 to 52, Range VI (J. Trempe and Bélisle):

The block of claims on these lots covers an area in which the rock is well exposed and forms several well defined ridges. The rock is largely well-banded tuffs with some associated pillow lavas. Intrusive into the tuff in the northern part of lot 50, range V, is a small stock of granite.

Near the northern border of this stock, the granite is cut by a series of white quartz lenses, somewhat irregularly distributed but with a general trend N.25°W. for a distance of 45 feet. The rock adjacent to the lenses is silicified and mineralized, mainly with pyrite. Some values in gold have been reported. A representative sample, composed of both quartz and mineralized wall-rock, which was taken by the writer for assay, gave no values.

In the same lot, but somewhat farther west, is a zone of quartz stringers and small lenses which parallel the strike of the banded tuff in a direction N.50°W. Pyrite is associated with the quartz. Granitic, intrusive material was noted in the vicinity. In lot 49 of range V, an eight-inch lens of fine, granular quartz carrying chalcopyrite has been traced over a short distance.

LOTS 36 AND 37, RANGE V:

There is a prominent ridge of Keewatin greenstone about midway in range VI, lots 36 and 37. Near the crest of the ridge, a small pit has been blasted in a dyke of altered, porphyritic rock. The dyke at this point is mineralized with chalcopyrite and pyrite, and, on weathered surfaces, the rock is stained green with a film of earthy malachite.

S. ½ LOTS 34 TO 41, RANGE IV:

The group of claims on these lots was staked in 1932 by Leo Springer, in the interests of Prospectors' Airways, Limited. Upon the completion of prospecting, which included stripping and sampling of the principal showing, the claims were allowed to lapse.

The rocks exposed on these claims are rhyolite and felsite, in intimate association. Cutting these, in the southern part of lot 38, is a quartz vein that strikes N.75°E. and has a somewhat variable dip, averaging approximately 45° to the south. It may be traced for about 500 feet in all, but only the eastern, 185-foot, portion is of substantial width, averaging about two and a half feet. In its most easterly exposure, over a distance of about 35 feet, the vein dips quite flatly to the south, the change in structure being accompanied by and related to faulting. Here the vein lies within felsite which is strongly chloritized near the vein.

The white, and in part finely granular, quartz of the vein is to a large extent barren, although there are patches that are well mineralized with chalcopyrite and pyrite. Small segregations of magnetite have also been observed. A sample from one of the most highly mineralized portions of the vein, taken by the writer for assay, yielded $3.47 in gold per ton. The values in the vein matter as a whole would undoubtedly be low.

LOT 62, RANGE VI (AND LOT 1, RANGE VI SENNETERRE):

The boundary between Courville and Senneterre townships, in range VI, traverses an exposure of schistose tuff intruded by dykes of quartz-porphyry and others of more basic composition. The schist strikes, as an average, N.15°W., and dips vertically, but in several

places it is contorted and interrupted by drag-folds. Several bands of heavy gossan, marking the presence of sulphide zones, parallel the schistosity of the country rocks. Some stripping has been done here, and two small test-pits have been sunk.

SENNETERRE TOWNSHIP

S. ½ LOTS 7 AND 8, RANGE VII; LOTS 7 AND 8, RANGE VI (PRÉVOST):

In the southern part of range VII is an exposure of pillow and amygdaloidal lavas with which some tuffaceous rocks are interbanded. The rocks are schistose and contorted. The general direction of schistosity varies from N.-S. to N.60°E. and the dip is steep to the west or northwest. The banding of the tuffaceous beds, on the other hand, strikes N.60°-75°W.

Near the boundary between lots 6 and 7, in the northern part of the outcrop, a number of irregular quartz lenses and stringers occur along a fault striking N.50°E. Indications are that movement along the fault has resulted in the displacement of its southeast side to the northeast. A pit sunk on the fault-zone has exposed a mineralized quartz lens two inches in width, together with a number of stringers consisting largely of carbonate. Fine pyrite is to be seen in the rock adjacent to the stringers. Some low values in gold are reported.

Close to the southeastern extremity of the same outcrop is an irregular quartz lens paralleling the schistosity of the enclosing rock, with strike N.50°E. and dip 70° to the northwest. A short distance south of the lens, and probably related to it, is a fault-zone with similar strike. The lens has been traced for about 50 feet and is opened-up in a ten-foot test-pit. The rock in this vicinity is a pillow lava intruded by narrow dykes of acid porphyry. A small amount of carbonate occurs with the white, vitreous quartz of the lens, which is sparingly mineralized with pyrite and some chalcopyrite. The sheared walls also show some mineralization. Some values in gold have been reported here. A sample of the mineralized quartz taken by the writer for assay gave a negative result.

Banded tuff, invaded on the northeast side by acid granite and on the south by hornblende-granite, is exposed in the southern part of range VI. A pit has been sunk in lot 7 near the northerly exposure

of granite. Quartz lenses carrying a little pyrite cut the tuff and porphyritic injections exposed in the pit. About 1,000 feet to the southwest other pits have been sunk in a strong shear-zone in the tuff. It strikes east and west and dips 70° to the north. The shear-zone has been traced for 225 feet, 150 feet of which is occupied by lenticular masses of quartz. While these lenses are for the most part narrow, they attain in places an aggregate width of as much as eight feet. At one point, the shear-zone is intruded by a dyke of porphyry. The white, glossy quartz of the lenses contains carbonate and greenish inclusions, and is in large part barren of mineralization. A little pyrite may be seen in the wall-rock. Low values in gold are reported. Another pit has been sunk on a porphyry mass intrusive into the tuff a short distance to the south of the shear-zone. A little pyrite was noted here also.

LOT 4, RANGE V:

In the central part of this lot, a hornblendic phase of the granite is exposed. Associated with a 'break' or narrow sheared zone is a quartz vein dipping 65° to the northeast. A small test-pit has been blasted in the vein. The quartz appears barren, but certain specimens from the pit showed massive sulphides associated with fine-grained magnetite.

N. ½ LOT 23, RANGE II (FORTIN CLAIMS):

Trenching was done in 1933 on a sulphide zone in Keewatin volcanics at the centre of lot 23, range II. In three of the trenches, a rusty band, 20 to 50 feet in width, which strikes N.65°W., was exposed. In this zone the greenstones are sheared, silicified, and mineralized with pyrite and some veinlets of sphalerite. In the west trench is a narrow quartz vein which is reported by the owners to carry visible gold. A single sample of fresh sulphides taken by the writer gave low gold values.

LOT 62, RANGE III (H. BUSH);

The main showing on these claims is at the centre of lot 62, close to the eastern boundary-line of the township. Here some mineralization occurs along an acidic dyke, two to eight feet in width, which intrudes Keewatin basalt in a north and south direction. The margin

of the main granite mass is not far distant. Irregular lenses of mineralized quartz are found along either side of the dyke. Along the west side, such lenses have a varying width of two to six feet, while on the east, quartz lenses with accompanying silicification and intervening country rock occur through a zone having a maximum width of 15 feet. These veins are exposed for some 180 feet. Although the quartz is well mineralized with chalcopyrite and some pyrite, gold values appear to be low.

LOTS 30 TO 34, RANGE V:

A little work has been done on these lots on a persistent zone of sulphides which can be traced for a mile in a northwesterly direction. The sulphides seem to follow a definite garnetiferous band in tuffaceous rocks. The usual width of the rusty zone is three to six feet. In this band, massive pyrite and pyrrhotite are accompanied by a little quartz. The staker, R. Thomas, reports that he has obtained a few low gold assays, but a sample of the sulphide taken by the writer gave no gold. Quartz is frequently seen in this vicinity along the apices of small drag-folds in the tuff.

TAVERNIER TOWNSHIP

CLARK AND MCHOULL CLAIMS:

The property is located in northwestern Tavernier township, and in September, 1933, included claims A-47027 to 47031. Gold was discovered during the summer of 1933 at a point two miles north of mile 7½ on the east and west centre-line of the township.

The showing, as seen by the writer in September of that year, consisted of visible gold contained in quartz stringers in a porphyry dyke five to ten feet wide, intrusive into sheared greenstones. The quartz is in cross-fractures in the dyke and in lenses along the walls. The largest lens exposed was one foot in width and 40 feet long. Some coarse gold was seen in the quartz. Trenching had been done a number of years ago on a zone of iron sulphides that follows a branch of the porphyry dyke at the east end of this showing. In addition to the rocks mentioned, some intrusive diorite, older than the porphyry, occurs in the vicinity. The presence of gold in this section gives hope of finding more extensive deposits associated with the porphyry dykes.

PROSPECTING CONDITIONS

Northwestern Tavernier Township

Outcrop is relatively abundant in the triangular area which is bounded on the west by the Tiblemont township-line, and on the south by the centre-line of Tavernier, west of mile IV. The rocks exposed in this area are principally Keewatin pillow lavas and tuffs which are cut by porphyry dykes and some bodies of hornblende-diorite. Sulphide mineralization is rather widespread, but none of the samples taken by the writer yielded gold values. The finding of gold in quartz stringers in a narrow porphyry dyke on claims staked by Clark and McHoull encourages hope that more extensive gold deposits may be discovered associated with the porphyry dykes.

North Tiblemont Township

The prospecting possibilities within the granite mass in north Tiblemont have been discussed on page 43. In the Keewatin rocks of the township, the most promising prospecting ground would seem to be in any satellitic intrusives connected with the granite, or in quartz diorite intrusives of similar nature to those which have proved important in Louvicourt township. Some rather fine-grained quartz diorite intrusives are known to occur to the east of the granite. Most of the rock shown on the map under the symbol *4* is a hornblende diorite rather than a quartz diorite, and the significance of this rock from a prospecting standpoint is not known. Although no important discoveries have been made as yet in the Keewatin rocks themselves, there is no reason why deposits should not exist, particularly in the more brittle rocks. Zones of carbonated schist and of iron sulphides occur in the eastern part of the township, and chalcopyrite was observed filling amygdules in basaltic rock in certain places in the western part.

Northern Pascalis Township

The northern half of this township—with the exception of a narrow strip in the western part, in which Keewatin rocks are exposed—is underlain by the Pascalis-Tiblemont intrusive. The vicinity of the granite-Keewatin contact is the most favourable pros-

pecting ground, but rock exposures there are sparse. The granitic rocks are better exposed farther east, and mineralized veins have been found in them to the east of lake Pascalis. Although strong faults and shear-zones in the interior of the granitic mass similar to those with which gold-bearing veins are associated in Tiblemont have not been observed in northern Pascalis township, the possibility of the occurrence of such structures should not be overlooked.

Courville Township

Although, from a geological standpoint, Courville township offers very favourable ground for prospecting, it is decidedly disappointing in the fact that so little rock is exposed. The Pascalis-Tiblemont intrusive underlies the southern and southwestern portions of the township, and gold has been reported in the margin of the mass, in range II. The rhyolitic rock in ranges III and IV may be a phase of the same intrusive mass, and merits careful examination. Rocks characteristically tuffaceous in nature are exposed in a zone extending southeast from the centre of the township to the vicinity of Courville lake. Some mineralization is to be seen here, chiefly in association with small granitic stocks and dykes.

Senneterre Township

The most likely-looking prospecting ground in Senneterre is that within a belt three miles wide at the south of the township. Exclusive of two areas of sand to the west of the Lepage and Senneterre rivers, rocks are well exposed in a number of localities in that portion of ranges I, II, and III lying to the east of the Bell river. The rocks here are pillow lava and tuff cut by narrow porphyry dykes. Zones of iron sulphides were seen in several places, but no gold values were found in samples collected by the writer. Since much of this area is difficult of access, it has received but little attention from the prospector. The portions of these ranges west of the Bell river likewise merit careful prospecting, but, unfortunately, rock outcrops are small and sparse. Here, the northern margin of the Pascalis-Tiblemont intrusive lies within the southern part of these ranges, and to the north of it are Keewatin rocks intruded by highly altered, dioritic masses not unlike certain intrusives associated with gold deposits elsewhere.

The greenstones in the area north of range III are near, and are intruded by, granitic masses, so that they may form a shallow crust overlying the granite. The granites in the northern part of this township, and those in the vicinity of the Bell river, have more strongly metamorphosed the rock adjacent to them than has the Pascalis-Tiblemont intrusive, which would suggest that they were intruded at a higher temperature. In some places, where small granitic masses and dykes have intruded the lavas and tuffs, there has been mineralization, but, so far as present observations go, gold values for the most part appear to be negligible. Iron sulphides have replaced certain relatively basic bands in the tuffs southwest of the town of Senneterre. One such band is continuous for almost a mile. No significant gold values are yet known to be associated with these sulphides.

The main granite mass in the northern part of the township is fractured by faulting, and in some places, as for example east of Adelphus bay, quartz veins carrying pyrite may be seen in the fractured rock. But a mass of granite so uniform in nature and of such wide extent as this does not appear to offer much hope of concentration of valuable minerals, even though the rock is strongly fractured.

Carpentier Township

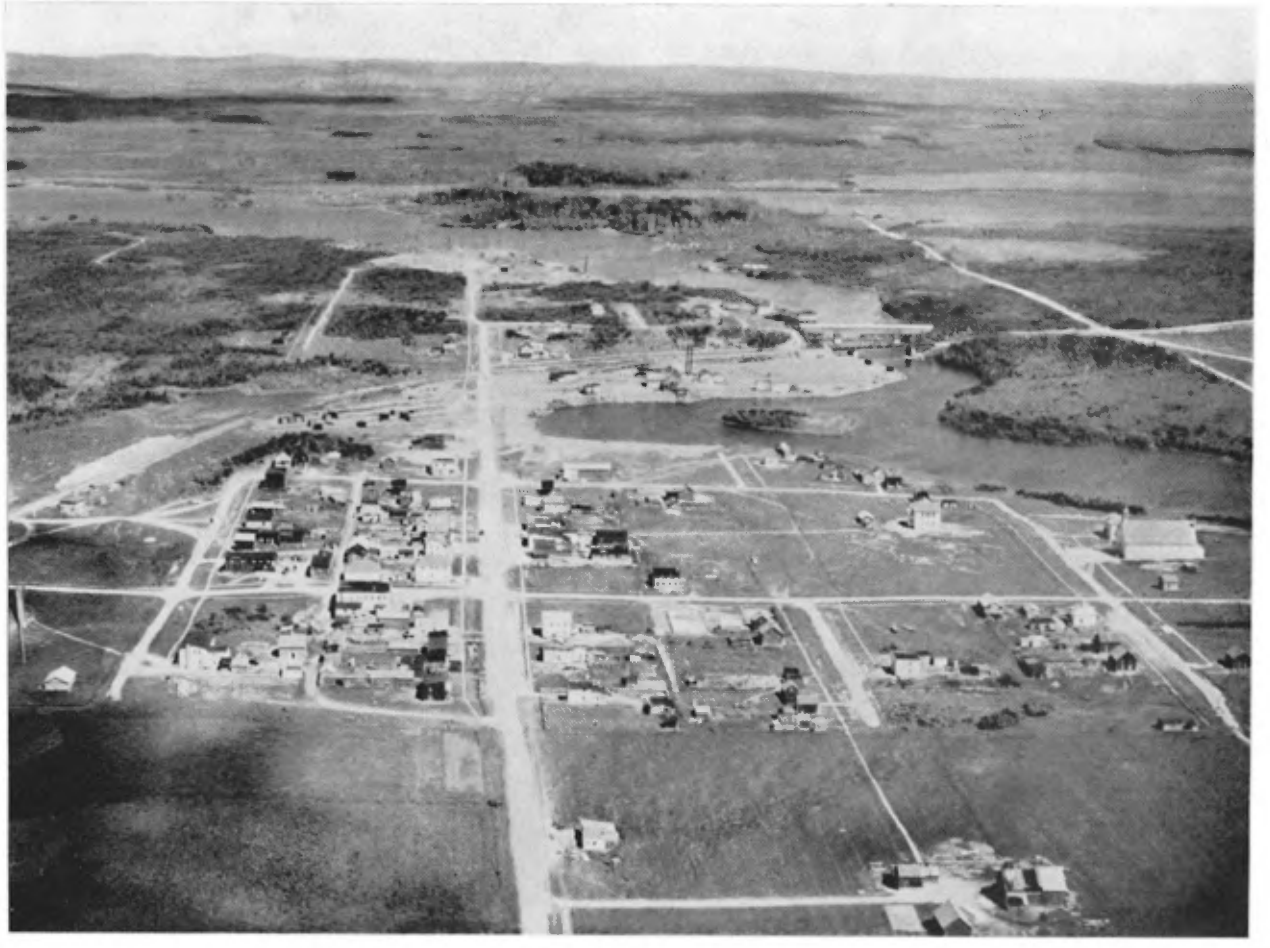
Small, gold-bearing veins have been found in the sheared phase of the rhyolite porphyry of this township, and in some places sulphide mineralization occurs along the margin of the same mass. This lends hope that larger concentrations might be found. Gold has been reported from a quartz stringer which occurs—together with many barren-looking quartz lenses—in the siliceous tuff in range V, near the centre of the township. Greenstones, cut in some places by granitic dykes, form a large exposure in ranges III and IV, near the eastern boundary. There are extensive rock exposures in the northwestern portion of the township. Rhyolite, narrow bands of iron formation, and carbonated zones in the Keewatin, as well as outcrops of the acid intrusive, make this section worthy of further investigation. In the northeastern quarter of the township, rock is exposed only in one locality at a point less than a mile from the eastern boundary.

Montgay Township

The greenstone areas in the southern part of Montgay township are highly metamorphosed and extensively intruded by granitic rocks. The conditions of high temperature thus suggested would be rather unfavourable for mineral deposition. A number of barren-looking quartz lenses have been noted in the massive, pink granite in ranges III, IV, and V. The margin of this mass, more particularly where in contact with greenstone, might warrant investigation. Sulphide zones occur in the Keewatin tuff exposed in ranges V and VI, near the western boundary of the township. Near the western margin of the granite, in the northern part of the township, the rock is relatively more basic and more fractured. A deposit in this type of rock is described on page 65. Farther to the east, the country is considered unfavourable for prospecting; exposures are rare, and the rock seen is exclusively granite.

Dollard and Brassier Townships

The opinion expressed with regard to the granites in northern Senneterre will apply equally well to those parts of Dollard and Brassier townships within the map-area.



(Photo by Canadian Airways, Limited)

Senneterre from the air.

A.—Banded iron-formation in tuffaceous rocks, Senneterre township.

B.—Siliceous tuff showing uniform banding, Carpentier township.

(Photo by Royal Canadian Air Force)

Diabase dyke, Senneterre township, south of the railway where it crosses the Senneterre river. Scale approximately 1,600 feet to the inch.

(Photo by Royal Canadian Air Force)

Intersecting system of faults, Dollard township, The top of the picture faces north. Scale approximately 1,600 feet to the inch.

A.—Sectional view of intersecting veins in trench on Wood-Etcheverry property, Tiblemont township.

B.—Aplite dyke with ladder veinlets of gold-bearing quartz. Carpentier township.

ALPHABETICAL INDEX