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JOSELIN-DELESTRE MAP-AREA, ABITIBI COUNTY, PART C

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PROVINCE OF QUEBEC, CANADA
Department of Mines and Fisheries
Honourable ONESIME GAGNON, Minister L.-A. RICHARD, Deputy-Minister

BUREAU OF MINES
A.-O. DUFRESNE, Director

ANNUAL REPORT
of the
QUEBEC BUREAU OF MINES
for the calendar year
1935

JOHN A. DRESSER, *Directing Geologist*

PART C

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JOSSELIN-DELESTRE MAP-AREA ABITIBI COUNTY

by H. M. Bannerman

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JOSSÉLIN-DELESTRE MAP-AREA, ABITIBI COUNTY

by H. M. Bannerman

INTRODUCTION

GENERAL

The following report relates to an area embracing the greater part of the townships of Delestre and Josselin and a narrow strip along the eastern margin of Ducros and Bartouille townships, Abitibi county. The area lies about the northern waters of Lac Parent, and its southern boundary is some twenty miles north of the Canadian National railway at Senneterre — the point at which the railway crosses Bell river.

The field-work upon which this report is based was begun in June, 1935, and continued until the end of September. Jean Archambault and Paul Pelletier served acceptably as field assistants, and Marc Hurtubise, Fernand Dugal, Yves Paré, and Paul Barrette, attached to the party as helpers, also aided in the furtherance of the work. To each of these and to Jim Pichette, of Senneterre, who served ably as canoeman throughout the season, the writer is indebted. Much of the technical work relative to the compilation of the report was executed in the geological laboratories of McGill University, and the author is under deep obligation to the officers of the Department of Geological Sciences of that institution for their kindly courtesy in placing at his disposal every facility required to carry on the work.

With the exception of certain waterways in Josselin township, the base-map upon which the results are compiled was derived from township plans and waterway surveys furnished by the Quebec Department of Lands and Forests. The navigable streams and lakes in Josselin township that are shown in solid line are mainly from telemeter surveys by Mr. Archambault and other members of the party. Waterways shown in broken line were located by land traverses controlled by the usual pace-and-compass methods. Streams thus shown were not navigable in 1935, and for the most part they are too small, sinuous, or precipitous ever to serve as lines of communication. The positions of rock outcrops, formational boundaries, and other geological features were likewise determined by pace-and-compass traverses. The traverses were variously spaced, and checked by reference to township or range lines, or to telemeter surveys.

MEANS OF ACCESS AND CONDITIONS OF TRAVEL

There are no roads, nor are there any human habitations, within the confines of the area, but an excellent water route afforded by the Bell river makes it readily accessible to the railway. The nearest and

most convenient railway connection is Senneterre, a town of some 300 people located on the Bell river some twenty miles south of the southern boundary of the map-sheet. This little town serves the surrounding farming community and is fast gaining importance as an outfitting centre for prospecting, mining, and hunting parties journeying in the surrounding region. It is equipped with stores, post-office, and hotels, and in 1935 three commercial airplane companies maintained operating bases there.

There are no portages or breaks in the Bell River route from Senneterre to the outlet of Lac Parent — a point just over half way across the area under discussion. Thence a half-mile of swift water is all that impedes canoe or small power-boat travel to within two miles of the north boundary of the sheet, where the river is broken by a series of falls and rapids that require portaging. The route is much frequented by parties seeking access to the country farther north. The portages are well cut, and though five of them are encountered here within a space of about two and a half miles, they are neither long nor difficult. Another way around these rapids is by following the wooden railway formerly used by the Quebec Fisheries Corporation. This track leads northwesterly from the old cabins on the west side of the river just above the first falls, to a point on the Taschereau river a quarter of a mile or so south of the confluence of this stream with the waters of Bell river. It thus passes around all five of the rapids on Bell River; but the trail is about $2\frac{3}{4}$ miles long, is little travelled now that the wooden rails have fallen into decay, and is not advised.

Within the area itself, a number of waterways tributary to the Bell river system make it possible to penetrate with comparative ease to parts somewhat remote from the main route. Thus there is a canoe route through the central part of Josselin township by way of a chain of small lakes. A short portage is necessary at the mouth of the creek where it falls into Bell river, but beyond that the route is unbroken to a point approximately half a mile north of Gustave lake. Thence a portage of one mile leading northwestward from the creek intersects Pichette lake, which in turn is connected by a trail, approximately one mile long, with a small lake on the north boundary-line of the township. The drainage of this little lake is northward, and according to report its waters pass by a chain of small lakes and streams into Tonnancour river. In like manner, the streams in Delestre township provide convenient avenues of canoe travel. Delestre river is a strong stream, averaging about 100 feet in width throughout its passage within the boundaries of the Josselin-Delestre sheet. Considerable stretches are smooth flowing and deep, well suited to navigation. Its course through Delestre township, however, is broken by eight rapids, all occasioned by sand and boulder ridges, through which the stream has been forced to cut its channel. Five of these rapids can be paddled or lined at low water. The remaining three require short portages. Hibou river is small; it averages not over 25 feet in width, and is beset with five rapids within three miles of its mouth. Beyond that it is not navigable because of log and alder entanglements, but it could be paddled for a considerable distance southward if cleaned out. Brassier (Jackpine) river has an average width of 75 feet, and is smoothly flowing and deep throughout the greater part of its course within Delestre

township. It is encumbered by a few log jams and, in range V, where it turns abruptly westward, it tumbles amongst boulders for the space of about half a mile. Other than that, however, it is admirably suited to canoe or outboard-motor travel.

PREVIOUS WORK AND RELATED PUBLICATIONS

Although a considerable amount of geological investigation has been carried on in the district surrounding the Josselin-Delestre sheet, and a number of reconnaissance maps and reports have been issued which include the area here described, the previous information on this specific area seems to be restricted to such data as could be obtained by an examination of the main waterways. The earliest explorations were those of A. S. Cochrane, assistant to Robert Bell, who in 1887 descended Bell river from its headwaters to some ten miles below Lac Parent. In 1895 and 1896, Robert Bell and R. W. Brock investigated the Bell river and explored many of its tributaries, among them the Coffee river, now known as the Taschereau. The results of these expeditions were compiled in a report by Dr. Bell in 1900, at which time a map covering a large section of the region, including the Bell River and Nottaway River basins, was published. During the survey for the location of the National Transcontinental railway, 1906-07, W. J. Wilson explored the region along the right-of-way, and his report and map include the larger part of the Josselin-Delestre area. Again, in 1912, a reconnaissance of the Bell river and of Shabogama lake (now Lac Parent) was conducted by M. E. Wilson. The results of this work, first published in the Geological Survey of Canada Summary Report for 1912, were later included in Wilson's memoir on Témiscamingue county, published in 1918. Since that date, apart from the Geological Survey of Canada's Nottaway sheet (Map 190A), no maps or reports bearing directly upon this area have appeared, but a number of reports and maps relating to adjacent regions are of particular interest to those engaged in work within the Josselin-Delestre area. Those most pertinent are included in the following list.

RELATED PUBLICATIONS

- BELL, ROBERT: Geological Survey of Canada, Annual Report, Vol. III, Part A, 1887-88; Vol. IX, Part A, 1896; Vol. XIII, Part K, 1900 (*Geology of the Basin of Nottaway River*, with map).
- WILSON, W. J.: Geological Survey of Canada, Summary Report, 1906, p. 119; Summary Report, 1907, p. 64; and Memoir 4, 1910 (*Geological Reconnaissance along the line of the National Transcontinental Railway in Western Quebec*).
- WILSON, M. E.: *A Geological Reconnaissance from Lake Kipawa via Grand Lake Victoria, to Kanikawinika Island, Bell River, Quebec*, Geol. Surv. Can., Summary Report, 1912, p. 315 (with map).
- WILSON, M. E.: *Timiskaming County, Quebec*, Geol. Surv. Can., Memoir 103, 1918.
- BAIN, G. W.: *The Geology and Mineral Deposits of the Harricanaw and Bell River Basin*, Bull. Can. Inst. Min. & Met., Feb., 1927, pp. 201-247.
- COOKE, H. C., JAMES, W. F., and MAWDSLEY, J. B.: *Geology and Ore Deposits of Rouyn-Harricanaw Region, Quebec*, Geol. Surv. Can., Memoir 166, 1931.

Map 190A — Nottaway Sheet, Quebec; scale 1 inch to 8 miles. Geol. Surv. Can., 1927.

BELL, L. V., and BELL, A. M.: *Senneterre Map-Area, Abitibi District, Que. Bur. Mines, Ann. Rept., Part B, 1933.*

FAESSLER, CARL: *Geological Exploration along the Laflamme River, Abitibi County, Que. Bur. Mines, Ann. Rept., Part C, 1934, pp. 35-44.*

MACKENZIE, G. S.: *Pusticamica Lake Map-Area, Abitibi District, Que. Bur. Mines, Ann. Rept., Part C, 1934, pp. 45-64.*

TOPOGRAPHY AND SURFACE FEATURES

The Josselin-Delestre area lies some 45 to 50 miles north of the height-of-land that separates the waters of Hudson bay from those of the Ottawa river. The general elevation is around 1,000 feet above sea level, and the maximum relief in the order of 400 feet. The area is characterized by wide undulating valleys and rather abrupt ridges. Particularly is this true of that portion which lies east of the Bell river. On the western side, for the space of five or six miles at least, the surface is largely low-lying, swampy muskeg or sand and clay covered. Rocky hills, 150 to 200 feet above the level of the surrounding country, do occur west of the Bell river, but they are more or less isolated. In contrast with this, the ridges that rise in Delestre and Josselin are well-ordered, north-northeast to northeasterly trending, ranges with *en échelon* arrangement, interspaced by wide sweeping systematic valleys. The higher of these hills rise 350 to 400 feet above the level of Lac Parent, and the ranges persist northeastward with rising elevation into the adjoining townships of Augier and Robin. Most of them have their steeper slopes on the east side; some are precipitous features, but mainly they tend to be broad-backed, rolling forms.

Evidences of continental glaciation are prominently displayed throughout the area. Much of the lowland is covered by a thick mantle of glacial débris of one sort or another. Rock is generally well exposed at the higher elevations, however, particularly east and north of Lac Parent, where the ravages of forest fires have destroyed not only the vegetation but much of the soil as well. Lakes are relatively few and shallow. Lac Parent, the most extensive body of water in this part of Abitibi district, though attaining a length of about 35 miles and a width of over 4 miles, is at low water rarely more than 25 feet deep. Its maximum recorded depth is only in the neighbourhood of 50 feet (1). Similarly, the lakes in Josselin township are shallow. Josselin lake, the largest of the group, seldom exceeds a depth of 6 feet, and in midsummer it is likely to be covered in large part by lily pads and other forms of vegetation. On the whole, however, the waters of the lakes and streams in the Josselin-Delestre area are clear and fairly free from the murkiness, imparted by suspended clay, common to so much of the surface water in many of the Abitibi areas to the west.

Drainage is northward to James bay, *via* the waters of Bell and Nottaway rivers and Rupert's bay. The drainage pattern, though in part deranged and obstructed as a result of Pleistocene glaciation, is distinctly

(1) Streams Commission, Quebec, 1934.

pre-glacial in its major aspects. In Delestre township, the major streams flow a little west of north in wide, well-carved valleys, now choked by sand and boulder deposits of glacial origin. The streams have notably narrow flood plains, and though they have cut modest channels in the glacial deposits, only at rare intervals have they encountered bed-rock, despite the fact that their gradients are fairly steep, thus ensuring a strong current. The direction of ice movement, based on striae and chatter-marks, was between 10 and 20 degrees west of south. In no case was it observed to parallel either the trend of the main valleys or the strike of the long axes of the prominent hills. The effect of the glaciation has been merely to disturb and modify previously well-ordered drainage patterns by scouring out, plucking, and widening eccentrically, parts of the valleys as the ice moved across them, or by damming them with glacial debris, particularly during the wasting stages of the ice sheet. Examples of the former mode of disarrangement may be seen in the ragged shore line of Hibou bay, and perhaps the deepening of the basin of Northeast bay, Lac Parent, is due to abrasion by the ice. Examples of damming are many, notably the numerous boulder rapids in Delestre river, and in the case of Brassier (Jackpine) river, which is forced to turn abruptly westward in range V, Delestre township, by a mound of sand and boulders that lies across the narrow neck of land between this point and the waters of Hibou bay, through which it formerly drained.

Moreover, in the greater part of the area, the major features of the topography bear little relationship to the folded structures within the underlying rocks. As has been pointed out above, the long axes of the ridges trend from north-northeast to northeast. In Delestre, the main valleys — excepting that of Brassier river — trend northward to slightly west of north, while in Josselin the valleys conform in large degree with the strike of the ridges. The strike of the fold axes of the rocks across this twenty-mile stretch varies, however, from east-northeast to southeast, and in no observed instance do the fold axes even approximately conform with the trend of the ridges. Some of the northeasterly-trending hills have in them small dykes of quartz diabase which are undoubtedly contributing factors toward their present topographic form and prominence. Likewise, the “bump” on Wigwam island, Lac Parent, and the abrupt narrow ridge that rises just west of Gustave lake, Josselin township, and persists northward for some $2\frac{1}{2}$ to 3 miles, are manifestly caused by the presence of a large diabase dyke (or dykes). These are isolated cases, however. Many of the higher ridges have no diabase, but are composed instead of well-banded granitic gneiss with a southeasterly trend, while others consist of siliceous tuff and interbedded schistose andesite. The delincation of many of the prominent topographic forms in this area cannot be attributed, then, to the influence of diabase dykes, nor to the effect of folded structures in the older rocks upon the processes of erosion. Rather do the etching processes seem to have been controlled by a strong system of joint fractures which break across the foliated rocks of the area, one set trending in a generally northeast, another in a north-northwest, direction.

GENERAL GEOLOGY

The rocks of the area are conveniently divided into four groups: First and oldest, a dominantly volcanic assemblage, now metamorphosed to schists of various sorts; second, a complex of granitic gneiss and associated dyke rocks intrusive into group I; third, a limited number of diabase dykes, which sharply transgress each of the previous groups; and fourth, a multitude of types of unconsolidated sediments, which spread as a relatively thin mantle across the truncated edges of the older formations. The nature and stratigraphic relationships of the several groups are summarized in the following tabulation:

TABLE OF FORMATIONS

PLEISTOCENE AND RECENT		River and lake bed deposits; muskeg; forest loam Sand and boulder deposits; varved clays; till
<i>Great unconformity</i>		
PRECAMBRIAN		Quartz and olivine diabase
		<i>Intrusive contact</i>
		Granite pegmatite and aplite dykes; soda-feldspar porphyry; biotite and epidote-bearing granitic gneisses; hornblende-diorite gneiss; and minor bodies of amphibolite
	Keewatin (?)	Acid to basic lava flows and associated tuffs and intrusives; minor bands of meta-argillites and quartzites, and local bodies of siliceous iron formation.

KEEWATIN (?)

The oldest rocks exposed in the area are a series of lava flows (with intrusive correlatives) and tuffs, together with some intercalated bands of clastic sediments and, rarely, thin bands of iron formation. All have been folded to some extent, and, in the main, converted into schistose types. These rocks are believed to form a conformable series and, following usual practice, they are tentatively designated Keewatin.

Flows and related intrusives of andesitic composition constitute by far the greater part of this assemblage, but more basic as well as rhyolitic types are also represented. Throughout the series as a whole, the tuffs and other sedimentaries are in minor amount, but in three localities they form belts of considerable width (see accompanying map).

SEDIMENTARIES AND TUFFS:

One of these belts outcrops on the Brassier-Delestre boundary and has been traced brokenly, in a northwesterly direction, across central Delestre township and Lac Parent — on the north end of Prospect island and on the southwest side of Wigwam island — to lots 70 and 71, range VIII, Ducros township, on the west side of the lake. As exposed on the Brassier-Delestre township line, the beds are dominantly greenish tuffs and fine-grained quartzites, with lesser pale buff, acidic tuffs and narrow, black argillaceous beds. Near the eastern margin of the outcrop is a 25-foot band of siliceous iron formation. Associated with these sediments, but in very minor amount, are highly altered rocks of intermediate composition, either lavas or intrusives. The average strike of the beds is $N.50^{\circ}W.$ and the dip is southwestward, at about 75° . The schistosity apparently parallels the bedding. Pillow and other lavas outcrop along the general strike of the belt in lots 18 and 19, range IV of Delestre, and in the central and northern part of Bannerman island. It would thus appear that the belt is divided here by a rather wide body of volcanics—presumably due to folding.

A closely similar belt in Bartouille township has been traced from lot 73, range II, to about the middle of lot 62, range III, and doubtless extends beyond these limits beneath the mantle of drift and muskeg. It has an arcuate trend, at first northwesterly and then northerly. A little iron oxide occurs in some of the beds, and large bodies of iron sulphides are associated with them, but no typical iron formation was observed in this belt.

The third belt of sedimentary rocks referred to is in the northern part of Josselin township. Unlike the other two, its trend is for the most part northeasterly, in which direction it has been traced across the northern end of Pichette lake into Tonnancour township. The beds are mainly acidic tuffs and fine-grained quartzites, with some of more basic material, and they dip at various angles (35° to 80°) to the northwest. Generally, the schistosity parallels the bedding, but local drag-folds plunge westward. Intrusives of gabbro, feldspar porphyry, and quartz diabase disturb the formation, and locally there has been considerable carbonatization and some pyritization of the beds, but no extensive bodies of carbonate or sulphides were observed.

These three belts of sedimentary rocks have much in common by way of sequence of beds and association, and they are obviously folded both within themselves and along with the adjacent formations. The field evidence suggests that the Delestre and Josselin belts represent horizons — possibly the same horizon — near the base of the Keewatin, but that the beds of the Bartouille occurrence are higher up in the series.

A detailed study of these belts could not fail to add much to our knowledge of the major structural features of the area. But apart from that, they are of great importance in that the main occurrences of metallic mineralization uncovered in the area to date have been found within them.

IRON FORMATION:

Small bodies of iron formation were observed near the Delestre-Brassier township line, about 3,300 feet west of Hibou river; on Prospect island, Lac Parent; and on lots 70 and 71, range VIII, Ducros township. In each occurrence, the material forms narrow zones interbedded with siliceous tuffs and black argillaceous sediments. It consists of well-banded quartz, iron oxides (chiefly magnetite), and amphibole, but with iron content far below commercial grade. Considerable bodies of pyrite and pyrrhotite are spacially associated with these outcrops of iron formation, and, owing to the magnetite and pyrrhotite, they exert a fairly strong local deflection on the compass needle. These several occurrences of iron formation are so similar, both in themselves and in their associations, as to warrant the assumption that they are to be correlated as occupying approximately the same horizon within the sedimentary belt of which they form a part.

A rather large isolated outcrop of iron formation of like character was observed on lot 58, range IX, Ducros township, about $3\frac{1}{4}$ miles west of Lac Parent. Pyrite-pyrrhotite deposits are associated with it, but its relationship to the other occurrences of iron formation in the area is not known.

SCHISTS (LAVAS) AND ASSOCIATED INTRUSIVES:

The greater part of the map-area west of Lac Parent and northwest of Josselin lake is underlain by lava flows. Apart from some minor occurrences of rhyolite and basalt, these are all andesitic in composition. Over wide areas, the andesites exhibit well-developed pillow structure, and the margins of the flows are commonly scoriaceous. Variolitic flows were seen in some places. On the whole, the andesite is fine-grained, greenish-grey, and schistose, although in Ducros township schistosity is pronounced only in the vesicular marginal portions of the flows.

At many points throughout the area, coarser-grained rocks, ranging in composition from diorite to gabbro, are intimately associated with the andesitic lavas and other Keewatin (?) rocks. Thus, the high hill on lots 70 and 71, range VIII, Ducros township, is composed of such material. Similar rock outcrops near Mile V on the north boundary of Josselin and has been traced for two and a half miles southwestward, paralleling more or less a band of tuffs, on whose northern margin it lies. Other bodies were observed within the tuffaceous band on lots 21 and 22, range III, Delestre, and there are smaller occurrences on Prospect and Bannerman islands, and in the tuffs near the sulphide deposits east of Swanson creek, Bartouille township.

Wherever these coarser-grained rocks were observed in direct contact with the andesitic flows or the tuffs, the relationship is intrusive. However, they are practically identical with the andesite in composition, and although in hand specimen they appear more massive, a well-defined alignment of the constituents is seen when the rock is examined in thin section. Moreover, the grade of metamorphism is similar to that of the

lavas. Both types consist mainly (upwards of 70 per cent) of highly pleochroic, greenish, frayed hornblende, which is distributed through a finely divided matrix of albitic feldspar and quartz, with minor carbonate, epidote, and zoisite.

It would thus appear probable that there is a close genetic relationship between the lavas and associated intrusives. From the field evidence at hand, it would seem likely that the latter belong to the same general period of vulcanism as the lavas, and hence are not much later than the rocks they intrude. The possibility remains, however, that they represent a younger series — post-Keewatin, but pre-folding, in age.

GRANITIC GNEISSES AND ASSOCIATED INTRUSIVES

GRANITE GNEISS:

Two large areas within the map-sheet are underlain by granitic gneiss. One body occupies almost the entire eastern half of the sheet; the other, the southwest corner. The two are separated by the narrow tongue of schistose rocks that extends diagonally across the central part of Delestre township. They may unite to the southeast, but within the area mapped they are entirely separate. The contact between these gneissic rocks and the adjoining schists is seldom exposed. Indeed, over a great part of the way, low, drift-covered ground separates the two formations, so that wide spaces intervene between outcrops. Wherever the contact was observed, however (as, for example, on lot 22, range III, Delestre township, and on Wigwam island), the gneiss was found to bear an intrusive relationship to the schist. Moreover, in the areas of schist adjacent to the gneiss proper, numerous dykes and sills of granitic composition may be observed. Conversely, within the areas of gneiss, remnants of the schistose formations are commonly encountered; and these, as well as the schistose rocks marginal to the gneiss areas, show considerable effects of contact metamorphism. Thus the intrusive relationship between the gneiss and the rocks of the Keewatin (?) schist series is manifest. Structurally, however, the two formations show a strong concordance, in that the foliation of the one parallels that of the other, even to the details of drag-folded structures. This is particularly well shown in the well exposed ridges southeast of Lac Parent, and in Josselin, where the gneiss reflects to a remarkable degree the fold structures encountered in the adjacent schists.

The southern body of gneiss is not well exposed, save along the shores of Lac Parent and on a ridge immediately west of the lake at the south boundary of the sheet. In the outcrops seen, the rock varies from a well banded, drab-grey, feldspar-biotite gneiss to a pale pink or flesh coloured epidote gneiss with a rather poorly developed foliation. Quartz, feldspar, and biotite are prominent in all types, and usually epidote also; but whereas in some the dominant dark mineral is biotite, in others it is epidote, and, generally speaking, the pinkish feldspar is more abundant in these latter than in the high-biotite types. A vast number of pegmatitic stringers and a few fine-grained porphyritic dykes traverse this body of gneiss in various directions. Some have sharply defined walls, but

with others there is a more or less gradual merging of one rock into the other. Evidently, the dykes are late products of the same period of igneous activity that produced the gneiss.

The pink gneiss contains 30 to 35 per cent of quartz, largely interstitial to well-formed crystals of sodic plagioclase, mainly albite but with some oligoclase. The groundmass consists of similar plagioclase and some microcline, together with quartz, biotite, and epidote, the two last named not exceeding 5 per cent of the volume of the rock. Occasional small crystals of zircon and sphene were noted in the thin sections examined. The drab-grey gneiss is similar to the pink facies but contains more quartz and biotite and less microcline. In the associated dykes, on the other hand, the percentage of microcline is higher, and, in addition, the pegmatites carry a little muscovite; otherwise, they are quite similar to the gneiss.

The wide body of gneiss that underlies the eastern half of Delestre and Josselin townships is similar in many respects to the southern body. It is well exposed along the south shore of Northeast bay, Lac Parent, and along the highlands east and north of the lake. The rock has a general drab-grey to dark grey colour, with pronounced banding, which in some outcrops is suggestive of bedding. In places, the gneiss includes schistose and highly altered remnants of the older Keewatin (?) rocks, some of them well-bedded and having the appearance of sediments, and others composed almost entirely of hornblende, with a little calcite, and perhaps representing andesitic and basic flows. The banding in the gneiss is invariably parallel to the foliation in the inclusions. In other outcrops, however, the gneiss, though strongly foliated, has a typically igneous appearance, with no textural or structural characteristics that can be attributed *a priori* to older rocks.

Dykes and stringers of pegmatite and aplite are in profusion cutting the gneiss. Most of the dykes are narrow, but some of pegmatite, ten to twelve feet wide, were observed. Many of them have gradational contact with the gneiss and partake of its foliation; and some irregular masses of pegmatite within the gneiss were noted that radiate finger-wise along the foliation planes from the crest of a drag fold. However, other dykes make sharp contact with the gneiss, generally following the foliation for some distance and then cutting across it, to resume again their parallelism. At some localities, aplite and pegmatite dykes were observed mutually cutting one another. Though the dykes seldom show any foliation, they appear to be closely related to the gneiss in time of origin.

Examination of a number of thin sections of the gneiss from various localities shows that it is somewhat variable in mineral composition from place to place, with quartz ranging from 25 to 45 per cent, biotite 3 to 25 per cent, and the balance mainly feldspar. As in the southern body of gneiss, the feldspar is predominantly albite, but oligoclase (Ab85) and microcline were noted in some slides. A small amount of muscovite is usual, and epidote is invariably present and in some facies of the rock is fairly abundant. Accessory minerals — zircon, apatite, and iron oxides — are quite unimportant.

The aplites are similar in composition to the gneiss, but contain little or no biotite. The pegmatites, like those associated with the southern

gneiss, are relatively rich in muscovite and microcline. Locally, where they have cut through large inclusions of basic schist, they contain a considerable amount of hornblende, in black, lustrous crystals up to two inches in length. A good example of such an occurrence may be seen on the west shore of Lac Parent, near the Delestre-Josselin boundary.

PORPHYRIES AND OTHER MINOR INTRUSIVES:

A number of small bodies of intrusive rock may be designated 'porphyry'. They are most common in the schist areas, relatively close to the schist-gneiss contacts, but several rather large exposures were observed in the area northwest of Pichette lake, Josselin township, and some isolated outcrops in ranges I, II and III of Bartouille township.

The rock is pink to buff coloured and usually distinctly porphyritic, though only vaguely so in some outcrops. It often displays a flow, or almost gneissoid, structure. In composition, these rocks strongly resemble the aplitic veins that cut the gneiss. The phenocrysts, up to a quarter of an inch in length, are of pink albite or zoned albite-oligoclase (Ab92 to Ab85), and only very rarely of quartz. These are distributed through a fine to medium-grained groundmass consisting of quartz (about 20 per cent), plagioclase, a little orthoclase, and usually minor amounts of muscovite and biotite, the last named largely altered to chlorite. Other secondary minerals are carbonate and epidote, both in small amount. The feldspar is fogged by sericite, and in many of the sections examined both it and the quartz are strained, often broken.

HORNBLLENDE DIORITE:

A body of fresh-looking hornblende diorite outcrops on the Augier-Delestre township line, at a point about 2,000 feet north of mile-post 4. The rock is grey, and has a strikingly gneissoid appearance, due to the parallel alignment of shiny, black hornblende crystals. Aplitic veins cut the diorite, and traversing the normal rock and merging into it are pegmatitic facies with hornblende crystals up to an inch and a half in length.

The diorite body appears to extend eastward into Augier township. It was not studied in detail, but, where seen on the township line, the diorite is intrusive into a fine-grained biotite gneiss, which is perhaps of sedimentary origin. Only one thin section of the rock was examined. In this, zoned plagioclase, Ab77 to Ab60 (andesine) makes up about 65 per cent of the rock, and hornblende 20 per cent. The hornblende is greenish, with a marginal growth of bluish-green sodic amphibole. Minor amounts of augite, biotite, magnetite, apatite, and zircon are present, and about 5 per cent of quartz, interstitial to the feldspar. The rock is very fresh, save for a slight saussuritization of the feldspar, and partial alteration of the augite to zoisite and carbonate.

AGE RELATIONSHIPS:

Much remains to be learned regarding the relationship and age of the granitic intrusives of this area. The great mass of gneiss east of Lac

Parent constitutes only the western portion of a body of that rock that extends eastward for an unknown distance. The structural relationship of this body of gneiss to that in the southwestern corner of the area and in Montgay township cannot be determined until further mapping is done toward the southeast. They may be one and the same body; in any case, there seems good reason to believe them genetically related.

The porphyritic bodies that invade the schists have a composition similar to that of the gneiss, and it seems probable that they are offshoots of the same magma, though they may conceivably belong to a later magma series. There is more doubt concerning the age of the hornblende diorite, which outcrops on the east boundary of Delestre township. It intrudes gneissic rocks, but it is possible that these are recrystallized Keewatin (?) sedimentaries.

The age of the gneiss and associated intrusives cannot be established by investigations in this area alone. They are, of course, younger than the lavas and sedimentary rocks of the Keewatin (?) complex. If the writer's interpretation of the structures that characterize the Lac Parent gneiss is correct — namely, that the foliation is largely inherited from a previously existing fold structure — then it follows that these gneisses are not only post-Keewatin (?), but that they are later than the folding of the Keewatin series here represented. They are clearly much older than the diabase dykes which so sharply transgress them.

As bearing on the question of age, certain peculiarities in composition of the granite gneisses in this area and of corresponding rocks in the region as a whole are of interest. In all the slides of granitic gneiss examined, the prevalence of albite and relative paucity of other types of feldspar is a striking feature. Intrusives characteristically rich in albite have been reported from many parts of northwestern Quebec, notably the granodiorites and many of the granites of the Rouyn-Harricana region (1). The age of these has been established as post-lower-Temiscamian pre-Cobalt, though they vary somewhat among themselves in time of intrusion; and the persistence of the soda-rich feature throughout the entire suite led the authors of the Rouyn-Harricana memoir to suggest the possibility that they constitute a petrographic province (2), and hence are related to a single magma stem. Moreover, the work of L. V. and A. M. Bell (3) has established the persistence of sodic granite and granodiorite bodies eastward in the Bell River basin, and although these authors do not specifically mention an albitic tendency in the gneisses of the Senneterre area (immediately south of the Josselin-Delestre sheet), the chemical analyses of these gneisses show them to have an unusually high soda content. MacKenzie (4) has reported sodic (albite-rich) gneisses and granitic

(1) COOKE, H. C., JAMES, W. F., and MAWDSLEY, J. B., *Geology and Ore Deposits of Rouyn-Harricana Region, Quebec*, Geol. Surv. Can., Memoir 166, 1931, pp. 108-138.

HAWLEY, J. E., *Gold and Copper Deposits of Dubuisson and Bourlamaque Townships, Abitibi County*, Que. Bur. Mines, Ann. Rept., Part C, 1930, pp. 3-95.

(2) *Op. cit.*, p. 118.

(3) BELL, L. V. and A. M., *Senneterre Map-Area*, Que. Bur. Mines, Ann. Rept., Part B, 1933, pp. 25-29.

(4) MACKENZIE, G. S., *Pusticamica Lake Map-Area, Abitibi District*, Que. Bur. Mines, Ann. Rept., Part C, 1934.

rocks from the Pusticamica Lake map-area, some 45 to 50 miles north of Lac Parent, and these gneisses he was led to believe, by a consideration of their structural and metamorphic features, are younger than a series of sediments that occur in that area, and which, in turn, are thought to be Temiscamian (1).

Thus the presence in this region of a widely distributed series of intrusive rocks peculiarly like the Lac Parent gneisses from a compositional — particularly mineralogical — viewpoint, is well known, and wherever positive evidence is forthcoming, these intrusives, including the gneissic phases, are found to be younger than the sediments commonly correlated with the Temiscamian. Taking these facts into account, and in view also of the structural relations that exist between the Lac Parent gneisses and the folded Keewatin rocks, it seems reasonable to assume, at least tentatively, that these gneisses and associated intrusives are post-lower-Temiscamian.

DIABASE DYKES

The area contains a goodly number of diabase dykes, some of which are shown on the accompanying map. For the most part they range in width from 8 feet to about 50 feet; but one dyke (or series of dykes) which has been traced brokenly from range IV, Ducros township, to Moose mountain, a high prominence a mile and a half north of the map-area, attains a width, in places, of 300 feet.

All the diabase dykes observed contain a little quartz, except one on range II, Delestre township, which carries a little serpentinized olivine.

These dykes commonly have a north-northeasterly trend, or between this and N.60°E. They are clearly later than any other rock in the area and are probably to be correlated with the 'later diabase' dykes of the Rouyn-Harricana region.

PLEISTOCENE AND RECENT

The unconsolidated deposits of the area are in large part of glacial origin, either formed directly as a result of glacial action or deposited from streams and standing bodies of water in or marginal to the ice.

Much of the high ground east of Bell river is covered by bouldery ground-moraine and hummocky till deposits. The wide valleys of the Delestre and Brassier (Jackpine) rivers, and the lowlands north and west of Lac Parent, have extensive sand and silt deposits, with a little clay. Westward, across the low-lying parts of Ducros and Bartouille, these sandy deposits become more and more clayey, until, in the northern part of the valley of Taschereau river, they are essentially varved clay and silt. The evenly bedded varved clays and silts are undoubtedly glacial-lake deposits, presumably co-extensive with the vast expanse of like deposits that lie to the westward, known as glacial-lake Ojibway (2).

(1) MACKENZIE, G. S., *Op. cit.*, pp. 58-59.

(2) COLEMAN, A. P., *Lake Ojibway: Last of the Great Glacial Lakes*, Ont. Bur. Mines, Vol. XVIII, 1909, pp. 284-293.

Whether the sand deposits flanking the higher lands in the eastern part of the area constitute a shore-line facies of the same lake, or are local outwash plains partly re-worked, cannot be told without further and more detailed study. Cross-bedded sand and gravel deposits which occur about the shore of Northeast bay, rising some 30 to 35 feet above the present level of Lac Parent, are probably deltas formed by streams entering from the surrounding highlands, at a time when the waters of the lake stood at least that much higher than now.

Sharp irregularities in the contour of the glacial deposits are common throughout the area, in the form of elongate ridges. Some of these are eskers, which persist for a few miles somewhat sinuously but usually in a south-southwest to southwesterly direction. They are relatively abrupt features, composed of sand and gravel, and clothed mainly by jack-pine. They are a future source of road-building material, and the better ones have been delineated on the map. Another type strikingly prominent in the eastern part of the area, particularly in Delestre and eastern Ducros township, are apparently crevasse fillings. In the sand covered and moraine covered portions of southern Delestre township, and in eastern Ducros, the long axes of these ridges have a southeasterly trend (approximately 60 to 65 degrees eccentric to the direction of ice movement, as determined by striæ), but farther west their strike is southward. Ridges of similar form, but composed mainly of cobbles and boulders, that occur among the highlands in Josselin township, have various orientations, while those along the west side of the high range of hills that bound the east side of Delestre township have a general southwest alignment. Deposits of this type have been recognized among the glacial sediments in regions farther south (1), but they do not appear to have been recorded heretofore in this region, although, of course, the normal type of esker is well known.

The Recent deposits comprise flood-plain deposits, muskegs, and forest loams. The extensive areas covered with muskeg bear testimony of the time when the region was literally dotted with shallow lakes. A few of these areas still have small lakes or ponds, and many of them are so spongy and wet that they can be travelled only with considerable difficulty. In the low areas marginal to these lakes, and indeed within some of the poorly drained, swampy areas, a fair amount of loam has been mixed with the sands and clays, so that, if drained, they would afford fairly rich soil. Soil on the uplands is extremely thin, however, and in large sections east of Lac Parent, as a result of forest fires, it has been practically all blown away. The best agricultural lands are restricted to the comparatively narrow flood plains and the deltas of the streams, where a fair amount of humus intermixed with the silts and sandy deposits has given rise to rich loamy soils.

STRUCTURAL GEOLOGY

Briefly, the general structure of the area may be described as a warped and broken anticlinorium, pitching rather sharply toward the west.

(1) FLINT, R. F., *Eskers and Crevasse Fillings*, American Journal of Science, 5th Series, Vol. 15, 1928, pp. 410-416.

Locally, there is a reversal in the pitch, which is probably due to faulting.

As may be seen by inspection of the accompanying map, the group of rocks collectively referred to as 'schists' wrap around the north and west sides of the gneissic complex that underlies the eastern part of the area. The foliation in the schists in the majority of places is very nearly parallel to the primary banding in the strata, and, broadly considered, the strike of the schists converges around the western end of the Lac Parent gneiss, while the dips are outward from it.

The foliation of the gneissic rocks conforms in most details with that of the schists, so far as it has been determined. Thus, all around its periphery, the Lac Parent gneiss dips beneath the schists. It is true that the southern gneiss at, and for some distance south of, its contact with the schists dips toward the southwest, away from the schists, but there is considerable evidence here of isoclinal folding in the schists, with overturning toward the northeast.

Contacts between the schists and the gneisses are nowhere well exposed and none have been observed north of Wigwam island. As a consequence, it is not known whether the gneiss invades a common horizon, or various horizons, within the schist series, but it is thought the latter is more likely.

Highly metamorphosed andesitic rock found dipping beneath the gneiss along the south side of the prominent ridge half a mile north of Whiskatec lake, Josselin township, suggests the possibility that the gneiss itself is a sheet-like body, underlain as well as overlain by Keewatin.

Faulting on a small scale may be observed at various places, and there is some evidence also of major faulting. At numerous localities, two sets of shear joints, striking respectively $N.50^{\circ}-55^{\circ}E.$ and $N.10^{\circ}-25^{\circ}W.$, are well developed within the schists and the gneisses. They are usually marked by a strong fracturing of the rocks, and, in places, offsets of a few inches or a few feet may be seen, especially along the northeasterly fractures, which are generally more prominent than the others. Whether or not there has been important movement along any of these lines of fracture is not known, owing to lack of data, but they do appear to have contributed toward the development of an eccentric topographic configuration in the eastern part of the area.

L. V. Bell and A. M. Bell (1) have shown that there is major faulting in a north and south direction in the Senneterre area to the south, particularly in the vicinity of the Bell and Brassier River valleys. There is evidence of similar faulting in the present area. For example, in south-central Delestre, the observed strikes and dips of the tuffaceous beds and nearby gneisses are such that, in order to explain the distribution of these formations, it is necessary to postulate either a sharp fold or faulting along the valley of the Brassier river. Supporting the probability that a major fault, with upthrow on the east side, follows this valley and passes northward into Lac Parent by way of Hibou bay is the fact that the gneiss outcropping on the east side of the river near the mouth of Hibou bay is markedly crushed; and, moreover, the remarkably straight north-south course of the valley is in itself suggestive. From the field data at hand,

(1) *Senneterre Map-Area*, Que. Bur. Mines, Ann. Rept., Part B, 1933, p. 36.

it seems not unlikely that this fault persists in a generally northward direction across the township of Josselin.

Evidence of a like nature points to the existence of another north and south fault to the west of that just described, following the western side of Lac Parent and the Bell river. Along both faults, the assumed movement has been of the east side southward.

ECONOMIC GEOLOGY

A considerable amount of prospecting has been carried on within this area from time to time, but nothing of proved economic importance has been found to date. At present, interest centres chiefly in the search for ores of gold, and attention is being directed particularly to the quartz veins that occur in fair abundance in various parts of the area. Certain relatively large pyrite-pyrrhotite bodies have also been examined, in the hope that they carried paying quantities of copper, nickel, or the precious metals. A fair amount of stripping and trenching has been done on some of these deposits, and one of the pyrite-pyrrhotite bodies occurring in Bartouille township has been diamond drilled. The results obtained to date, however, have not been particularly encouraging.

VEIN DEPOSITS

Veins composed almost entirely of quartz, but in places carrying a sprinkling of pyrite, are common within the schistose and gneissic rocks of the area; and carbonate veins, in which there is usually more or less pyrite and a little quartz, occur here and there within the lavas in Ducros, Bartouille, and Josselin townships.

The carbonate veins are found particularly in the scoriaceous or brecciated parts of the lavas, and at contacts between successive flows. Some, however, were seen that break sharply across fairly compact andesite. The carbonate is pale grey in colour on fresh surfaces, and weathers reddish-brown. Its composition has not been determined. The accompanying quartz is usually whitish, somewhat opalescent. The pyrite, usually in fine grains, is disseminated throughout the carbonate. One of these veins is exposed on the west shore of Lac Parent, on lot 74, range VIII, Ducros township. Similar veins occur in the lavas at the falls on Bell river near the north boundary of the sheet; and on Taschereau river, at the first rapid above its confluence with Bell river, veins of this sort have been opened-up by trenching. To date, none of these carbonate veins have been found to carry commercial quantities of useful metals.

The quartz veins are more widespread in occurrence and indiscriminate in association, in that they are likely to be encountered among any of the members of the schist or the gneiss complex, while, so far as observed, the carbonate veins occur only in the volcanics. The quartz is glassy to pale milky, greatly fractured, and barren looking. It occurs as blotches and filling irregular gashes in the lavas; as stringers and lenses paralleling the bedding in the tuffs and the banding in the gneiss; and as well-defined fissure fillings of various orientation in both the gneisses and the schists.

Usually, the quartz is not accompanied by appreciable amounts of other minerals, but in some occurrences it carries a little pyrite, and, more rarely, some carbonate and white mica. Most of the veins are but a few inches in width, but some are several feet wide. Thus, two were seen on Wigwam island — one in the tuffs and the other a short distance north of it in the gneiss — that have widths of 5 to 6 feet.

Quartz veins of two widely different ages were recognized — one group older than the gneiss and presumably than the major folding, the other younger than the pegmatites and aplites associated with the gneiss. Evidence of these age differences may be seen on the ridges east of Hibou bay, where lenses and stringers of quartz paralleling the banding in the gneiss have been sharply severed by dykes of pegmatite and of aplite, while, within the same outcrops, small veins of quartz cut across the dyke rocks as they traverse the gneiss. The practical significance of this age distinction is somewhat nullified, however, by the fact that, in the absence of structural evidence, the older veins cannot be distinguished from the younger with any degree of assurance.

None of the older quartz veins were observed to be mineralized; but in a few places, particularly among the schists in northern Josselin, certain of the definitely later ones were found to carry some pyrite. Assays (1) of samples selected from three veins more or less representative of the younger group failed, however, to yield values in gold or silver, though traces of both metals were reported in two of the samples.

SULPHIDE DEPOSITS

Large lenses composed mainly of pyrite and pyrrhotite occur in the schistose sediments in Delestre, Ducros, and Bartouille townships, and pyritic bodies have been found in Josselin. Some of these deposits were exposed by stripping and trenching several years ago; but, at the time of the writer's visit, water, clay, and vegetable matter concealed the rock in many of the workings.

JOSSELIN TOWNSHIP:

The only sulphide deposit observed in Josselin township upon which any appreciable amount of development work has been done is located just east of the portage leading around the rapids on Josselin creek near where it joins the waters of Bell river. Here a group of trenches reveals the presence of considerable pyrite in crushed and heavily sheared andesite. The deposit was discovered by Peter Swanson, of Timmins, Ontario, and the trenching was carried on under his direction.

The rock in the trenches is mainly andesite, though toward the northwest side of the property a band of bleached tuffaceous-looking material is exposed. The foliation strikes N.45°E. and dips at 45 degrees toward the northwest. Shearing is quite pronounced — so much so that over narrow widths the rock is almost fissile. In the most southerly trench, a 16-inch dyke of mica lamprophyre was observed to cut across

(1) Analyst, Maurice Archambault, Quebec Bureau of Mines.

the foliation. The sulphides follow the schistosity much after the nature of fahlbands. As exposed in the trenches, the mineralization extends sporadically over a width of 75 feet and is traceable for 300 feet or more along the strike. It consists almost exclusively of pale brassy, medium-grained pyrite, accompanied by a little quartz. Pyrrhotite was noted, but in very inferior amount. The pyrite content of the rock exposed does not exceed 3 to 5 per cent, but locally, over 5-foot widths, it makes up 10 to 12 per cent of the rock, and here and there bands 8 inches to 12 inches wide contain upwards of 50 per cent pyrite. Low values in gold are reported in some samples taken from this deposit.

Pyritic deposits in carbonated tuffs and andesites occur at several localities west of Pichette lake, but no work has been done on any of them. Just east of the trail leading from this lake to the north boundary of Josse- lin, at a point approximately a quarter of a mile south of the township line, a crumpled outcrop of quartzite is impregnated with pyrite and veined by tiny stringers of quartz and chalcopyrite. A sample from this occurrence, assayed in the laboratories of the Quebec Bureau of Mines, yielded traces of gold and silver.

BARTOUILLE TOWNSHIP:

Lot 65, Range III.— Large lenses of pyrite and pyrrhotite in intimate mixture are exposed on lot 65, range III, Bartouille township. They may be reached conveniently by way of a trail that leads westward from Bell river at a point directly west of the most westerly tip of a large island in the river. Little surface work has been done on these deposits, but persistence of the sulphides can be traced by exposed gossan. The country rocks are mainly well-bedded rhyolite tuff and fine-grained quartzite, the latter containing so much magnetite in certain layers as to almost merit the designation 'iron formation'. Interbedded with the quartzite are bands of black schist — representing former argillaceous sediments — and some pillow andesite. Intruding this sedimentary series are bodies of dioritic and gabbroic composition, which in turn are cut by intrusive rhyolite. The rocks are all foliated, with general trend N.25°-30°W. and dip 60°-70°S.W.; but there is a considerable amount of local crumpling, and apparently some small-scale faulting.

The sulphide bodies, so far as exposed, are restricted to the siliceous sediments, and commonly they are bounded on the hanging-wall side by a band of the black argillaceous schist. In general, they conform in strike and dip with the enclosing rock, but traced along the strike they appear as lenses, arranged somewhat *en échelon*. In the trench near the trail leading to Bell river, a total mineralized width of 55 feet was measured, 15 feet of which consisted merely of rusty schists, and the balance of material averaging 20 to 25 per cent combined sulphides, with narrower, fairly massive lenses containing 50 to 60 per cent. The continuation of this body along the strike is obscured by a thin mantle of drift, but, about 400 feet south, what is probably another body outcrops, and can be traced on the surface for 250 feet in a direction S.25°E. In this distance it attains a maximum width of 35 feet, the average being 24 feet. Here, too, the

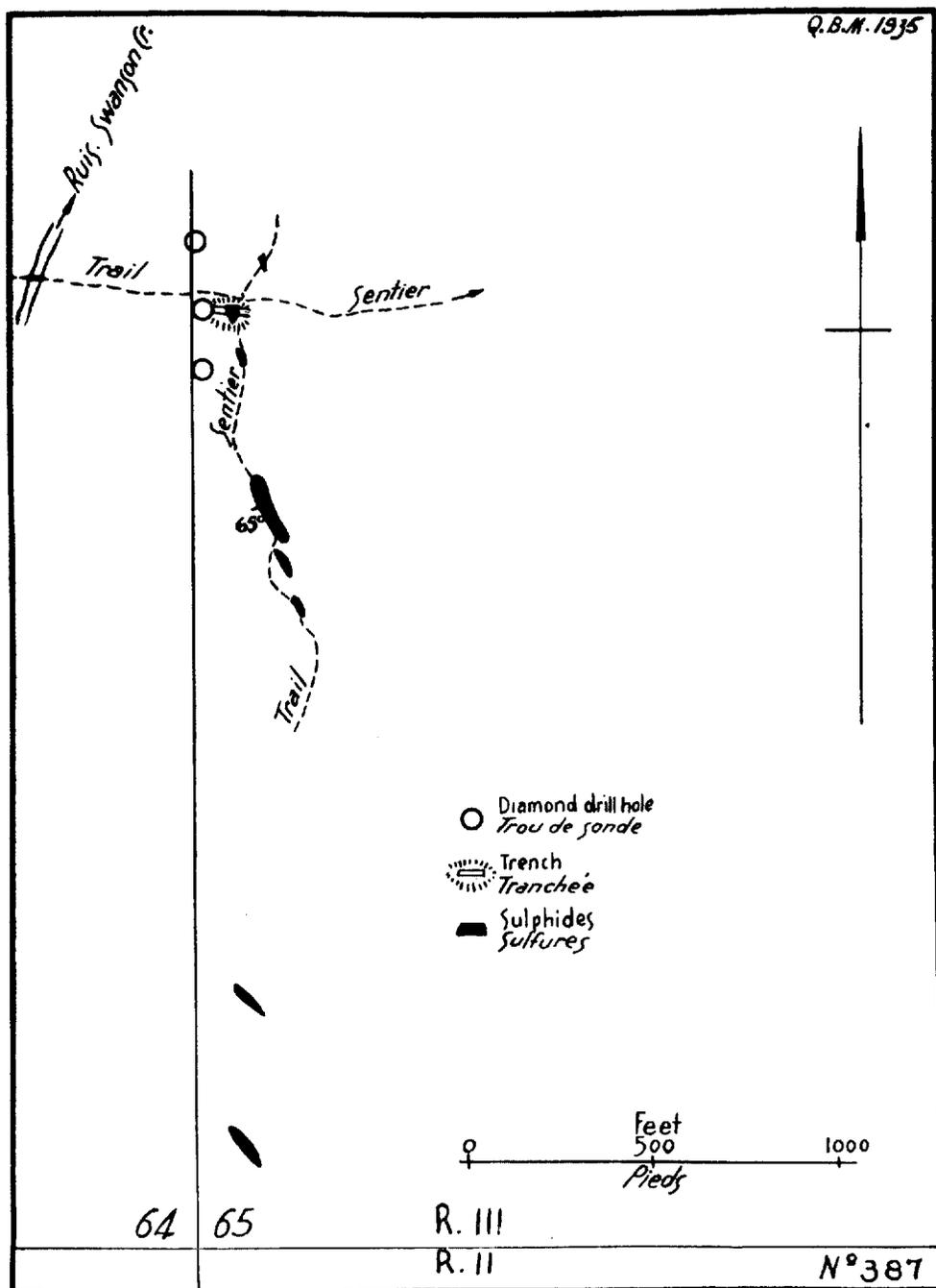


FIGURE 1.— Sketch showing distribution of sulphides exposed on lot 65, range III, Bartouille township, August 1935.

mineralization along and across the strike is not constant, but on the average the combined sulphides make up 25 to 30 per cent of the body, which, over widths of 20 feet or so, is fairly massive. Seventy-five feet farther southwest, another body appears, with an exposed width of 16 feet. Its length is not known, but an outcrop of rusty schists 150 feet farther along the general strike (S.25°E.) may perhaps be a continuation of the same deposit. Still other outcrops impregnated with pyrite and pyrrhotite occur near the west boundary of the lot (lot 65), approximately a quarter of a mile south of the last described occurrence.

In all these deposits, the sulphides are exclusively pyrite and pyrrhotite, which are present in about equal amount. The sulphides clearly replace the wall-rock, and, among themselves, pyrrhotite is found to corrode and vein the pyrite.

The most northerly group of these deposits was diamond-drilled some years ago by the Mining Corporation of Canada, but the results of this work are not available.

Lots 74 and 75, Range II.—Sulphides with associations similar to those described above are exposed in a long trench that crosses the line between lots 74 and 75, range II, at a point approximately 225 feet east of their western boundary. The strike of the foliation here is N.55°-60°W., and the dip 70 to 75 degrees northeastward. The bedding planes are contorted, so that various strikes and dips may be read, but the axial plunges on the minor folds are in the order of 45 degrees toward the northwest, from which it seems not unlikely that the beds are here tightly compressed, but face toward the northeast. The sulphides replace the schists, and in many places tiny stringers of pyrite break across the foliation planes. They are scattered sparsely through a belt 400 to 500 feet wide, but in only three zones, 35, 15, and 8 feet wide respectively, each separated by a hundred feet of practically barren schist, do they attain a concentration as high as 8 to 10 per cent of the whole. The heaviest mineralization is restricted to the quartzitic or rhyolitic beds.

In this occurrence, pyrite is much more abundant than pyrrhotite. A considerable amount of silicification has occurred, and, locally, tiny veinlets of quartz — some carrying pale coloured pyrite — break across the foliation. At one place, a four-foot section of silicified tuff, intricately veined by stringers of quartz bearing a little chalcopyrite, was noted.

DELESTRE AND DUCROS TOWNSHIPS:

Other occurrences of pyrite and pyrrhotite were observed on the Delestre-Brassier township-line, some $2\frac{3}{4}$ miles east of Brassier (Jackpine) river; on lots 25 and 26, range V, and on Prospect island (Lac Parent), Delestre township; and on lots 71 and 72, range VIII, and lot 58, range IX, Ducros township. A little trenching has been done on lots 25 and 26, Delestre, and on lots 70 and 71, Ducros, and two small strippings have been made on Prospect island. Other than that, no development work has been undertaken.

The geological relationships of these deposits are essentially the same as those of the sulphide bodies already described except that, in the occurrences on the Delestre-Brassier township-line and in Ducros

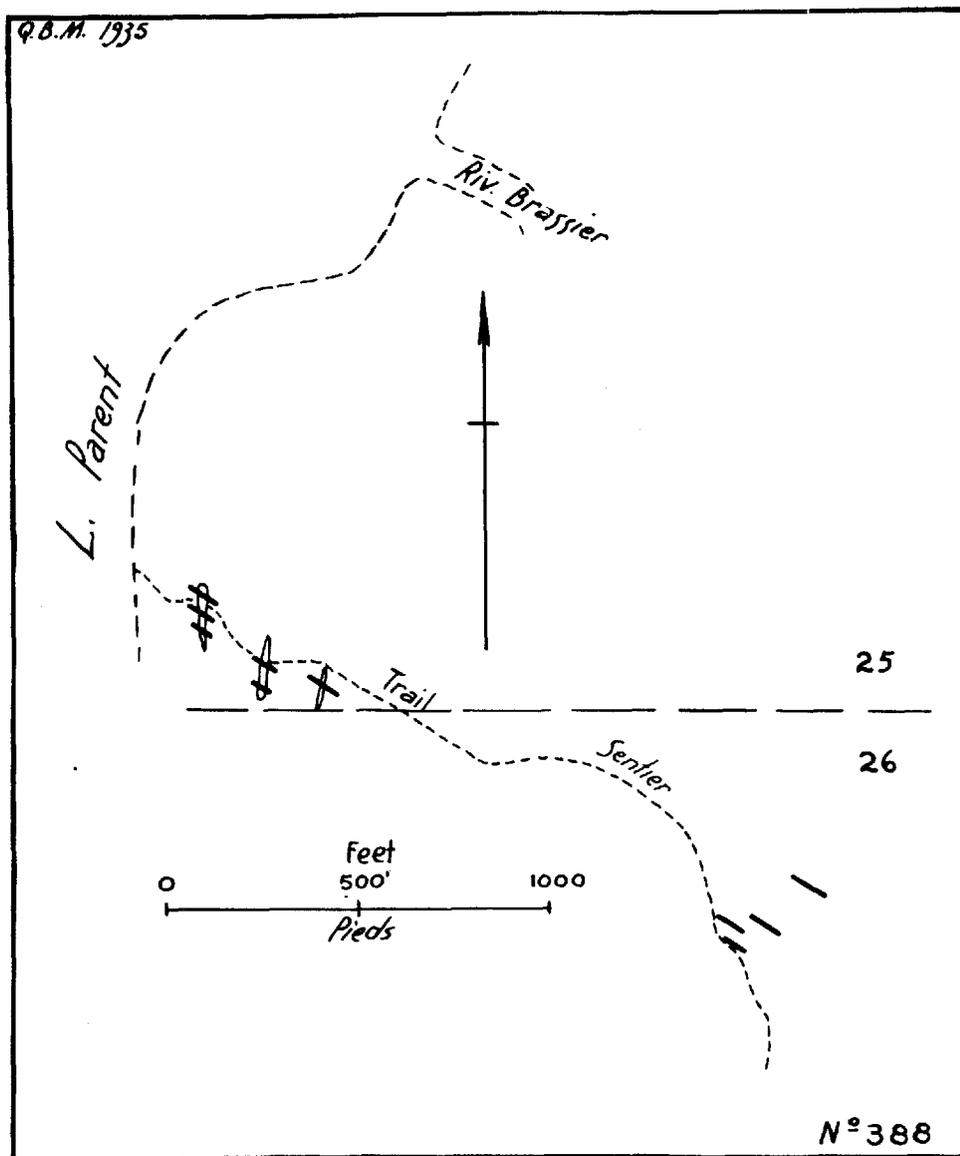


FIGURE 2.— Sketch showing distribution of sulphides exposed on lots 25-26, range V, Delestre township, July 1935.

township, the hanging-wall of the deposits is banded iron formation. The sulphides replace the country rock, and in the main they parallel the foliation, but in places veins bearing pyrite and pyrrhotite cut across the banding in the schists.

Judging by the amount of rusty gossan and siliceous limonitic material that occurs on the lots referred to in Ducros township, the sulphide bodies here are of considerable size. Outcrops of fresh rock, however, are scanty, and little is known of the actual size and grade of the deposits. The same is true of the occurrence on the Delestre-Brassier township-line. A vein bearing some chalcopyrite is reported to have been found on lot 71, range VIII, Ducros township, during the summer of 1935, but it was not seen by the writer.

The sulphides are better exposed on Prospect island, where, about the central part of the eastern lobe of the island, strippings reveal two bodies of heavy sulphide mineralization, one 12 to 15 feet wide, the other 2 to 3 feet wide, separated by about 20 feet of barren rock. The wall-rocks are tuffaceous sediments, with northwest strike and dip about 60 degrees southwest. A strong deflection of the compass, and a ridge of rusty siliceous schists trending in a more northerly direction across the middle of the western part of this island, suggest that sulphides may be found here also.

The trenches that have been dug across the sulphide zones on lots 25 and 26, range V, Delestre township, were much littered with débris when the writer visited the property, so that little could be seen in them. They serve to establish the presence of a light and scattered sulphide mineralization across a width of a hundred feet or so, but, so far as exposed, massive sulphides are very limited in width; in fact, the greatest observed width was only 27 inches. The rocks are siliceous tuffs, which strike N.55°W. and dip 60 to 64 degrees southwest. The sulphide bodies parallel them in the main, but the distribution of the more concentrated bands is such as to suggest that they are a series of lenses at different horizons within the schists. Structural considerations and strong local magnetic attraction suggest that a heavier mineralization than any at present exposed on this property might be uncovered in the depression to the north of the trenches that have already been dug.

MICROSCOPIC CHARACTER OF THE SULPHIDES:

Microscopic examination of polished specimens from these various deposits showed that pyrite is invariably more abundant than pyrrhotite, although in some places the latter makes up 35 to 40 per cent of the total sulphides. A few tiny specks of chalcopyrite were observed in the pyrrhotite in some of the specimens, but no other sulphide was seen. In thin section, the sulphides are found to replace and corrode the minerals of the wall-rock, so that remnants of such minerals as amphibole, albitic feldspar, quartz, and carbonate of the host-rock occur among the ore minerals. A second generation of quartz accompanies the latter, and possibly some younger carbonate.

Assays of samples taken from the deposits on lots 25 and 26, range V, Delestre, and on Prospect island, yielded traces of gold, and one of them a trace of copper. Silver was reported to be absent from all the samples assayed. One sample tested for nickel failed to show a trace of this metal.



Looking east from the top of "The Wigwam", Wigwam Island, lac Parent. Ridges in background are about 8 miles distant, those at the right from to 3 to 4 miles.



A.— Pegmatite in folded gneiss, northwest side of Blanche island, lac Parent. Note the manner in which the stringers of pegmatite feather along the banding in the gneiss.



B.— Porphyritic facies of the gneiss; ridge east of range VIII, Delestre township. The crosscutting vein is aplite.



A.— Aplite dyke severing quartz vein as it cuts across foliation in gneiss: ridge east of Hibou bay, range VI, Delestre township.



B.— Drag folding in banded gneiss, north side of Blanche island, lac Parent. Note tendency of aplitic facies of gneiss to develop along the plane of the folds.



A.— Rapids and falls on Bell river, near Bartouille-Josselin north boundary.



B.— Inclusion of an desitic lava in gneiss. East shore, lac Parent, range III, Delestre township.