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Preliminary report, geology of the southwest part of Baby township, Témiscamingue county

GOUVERNEMENT DU QUÉBEC
DEPARTMENT OF NATURAL RESOURCES
MINES BRANCH

MINERAL DEPOSITS SERVICE

GEOLOGY OF THE

SOUTHWEST PART OF BABY TOWNSHIP

TÉMISCAMINGUE COUNTY

PRELIMINARY REPORT

by

L. Imreh

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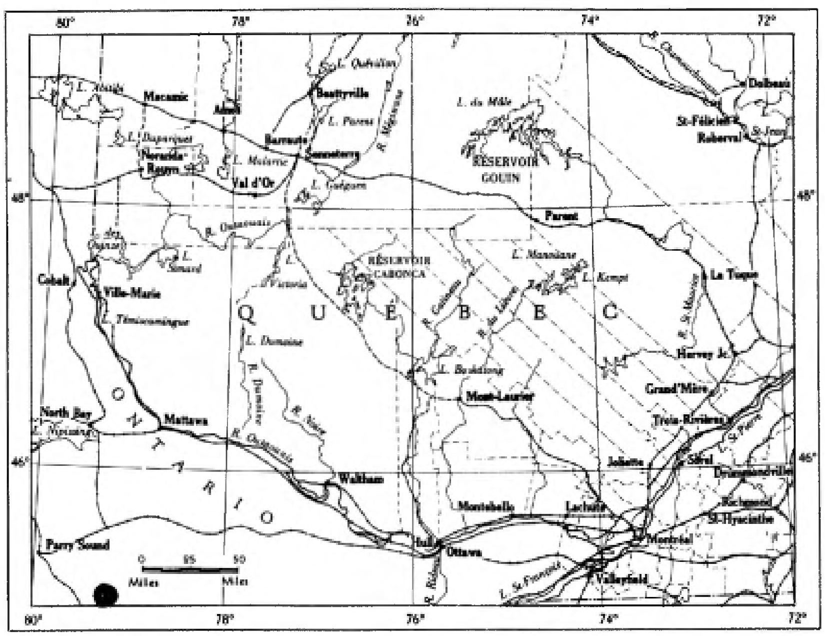

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P.R.-592

Preliminary Report

on

The Southwest Part of Baby Township

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INTRODUCTION

The object of the present report is to provide tentative information based on the principal data obtained during the geological field season of the summer of 1968. Its purpose is merely to serve as an explanatory note for the map accompanying this report. The map is only the first sheet of a series of publications which will cover a distinct geological entity. The present report cannot, therefore, present evidence of functional ties between local observations and the regional context, especially since the latter is not yet defined. An effort is made, nevertheless, to go beyond the stage of analysis, and the right to modify at a later date all which is related to the synthesis is being reserved. The reader is advised to keep this fact in mind when studying the present report.

The geological survey, conducted at a scale of 1 inch to the 1,000 feet, covers the southwest part of Baby township and a strip about 1 mile wide in the SE. quarter. The area mapped covers 31 square miles.

The well-developed road network and the character of the vegetation, especially that of the forest, have helped the survey. In addition, the density of outcrops has made easy the observation, especially in the wooded sections and those parts of relatively uneven topography.

The only available geological report on the area studied is that written by J.F. Henderson in 1936. It is accompanied by maps on a scale of one inch to the mile and covers the area extending from Témiscamingue lake to Soufflot lake (east of Belleterre). This very concise work is still acceptable in its concepts and constitutes an excellent starting point for surveys made on a detailed scale.

The geological surveys carried out on parts of the area by mining companies have been of little use because of numerous factors beyond the scope of this report. On the other hand, the study of drill cores may contribute a more concise knowledge of the microphenomena within the copper and nickel mineralized zones.

GEOLOGICAL SKETCH

The area studied is composed of four major geological elements, as follows:

- A basic volcanic sequence covering almost all the southeast part of the area and bevelling to the west. It reappears at the northern boundary of the area.

- A basic intrusive series inside the volcanic sequence.

- An acid hypovolcanic series, composed in great part of various types of quartz porphyry in the west-central part of the area. It is responsible for the disappearance of the basic volcanic series to the north and west.

- A granodiorite mass partially framing the major elements cited above.

The major geological elements can be decomposed and completed in chronological order, from top to bottom, as follows:

AGE	FORMATION	GEOMETRY
Upper Precambrian	Diabase	In dikes
Lower Precambrian	Syenite and lamprophyres	Dikes, bodies and veinlets elongated parallel to the direction of fractures.
	Granodiorite and its aplites	Mass on a regional scale
	Quartz porphyry and its varieties	Dikes and a large mass of irregular contour
	Metagabbros with various structures and compositions	Peneconcordant bodies and sills, within and at the base of the basic volcanic series
	Undifferentiated meta-andesite and metabasalt, dacite and pyroclastic rocks.	Successive flows of various thicknesses

Basic Volcanic Sequence

It is a series affected by the regional metamorphism and having members with the chemical composition of basalt, andesite or, in a subordinate manner, dacite. The distinction between the andesite and basalt is almost impossible, owing to the monotony of the texture and to the lack of tangible criteria. The series is composed, in great part, of successive submarine flows, in places well pillowed. The structure of the rock and the presence or absence of pillows suggest that the thickness of the flows was extremely variable both in time and space. Some pyroclastic rocks are included in this sequence.

Basic Intrusive Rocks

The basic intrusive group comprises an impressive variety of rocks that all belong to the petrographic family of the gabbros. Because of the economic importance of some of its members, the main points on which their subdivision is based are given below.

It must be emphasized that all the gabbros have been affected by regional metamorphism and that the sensitive minerals, such as feldspars and pyroxenes, have been transformed to amphibole, albite, epidote, clinozoïsite,etc. In spite of the effect of regional metamorphism, the study of these rocks was fruitful.

Common Metagabbro

This dark,tenacious rock, which is of variable granulometry, has only the constituents of a common gabbro. It forms more or less elongated bodies of varying length and width. It is more wide-spread at the base of the volcanic series where it is highly faulted and fractured.

Quartz Metagabbro

The quartz metagabbro has the same chemical composition as the common metagabbro. They both contain free quartz, but, while this mineral is visible to the naked eye in the former, it is only developed microscopically in the latter.

The observation made in the field that the common metagabbro and the quartz metagabbro are but two facies of a single entity is, therefore, justified microscopically and chemically.

Subophitic Metagabbro

The subophitic metagabbro is the most characteristic member of the series. To the naked eye it is definitely more leucocratic than the gabbros described above. The subophitic-ophitic structure is its distinctive feature. It seems to be more extensive in the middle of the enclosing series. With few exceptions, the subophitic formations show a marked tendency for the concordant position.

As for the chemical composition, the fairly small number of analyses done so far indicates that it seemingly differs only little from that of the preceding gabbros. On the other hand, the preliminary microscopic study gives the impression that the feldspars are epidotized to a higher degree than in the other gabbros.

"Favorable" Metagabbro

This gabbro, which was termed "favorable" by prospectors, is distinguished by its geometry and its stratigraphic position. In fact, it generally occurs in smaller bodies than those formed by the other gabbros and is found only in the upper part of the enclosing series, in which location the metagabbros previously described are rare or non-existant. Most of it is more basic than the other gabbros mentioned above and includes portions that may go as far as ultrabasic facies in some places.

The alteration, of different origins, is generally more pronounced and more complex than in the preceding gabbros. In the field, it is distinguished by the texture (in many places very coarse grained), the color from greenish to blackish, and the friability, which is quite pronounced; the alteration phenomena also help in the distinction.

The qualifying term "favorable" comes from the fact that the studies conducted by the mining companies have been conclusive only in this gabbro. It seems, in fact, that the copper and nickel mineralization, disseminated and massive, is exclusively linked to it.

Serpentinized Olivine Metagabbro

This variety of metagabbro must probably be related to the favorable gabbro. It has been found until now at one location only, near the east boundary of the area. A few small ultrabasic lenses in the southern part of the area are also linked with it.

Hypovolcanic Series

The hypovolcanic series covers two thirds of the area and constitutes a single mass with the center of gravity west of Long lake. Its emplacement occurred at the expense of the formations described above, of which it forms the western boundary, this boundary being discordant and irregular in contour. It has many major and minor ramifications, especially veins and dikes, which are seen almost everywhere within the formations described above and, in places, at great distances from the hypovolcanic mass proper.

On the basis of the textural features, one may distinguish fine-, medium- and coarse-grained quartz porphyries. Structurally, one may distinguish a few horizons containing intrusive breccias conformably aligned with the fracturing structures.

With respect to the mineralogical composition of the series, it may be said here that it is remarkably homogeneous at the scale of field observations. The sodic tendency of the samples studied in thin-section must, however, be emphasized.

Granodiorite

The granodiorite is a homogeneous rock composed essentially of quartz, feldspar, amphibole, epidote and chlorite. It forms the south boundary of the preceding formations.

There are no visible contacts between the granodiorite and the other formations disclosed during the geological survey. The chronological classification of the granodiorite is still subject to modification since its age relation with the hypovolcanic series has not been definitely established.

It must be noted that the proximity of the granodiorite seems to be a factor in the intensity of fracturing observed in the basic formations in the southern part of the area.

Syenites and Lamprophyres

The apparently heterogeneous formations grouped in this subchapter have more features uniting them than they have separating them.

They are first united by age, since they are all younger than the representatives of the hypovolcanic series, and some lamprophyres even cut across the granodiorite. They are also united by the wide-spread presence of clearly potassic minerals, such as biotite and microcline, etc., which were not noted in the preceding formations.

Holomelanocratic Rocks

The holomelanocratic rocks, found exclusively in the south part of the area mapped, are related to the E.-W., ESE.-WNW. faults. They form a few, small, unimportant lenses.

Quartz Veins

Found exclusively in the faults and fractures which characterize the structure in the south of the area, the quartz veins have attracted the attention of the first prospectors to come into the area. Their short length affords little encouragement, and they show a very small amount of sulfide mineralization.

Diabase

The diabase has no particular feature. It forms dikes of various sizes oriented N.-S. and NNW.-SSE. and cuts across all the other formations.

STRUCTURAL SKETCH

Folding

Although the full understanding of the structural phenomena requires the completion of detailed mapping of the township, it is possible to present, at this time, a certain image of the structure.

The basic volcanic sequence, the oldest formation in the area, is well suited for lithostratigraphic and structural investigations because of the presence of pillows. It was thus possible to observe that the dip of the pillows is generally in the NW. direction, which suggests that the southeast part of the area forms the south flank of a syncline having an axis oriented NE.-SW. and plunging southwestward.

The presumed structural movement, with a large curvature radius, has been accentuated and decomposed,during the very last stage of yielding deformation, into numerous local crenulations. The inverted dips, often on the scale of the outcrops,are witness to this. One may suppose that the emplacement of gabbroic bodies took place at the time of this deformation. With regard to the hypovolcanic member which occupies the center of the syncline, one may advance the hypothesis that it is slightly later than this phase. In any event, its dikes cut across the formations already folded.

When seeking the cause of the structural movements, one must put in evidence the role of the granodiorite, which limits the southern flank of the syncline. If we suppose that the area's basic volcanic series is identical to that mapped by Kish (1967) in Blondeau and Gaboury townships, we may conclude, as he did, that the granodiorite is located in the axis of a wide anticline having a NW. flank made up of the basic volcanic formations of Baby township and a SE. flank occupied by those of Blondeau and Gaboury townships.

A regional orogenesis would thus be the cause of the major NE.-SW. folding,and the granodiorite would be paratectonic to this folding.

Faults and Fractures

Faults and fractures affect all the formations studied. The main directions are NE.-SW. and NW.-SE. It must be noted that faults with considerable displacement are rare and difficult to show. On the other hand, fractures, showing a high degree of lamination, are very numerous, especially near the granodiorite in the south part of the area.

The younger formations of the Lower Precambrian, such as the lamprophyres, the ultrabasic rocks, the quartz veins and, very probably, the syenites, have been emplaced along these structural lines.

ECONOMIC GEOLOGY

This chapter gives a resumé, in alphabetical order, of the principal prospecting work done by mining companies. The deleting of certain companies or of certain claim-holders or the length of description of the activity of the companies must, in no way, be interpreted as having been done to the detriment of any one. The figures are given with the caution of possible errors or chance omissions.

This same chapter gives also a brief interpretation of the data in order to build a hypothesis as a guide to future prospecting. It goes without saying that this part is subject to changes at a later date and in no way pretends to be an imposition for those who will be called to do research work in the future.

The drill-holes which will be mentioned and the claim boundaries are shown on the geological map.

Description of Mining Properties

1) Acme Gas and Oil Co. (Roy option)

The drilling done by this company in 1965 is located partly in range VI, lot 27, and partly in range V, lot 21.

On lot 27, range VI (claim 208217), there is only one drill-hole. It is 425 feet in length and has crossed many barren formations.

On lot 21, range V (claim 205748), there are nine drill-holes totalling 3,327 feet in length. Among these drill-holes, those that have crossed the different facies of favorable gabbros attract attention because of the copper-nickel mineralization encountered. However, the small size of the gabbroic body favorable to mineralization remains an economic factor of little encouragement.

The indirect workings of the Acme company include a great variety of geophysical surveys (E.M., I.P., S.P., magnetometer) on the Roy option, covering parts of lots 22 to 27, range VI, and lots 16 to 19, range V. A geological map accompanies the geophysical work on lots 15 to 26, range V.

2) <u>Anglo American Nickel Mining Corp. Ltd.</u>

Drilling was done in 1966 on lot 3, range I (claim 202879). The total footage was 904.2 feet. This work was centered on molybdenite showings associated with a network of fractures in the granodiorite. The mineralization is very poor; it includes only flecks of molybdenite and chalcopyrite.

3) <u>Authier, Magnan, Salamis Property</u>

This property is located on lots 15 to 22, range VI. Three holes, totalling 1,270 feet, were drilled on lots 18 and 19, claims 205731 and 202850. The property, very poor in outcrops, has been surveyed magnetometrically. The drill-holes, spotted near a known fault bringing several formations in contact, encountered only one insignificant copper mineralization in the gabbros. The work was done in 1963.

4) <u>Black Bay Uranium Mines Ltd.</u>

This company drilled seven holes totalling 1,026 feet in 1963-64 on lot 4, range IV (claim 197602). The holes, collared in a zone marked by faults and fractures, gave results of little economic interest, the copper values being always very low.

5) <u>Delhi Pacific Mines Ltd.</u>

The drilling by this company was done in 1963 on lots 9 and 10, range IV (claims 202888-2 and 202888-1). The total footage was 1,101 feet. The copper-nickel mineralization anticipated at depth on account of the surface showings in the favorable gabbros was rather deceiving. The geological report which accompanies the drill sections emphasizes the necessity of understanding the cause of the phenomena with the help, above all, of a detailed geological survey.

6) <u>Falconbridge Nickel Mines Ltd.</u>

This company has conducted magnetometer and electromagnetic surveys on lots 9 to 12, range IV and V, and on lots 15 to 22, range IV.

The drill-holes are located in two separate areas.

The southern area includes drill-holes F-67-1 (range IV, lot 9, claim 227111), F-67-2 (range V, lot 9, claim 214636) and F-67-3 (range VI, lot 12, claim 258087). They total 1,396 feet in length. The copper-nickel mineralization encountered in this drilling, which crossed the favorable gabbros, is scattered and apparently of no significance.

The northern area includes six drill-holes on lots 19 and 20, range IV (claims 253713 and 253711). They total 2,219 feet in length. Collared over electromagnetic anomalies, they nowhere crossed the gabbros; on the other hand, drill-holes F-68-4 and F-68-6 encountered a tuffaceous horizon particularly rich in pyrite, having respective lengths of 38 and 25 feet.

The above work was performed in 1967-68.

7) Canadian Aero Mineral Surveys Ltd.

Aeromagnetic and aeroelectromagnetic surveys were conducted by this company in 1964 for W. Bert Lang. These surveys, covering especially the western part of the township, have revealed several anomalies.

8) Midrim Mining Co. Ltd.

The activity of this company extends over the years 1967 and 1968.

The geophysical surveys already published cover lot 4 of range IV, lot 5 of range V (electromagnetic method) and lot 7 of range III (electromagnetic and magnetic methods).

Drilling was done in five different areas as follows:

1 - Five holes on lot 12, range V (claim 227112-2)

2.- Fifteen holes on lot 9, range IV, and lots 8 and 10, range V (claims 227111-1 and 252436-1, 214636-1 and 2)

3 - Three holes on lots 16 and 17, range V (claims 205745-2, 205746-1).

4 - Ninety-three holes on lots 19 and 20, range V (claims 205747-1, 205747-2).

5 - Nine holes on lot 21, range V (claim 205748-1).

Since this work is particularly recent and impressive in volume (at least 35,000 feet), it is difficult, if not impossible, to give a detailed account of it.

With regard to the collaring of the holes, it must be said first that this was done in relation to the geometry of the copper-nickel mineralization controlled by the extension of certain gabbroic bodies. It must be mentioned that much attention was paid to the mineralized gabbroic body lying at the "core depot" on claims 1 and 2 of number 205747.

The importance of the investigated areas appears unequal in the light of the work already done. Although copper-nickel mineralization was encountered in the southern area (south of Robinson lake), the best results were obtained in the northern area (lots 19, 20 and 21, range V).

The mineralized gabbroic body at the "core depot" was particularly promising. The disseminated mineralization is replaced by numerous sections of massive mineralization, generally richer in copper than in nickel.

It must be emphasized that all copper-nickel mineralizations on this property have been found within the gabbros called "favorable". The values and sizes are of much interest in many places. For example, a few drilling results from holes collared in the gabbroic body of the "core depot" are given below:

Hole 65 - 30 feet of 1.11% Cu-Ni
- 90.8 feet of 0.82% Cu-Ni

Hole 66 - 37 feet of 1.32% Cu-Ni

Hole 80 - 34.6 feet of 2.04% Cu-Ni

Hole 88 - 187 feet of 1.5 - 1.7% Cu-Ni

Hole 90 - 12.5 feet of 4.04% Cu-Ni
15.9 feet of 3.25% Cu-Ni

9) Quebec Mining Exploration Company (SOQUEM)

The work done by SOQUEM includes first the geological magnetic and electromagnetic surveys of lots 5 to 10, range II, then the geological survey of lots 9 to 12, range III, and, finally, a drill-hole 260 feet in length within the quartz porphyries, spotted on lot 9, range II. This drilling crossed a low-grade pyrite zone.

The surface work was done in 1966 and the drilling, in 1968.

10) Texmont Mines Ltd.

The work done by this company consists of electromagnetic and magnetometer surveys covering lots 23 to 26, range V. This work was done in 1968.

11) <u>Zullo Min. Expl.</u>

This company drilled five holes in 1947-48 on lots 3 and 4, range IV (claim 36391), and on lot 3, range V. The total length of drilling was 1,644.5 feet. The drilling, centered on a fault structure, did not meet economically valuable mineralization in the basic rocks encountered.

In 1953, the company did a geological survey over lots 3 to 5, range IV, and lot 2 to 6, range V.

Interpretation of Data

The brief resumé given above concerning the activity of the mining companies shows three fundamental orientations in the choice of drill-hole location.

There is first the choice based on the faulted structures within the basic formations where there was some promise due to certain surface indications, even weak ones. Then, the choice based almost exclusively on geophysical anomalies, neglecting the lithology of the surroundings. Finally, a choice neglecting the faulted structures and based solely on geophysical, geological and lithological data.

The following remarks must be made here. The copper-nickel mineralization associated with the faulted structures and confined to the vicinity of the granodiorite does not appear to be of any economic interest. With regard to the network of fractures within the granodiorite (work done by Anglo American Company), the molybdenite showings at the surface have not been substantiated by any notable mineralization at depth.

The drill-holes spotted only on the strength of geophysical data have been little or not at all conclusive relative to the copper-nickel mineralization.

By elimination, it becomes evident that only the third approach has some promise of success, that is subsurface work based partly on geophysical data geologically screened. The drilling done in this light has given encouraging results, particularly on some properties of the Midrim company.

Combining the data obtained in the drill logs with the writer's observations in the field and his laboratory investigations, the following working hypotheses may be advanced at this time.

1 - Among the copper-nickel mineralizations, disseminated or massive, only those associated with gabbros are likely to give economically encouraging results.

2 -Among the numerous gabbros mapped, only the "favorable" gabbro is likely to contain any mineralization of consequence. The difference between the favorable gabbro and the common gabbro is, in many places, subtle and difficult to assess. It must, nevertheless, be emphasized here that certain lithological and lithochemical parameters (e.g.: CaO/MgO ratio) allow a distinction between the favorable gabbros and the others.

3 -An inverse ratio seems to exist between the volume of a gabbro body and the degree of mineralization. In fact, the relatively small bodies appear more susceptible to significant mineralization than the relatively large bodies.

This working hypothesis implies that the main control factors which would be useful to keep in mind are the following:

- general lithological control (gabbros)
- specific lithological control ("favorable" gabbros); the CaO/MgO ratio, the structure, etc., afford a distinction between the different gabbros.*
- geometric control (volume)
- "stratigraphic" control; considering the fact that the "favorable" gabbros are located in the upper third of the basic effusive rock sequence.

It is the writer's hope that the next field season of geological mapping and related laboratory studies will provide definitive proof or disproof of the importance of the control factors advanced.

GEOCHEMISTRY

The interpretation of the analytical results of the geochemical sampling of stream sediments is the subject of a special study (Imreh, 1970) which is beyond the scope of the present report. The author, therefore, limits his discussion to a few remarks on the geochemical prospecting work done at this time.

It is, nevertheless, useful beforehand to define a few elements of orebody formation and of geochemistry.

* At the present stage of field work, it seems that the CaO/MgO ratio in the "favorable" gabbros is lower than in the common gabbros and that the ferromagnesian crystals in the "favorable" gabbros form better developed spots than in the common gabbros.

Favorable Zones - These are the zones, within a given area, which gather all the factors presiding over the emplacement of mineralization.

Geochemical Anomaly - The geochemical anomaly is the grouping of non-erratic values surpassing the threshold of an anomaly which has been fixed either empirically or with the help of statistical calculations. If the location of the values thus recorded is in real contradiction with the orebody context, the nature of the anomaly must be reexamined.

Nature of a Geochemical Anomaly - One must distinguish the primary and secondary autochthonous or semi-autochthonous dispersion from the allochthonous dispersions. The secondary autochthonous dispersions are either "in place" anomalies or "transported anomalies", forming the aureole of the deposit. The allochthonous dispersions do not reflect the composition of the subjacent ground and indicate only, in a regional manner, the probability of the presence of mineralization, which still must be located.

Geochemical Prospecting - Geochemical prospecting places in direct evidence regions, sections or favorable zones for mineralization or outlines orebodies. The method to be followed depends to a certain degree on the extent of previous geological work. It will be effective only if it discloses the inherent variations of existing mineralizations.

* * *

The 232 samples collected during the mapping season have been analysed for 12 elements, and the results are given in the annex and on the geochemical map accompanying this report. Of the 12 elements analysed, only copper, nickel, zinc, cobalt and manganese have been observed in all the samples.

As for the other seven elements, they can be placed in several groups according to their proportion in the samples.

There are, first of all, two elements which have been detected in at least 80% of the samples. These are uranium and silver, found in 220 and 199 samples respectively. Then there is lead, which was found in 112 samples, and tin, which was present in only 26 samples. Finally, there is the group of elements which were not detected in any of the samples. These are tungsten and, for all practical purposes, molybdenum, since it was found in only four samples.

At the present mapping scale, one might ask whether the geochemical prospecting of stream sediments is capable of reflecting, in addition to the marked differences in content of trace elements in the greater lithological units, the presence of favorable zones for mineralization or mineralized bodies. In the area under consideration, the favorable zone for copper-nickel mineralization corresponds to the upper part of the stratigraphic column of basic volcanic rocks. Within this zone are the gabbro bodies known as "favorable" which have different lithochemical, lithostratigraphical and, possibly, volumetric characteristics different from those of the other gabbros occurring in the area.

The statistical tests of homogeneity indicate that values of the geochemical samples of stream sediments are entirely independent of those of the subjacent rocks and do not, therefore, point to the favorable zone defined above.*

This negative result does not, however, lessen the value of geochemical prospecting, but it points to the fact that the chosen method does not correspond to the scale precision of the geological work performed. It then follows (and this is a salient point) that the absence of geochemical anomalies in the stream sediments <u>does not signify in any way the absence of mineralization</u> or of <u>zones favorable to mineralization</u>. Indeed, it only translates this inefficiency of a given ineffective method owing to many factors such as hydrological conditions, erosion, impermeable layer of the soil, allochthonous and well-exposed paragenesis of the glacial formations, too loose a grid, etc. It remains to be emphasized that, exactly over the favorable zone, outcropping conditions are particularly mediocre, if not bad.

CONCLUSION

On a strictly local plan, the establishment of subdivisions within the two major series described by Henderson (1936) merits attention. As the different types of gabbro are put in evidence, it becomes possible to study the divergences in the spatial distribution of the disseminated mineralization; this will make it possible to give some precision on a few important control factors at the end of future field seasons.

In any event, much direct and indirect prospecting will still be needed in the favorable zone before one can come to a definite conclusion on the mining potential of the area. The author believes that a few strategic drill-holes spotted with care could clear up the present uncertainty.

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* It appears, however, that the Ni values found within the area studied are generally higher than those in many other sampled regions.

Within a wide scope, the interaction of magmatic and orogenic activities should be considered as well as certain facies analogies. If it can be established definitely that a correlation exists between the basic volcanic series outcropping in the township of Baby and in the townships of Blondeau and Gaboury, it is not forbidden to presume, by extrapolating the direction of major folds over a long distance and by taking into account the facies analogies, that the basic series in Villebon township (Val-d'Or area) can be correlated with the series of the present area. If this idea is found to be correct, it could have favorable repercussions in mining research.

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Sample No. on the map	Code No. of sample in files of Dept.	RESULTS OF ANALYSES IN P.P.M.													
		Cu	Zn	Pb	Mo	Ni	U	Co	W	Mn	Sn	Au	Ag		
1		20	75	0	0	53	1	15	0	416	2	0	0.5		
2		10	60	4	0	60	1	0	0	736	0	0	0.3		
3		16	60	6	0	40	1	15	0	505	0	0	0.3		
4		10	75	2	0	65	2	13	0	604	0	0	0.3		
5		6	60	2	0	63	2	0	0	580	0	0	0.5		
6		16	60	4	0	43	0.5	0	0	302	0	0	0.3		
7		10	50	2	0	48	1	0	0	585	0	0	0.7		
8		4	15	0	0	8	0.5	3	0	70	0	0	0		
9		6	25	0	0	25	0.5	18	0	215	0	0	0.4		
10		4	25	0	0	20	0.5	13	0	180	0	0	0.4		
11		16	90	0	0	58	1	25	0	755	0	0	0.6		
12		20	75	0	0	65	2	25	0	310	0	0	0.7		
13		20	100	0	0	45	2	20	0	305	0	0	0.6		
14		24	90	0	0	58	2	30	0	650	0	0	0.6		
15		20	90	0	0	55	1	23	0	750	0	0	0.7		
16		36	90	0	0	75	1	25	0	665	0	0	1.0		
17		20	75	0	0	50	0.5	8	0	560	0	0	0.9		
18		16	110	10	0	75	2	38	0	4650	0	0	0.6		
19		24	140	0	0	63	2	20	0	960	4	0	0.6		
20		20	125	0	0	65	2	23	0	750	2	0	0.4		
21		24	140	0	0	33	0.5	35	0	850	0	0	0		
22		10	75	6	0	45	2	0	0	225	0	0	0.5		
23		10	50	160	0	33	1	238	0	–	–	–	–		
24		16	125	2	0	70	2	23	0	970	0	0	0.7		
25		20	100	4	0	58	3	15	0	1100	0	0	0.3		
26		16	50	2	0	43	2	10	0	376	0	0	0.3		
27		30	125	60	0	53	1	20	0	2200	0	0	0.5		
28		10	75	2	0	53	1	0	0	344	0	0	0.7		
29		24	90	0	0	45	1	18	0	640	0	0	0.4		
30		20	110	2	0	78	2	8	0	1200	2	0	0.9		
31		20	100	4	0	53	3	13	0	1100	0	0	0.3		
32		6	75	6	0	25	0.5	5	0	156	0	0	0.7		
33		16	100	4	0	48	0	18	0	348	2	0	0.5		
34		6	50	0	0	28	3	26	0	1175	0	0	0.4		
35		20	90	0	0	63	4	35	0	290	0	0	1.1		
36		16	75	0	0	63	1	5	0	385	0	0	0.8		
37		10	90	0	0	45	1	18	0	340	0	0	0.9		
38		10	50	0	0	43	1	15	0	465	0	0	0.4		
39		6	50	0	0	38	1	13	0	345	0	0	0.4		
40		30	125	40	0	70	–	18	0	–	0	–	–		
41		16	25	0	–	18	0.5	3	–	–	–	–	–		
42		6	15	0	0	35	1	13	0	370	0	0	0.5		
43		2	15	0	0	40	1	12	0	260	0	0	0.4		
44		4	25	0	0	38	1	13	0	275	0	0	0.5		
45		4	20	0	0	38	1	15	0	315	0	0	0.4		
46		10	25	0	0	33	2	15	0	355	0	0	0.9		
47		6	20	0	0	35	1	8	0	380	0	0	0		
48		10	25	6	0	58	2	18	0	270	0	0	0.4		
49		10	25	0	0	40	1	15	0	490	0	0	0.5		
50		4	25	0	0	48	2	18	0	390	0	0	0.6		
51		6	25	0	0	43	0.5	18	0	385	0	0	0.8		
52		4	40	0	0	40	1	8	0	295	0	0	0.7		
53		10	25	0	0	28	0.5	5	0	250	0	0	0.7		
54		36	90	0	0	75	0.5	23	0	545	0	0	0.9		
55		36	90	0	0	75	0.5	23	0	1225	0	0	0.6		

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Sample No. on the map	Code No. of sample in files of Dept.	RESULTS OF ANALYSES IN P.P.M.													
		Cu	Zn	Pb	Mo	Ni	U	Co	W	Mn	Sn	Au	Ag		
56		36	50	0	0	68	1	28	0	615	0	0	1.3		
57		10	60	0	0	45	0.5	25	0	780	0	0	0.6		
58		30	60	0	0	55	1	26	0	575	0	0	1.1		
59		30	75	0	0	50	1	20	0	510	0	0	1.1		
60		16	75	0	0	55	0.5	25	0	695	0	0	0.7		
61		50	90	0	0	55	0.5	5	0	670	0	0	0.8		
62		20	90	0	0	65	1	25	0	1200	0	0	0.9		
63		36	75	0	0	58	1	18	0	635	0	0	0.9		
64		36	90	0	0	63	0.5	8	0	610	0	0	1.1		
65		16	50	0	0	38	0.5	18	0	390	0	0	0.4		
66		30	75	0	0	63	1	23	0	1225	0	0	1.2		
67		20	90	0	0	53	1	28	0	825	0	0	0.6		
68		10	90	0	0	68	0.5	15	0	605	0	0	0.7		
69		10	75	0	0	50	0.5	13	0	480	0	0	0.6		
70		16	100	0	0	45	2	15	0	560	0	0	0.7		
71		16	75	0	0	50	1	25	0	260	0	0	0.4		
72		40	150	90	2	75	1	38	0	6200	0	0	0.9		
73		50	125	0	0	55	1	55	0	4150	0	0	1.6		
74		16	75	0	0	58	0.5	36	0	650	0	0	0.6		
75		40	140	40	2	48	1	15	0	530	0	0	0.9		
76		16	90	0	0	55	0.5	20	0	500	0	0	0.6		
77		10	90	0	0	45	1	30	0	1850	0	0	0.9		
78		20	90	0	0	45	0.5	28	0	1050	0	0	0.4		
79		10	100	0	0	55	0.5	46	0	730	0	0	0.7		
80		20	90	0	0	38	0.5	38	0	1350	0	0	0		
81		10	60	10	0	35	0.5	13	0	180	0	0	0		
82		16	60	10	0	53	2	25	0	745	0	0	0.6		
83		4	25	0	0	45	1	13	0	640	0	0	0.4		
84		6	20	0	0	40	2	20	0	395	0	0	0.9		
85		10	50	20	0	38	0.5	23	0	690	0	0	0.5		
86		8	40	0	0	45	2	16	0	410	0	0	0.4		
87		10	40	0	0	43	0.5	18	0	425	0	0	0.6		
88		20	60	0	0	35	0.5	13	0	463	2	0	0		
89		30	140	0	0	45	0.5	18	0	430	4	0	0		
90		16	90	0	0	28	1	18	0	308	0	0	0		
91		16	75	0	0	43	0.5	15	0	608	0	0	0		
92		20	125	0	0	35	1	15	0	320	0	0	0.4		
93		6	100	6	0	43	2	23	0	484	0	0	0.7		
94		16	50	0	0	10	0.5	8	0	88	0	0	0		
95		30	50	0	0	13	2	5	0	430	2	0	0		
96		4	90	4	0	33	0	15	0	120	0	0	0		
97		20	60	0	0	33	0.5	8	0	520	2	0	0		
98		10	50	0	0	23	0.5	15	0	406	0	0	0		
99		10	50	2	0	28	1	13	0	138	2	0	0.7		
100		10	75	2	0	35	0.5	18	0	326	2	0	0.5		
101		10	40	0	0	25	1	13	0	438	2	0	0		
102		6	90	4	0	38	0.5	13	0	344	0	0	0.3		
103		36	60	0	0	45	3	10	0	553	2	0	0.5		
104		6	50	0	0	15	0.5	5	0	215	2	0	0		
105		16	60	0	0	48	2	18	0	480	4	0	0.5		
106		10	50	0	0	38	2	13	0	375	4	0	0.5		
107		20	75	20	0	38	2	18	0	1170	0	0	0.5		
108		16	60	6	0	45	2	18	0	265	0	0	0.5		
109		10	25	16	0	38	2	18	0	385	0	0	0.6		
110		10	25	20	0	33	0.5	5	0	220	0	0	0.4		

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Sample No. on the map	Code No. of sample in files of Dept.	RESULTS OF ANALYSES IN P.P.M.													
		Cu	Zn	Pb	Mo	Ni	U	Co	W	Mn	Sn	Au	Ag		
111		10	75	4	0	48	2	10	0	412	2	0	0.3		
112		10	75	10	0	38	1	18	0	585	0	0	0.3		
113		10	50	6	0	45	1	13	0	400	0	0	0.5		
114		16	75	10	0	40	1	10	0	460	0	0	0.4		
115		10	40	10	0	38	0.5	18	0	275	0	0	0.5		
116		16	100	4	0	45	4	13	0	420	2	0	0.5		
117		20	60	30	0	40	1	13	0	870	0	0	0.3		
118		20	50	6	0	43	2	23	0	515	0	0	0.3		
119		10	40	0	0	50	3	13	0	325	0	0	0.9		
120		30	75	40	0	43	1	15	0	2200	0	0	0.6		
121		4	20	0	0	48	3	25	0	320	0	0	0.6		
122		4	20	0	0	48	3	13	0	300	0	0	0.5		
123		2	25	0	0	40	0.5	12	0	270	0	0	0.6		
124		24	60	6	0	45	2	20	0	430	0	0	0.4		
125		30	75	16	0	38	0.5	18	0	650	0	0	0.5		
126		6	20	10	0	15	0.5	5	0	160	0	0	0.4		
127		2	15	0	0	13	0.5	5	0	145	0	0	0		
128		16	60	10	0	53	1	28	0	600	0	0	0.4		
129		40	40	0	0	38	0.5	15	0	465	0	0	0.4		
130		10	60	0	0	38	1	18	0	325	0	0	0.5		
131		10	60	0	0	38	1	20	0	335	0	0	0.6		
132		30	75	0	0	55	0.5	26	0	370	0	0	0.9		
133		20	60	0	0	40	0.5	8	0	390	0	0	0.5		
134		20	50	0	0	43	1	13	0	615	0	0	1.3		
135		24	60	0	0	55	0.5	25	0	655	0	0	1.1		
136		24	50	0	0	55	0.5	23	0	595	0	0	0.9		
137		10	40	0	0	40	0.5	8	0	285	0	0	0.6		
138		16	40	0	0	33	0.5	18	0	260	0	0	0.4		
139		16	60	6	0	75	2	13	0	570	0	0	0.4		
140		10	60	10	0	38	0.5	15	0	285	0	0	0.5		
141		10	90	0	0	13	0.5	18	0	292	0	0	0		
142		16	50	0	0	13	0.5	13	0	220	0	0	0		
143		20	50	0	0	13	2	3	0	110	6	0	0		
144		6	50	0	0	18	1	15	0	240	2	0	0		
145		10	50	0	0	33	1	13	0	206	2	0	0		
146		6	60	0	0	18	0.5	15	0	300	2	0	0		
147		16	60	0	0	20	0.5	13	0	288	2	0	0		
148		40	125	20	0	55	0.5	0	0	328	0	0	0.5		
149		6	50	0	0	25	0.5	8	0	206	6	0	0		
150		24	75	0	0	60	1	25	0	500	2	0	0.4		
151		10	100	4	0	50	0	0	0	158	0	0	0.5		
152		30	60	0	0	45	2	25	0	532	0	0	0.4		
153		20	75	0	0	40	4	18	0	553	0	0	0.4		
154		36	60	0	0	48	2	20	0	705	2	0	0.6		
155		6	90	4	0	45	1	5	0	324	0	0	0.5		
156		16	60	0	0	38	2	25	0	618	0	0	0.4		
157		30	50	0	0	65	1	23	0	715	0	0	0.4		
158		16	50	2	0	38	0.5	3	0	234	0	0	0.3		
159		20	100	6	0	35	0.5	20	0	440	0	0	0.3		
160		40	140	60	0	45	–	13	0	–	–	–	–		
161		20	50	6	0	43	1	13	0	595	0	0	0.6		
162		20	125	2	0	45	2	0	0	410	0	0	0.3		
163		20	50	4	0	38	1	13	0	665	0	0	0.7		
164		40	125	20	0	58	0.5	55	0	29,000	0	0	0.6		
165		30	75	40	0	43	0.5	18	0	1040	0	0	0.8		

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Sample No. on the map	Code No. of sample in files of Dept.	RESULTS OF ANALYSES IN P.P.M.													
		Cu	Zn	Pb	Mo	Ni	U	Co	W	Mn	Sn	Au	Ag		
166		20	75	6	0	48	1	23	0	675	0	0	0.8		
167		16	75	16	0	60	0.5	5	0	600	0	0	0.5		
168		20	50	2	0	45	0.5	18	0	480	0	0	0		
169		80	90	10	0	152	1	35	0	3800	0	0	0.9		
170		30	90	0	0	53	4	23	0	785	0	0	0.9		
171		16	75	16	0	55	2	32	0	1100	0	0	0.8		
172		20	60	20	0	38	2	26	0	715	0	0	0.8		
173		30	90	0	0	55	1	13	0	925	0	0	1.1		
174		24	60	0	0	40	2	15	0	525	0	0	0.4		
175		16	75	80	0	40	0.5	16	0	690	0	0	0.4		
176		20	75	0	0	45	1	8	0	715	0	0	0.5		
177		20	90	20	0	58	2	18	0	525	0	0	0.7		
178		20	50	0	0	43	0.5	15	0	340	0	0	0.6		
179		50	40	0	0	28	1	28	0	355	0	0	0.4		
180		10	40	0	0	13	0.5	13	0	1425	0	0	0.6		
181		20	75	0	0	55	3	25	0	1475	0	0	0.7		
182		24	75	0	1	53	6	25	0	270	0	0	0.8		
183		10	50	0	0	38	0	8	0	335	0	0	0		
184		56	100	0	2	65	4	26	0	795	0	0	0.6		
185		50	90	0	0	65	8	32	0	350	0	0	0.9		
186		20	60	16	0	68	1	30	0	585	0	0	0.6		
187		16	75	4	0	38	1	25	0	545	0	0	1.0		
188		20	75	4	0	40	1	23	0	600	0	0	0.3		
189		20	50	6	0	50	1	23	0	620	0	0	0.6		
190		30	50	4	0	58	2	23	0	500	0	0	0.2		
191		20	40	6	0	43	1	23	0	465	0	0	0.3		
192		16	50	10	0	38	2	20	0	580	0	0	0.6		
193		10	90	2	0	45	1	23	0	398	0	0	0.5		
194		16	50	10	0	35	0.5	13	0	440	0	0	0.4		
195		20	125	4	0	70	0	23	0	592	0	0	0.5		
196		2	180	20	0	65	1	25	0	666	0	0	0.7		
197		40	140	6	0	53	0	18	0	2075	0	0	0.5		
198		16	140	4	0	48	0	23	0	420	0	0	0.5		
199		40	100	0	0	48	1	20	0	328	0	0	0.5		
200		60	90	0	0	63	1	25	0	1200	0	0	0.9		
201		50	100	0	0	45	1	18	0	310	0	0	0.7		
202		36	60	0	0	55	0.5	15	0	472	0	0	0		
203		30	125	20	0	53	1	13	0	454	0	0	0.7		
204		30	90	0	0	53	1	18	0	728	2	0	0.4		
205		30	50	2	0	45	0	0	0	562	0	0	0.4		
206		30	60	6	0	48	0.5	0	0	578	0	0	0.7		
207		24	75	4	0	55	0.5	0	0	442	0	0	0.7		
208		24	75	4	0	55	0.5	10	0	475	0	0	0.7		
209		20	75	2	0	45	0	13	0	394	0	0	0.7		
210		20	110	10	0	40	0	23	0	1075	0	0	0.7		
211		6	90	2	0	45	0	15	0	422	0	0	0.5		
212		10	140	6	0	43	2	15	0	536	0	0	0.5		
213		20	90	4	0	50	4	18	0	506	0	0	0.3		
214		6	125	4	0	40	0.5	25	0	900	0	0	0.7		
215		16	125	4	0	48	3	20	0	360	0	0	0.7		
216		10	140	16	0	38	0.5	8	0	364	0	0	0.3		
217		20	140	20	0	40	2	8	0	504	0	0	0.5		
218		10	50	2	0	43	0.5	18	0	424	0	0	0.7		
219		20	100	6	0	40	4	8	0	1115	0	0	0.3		
220		16	90	6	0	55	3	10	0	502	0	0	0.7		

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Sample No. on the map	Code No. of sample in files of Dept.	RESULTS OF ANALYSES IN P.P.M.													
		Cu	Zn	Pb	Mo	Ni	U	Co	W	Mn	Sn	Au	Ag		
221		10	90	6	0	48	2	20	0	611	0	0	0.5		
222		20	100	4	0	55	0.5	3	0	606	0	0	0.3		
223		16	100	2	0	48	0	18	0	462	0	0	0.3		
224		24	60	60	0	65	1	13	0	530	0	0	0.3		
225		50	40	10	0	55	1	23	0	925	0	0	0		
226		24	50	40	0	40	1	15	0	380	0	0	0.4		
227		16	40	16	0	55	2	13	0	780	0	0	0.3		
228		20	25	6	0	55	1	18	0	525	0	0	0.2		
229		30	60	10	0	38	0.5	18	0	555	0	0	0.4		
230		20	60	10	0	48	2	18	0	435	0	0	0.6		
231		50	60	20	0	40	2	18	0	430	0	0	0.5		
232		30	50	10	0	38	1	13	0	320	0	0	0.3		

N.B.: A dash (-) indicates absence of determination

A zero (0) indicates that the element was not detected