The Geology of Darling Township and Part of Lavant Township

BY

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INTRODUCTION

The townships of Darling and Lavant lie in the western part of Lanark county about 20 miles west of the town of Carleton Place and 16 miles southeast of the town of Renfrew. The area is well served by roads and railway. A gravel-surfaced road from Lanark to Calabogie passes through Darling township, and from this the whole area is accessible by means of numerous concession roads. The northeastern part of Darling township is most easily reached by concession road from Arnprior and from provincial highway No. 29 through the village of Clayton. The Kingston-Pembroke line of the Canadian Pacific railway runs across the west side of Lavant township, with railway stations at Lavant, Folger, and Flower and a small spur line to Clyde Forks. The Ontario Hydro-Electric Power Commission's Toronto–Paugan Falls transmission line runs through the middle of both townships.

Natural Resources

Farming is carried on chiefly along the southeast edge of Darling township where the land is well cleared of bush. The soil is poor and thin, bedrock appearing at the surface in many of the arable fields. Much of the income of the area comes from the lumbering industry; there are small sawmills at Tatlock and Clayton. At the time of mapping, however, most of the timber cut in the area was being sent by road to Ottawa for milling.

Good stands of immature hardwood bush were seen; they consist mostly of maple, beech, oak, and elm. There is a small amount of good white pine timber in addition to spruce, balsam, and cedar. In the Indian Creek area along the northeast side of Darling township the country is covered by poplar and birch scrub, apparently the remains of an old brulé.

White Lake is popular with tourists; there are numerous summer cottages along its east shore. The fishing in the lake seems to be good; pike, pickerel, and bass are caught.

Topography

The eastern part of Darling township south of White Lake is relatively flat with low, rocky ridges between swamps and beaver ponds. To the west the country becomes more rolling with the relief as much as 400 feet. The general level slopes eastward towards the Ottawa Valley. There are numerous small lakes between the rock ridges, and the drainage is to the Indian River on the east and the Clyde River on the west. The whole area is very rocky, there being a high proportion of outcrop and, except for numerous small swamps, little continuous drift. The topography shows, to a marked extent, the structure of the bedrock, particularly in the eastern part of Darling township where long ridges follow the strike of the gneisses. East of Flower Lake dragfolding in the schists shows up as marked sigmoidal ridges, a feature especially noticeable in vertical air photographs. The courses of the creeks and the shapes of the lakes show strong control by the geological structure, particularly in the case of the Indian River and the long arm of White Lake, which probably lie along faults.

Acknowledgments

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Previous Work

The earliest complete geological report and map covering the area was produced by R. W. Ells of the Geological Survey of Canada in 1904 as part of a series of reports and maps "relating to the geology of the area traversed by the Ottawa River and contiguous to it." Ells discusses fully the views, current at the time, of the relative ages of the crystalline rocks in the Ottawa River area and quotes such authorities as H. G. Vennor, F. D. Adams, Sterry Hunt, and W. E. Logan.

A few years previous to Ells' survey, E. D. Ingall of the Geological Survey of Canada made a report on the iron ore deposits along the Kingston and Pembroke railway. In Darling and Lavant townships he describes, among others, the Yuill mine and the Radenhurst and Caldwell mines, at about the time work was being carried out on the deposits.

In the summary report of the Mines Branch of the Canadian Department of Mines for 1909, H. Fréchette describes briefly iron ore deposits or showings in the townships of Darling, Bagot, Blithfield, and South Canonto. He gives analyses of samples taken from most of the deposits visited.

Both the reports of Fréchette and Ingall are quoted in the report of the Ontario Iron Ore Committee.

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Report of the Ontario Iron Ore Committee, 1923, Ont. Dept. Mines, 1924, pp. 229–31.

GENERAL GEOLOGY

The mapping, on which this report and the relevant part of the accompanying map (No. 1956-4, in map case) are based, was carried out during the field season of 1948. Pace-and-compass traverses were made at intervals of a quarter of a mile. A compilation of parts of the Clyde, Renfrew, and Carleton Place topographic sheets was used as base map, and Royal Canadian Air Force vertical air photographs served to provide topographic control.

The consolidated rocks underlying the area under consideration are of Precambrian age.

TABLE OF FORMATIONS

CENOZOIC	
PLEISTOCENE	Sand, gravel, boulders.
	Unconformity
PRECAMBRIAN	
INTRUSIVES	Granite, granite-gneiss, granite pegmatite. Diorite, amphibolite, or hornblende rock.
SEDIMENTS	Crystalline limestone including dolomite. Biotite schist, hornblende schist, chlorite schist, sericite schist. Biotite gneiss, hornblende-biotite gneiss.

Sediments

Metamorphosed sediments underlie the largest part of the area. They may be divided into two groups: (1) argillaceous (schists and paragneiss) and, (2) calcareous (limestone and dolomite).

Schists

The schists form a broad belt striking about northeast across the northwestern part of the map area. From this, a small belt has the appearance of having been split by the granite-diorite intrusive complex to the northwest of Brightside. The rocks are, for the most part, dark-brown to grey biotite schists strongly foliated. Locally, however, they may show change, particularly in the vicinity of the intrusive complex mentioned above, where they present a baked appearance, with a tendency for the schistosity to be lost, becoming more like a hornfels in hand specimen. In addition, the dominant ferromagnesian mineral is hornblende as distinct from the biotite of the less highly altered rock. These effects may be readily seen along the access road of the Ontario Hydro-Electric Power Commission transmission line south of Raycroft Lake, and along the Lanark-Calabogie road in lots 19 and 20, concession IV, Darling township. In the latter locality it was difficult in the field to distinguish between the recrystallized schist and a fine-grained phase of the diorite amphibolite. In Lavant township, just north of Clyde Forks, a small patch of schist, consisting almost entirely of white mica, was encountered in a roadside rock-cut. Some of the rocks mapped as hornblende schist may represent highly metamorphosed lava. No pillows or other lava-flow structures were positively identified in the field. Therefore any such possible altered flows are included under the general heading of sediments, and no attempt was made to incorporate them in a distinct division of the rocks.

Gneisses

North of Joe Lake, and extending to the Darling-Lavant boundary, the schists give way to an oval-shaped body of gneiss. This is a bright-pink, rather fine-grained rock with a definite lineation parallel to the strike of the surrounding schists. The contact with the schists is nowhere sharp, being gradational. This, together with the general similarity of the two rock types, suggests that the gneiss is a baked and injected phase of the schist. No intrusive was found, in the area mapped, that might have contributed to the conversion of the schist to gneiss.

Pegmatite dike intruding paragneiss near the northeast boundary of Darling township on the hydro-electric power line. It shows typical pinching and swelling.

Along the northeast boundary of Darling township from Lowney Lake to the Indian River the schists again give way to gneisses. Here the gneiss is mostly pink, sometimes grey, and of a somewhat coarser grain than the exposures in Lavant. Here again the contact is gradational and is marked by the gradual lightening in colour of the schists and the appearance of pink feldspar accompanied by a coarsening in grain size. The gneiss is not completely homogeneous, ranging from a coarse pink variety to a fine-grained grey rock, closely approaching the typical schist in appearance. The dominant dark mineral is biotite with occasionally subsidiary hornblende. In a few places large "augen" of garnet mixed with epidote were encountered, though in general the rock is not garnetiferous. This area of gneisses is characterized by a network of small pegmatite dikes ranging from a few inches to a maximum of about 15 feet in width. It seems obvious that these pegmatites are responsible for the migmatization of the schists and the production from them of the various phases of gneiss. Study of thin sections made of a suite taken across the contact between the gneiss and schist reveals that the original hornblende schist, which consists essentially of about 75 percent hornblende with minor amounts of quartz and plagioclase, gives

way gradually to a gneiss consisting mainly of orthoclase, sodic plagioclase, quartz, and biotite. All intermediate stages between the two are seen, biotite appears at the expense of hornblende, and the proportion of alkali feldspar and quartz increases greatly.

Limestones

The calcareous sediments in the area mapped form two large bodies separated by the belt of schists described above, with, in addition, numerous small lenses scattered throughout the schists and intrusives. The strike follows closely the strike of the schists and the intrusive contact.

They are the typical Grenville marbles or crystalline limestones, coarse-grained and somewhat friable on the surface, usually of a light-grey or white colour. In most of the exposures seen they present a banded or striped appearance with parallel bands of light or dark grey. In some places, however, the limestone is very fine-grained and dense, usually cream or yellow in colour, but sometimes dark-grey. These finer-grained varieties seem to be more dolomitic than the rest, but since there can be all possible degrees of dolomitization from pure limestone to pure dolomite, no systematic check was made of the composition of the rock being mapped. The fine-grained, more dolomitic varieties seem to be associated with the intrusives, and typical examples may be seen south of Joe Lake in Lavant township and in the vicinity of the hematite deposits east of White Lake.

Local variations in the limestone include the formation of calcium silicates and calcium magnesium silicates around acid intrusive bodies. At Marble Bluff on the Lanark-Calabogie road, such a contact has resulted in a serpentine marble.

East of White Lake a number of small deposits of hematite have been formed in dolomitic limestone closely associated with pegmatite or quartz dikes. The host rock has been brecciated to a certain extent, and for some distance on either side of the deposit it contains small cavities filled with hematite.

Granite-Diorite Intrusives

Cutting the sediments described above are a number of intrusive bodies acid to intermediate in composition. Two small bodies of diorite intruding the limestones are to be seen on the Tatlock-Clayton road near Tatlock in Darling township. The rock is dark in colour, mostly coarsely crystalline and carries, in a few places, large nodules of red garnet. It varies considerably in grain size. Although the rock seems to be more or less homogeneous in composition, patches of much coarser grain appear throughout the medium-grained phases.

Between White and Darling Long lakes, just south of Darling Long Lake, and on the Darling-Lavant boundary, are to be found intrusives of a somewhat complex nature. They appear to be made up of cores of granite surrounded by diorites of hybrid origin into which they grade sometimes imperceptibly. The largest of these bodies spanning the Darling-Lavant boundary has a core of pink biotite granite having the composition (determined from thin section study) as follows:

	Percent
Quartz	43
Orthoclase (perthitic)	28
Oligoclase ($Ab_{88}An_{12}$)	19
Biotite	4
Sericite, Epidote, Magnetite	small amounts

This is in a W-shaped band following a ridge of high ground from west of Marble Bluff, by way of Gordon Rapids, to Lammermoor in Dalhousie township. Outward from the granite the rock becomes progressively less silicic, the orthoclase and quartz diminish in percentage, the plagioclase becomes more calcic, and hornblende makes its appearance, the rock assuming the composition of a granodiorite. In the field this is marked by the gradual change in colour from pink to grey. However some pink feldspar can still be detected in hand specimens. Still farther from the granite the composition shows a considerable drop in the percentage of potash feldspar, a change in the plagioclase to one of intermediate composition, and a considerable increase in the amount of hornblende.

These effects are illustrated by study of thin sections of the rock, the granodiorite having approximately the following composition:

	Percent
Oligoclase (Ab_8 An_2)	40
Orthoclase	12
Hornblende	25
Biotite	10
Quartz	5
Magnetite, Apatite	minor amounts

This grades into quartz-diorite or tonalite, having the composition:

	Percent
Andesine (Ab_{68} An_{32})	40
Hornblende	32
Biotite	8
Quartz	10
Magnetite, Sericite	minor amounts

The diorite, into which the above grades, is typical for the whole area and has the composition:

	Percent
Andesine (Ab_{60} An_{40})	40
Hornblende	50
Quartz, Orthoclase, Sericite, Epidote, Sphene	minor amounts

These changes are gradational in most exposures, but for the purposes of reproduction on a map, an arbitrary contact was chosen to lie between the granodiorite and the quartz-diorite. Hence for the map, granite and granodiorite are classed together as granite and shown as a single colour. The diorite is highly variable in nature both in composition and grain size. There are patches where the rock seems to consist entirely of hornblende crystals. This is especially true around the edges of the complex where it also frequently contains much disseminated magnetite. The most noticeable character of the diorite, however, is its great variability of grain size, the hornblende crystals ranging from 1 millimetre to 5 centimetres long. Frequently also both extremes are found in the same outcrop within a few feet of each other.

The similarity in the petrology between the granite core and the diorite phases of the complex and the gradational nature of the transition between the

two, and the fact that they are intrusive into crystalline limestone, suggests a syntectic origin for the diorite. It seems likely that, in the process of intrusion, the granite assimilated a quantity of the limestone, becoming desilicated in the process. There is little evidence in the limestone of silicification round the contact, other than the production, in a few places, of tremolite and actinolite immediately adjacent to the contact. This might be attributed to the almost fugitive nature of limestone under stress, and it is probable that it has flowed and recrystallized subsequent to the intrusion. The diorite immediately in contact with limestone, however, is almost invariably much darker and seems to consist largely of hornblende with such lime silicates as epidote and scapolite.

The two smaller complexes south of White Lake are similar to that just described, being much smaller in area and having proportionately smaller granite cores.

On the northwest shore of White Lake granite gneiss was encountered, part of a large body lying to the north in Bagot township. This rock is of the composition of biotite granite, light-pink in colour and showing pronounced gneissic banding. It is distinguished from the gneisses to the southeast on the Darling-Pakenham boundary by being much coarser and more even-grained and by the absence of schist inclusions and lack of the network of pegmatite dikes, which characterized the latter area. The strike of the banding in the gneiss was found to be conformable with that of the limestones on the islands and on the other side of the lake.

Pegmatite Dikes and Quartz Veins

Numerous pegmatite dikes were encountered in the area mostly cutting the gneisses southeast of White Lake on the Darling-Pakenham boundary. They are in general too small to be reproduced on the map and only those over 10 feet wide are mapped as such.

The pegmatites are all simple in nature, composed essentially of quartz and microcline feldspar with minor amounts of tourmaline and occasionally a little specular hematite. None of the dikes examined contain any of the rare-element minerals. Where the dikes cut the crystalline limestone the latter shows evidence of silicification usually with the production of lime silicates such as tremolite. In Darling township, in lot 9, concession VIII, a small deposit of graphite appears in limestone near the contact with the largest pegmatite dike mapped in the area, and seems to be of the same mode of origin as that at the Black Donald mine in Brougham township to the north.

On lot 5, concession IV, Darling township, a quartz-tourmaline vein carrying much pyrite was at one time mined for pyrite. No outcrop of this dike was seen, only material on the mine dump being examined. The tourmaline is of an unusual light-buff or brown colour.

Pleistocene and Recent Sediments

Considerable evidence of glaciation was seen throughout the area, both in the rounded appearance of the outcrops (*roches moutonnées*) and in the appearance of very large erratics. Fine kame deposits were seen near Tatlock and White. Good glacial striae were seen on outcrops along the road from Gordon Rapids to Poland, indicating ice movement in a north-south direction.

STRUCTURAL GEOLOGY

Folding

The rocks of sedimentary origin in Darling and Lavant townships all exhibit the effects of severe folding and shearing. They lie in an area where dynamic and regional metamorphism has been particularly intense, and they have been more or less completely recrystallized.

The general strike of the foliation is approximately north-south, but this is modified to a large extent by the intrusive bodies, particularly in the case of the complex on the Darling-Lavant boundary. Here the limestones and schists have been squeezed out by the intrusive and strike parallel to its contact.

Potholes in limestone on the Clyde River southwest of Brightside. The large potholes are about two feet in diameter.

Dragfolding on a large scale is prevalent in the schists, and this shows up in a striking way on the Royal Canadian Air Force vertical air photographs of the area southeast of Brook Lake. Throughout most of the map area a simple explanation of the structure is impossible due to the intense cross-folding, and little can be done to plot anticlinal or synclinal axes. Due to the intense regional metamorphism no indication of the original bedding remains in the argillaceous sediments, and the limestones are so completely recrystallized that strikes and dip determinations may only be made on planes of dusty inclusions within them.

Faulting and Shearing

No faults as such could be positively identified in the field. Due to the highly folded and sheared nature of the rocks prevailing over the whole area it would be extremely difficult to pick out a particular fault zone unless identified by a major topographic feature, or by offset in the contacts between rock types. However the vertical air photographs indicate, by the presence of strong lineaments, the possibility of faulting. The locations of these possible faults are shown

on the geological map (map case). This fault pattern fits to a certain extent that suggested by J. Satterly's report on the Renfrew area, northwest of the present area.[1]

The most pronounced of these faults cuts across the middle of the Darling-Lavant area almost due east and is followed along part of its way by the Indian River for about 6 miles before its entrance into Clayton Lake.

A fault that seems to be the north branch of the Mount St. Patrick fault is offset by a shear lying along the Darling-Bagot boundary and appears again in the long arm of White Lake, known locally as Three Mile Bay. The air photographs show a strong lineament to extend from the east end of the bay and continue into the area of gneisses in Pakenham township.

A major shear zone extending from the east end of White Lake to the Indian River near Madden Lake, cuts the schists near the southwest contact of the gneisses. This shows up as a strong lineament on the air photographs and on the ground is apparent as a fairly pronounced valley. Owing to the filling of drift no samples of gouge or mylonite could be seen, and hence no indication of the direction or type of movement can be obtained.

Pronounced shearing was observed along the limestone schist contact south of Three Mile Bay. Movement seems to have been horizontal, and the shear zone carries minor amounts of hematite.

ECONOMIC GEOLOGY

The area has been very thoroughly prospected, particularly for magnetite and hematite mineralization, the many small showings being described in government publications dating as far back as 1901.

The most thorough report of the iron showings in the area was made by H. Fréchette[2] in 1909. This is quoted fully in the Report of the Ontario Iron Ore Committee, 1923, pp. 229–31. It is interesting to note that Fréchette encountered difficulty in finding many of the showings mentioned in earlier literature. Forty years later the present author encountered the same difficulty. It was frequently difficult even to find local residents who knew the location of some of the deposits, particularly with respect to those lying just northeast of the Lanark-Calabogie road. Much time was spent searching for the showings, but the effects of deadfall and new growth of bush have in most cases obscured them, and it would require more time for closer searching than was available.

Hematite

Lot 26, Concession XI, Darling Township (Fahey or Bell Mine)

The Fahey mine is located . . . about 1,000 feet east of White Lake. The workings consist of a shaft 20 feet deep, and a few trenches, all of which are on a hematite vein. The ore deposit is exposed in one place from wall to wall, showing a width of 15 feet. Both walls are crystalline limestone. A sample from an ore pile gave the following analysis:[3]

	Percent
Iron	34.73
Sulphur	0.054
Phosphorus	0.029
Lime	20.30
Magnesia	3.44
Manganese	0.32
Insoluble	2.44

[1] J. Satterly, *Mineral Occurrences in the Renfrew Area*, Ont. Dept. Mines, Vol. LIII, 1944, pt. 3.

[2] Howells Fréchette, "On a Number of Iron Ore Properties in Northeastern Ontario," *Summary Report of the Mines Branch of the Department of Mines*, Can. Dept. Mines, 1909, pp. 82–85.

[3] *Report of Ontario Iron Ore Committee, 1923*, Ont. Dept. Mines, 1924.

In spite of intensive search it was impossible to find this showing, because of heavy bush and thick cedar swamp. None of the local residents contacted knew of the existence of the workings.

Lot 23, Concession XI, Darling Township

The following is taken from Fréchette:[1]

A pit had been sunk about 7 feet into hematite, at a point where a vein has been enlarged by the crossing of another small vein. The body at this point is about 30 by 35 feet. The vein itself is only 2 feet wide.

An average sample gives the following analysis:

	Percent
Iron	62.52
Phosphorus	0.44
Sulphur	0.004
Insoluble	3.20

A small amount of stripping has recently been done on this showing, but most of the body described by Fréchette is covered by thick cedar swamp. The vein in the largest of the prospect pits measured between 6 and 8 feet wide. The hematite is dense and blue, and selected samples, submitted to the Provincial Assay Office, gave the following analysis:

	Percent
Iron	62.29
Manganese	0.25
Titanium	0.08
Sulphur	nil
Silica	0.09
Phosphorus	0.10

The vein seems to strike about N.35°E., being picked up at a number of places for about 1,500 feet to the northeast. The wall rock is fine-grained ocherous crystalline limestone, which for about 60 feet on either side of the vein contains small disseminated pods of hematite. No positive source of origin for the hematite can be suggested, but at most of the exposures the limestone close to the hematite is cut by a hematite-rich quartz vein. The following is taken from Fréchette:[2]

Following in a direction S.35° W. small veins of hematite are found at several points for a distance of 1,400 feet, and also along the same line on the opposite side of a small bay of White Lake. A sample taken from a 2-foot vein at this point gives the following analysis:

	Percent
Iron	60.10
Phosphorus	0.127
Sulphur	0.035
Insoluble	9.51

To the south of a small bay on White Lake, known as Pickerel Bay, disseminated hematite in small pods throughout crystalline limestone was seen in association with a quartz vein. None of the ore seen by Fréchette was encountered, most of the material found being very high in silica. This showing appears to be on the strike of the vein in the last mentioned deposit, and it seems that the hematite-bearing zone follows the general strike of the limestone in this area.

A number of small veinlets, most of them quartzose, cutting the limestones east of White Lake, were seen carrying minor amounts of both earthy, red hematite, and specularite. It would seem, therefore, that thorough prospecting of the area might uncover a worthwhile deposit. This would be hampered by the swampy nature of the country and the thick cedar growth in places.

[1] Howells Fréchette, *op. cit.*
[2] *Ibid.*

In lot 21, concession IX, south of Three Mile Bay on White Lake a small zone of hematite about 2 inches wide lies in the sheared contact between the limestones and schists. This is exposed in the banks of a creek, but owing to the overburden, it was not found possible to follow it along strike.

Magnetite

The diorite of the complex intrusive lying on the Darling-Lavant boundary frequently carries disseminated magnetite with numerous small concentrations, particularly at the contact with the schists. Most of these have been prospected, and some have been worked. The principal of these is the Yuill mine in Darling township. The report of the Iron Ore Committee[1] gives the following description:

Yuill Mine—The Yuill mine is located on lot 25, concession V. The workings consist of an open pit, 100 feet long, 30–40 feet wide, and a little over 70 feet deep. At the east end of the pit the magnetite band is 6 feet wide, and at the west end it is 10 feet wide. The ore dips steeply to the south, having a foot-wall of diorite and schist and a hanging wall of crystalline limestone. Small veins of pyrite occur in the ore. A sample of ore exposed in the workings and on the dumps gave the following analysis:

	Percent
Iron	63.00
Sulphur	0.006
Phosphorus	0.025
Insoluble	10.08

This deposit does not seem to extend far beyond the limits of the open pit since it did not appear anywhere along strike, nor was there much effect on a Brunton compass around the pit. The pit was full of water and was well overgrown with bush when visited. The ore was not seen in place. Selected samples from the ore dump submitted to the Provincial Assay Office gave the following analysis:

	Percent
Iron	64.08
Manganese	0.23
Titanium	0.10
Sulphur	0.05
Silica	1.87
Phosphorus	0.02

A few hundred tons of ore still remain on the dump and appear to have been mined but not shipped. The following is taken from the Ontario Iron Ore Committee's report:[2]

Lot 20, Concession IV, and Lot 20, Concession V.—The amphibolite rocks are impregnated with magnetite. The magnetometer survey shows the impregnations to be very irregular. The deposits are not considered to be of economic importance. A surface sample gave the following analysis:

	Percent
Iron	24.21
Sulphur	0.031
Phosphorus	0.468
Insoluble	53.00

Lot 22, Concession IV.—Several pits have been opened on small pockets of magnetite, and some shipments of ore have been made, but judging from the magnetometric readings, these deposits cannot be considered of any importance.

Lot 22, Concession V.—A pit has been sunk about 20 feet into a small pocket of fine-grained magnetite. A picked sample of the magnetite gave the following analysis:

	Percent
Iron	61.17
Sulphur	0.042
Phosphorus	0.046
Insoluble	8.34

[1] *Report of the Ontario Iron Ore Committee, 1923*, Ont. Dept. Mines, 1924, p. 230.
[2] *Ibid.*

The locations of these showings were visited, but in most cases the pits had disappeared. In the pits that were found the diorite carried much disseminated magnetite although not of ore grade. Disseminated magnetite was encountered throughout the area of these lots, good octahedral crystals being obtained in a few places, but at no time was a concentration of magnetite encountered sufficient to affect a Brunton compass.

Main shaft of Radenhurst and Caldwell mine, showing the state at the present time, typical of the abandoned properties in the area.

Lots 21 and 22, Concession III, and Lot 17, Concession II, Darling Township

Here again, as in the last instance, a number of small pits were put down about 60 years ago in local concentrations of magnetite in the diorite. These have long since caved in, but the rocks show strong magnetic effects in places, particularly on the slope of the high ground along the road that runs southwest from White.

A few outcrops of fine-grained limestone south of this high ground carry a small amount of disseminated hematite.

Lot 11, Concession I, Lavant Township

A small pit, about 10 by 10 by 6 feet deep, has been put down on a concentration of magnetite in the diorite. The rock shows a strong magnetic effect over

an area of about two acres. Selected samples picked up in the pit and submitted to the Provincial Assay Office gave the following analysis:

	Percent
Iron	65.07
Manganese	0.23
Titanium	0.14
Sulphur	1.84
Silica	0.17
Phosphorus	0.02

Lot 22 (west half), Concession III, and Lot 22 (east half), Concession IV, Lavant Township, (Radenhurst and Caldwell Mine)

This property was opened up many years ago by a number of pits and strippings spread over a distance of 1,500 feet in a general east-northeast direction. The main pits are now partially caved and overgrown by bush. The country rock consists of rusty schists and gneisses that dip 60°–70°S. No limestone is visible in the immediate vicinity of the workings. Magnetite, associated with pyrite and silicates, was seen on the dump.

The ore was reported to occur as small seams and ribs of magnetite, associated with chlorite and rusty schistose rocks.[1] The ribs and seams are generally parallel to the strike of the enclosing rocks.

A full description of this property and of the Yuill mine made at or about the time they were being worked is given by E. D. Ingall.[2]

A program of exploration by diamond-drilling was carried out on the property in 1942 by Frobisher Exploration Company, Limited. The results of this investigation are set forth in the following excerpts from one of the Company's Summary reports:

> Investigation by Frobisher indicated the presence of four separate zones, referred to as A, B, C, and D. The most persistent, zone A, was tested by 14 shallow drill holes at 150-foot intervals. These indicated a length of 2,000 feet with an average normal width of 31.3 feet and an average dip of 70 degrees to the south. Calculations showed that a tonnage of 6,500 tons per slope-foot was indicated, which would grade: Fe (Sol), 32.77 percent; S, 1.64; P, 0.07; and SiO_2, 26.44 percent.
>
> A total of 13 holes were drilled in zones B, C, and D, indicating an aggregate length of 1,650 feet. The magnetite intersections showed a relatively low grade, high in silica.

Lot 7, Concession V, Darling Township

On top of a small round hill, similar rustiness was seen in the schists, which had a strong magnetic effect over an area of about 2 acres. Here the rock is exposed on the side of a hill, but little mineralization other than pyrite was seen.

Pyrite

Lot 5, Concession IV, Darling Township

> Here a mine had been worked some 10 years ago for pyrites.
>
> The vein is almost vertical, about 8 feet wide and running northeast and southwest; the east wall of which is amphibolite, and the west wall crystalline limestone. It was impossible to determine the length of the vein without digging deep trenches. A tunnel runs along the vein for about 100 feet.[3]

At the present time the workings have caved in, and the only indication of the nature of the deposit is to be found on the dump. No outcrop of the vein

[1] *Report of the Ontario Iron Ore Committee*, 1923, Ont. Dept. Mines, p. 229.

[2] Elfric Drew Ingall, "Report on the Iron Ore Deposits along the Kingston and Pembroke railway in Eastern Ontario," *Annual Report*, Geol. Surv. Can., Vol. XII (new series), 1899, pt. i (1901).

[3] Howells Fréchette, *op. cit.*, p. 87.

was seen. The vein material seems to be massive white quartz carrying a large amount of pyrite together with tourmaline of a peculiar light-brown colour.

Graphite

Lot 9, Concession VIII, Darling Township

A small showing of graphite appears in association with a pegmatite dike cutting the crystalline limestone. The graphite, which is massive and not flaky, is exposed for about 30 feet in the edge of a clump of cedars. A small pit has been dug and shows the body to be about 3 feet wide and dipping steeply east. The graphite is much contaminated with calcite although it seems to be relatively free from silicates.

Marble

The crystalline limestone in the area studied is in general too coarsely crystallized for ornamental purposes. In the proximity of an intrusive, however, it has been recrystallized with the development of silicates, as at Marble Bluff on the Lanark-Calabogie road, where a small exposure of serpentinized limestone has been worked for ornamental stone. An open cut about 20 by 120 by 15 feet deep has been made on the side of a hill and the marble taken out by sawing or drilling and blasting. The stone is of a pleasing light-green and white mottled appearance. At the time of writing there is a small amount of stone as rough blocks piled both at the quarry and at the end of the railway spur at Clyde Forks.

RECOMMENDATIONS FOR FUTURE WORK

In view of the fact that the area has in the past been so thoroughly prospected there is little likelihood that further prospecting will uncover a completely new deposit. However it is well to bear in mind that the iron showings, which in the past have been worked to a greater or less extent, shut down about 1900, doubtlessly due to inability to compete with Lake Superior iron ores. If at any time in the future there is a great demand for iron ore, then some of the old properties might be worked with profit. It is very unlikely that any of the deposits are large, and mining should be undertaken with this in view. Modern geophysical prospecting should prove invaluable in outlining the deposits, particularly those of magnetite, and a geomagnetic survey is recommended, before much other work is undertaken. Particular attention should be paid to the contacts of the diorite intrusives with the sediments, especially in the vicinity of off-shoots of the former such as that on which the Yuill mine is situated.

The hematite showings on the shore of White Lake are promising as far as grade of ore is concerned, but considerable stripping will have to be done before a good estimate can be made as to whether the deposits are extensive enough to mine.

The graphite deposit on lot 9, concession VIII, Darling township is of very small extent on the surface, but owing to the fact that it is located a little way from the outcropping of the main pegmatite body, it is possible that considerable surface stripping might show the deposit to be more extensive.

No evidence of lead-zinc mineralization was found, and a small copper showing carrying malachite and azurite located just outside the area mapped, about 1 mile south of Joe Lake, proved to be very small.

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