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GEOLOGICAL REPORT, CLAIM GROUPS 2 AND 3

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FENIMORE IRON MINES, LIMITED

Geological Report

Half Mile to the Inch Mapping

of Claim Groups 2 and 3

New Quebec

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Montreal, Que.
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INTRODUCTION

Introduction

This report is a description of the geology of an area about claim groups 2 and 3, of Fenimore Iron Mines, Limited.

These areas were mapped by a seven man geological party, at a scale of one inch equals half a mile. The occurences of Iron Formation were checked for economic significance.

Location of the Area

The area is located approximately 60 miles west of Fort Chimo on Ungava Bay. It extends from a point six miles south of Leaf Lake, southward a distance of 45 miles, to Strain Lake. The area includes Finger and Bones Lakes. Its width varies from three to eight miles.

The total area mapped was approximately 265 square miles.

Access and Transportation

Planes from the company base at North Ring Lake provided easy access to the area. Transportation by canoe along the map area is feasible, as the rapids are passable with light loads.

Timber

Trees, sufficient for tent poles and fire wood, occur throughout the area, with the exception of the region north of Finger Lake. The absolute limit of trees passes through the centre of Finger Lake.

No stands of timber capable of producing merchantable lumber were observed.

Climate

The climate was cool and generally very agreeable for summer work (end of May to first of October).

Method of Work

The rock formations were mapped by traverses across the structure at half mile intervals. The areas of Iron Formation were more extensively mapped, every attempt being made to pick up and investigate all outcrops.

Aerial photographs, at half mile to the inch scale, were used, and on these the outcrops were outlined. Tracings of these showed the geology in detail and topographic details. This method is simple, fast and accurate.

From these tracings, a base map was prepared.

GENERAL GEOLOGY

General

All the rock formations exposed within the map area are of Precambrian age. Generally they show a strong resemblance to the formations exposed further south in the Labrador Trough, notably on the property of the Iron Ore Company of Canada.

As in the south, the formations consist of a sedimentary series of Upper Precambrian age, tying between gneisses to the westward and basic igneous rock to the eastward. Within this sedimentary series are found the iron bearing series of the Labrador Trough.

Surface Features

The area of sedimentary rocks is characteristically one of gentle slopes to the east, with steeper or cliff-like western slopes. Difference of relief is usually about 100 feet with 250 feet as a maximum.

The hills and valleys are usually elongated in a north-south direction, dividing the country into fairly pronounced and continuous ridges and valleys.

To the west, in the area of diorites and volcanics, this ridge and valley topography is even more strikingly developed.

Throughout these areas, the streams and rivers flow northwards and are presently downcutting through fairly thick gravel deposits.

The ridge tops generally are lacking any gravel or sand deposits, and thus yield good outcrops.

GEOLOGICAL FORMATIONS

TABLE OF FORMATIONS

Quaternary	Recent	Sand, Gravel & silt
	Pleistocene	Till & gravel
	U N C O N F O R M I T Y	
Precambrian	Chimo Series	Lavas, (massive & pillow) tuffs, agglomerates & greenstones, diorites & metadiorites
	Shales & Schists	Argillite, shales, slates Chloritic schists, black shales
	Abner Dolomite (Upper Dolomite)	Buff to light grey, dolomite, limestone, sandy dolomite 0 - 400 ?
	Chloack Formation	Sandstone, arkose, Conglomerate & grits Shales
	D I S C O N F O R M I T Y	
	Fenimore Iron Formation	Iron Formation Conglomerate Spotted Silica, I.F. 30 Carbonate, I.F. Granular Silica, I.F. 35 Finely Bedded Chert, I.F. 20-40' Metalic, I.F. 20-50' Thin Bedded Jasper or Chert, IF. 150' ?
	Alison Quartzite	Black quartzite Grey quartzite light green quartzite
	Lower Dolomite	Green dolomite
	U N C O N F O R M I T Y	
	Gneiss	Quartz biotite schists Migmatite Granitic gneisses Granites

Granite Gneiss

The older gneissic formations which form the western border of the Trough are more or less granitic in composition. In many places true granite and pegmatites are found.

West of Strain Lake, the rocks mapped as gneisses are mainly quartz-biotite schists, magmatites and granites.

Elsewhere, they are true gneisses and granites.

The composition of the granites is identical to that of the granite pebbles found in the Chioack Formation conglomerates.

Lower Dolomite

Only two outcrops of this formation were observed and these were in the region southwest of Strain Lake.

These are light green, fine grain, soft dolomitic rock, with no quartz veins or other secondary quartz, as is found in every case in the Abner Dolomite or Upper dolomite.

One of these outcrops, 300 feet west of the south end of Strain Lake, shows a surface of disconformity. Here the dolomite is in contact with an arkose of the Chioack Formation. The surface of the contact is cliff-like, and the arkose contains large blocks of dolomite, of random orientation. The surface is due to erosion of the dolomite, followed by deposition of the Chioack arkose, with no angular discordance.

The dolomite in the above locality is overlain by a chlorite schist, and a vein-like body of brecciated quartz or chert.

Alison Quartzite

The Alison Quartzite makes a good horizon marker as its characteristics are distinctive.

All grains, unless recrystalized, are rounded. They are commonly about 1 mm. in diameter, clear and glassy. The grains are very regular in size; sorting reached a high degree of perfection. All grains are between 1/2 mm. and 1 1/2 mm. in diameter.

In rare cases where the rock has been recrystalized, the grains are about the same size, but they may appear hexagonal shaped, or show a fuzzy grain surface.

The colour of this Quartzite ranges from grey to brown. In the region from Strain to Bones Lakes, the rock is typically grey or grey-blue on fresh surface, and a similar but lighter colour on weathered surface. North of Bones Lake, particularly in the Finger and Irony Lakes area, the Alison Quartzite is brownish on fresh and weathered surface. This is due to some carbonate in the interstices between the grains. In the Strain Lake area, a black quartzite is found at the top of the Alison Quartzite, and also interbedded with the lower-most Iron Formation member. South of Strain Lake, the quartzite is light green in colour.

The material of the grains of the rock is almost 100% quartz. The cement is generally siliceous, but carbonate is often present. The colour of the black quartzite is due to a very thin coating of iron-oxide about the quartz grains.

Fenimore Iron Formation

The iron formations observed in the area are believed to be all part of

the same stratigraphic horizon, i.e., there is only one horizon of Iron Formation in this area.

The Fenimore Iron Formation is composed of definite members, which are generally separable and distict, and may be classified as follows:

4h	-	Iron Formation Conglomerate
4g	-	Spotted Silica Iron Formation
4f	-	Carbonate Iron Formation
4e	-	Granular Silica Iron Formation
4d	-	Finely Bedded Cherty Iron Formation
4c	-	Metalic Iron Formation
4b	-	Thin Bedded Jasper or Cherty Iron Formation

Thin Bedded Jasper or Cherty Iron Formation

This member of the Iron Formation consists of alternate thin layers of chert or jasper, and shaly material. The layers of jasper or chert range up to 1/2 inch in thickness and may be made of one or many thinner beds.

The shaly layers may be rich in hematite, magnetite or an iron carbonate. They may consist of black quartzite.

The characteristic feature of this formation is the thin layers or lenses of jasper, usually separated by shaly layers.

The principal occurance of this member is west of Strain Lake. Here, however, it varies considerably in composition, even though its thin-bedded feature is persistant.

West of the centre of Finger Lake a thin-bedded carbonate member underlines the "Metalic Iron Formation."

Metalic Iron Formation

The Metalic Iron Formation is composed of thin to thick beds of jasper or chert, separated by beds of hematite and magnetite-rich material.

The iron content is usually fairly high, and occurs in the form of oolites or fine to medium sized grains of hematite and magnetite. These grains

may, as in the case of magnetite in the vicinity of Irony Lake, be crystaline.

The remainder of the iron-rich layers is made of chert usually in the form of oolites.

The jasper or chert layers may be from 1/2 inch to 1 foot thick, usually 2 to 6 inches.

West of Strain Lake, this formation has a rather high iron content, either as oolites or, as at the south west of the lake, almost pure magnetite layers. In these areas the chert beds are 1/2 to 1 inch thick.

East of Irony Lake, this formation is composed of thick layers of jasper (slightly granular) with disseminated magnetite in the jasper layers, grading outwards to a very rich thin magnetite layer. The magnetite mainly occurs as euhedral grains. The jasper layers comprise about 75% of the rock by volume and are generally about 6 inches thick.

North of Finger Lake the rock is more massive, with fewer jasper layers. It is a rather massive rock composed of oolites of hematite and chert. The fresh surface is blue-grey, a very "metalic" looking rock.

The Metalic Iron Formation varies from 10 to 50 feet in thickness. Usually it is about 25 to 30 feet thick. It is one of the more persistent members of the Iron Formation series, but it is often missing from outcrops of Iron Formation immediately adjacent to the granite.

Evidence of metamorphism is evident in this member, particularly in the Finger Lake district. Here secondary amphiliole crystals are common. Replacement blebs and large lenses of carbonate material are also present. Crystals of magnetite are feadily observable in the more granular jasper layers. In these cases, the number of grains of magnetite increases towards the edge, until finally they form a layer, very rich in magnetite, between jasper layers.

5%

Of all the members of the Fenimore Iron Formation, the Metalic Iron Formation is probably the most variable in composition and nature. The term is used as a group heading for formations in which the iron oxides, hematite and magnetite are present in considerable quantity. Jasper is usually present, but in a great variety of thickness of layers. Chert is usually present, generally as oolite, intermixed with oolites of magnetite or hematite.

The formation always occurs in the same position in the stratigraphic horizon, and is the one with the interesting, or metalic appearance.

Finely Bedded Chert Iron Formation

North and east of Alison Lake, there is an Iron Formation member consisting of very finely-bedded chert, with sometimes a little hematite.

East of Alison Lake this member overlies the Metalic Iron Formation. Also, in that area, it shows some stringers of "enrichment" type iron. These are thin (1/8 to 4 inches thick) and discontinuous. As the outcrops are on the side of a hill, any large masses of "enrichment" should show up in the gravel, if present. None could be found.

The Finely Bedded Chert member is distinguished by the very finely-bedded chert composing almost 100% of the rock. Hematite, if present, occurs in small quantities in some beds. The chert generally is light grey to white on weathered surface.

The formation in the above area is 20 to 40 feet thick.

Granular Silica Iron Formation

The distinctive feature of this member is its granular or sugary texture. The rock appears to be composed principally of clear, glassy grains of quartz. The grains are less than 2 mm. in diameter.

This formation is principally found near the granite, west of Strain and Teeter Lakes.

It is about 35 feet thick here.

Carbonate Iron Formation

The Carbonate Iron Formation is one of the most important and striking horizons of Iron Formation. It occurs throughout the map areas, but principally in the northern half. The carbonate weathers either dark blue or brown, and can be seen for great distances. It is particularly noticeable from the air.

This member consists of massive fine-grain carbonate with lenses, beds, or nodules of grey-brown chert.

The chert lenses or beds are usually 1 - 6 inches thick, with an average of about 2 inches. The nodules are nearly circular and may be as much as 2-1/2 feet in diameter. A diameter of 16 inches is common. These nodules usually contain a shrinkage pattern of white quartz in their centre.

The Carbonate Iron Formation may, in some places, be subdivided into a sub-member containing lenses or beds of chert and a lower member with nodules of chert. Each is about 12 feet thick. These two sub-members are generally separated by a magnetite-rich member, described in the next section.

As the name implies, the iron in the Carbonate Iron Formation member occurs in the form of an iron carbonate. Some magnetite may be present. The composition of this carbonate is between ankerite and siderite. It is grey or grey-green fine-grain and massive.

The percentage of iron in this member is fairly constant, except that the dark blue weathering part grades upward into a thin chocolate weathering carbonate iron formation, which is poor in iron.

This brown weathering carbonate horizon is usually thin and irregular. It often occurs as lenses between the top of the dark blue weathering Carbonate Iron Formation and Spotted Silica Iron Formation, or as lenses in the "Spotted Silica". The iron content is low, i.e., between 9 and 13 percent, with no manganese present. It may almost be dolomite in composition.

Thus, there are three submembers:

Top:-	Chocolate Weathering Carbonate, I.F.	9-13% Fe
	Dark Blue Weathering Carbonate, I.F. layer chert	27-31% Fe
	Dark Blue Weathering Carbonate, I.F. nodule chert	24-34% Fe

These always appear in the above order. The upper two are generally found but the lower submember only occurs east of Irony Lake.

The colour of the weathered surface is diagnostic of the percentage of iron and manganese present. The Dark Blue Weathering C.I.F. carbonate contains about 35% iron, 2.8% manganese and 3.2% silica (excluding the chert layers). The Chocolate Weathering C.I.F. contains about 10% iron, 1% manganese and 1% silica.

The silica content occurs primarily in the lenses, beds and nodules of chert. These make up 25 to 50 percent of the rock by volume. These chert masses are usually sharply-bordered, structurally competent masses.

Magnetite and Chert Iron Formation

This member occurs in the Irony Lake area and the area west of the West Arm of Finger Lake.

It consists of alternate 3/4 inch thick beds of chert and magnetite-rich material. In some cases the magnetite-rich material may be almost pure magnetite. One grab sample of a 1 inch thick bed of apparently pure magnetite assayed 63.5 iron, 5% manganese and 8.7 silica.

The Magnetite and Chert horizon is usually about 5 feet thick, and is somewhat patchy in its occurrence. It swells (slightly) and pinches along the

strike.

The greatest thickness measured was east of Irony Lake where it was 15 feet thick in one place, however, it had considerable carbonate intermixed with it. It assayed 46% iron, 0.7 % manganese and 32% silica across the 15 foot width.

Another chip sample across a 10 foot thickness gave: 40% iron, 0.3% manganese and 40% silica. A sample across a 5 foot thickness gave 49% iron, 1.5% manganese and 23% silica.

The silica content is principally confined to the beds of chert. In many cases these are well-defined and distinct units, separate from the magnetite-rich part, while in other cases the chert layers have more gradational boundaries, and appear to be not so structurally well-defined.

Spotted Silica Iron Formation

Spotted Silica Iron Formation is the uppermost member of the Iron Formation series.

It consists of a cherty material with scattered spots of limonite or carbonate. The rock is probably about 90% silica. This cherty material may be massive, dense and very, very fine grain, as in typical chert, but most commonly it consists of granular fine grains of silica. Its colour is light grey.

The Limonite coloured spots on the weathered surface make this rock distinctive. It serves as a good horizon marker. In some cases it contains lenses of brown weathering carbonate.

It seems to be about 30 feet thick where exposed.

Iron Formation Conglomerate

West of Strain Lake there occurs a conglomerate composed entirely of Iron Formation debris. For this reason it is included within the Iron Formation, although it represents erosion of the Iron Formation at or near the end of its deposition.

This conglomerate consists of rounded to angular fragments of Iron Formation in a matrix of finer fragments. The larger fragments are generally 6 inches to 18 inches in diameter.

All fragments are coated with a thin coat of red iron oxide giving a striking appearance to the rock. Actually, the fragments are mainly jasper and chert, and the iron content is probably lower than the Iron Formation as a whole.

Some chunks, 1/2 inch in diameter, of massive hematite were observed, but there were no indications of any economic significance.

The rock is generally very fresh and shows little sign of chemical breakdown either recently or during past geological ages.

It appears to be a beach type of conglomerate which formed at the base of Iron Formation cliffs.

GENERAL

General

The members described above have distinct lithological characteristics and may be readily recognised in the field. There are many transitional phases but generally the contacts are reasonably well defined.

Some of the members may be traced for a distance of several miles, however, it is equally common to find them pinching or lensing out. The Fenimore Iron Formation may be said to consist of an assemblage of lenses, of reasonably well-defined units, although one or more may be missing in any locality.

Particularly near the granite contact, the Iron Formation seems to be thinner, and only the upper series are found, immediately adjacent to the contact.

The thickness of the formation as a whole, from Strain Lake to Finger Lake, is about 100 feet. North of Finger Lake the formation seems to be thickening. In one case in this areas it was about 150 feet thick.

Chioack Formation

The Chioack Formation overlies the Iron Formation, and in most cases the contact appears to be conformable; however, in many cases a surface of erosion is seen to separate the two formations. This period of erosion appears to have been of some consequence since, in several cases, the Iron Formation has been entirely removed. In one case, already mentioned, the Chioack Formation is in contact with the Lower Dolomite. West of the East Arm of Finger Lake is the only area where there is any angular discordance between the lower formation and the Chioack.

The Chioack Formation consists of conglomerates, arkoses, sandstones, grits and shales.

West of Strain and Teeter Lakes, conglomerates, arkoses and sandstones make up the main part of the formation. The conglomerate consists of boulders, cobbles, pebbles and granule size fragments of Iron Formation (mainly jasper and chert), granite, pegmatite, vein quartz, diorite, quartzits and sandstone, in a buff or red sandstone or arkosic matrix.

Interbedded with the conglomerates are beds of sandstone and arkose. These are buff, red or grey in colour. The sandstones are rather well lithified, although fracture takes place around the grain.

West of Strain Lake the section is as follows:

Upper Dolomite
Red sandstone
Red conglomerate
Red Sandstone
Buff arkosic conglomerate
Buff sandstone
Iron Formation

These are not definite horizons, but a series of interbedded lenses, with one type predominating, as shown above. The thickest bed of conglomerate is 20 feet. Usually, where the conglomerate occurs, it consists of alternate 3 foot thick beds of sandstone and conglomerate.

West of the south end of Strain Lake, the formation consists almost entirely of sandstones and granule conglomerates or grits.

West of Bones Lake, it is composed principally of shales or very fine grain sandstones. These are dark grey on fresh surface, and have a brownish tint on the weathered surface. Lenses of sandstone are common.

West of Chioack Lake, the rock consists of a lower dark grey shale (about 80 feet thick) and an upper blue grey grit or granule conglomerate, or feldspathic quartzite (also about 80 feet thick). The upper member is massive, solid rock, breaking in large blocks, and would be very good building stone.

The areas mapped as shales in the vicinity of the East Arm of Finger Lake, may all belong to the same horizon, even though some have been included in the Chioack and others in the Shales and Schists. In the Bones Lake area these two rock types are separated by the Abner Dolomite, but northwards the dolomite seems to peter out and the Chioack Formation probably grades into the Shales and Schists.

Throughout the Chioack Formation the grains composing the rock are very fresh, showing only grinding and mechanical fracture. The only sign of chemical weathering is some reduction in the iron content of the Iron Formation fragments in the conglomerate. The granitic arkoses are remarkably fresh.

Abner Dolomite (Upper Dolomite)

The Abner Dolomite is a light grey or buff weathering dolomite. Quartz stringers and disseminated secondary quartz are always present. These

features are characteristic.

The colour of the fresh surface is light grey to white.

Generally the rock is massive and the bedding planes are difficult to determine. Impure sandy layers are common in some localities, usually in the upper or lower horizons.

The secondary quartz distributed throughout the rock, results in a rough, sharp, weathered surface. Quartz stringers are a persistent feature of this rock.

The formation south of Bones Lake is probably 200 to 500 feet thick, and seems to thin out towards the north.

East of Finger Lake this horizon may not exist at all. Northeast of the lake the upper contact is gradational, that is, it consists of a series of interbedded layers of dolomite and shaly material.

Shales and Schists

Overlying the Abner Dolomite and extending into the area occupied by volcanics and intrusive rocks, are a series of chloritic schists, argillites, grey shales, black schists and dolomitic shales.

Everything stratigraphically higher than the Abner Dolomite, and not an igneous rock, has been grouped into this section.

East of Strain Lake, black shales immediately overlie the dolomite which is followed by grey slates and further east dolomitic shales.

East of Teeter Lake, black schists with replacement black cherts occur above the Abner Dolomite, and these in turn are overlain by grey shales.

East of Ali and Laura Lakes, chloritic schists occur, these continue to the north end of the map area. In these, schistosity is highly developed and bedding planes can rarely be determined.

These chloritic schists are seen outcropping in the low lying areas, well into the areas of volcanic and dioritic intrusives.

Chimo Series

The Chimo Series of volcanic and intrusive rocks occupies the eastern part of the area, and extends many miles further eastwards.

This series consists of diorites, metadiorites and gabbros, mainly in the form of sills, and volcanic rocks of intermediate composition.

The sills have intruded chloritic schists and the volcanic rocks.

The volcanic rocks include: pillow lavas, massive lavas, tuffs and agglomerates. Many of the metadiorites may be thick metamorphosed volcanic flows.

Disseminated sulphides, mainly pyrite, are common in the diorites. Small rust zones are numerous, some more than 1,000 feet long and 100 feet wide, were observed. These consist of scattered outcroppings of rusty, rotten rock, with or without pyrite and pyrrhotite. There were no indications of any economic significance.

An 80 foot thick mineralized zone, exposed on a cliff, two and a quarter miles east of Laura Lake, showed pyrite, some pyrrhotite, considerable secondary quartz, and a large thickness of iron carbonate. Samples were sent for assay but the results were not returned, however. There did not appear to be anything of interest.

STRUCTURE

The map area consists of a sedimentary series, bounded on the west by granites and gneisses and on the east by a volcanic intrusive rock series.

Between those igneous rock borders, the structural trend of the sediments is almost north-south. The dips are generally 15° - 45° eastward.

Adjacent to the gneisses, the dips are particularly gentle, i.e. 10°- 20° E.

Eastward and into the diorites the dips are 35° - 45° E. and, therefore, still relatively gentle. One exception is the overturned formation west of the East Arm of Finger Lake.

The central area of sediments features broad open folds, structural terraces, or homoclinal dips to the east.

Faults, producing a displacement of any consequence in these formations, are rare. The only exceptions observed are the eastward projection of the granite contact, which are the result of faulting.

The centre of Finger Lake shows this feature. Here, there is a shear zone striking N 70°E and dipping north at 80°N along the contact between the eastward projection of the granite and the younger sediments.

The projection of the granite contact west of Strain Lake also appears to be due to faulting.

It is possible that the considerable indicated thickness of Chicack Formation west of Strain and Teeter Lakes, is due to repitition of the same horizon by faulting.

The map areas have not been highly deformed, as the geological structures are relatively simple. Thus there are large areas of almost undisturbed formations. This is particularly true in the case of the Iron Formation. The large Iron Formation outcrops show continuous uniform geological structure. The outcrops are often cliff-like, the exposures are good, and details of the rock are readily available.

These features have simplified and verified the occurance of the disconformity at the top of the Iron Formation. Evidence of this has already been cited in the section: "Lower Dolomite".

Further evidence occurs west of Strain Lake. The Iron Formation conglomerate indicates erosion before Chicack deposition. South west of the south

end of Strain Lake, a Chioack sandstone occurs, abutting against Iron Formation of two different horizons. That is, the bedding planes of both formations are parallel and one runs into the other. This indicates erosion of the Iron Formation and deposition of the sandstone around the old outcrop of the Iron Formation.

In other places the Iron Formation has been completely removed before deposition of the Chioack as there is no room for the Iron Formation between the Chioack and the Underlying Alison Quartzite.

Thus, erosion of the Iron Formation before deposition of the next sedimentary member is established.

The economic importance of this feature is that the Iron Formation does not occur everywhere as a constant thickness in the sedimentary series. In places it is missing entirely. Thus it is not logical to project this formation under other members for any great distance. In the case of the Strain Lake area the Iron Formation exposed is probably a large percentage of that present.

ECONOMIC GEOLOGY

The summer's work was to locate and examine the outcrops of Iron Formation. Considerable effort was made to determine the stratigraphic position and structural details of this formation. It was felt that these were important points, if all areas favourable to the occurrance of Iron Formation were to be thoroughly investigated.

The writer feels that all outcrops of any consequence have been located, and all brands of Iron Formation delineated.

Concerning enrichment, only two unimportant occurances were observed. One was west of the centre of Strain Lake on the side of a steep hill. In this

place stringers or bands of "enrichment" type of iron from 1/4 to 5 inches thick were noted. These were local and soon petered out. As the outcrops were on the side of a hill, it is felt that if there had been any indication of further importance they would have been noticed. Frost very effectively breaks up this "enrichment" type of rock and distributes it through the gravels, producing a pronounced red colour. The formation in which this occured was very siliceous and iron-poor.

The other occurance suggesting the possibility of enrichment of iron content of the rock was southeast of Irony Lake. This was of no consequence, and meraly evidence of leaching of silica from the rock.

The note-worthy feature of these two cases is that they are the only occurances observed after a thorough study of such a large area. This strongly suggests that enrichment is a feature of little importance in these areas.

The thickness of Iron Formation between Finger and Strain Lakes is about 80 - 100 feet. This includes the Spotted Silica member which is about 30 feet thick and contains little, if any, iron. All iron ore bodies within the Labrador Trough have been found in the Iron Formation, thus in this area there is only a thin layer available for such bodies.

Another feature pertaining to the location of iron ore is structure. The formations within the map areas are only very slightly folded and faulted, with only one exception. There is no "action", as the prospectors say. Folding and faulting are relatively conspicuous by their absence.

The lack of significant or even frequent occurance of "enrichment", the thinness of the Iron Formation and the relatively undisturbed nature of the formations, strongly suggest that the occurance of "direct shipping" iron ore is highly improbable.

The next point worthy of consideration is benification. Will any of the

members lend themselves, economically, to this process ? With this point in mind the Iron Formation in each of the main localities is described in a general way in the following sections:

Iron Formation West of the South End of Strain Lake

The group of outcrops in this area expose the lower members of the Iron Formation. They include:

Carbonate I. F.	thin
Finely Bedded Chert I.F.	15 ft. thick
Metalic I.F. beds, jasper or chert	15-20 ft. thick
Thin Bedded Chert I.F.	15 ft thick

The iron content of the Metalic Iron Formation is probably about 40 per cent, though no assays were made. It consists of material rich in hematite and magnetite, with beds of jasper or chert. These chert or jasper beds are 1/2 - 1 inch thick, with sharply defined contacts.

This area might be worth further study from a benification point of view but it is felt that these outcrops are the only remnants of Iron Formation remaining in the area. The rest has probably been removed by erosion before the deposition of the Chioack sandstones.

At any rate, the structure is more irregular than in most localities, and considerable rock stripping would be necessary before any large area of Iron Formation could be found.

Iron Formation West of the Centre of Strain Lake

The sequence here is as follows:

Finely bedded Chert I.F.	25 ft. thick
Metalic I.F. bed chert	15 ft. thick
Thin bedded Chert and Jasper I.F.	20 ft. thick

The Iron content is not notably high in any of these formations. The Metalic Iron Formation member is a hematite magnetite rich rock with beds and lenses of chert, but it is thin and nowhere is it exposed to any degree. The

iron content is probably less than 25 percent.

Iron Formation North of Alison Lake (Map #5)

This area is likewise of no interest economically. It consists of Finely Bedded Chert, and Granular Silica Iron Formation, both of which are very high in silica and low in iron.

Iron Formation Southwest of Dragon Lake, (Map #6)

The formations exposed here are Carbonate Iron Formation, of the dark blue weathering variety. They are small, flat, poor exposures. One chip sample through a 10 foot thickness assayed 22.7 % iron, 1.0 % Manganese and 43.0% silica. (Sample #951).

Iron Formation East of Irony Lake, (Map #6)

This is one of the best exposures of Iron Formation in the district. Here the formations are exposed continuously along the face of a cliff, for a distance of 3 miles. The formations are also exposed to a lesser degree for considerable distance, both northwards and southwards.

The width of this exposed land is between 300 and 1,000 feet.

The thickness of the Iron Formation is about 100 feet. This includes the members shown in Table No. 1, on the following page, and described generally below.

Ferruginous Shale

Ferruginous Shale is a massive shale, rich in carbonate, underlying the Iron Formation proper. At one place, it was interbedded with the Alison Quartzite.

Ferruginous Shale is dark brownish-grey in colour and fine grain. Bedding is raraly evident.

The average iron content, mainly as a result of grab samples, is 27%,

DATA FROM FOUR CHIP SAMPLES ACROSS THE IRON FORMATION EAST OF IRONY LAKE

MEMBER	Thickness			% Iron			% Manganese			% Silica		
	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.
Spotted Silica I.F.			30'	almost nil			almost nil			high		
Dark Blue Weathering Carbonate I. F. Layers chert	15'	3'	10'	30.9	27.2	29.6	2.5	2.0	2.3	32.6	17.5	24.3
Magnetite & Chert I.F.	15'	0	5'	46.0	39.9	43.0	0.6	0.3	0.5	40.6	32.2	36.1
Dark Blue Weathering Carbonate I.F. Nodules chert	17'	0	10'	34.7	24.3	29.1	3.0	0.6	1.8	55.2	31.9	38.0
Thin Bedded Carbonate I.F.	20'	10'	15'	35.4	21.2	31.3	1.8	0.9	1.2	45.3	38.0	41.0
Metalic I.F. Thick beds Jasper	35'	8'	25'	35.9	23.8	28.7	3.4	0.7	1.1	53.1	34.8	45.7
Ferruginous Shale	8'	0	5'	30.7	24.3	27.0	1.3	0.9	1.0	45.5	34.7	41.0
GRAB SAMPLES												
Massive pure carbonate part of Dark Blue Weathering Carbonate I.F.				27.4	27.2	27.3	5.1	3.5	4.2	9.9	3.2	6.2
Nearly pure magnetite layer from magnetite & chert I.F.				63.5		63.5	0.5		0.5	8.7		8.7

the manganese 1% and silica 41%.

The silica probably occurs as a fine-grains, mixed with the carbonate.

Metalic Iron Formation

This is the thickest member and also that highest in silica.

In this locality it consists of thick jaspery layers, separated by magnetite rich material.

The magnetite is found disseminated through the jaspery layers as well as in 1/2 - 1 inch thick magnetite-rich layers between the jasper layers. The desseminated magnetite content of the jasper layers is highest towards the edges of the layers.

The magnetite grains are generally euhedral and about 1 mm. in diameter.

The jaspery layers vary in thickness from 1/2 inch to 18 inches. They are thickest near the bottom and considerably thinner towards the top.

There is often a considerable quantity of iron carbonate irregularly distributed throughout the member.

Thus, the iron content of the Metalic Iron Formation is not in one particular form or in definite distinct layers separated by chert lenses or beds, as is found in the upper members.

Thin Bedded Carbonate Iron Formation

Beneath the main horizon of carbonate iron formation, there occurs a thinly bedded iron carbonate member.

The nature of this member is quite variable. It represents a gradation between the thick bedded jasper "Metalic Iron Formation" and the "Carbonate Iron Formation".

The silica content is contained in thin, indefinite lenses and also disseminated throughout the rock.

Carbonate Iron Formation

The Carbonate Iron Formation may be divided into two submembers, both having a massive, fine grain blue weathering carbonate. The upper member has layers or beds of brownish-grey chert. The lower one had nearly circular nodules of chert. The assay results suggest that there is more disseminated silica in the lower member, as the silica content is higher but that the outcrop appears to contain less chert.

The iron carbonate layers are massive and the only indication of bedding is the layers of chert. Especially in the upper member, these are distinct units with sharp boundaries. It is felt that this structural and chemical difference between the two types of material in this rock would facilitate the separation of these two components.

The rock as a whole contains about 29 percent iron, 2 percent manganese and 11 percent silica. It is probable that the iron content of these results is 2 to 5% high due to secondary enrichment on the surface of the rock chips forming the sample.

One grab sample from a massive pure carbonate layer gave 27.5 percent iron, 4 percent manganese and 6 percent silica. The remaining percentage represents water, CO_2 and other gasses lost after heating the sample.

Magnetite and Chert Iron Formation

Separating the upper and lower horizons of Carbonate Iron Formation is the Magnetite and Chert Iron Formation member which is 5 to 15 feet thick and very rich in magnetite.

It consists of alternate 1/2 to 3 inch thick beds of chert and magnetite. The Magnetite layers are almost pure magnetite in some localities and in others there is a considerable content of iron carbonate. Where the member

is only 5 feet thick, notably west of the West Arm of Finger Lake, the magnetite rich layers are almost pure magnetite. Where the formation is thicker there is considerable iron carbonate mixed with the magnetite.

The chert is mainly confined to distinct lenses and beds.

The average of three chip samples across 10 to 15 foot widths of this formation, where there was a noticeable quantity of iron carbonate, gave 43 percent iron, 0.5 percent manganese and 36.1 percent silica.

A grab sample of a 1 inch thick bed of nearly pure magnetite assayed 63.5 percent iron. 0.5 percent manganese and 8.7 percent silica.

Spotted Silica

This member may be considered as a quartzite. It is about 90 percent silica and has about the consistency of a quartzite. It is highly jointed throughout.

The lower limit of this member, contains lenses of brown weathering carbonate.

The member is 30 to 35 feet thick.

General

The Carbonate Iron Formation and the Magnetite and Chert Iron Formation are those members with the most favourable characteristics for large scale low grade treatment for iron.

Together, these two represent a thickness of about 25 feet. In this area they are overlain by about 30 feet of Spotted Silica Iron Formation and some gravel.

The main exposure of these two members which is 3 1/2 miles long, with a width of 1,000 feet, contains about 45 million tons of these rocks, averaging 32 percent iron and 32 percent silica, with about 1.8 percent manganese.

One mile south of this area there is another area with dark weathering Carbonate Iron Formation exposed on the surface.

To the north on Map No. 7 there is an area of Iron Formation exposed west of the West Arm of Finger Lake. The members exposed are: the Carbonate Iron Formation, the Magnetite and Chert Iron Formation and the Spotted Silica Iron Formation. This area appears to contain about 60 million tons of the Carbonate and Mangetite and Chert Iron Formation members, if the same 25 foot thickness is assumed, (2.75 miles long, 0.3 mile wide).

The exposures in the above area are much poorer, no chip samples across the formation were taken, so the results above are only hypothetical, but they serve to point out the tonnages which might be present with little rock or overburden stripping.

A problem which must be borne in mind when considering these formations is the occurrance of the iron in two forms, siderite (iron carbonate) and magnetite (iron oxide).

In both formations the silica is mainly present in distinct, sharply defined chert layers.

Iron Formation East Arm of Finger Lake

The Iron Formation in this area is exposed discontinuously over an area two miles long and three-quarters of a mile wide. It is about 100 feet thick, and is made up of the following members: (The assay results are from one chip sample).

FORMATION	THICKNESS Max.	Min.	Ave.	PERCENTAGE Iron	Manganese	Silica
Spotted Silica	30	10	25	nil	nil	high
Chocolate weathering Carbonate, I.F.	40	10	25	13.5	0.7	49.1
Dark Blue weathering Carbonate, I.F.	45	5	25	28.5	1.6	32.2
Metalic, I.F.	30	10	20	35.7	0.7	42.3

The Metalic Iron Formation, with chert or jasper beds and lenses, contains hematite and magnetite in variable proportion. The iron oxides occur in the form of oolies or very fine grains, in thin to thick beds; separated by beds of jasper up to 1 foot thick, but usually 1/2 to 3 inches thick. A fiberous amphiliole is also present in the magnetite and hematite-rich layers, as well as chert in the form of oolites or fine grains.

The thickness of the above member is very erratic, its position often being occupied by Dark Blue Weathering Carbonate Iron Formation.

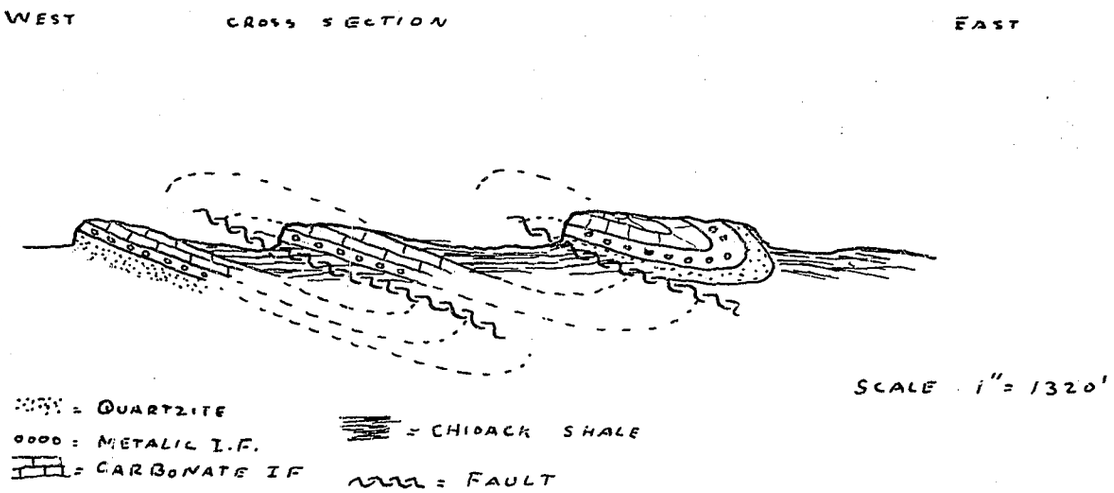
The Dark Blue Weathering Carbonate Iron Formation is of the usual type. It consists of alternate layers of massive iron carbonate and chert. The chert layers are about 2 to 4 inches thick and occupy about 30 to 50 percent of the rock, by volume.

The Chocolate Weathering Carbonate Iron Formation contains relatively little iron, and contains a large proportion of chert layers.

The Spotted Silica is as usual, a very siliceous well-jointed rock, forming the top of the Iron Formation.

The structure in this area is considerably more distorted than in the surrounding districts. The eastern edge of the Iron Formation and Alison Quartzite, is overturned. There is considerable evidence of thrust faulting and cross faults. The Formations are irregularly displaced.

The following is the interpreted structural picture:



It is believed that the northern, eastern and western limits of the Iron Formation are surfaces of unconformity. That is to say, that the Iron Formation was eroded away before deposition of the Chioack shales. It is possible that these limits represent faults but this hypothesis does not find much supporting evidence.

The possible removal of the Iron Formation by erosion, before deposition of the overlying Chioack Formation, makes the eastward, and the northward, prolongation of the Iron Formation unlikely.

In summation, this area does not seem to warrent further attention. The quantity of Iron Formation present is small, and the iron content is not high.

Iron Formation North of Finger Lake

This region contains large, very good exposures of Iron Formation. One outcrop is about three miles long and a thousand feet wide. From outcrops such as this it is possible to obtain a good indication of the type of formation

present, as the rock types are well exposed on clean, fresh surfaces.

The work suggests that the Iron Formation is about 130 to 150 feet thick, which is somewhat thicker than to the south. It appears that the iron content is higher also, particularly in the Metalic Iron.Formation horizon.

Unfortunately, as this region was mapped at the end of the season, the writer had an opportunity to visit only the southernmost outcrop in the area. The remainder of the information was gained from the work of assistants.

This region was actively prospected, for a period of more than one month, by a pair of competent prospectors but no indications of "direct shipping" iron ore were found. Neither did subsequent geological mapping uncover any evidence of this feature.

The structure of the region suggests that there is a large volume of Iron Formation near to the surface.

Another significant feature is that the outcrops of Iron Formation lie in a gravel-filled valley, along which it is only eight miles to the sea.

The formations comprising the Iron Formation in this district, along with the thickness and grade, are given in table 2, on the following page, and described in general terms below.

Metalic Iron Formation

The Metalic Iron Formation is thicker in this area than further to the south. The iron content is higher, and it includes a massive Metalic horizon.

In table 2 the member has been subdivided into four types, to better point out the nature of the material present.

The lowermost horizon is an altered, thick bedded jaspery rock. The jasper beds are about 6 inches to 1 foot thick and somewhat recrystalized, with some carbonate present. The iron content is low.

DATA FROM SIX CHIP SAMPLES - NORTH OF FINGER LAKE

MEMBER	THICKNESS			% IRON			% MANGANESE			% SILICA		
	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.
Spotted Silica						nil			nil			high
Dark blue weathering Carbonate I.F. Layer chert	15	5	12	38.3	15.8	25.8	4.1	0.4	2.3	66.6	27.4	45.7
Metalic I.F.(massive) Layer chert in some cases	35	10	21	48.3	29.6	42.0	5.2	0.5	2.6	48.6	23.4	31.0
Metalic I. F. Shaly	45	0	only important in one outcrop	45.3	26.8	35.0	3.3	0.8	1.5	53.3	37.6	45.6
Metalic I.F. Thick Jasper beds	15	5	7	48.6	28.2	36.0	2.6	0.1	1.4	51.2	25.6	39.1
Metalic I. F. Altered thick Jasper Beds	20	5	10	34.0	21.2	28.0	2.0	0.5	1.3	58.1	42.1	50.9

The Metalic Iron Formation with thick beds of jasper, is a fresher looking rock. The jasper beds are about 3 to 9 inches thick, and there is a noticeable quantity of iron oxides between the jasper beds. The jasper layers are faily sharply defined, distinct units.

The shaly Metalic Iron Formation horizon is principally found in the easternmost outcrop of Iron Formation. It is probably the result of folding and metamorphisms, and might be better termed a schist than a shale, as the structure of this outcrop is considerably more disturbed than is usual. The rock appears to be a fine grained, granular mixture of quartz and hematite, which occurs in shaly layers.

The massive Metalic Iron Formation is the horizon with the highest percentage of iron and the lowest percentage of silica. Essentially, it consists of a massive mixture of oolites of chert and hematite, Thin lenses or beds of chert are present in some localities. This horizon appears in all main outcrops of the Iron Formation in the area.

Carbonate Iron Formation

The Carbonate Iron Formation, though thinner and of less relative importance, is found at all exposures of Iron Formation. It consists of both the chocolate weathering type and the dark blue weathering variety. The latter is found in all localities as a 10 to 12 foot thickness. It is the usual type, consisting of massive iron carbonate with beds and lenses of chert. The chert is often brecciated.

Spotted Silica Iron Formation

The above members are overlain by Spotted Silica Iron Formation similar to that previously described. It is probably 30 to 50 feet thick, though

this figure is not certain.

Overlying the Spotted Silica is found the Chioack shale.

General

To indicate the possible tonnages of the various members of the Iron Formation which are present, calculations, using the following figures, were made:

Length of the main band	3 miles	
Width of the Main band	1200 feet	
Thickness of the massive Metalic I.F.	12 ft. grade	42% Fe
Thickness of the thick bedded Metalic I.F.	7 ft. grade	36% Fe
Thickness of the Carbonate Metalic I.F.	12 ft. grade	26% Fe

No. of tons of I.F. exposed, or nearly so:

Massive Metalic,	23 million	42% Fe
Thick bedded Metalic	13 million	36% Fe
Carbonate	23 million	26% Fe

These estimates are conservative, and do not include the probable large volume of rock lying to the east, under the Chioack shale and the gravels. It is possible that many times the above volume of rock lies between this band of Iron Formation and the easterly large outcrop.

It is estimated that this easterly outcrop of Iron Formation may contain about 50 million tons averaging 37% iron and 42% silica, (1 mile long, 1200 feet wide and 80 feet thick).

There is also the area about the most southerly outcrop of Iron Formation, which should yield a large tonnage also.

While all these figures are approximate, they do serve to point out the large tonnages of high iron content, Iron Formation, which is present close to the surface, and they also suggest the large potential of this area if it were economical to carry on rock stripping, to the east of the large outcrops.

GENERAL

The main occurances of Iron Formation have been described, and the larger, more impressive, outcrops have been sampled. From this information a rough approximation of the amount of Iron Formation at or near the surface, was calculated.

While these figures are only rough approximations, they serve to indicate the large tonnages of Iron Formation, and its grade, which are present.

In the light of this information it seems advisable to determine whether any of these rocks could be treated to produce a product which may be sold at a profit.

This problem is essentially one of separating the silica from the iron content of the rock. It was with this point in mind that each of the occurrances of Iron Formation was described to indicate the nature of the rock present.

More specific and detailed information concerning the nature and amount of Iron Formation available could be relatively easily obtained by detailed mapping followed by a drill program. The excellence of the outcrops and the simplicity of the structure would considerably reduce the expense of obtaining this information.

For a complete list of all samples taken with: Location, rock type, thickness, type of sample and grade, please see an accompanying map.