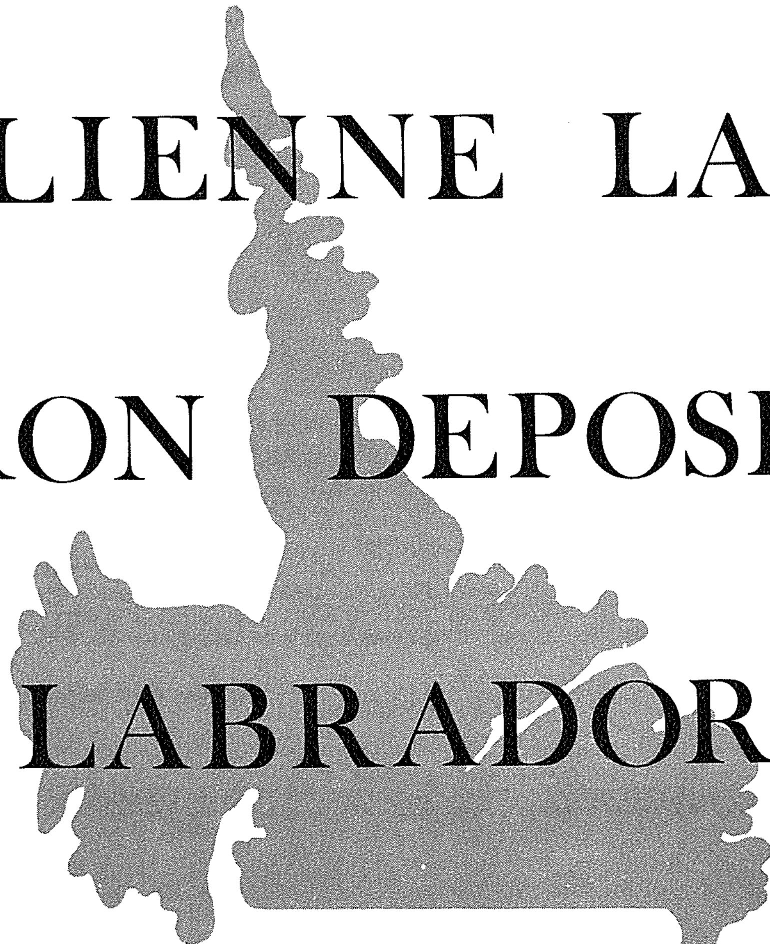
JULIENNE LAKE IRON DEPOSIT LABRADOR

SUMMARY REPORT

DEPARTMENT OF MINES AND ENERGY

PROVINCE OF NEWFOUNDLAND

1975



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SUMMARY

The Julienne Lake iron deposit, potentially a major deposit of iron ore, is located only 13 miles from the well-established iron ore centre of Wabush-Labrador City in Western Labrador.

The deposit consists of a broad belt of iron-formation striking northeasterly across the northern tip of the Julienne Peninsula which separates Wabush Lake from Julienne Lake. Estimates based on limited diamond drilling, surface sampling, geological mapping and magnetometer surveying indicate that the deposit contains in the order of 500 million tons with an average grade probably about 35% iron. The subsurface shape of the deposit is not well defined by drilling, however, it is thought to have a synclinal or trough shape with a maximum thickness of 600-800 feet. Magnetometer surveys have traced extensions of the deposit for considerable distances under both Wabush and Julienne Lakes.

The deposit is a coarsely recrystallized cherty iron-formation consisting principally of quartz, specular hematite and magnetite, occurring in a variety of banded mineralogic assemblages. The iron-formation is underlain by quartzite and schist. Most of the deposit has only a very thin cover of glacial overburden.

The Julienne Lake iron deposit is of similar type to the iron ore presently being mined by open pit methods, concentrated and pelletized at Wabush and Labrador City. Extensive grid drilling is required to outline the deposit, prove the tonnage, and define the average and range of variation of the grade.

INTRODUCTION

This report has been prepared by the staff of the Mineral Development Division of the Department of Mines and Energy, mainly from information submitted by Canadian Javelin Limited. It is intended to serve as a brief summary of the available data on the Julienne Lake iron deposit.[1] The mineral rights formerly held by Newfoundland and Labrador Corporation, Limited (Nalco) and by Canadian Javelin Limited with respect to the deposit have reverted to the Crown by virtue of the Julienne Lake Deposit (Reversion) Act 1975, the Act No. 65 of 1975, of the Newfoundland Legislature.

In compiling this report particular attention has been paid to the reports concerning the geology, exploration, diamond drilling, sampling and reserves. The exploration work performed by Nalco and Canadian Javelin Limited to date has served only to indicate the presence of a large iron deposit underlying the Julienne Peninsula. The diamond drilling programs, which totalled 3,477 feet for only nine holes, do not permit the 'grade and tonnage' to be classed as proven. Canadian Javelin Limited has commissioned numerous metallurgical, engineering and other studies on this deposit, however, these have not been incorporated into this summary report because they were based on insufficient sampling data. Many of these studies may have to be revised or re-done when sufficient grid drilling of the deposit is completed to prove the tonnage. An extensive list of reports on all aspects of this deposit is given in the Bibliography.

The Julienne Lake iron deposit is situated in Labrador, on the Julienne Peninsula at the north end of Wabush Lake, approximately 13 air miles northeast of the major iron ore producing centre of Wabush-Labrador City (Figures 1 and 2). There is a 20 mile access road from Wabush to the deposit. The Wabush area is served by railway transportation from Sept Isles, Quebec and scheduled airline service from Montreal and points within Newfoundland and Labrador. The deposit

[1] The deposit is referred to as the "Julian" deposit in the reports of Canadian Javelin Limited. "Julienne Lake" is used in this report to be consistent with Act. No. 65.

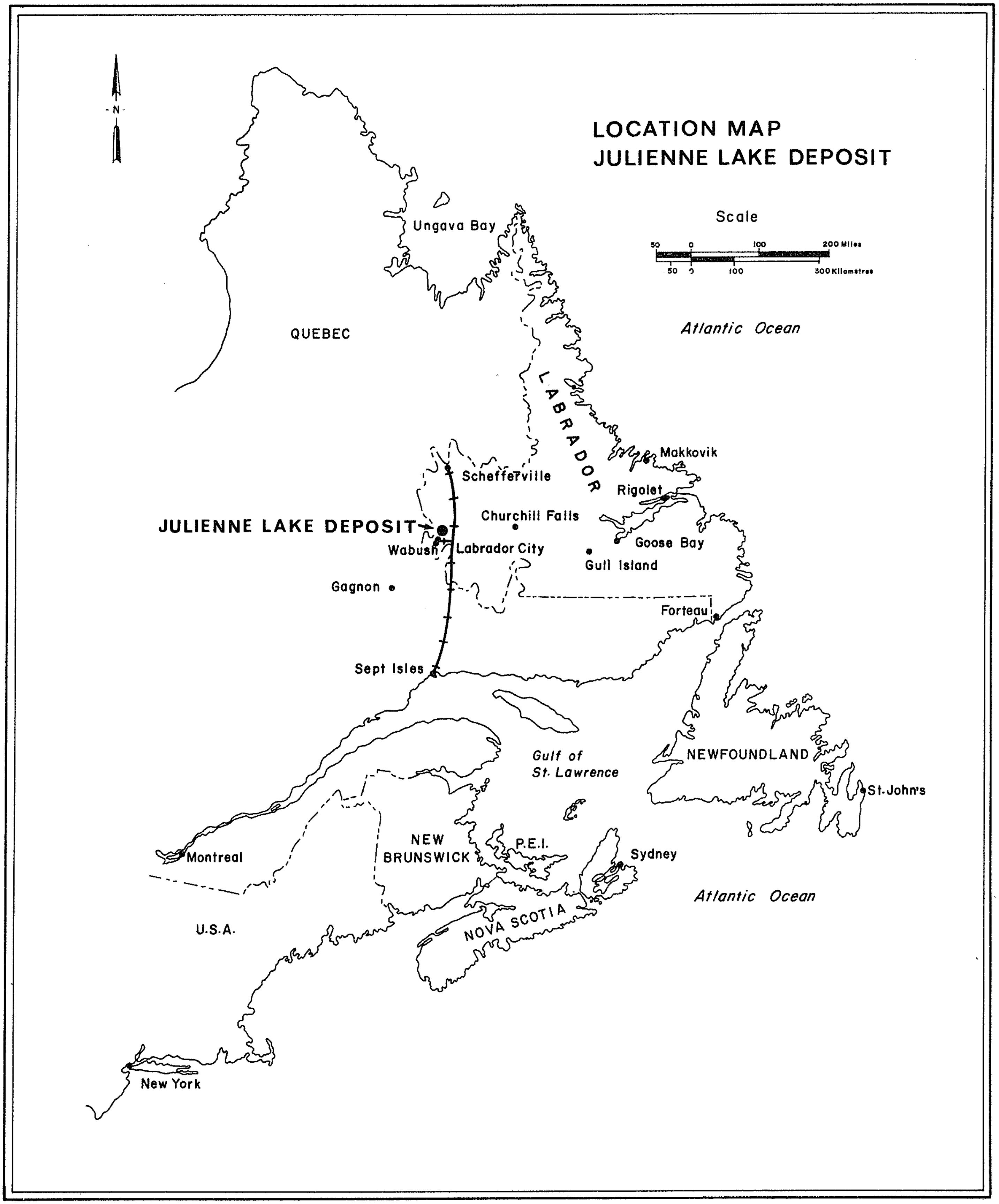

LOCATION MAP
JULIENNE LAKE DEPOSIT
Scale
50
0
100
200 Miles
50
0
100
300 Kilometres
N
Ungava Bay
QUEBEC
Atlantic Ocean
LABRADOR
Makkovik
Schefferville
Rigolet
Churchill Falls
JULIENNE LAKE DEPOSIT
Goose Bay
Wabush
Labrador City
Gull Island
Gagnon
Forteau
Sept Isles
Gulf of
St. Lawrence
NEWFOUNDLAND
St. John's
NEW
BRUNSWICK
P.E.I.
Sydney
Montreal
Atlantic Ocean
NOVA SCOTIA
U.S.A.
New York

FIGURE I

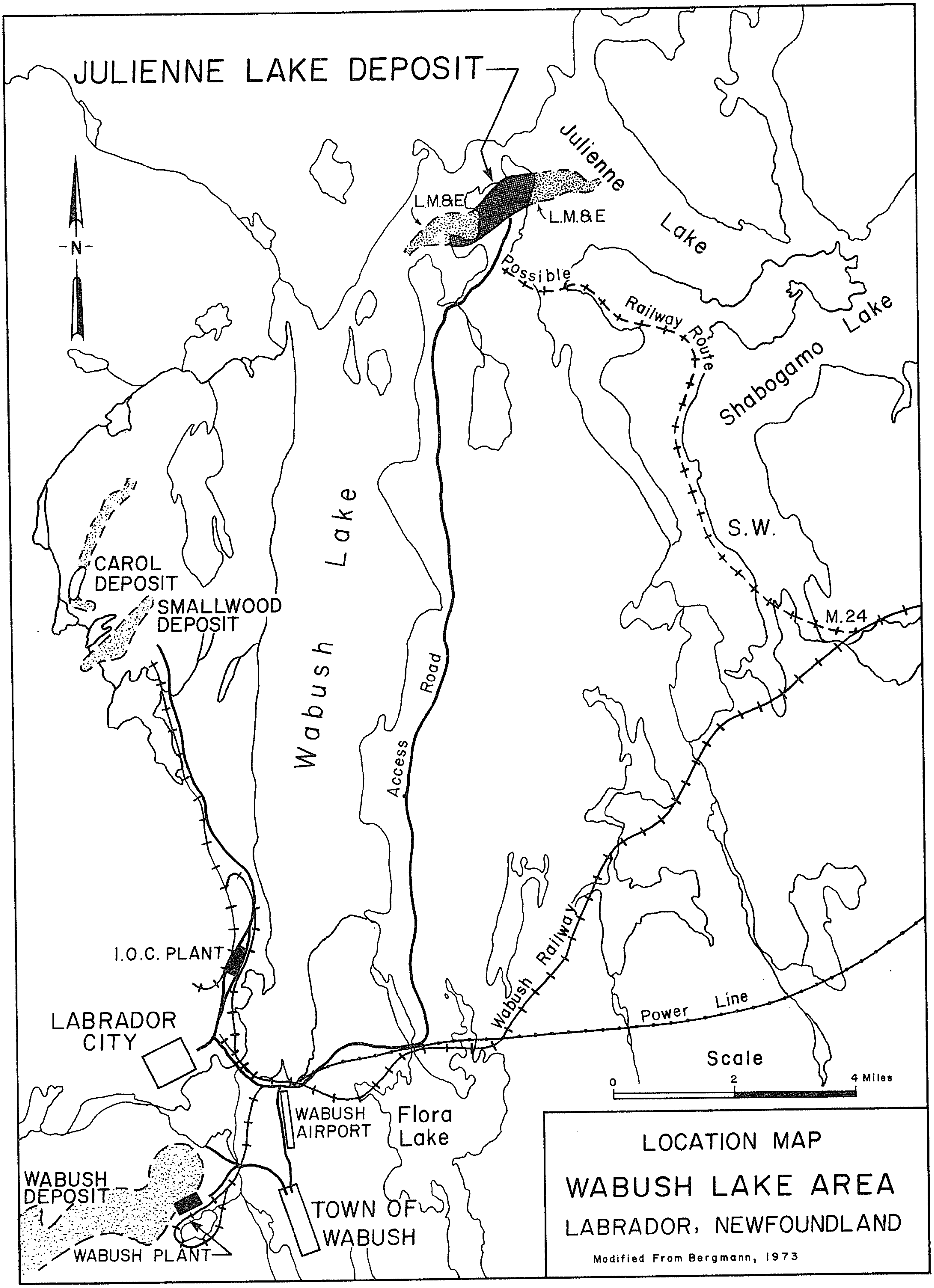

JULIENNE LAKE DEPOSIT
N
Julienne Lake
L.M.&E
L.M.&E
Possible Railway Route
Shabogamo Lake
S.W.
M.24
CAROL DEPOSIT
SMALLWOOD DEPOSIT
Wabush Lake
Access Road
Wabush Railway
I.O.C. PLANT
LABRADOR CITY
Power Line
Scale
0
2
4 Miles
WABUSH AIRPORT
Flora Lake
WABUSH DEPOSIT
WABUSH PLANT
TOWN OF WABUSH
LOCATION MAP
WABUSH LAKE AREA
LABRADOR, NEWFOUNDLAND
Modified From Bergmann, 1973

FIGURE 2

is approximately 268 rail miles from Sept Isles, currently the main shipping point for iron ore from Labrador City. The distance to the Labrador coast is apporximately 270 miles to Goose Bay, 350 miles to Rigolet and 430 miles to Forteau (Figure 1).

The existing iron ore operations in Western Labrador are supplied with hydro-electric power from Churchill Falls, 120 miles to the east. It is anticipated that by 1981 a second major hydro-electric development will be completed at Gull Island on the Lower Churchill River.

In 1970, Kilborn Engineering Limited (Dewar 1970) prepared a capital cost estimate of approximately $140 million for the development of the deposit. This estimate included cost of construction, pit preparation and equipment, crushing plant, concentrator, tailings disposal, townsite, and other services related to the proposed mine and town, but did not include pelletizing facilities. The estimate was based on an operation producing 9 million tons of concentrate per year.

EXPLORATION

The Julienne Lake iron deposit was first noted by Boyko (1953) (who called the deposit Boyko No.1) during a Nalco exploration program on their mineral concession area (Nalco Act 1951, the Act No. 88 of 1951). He described the deposit as follows:

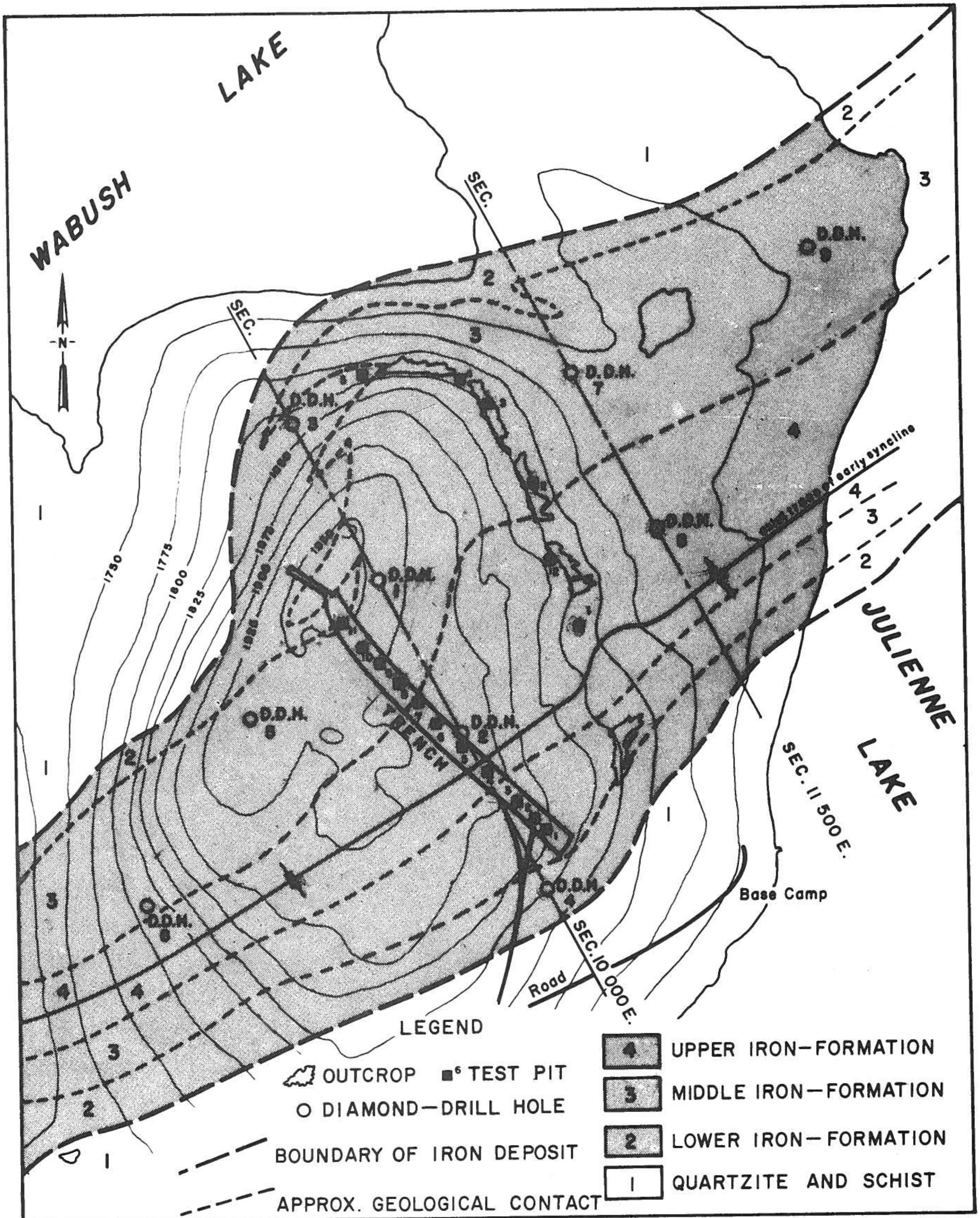
> *"Concentrations of iron ore occur in iron-formations at the north end of the peninsula between Wabush and Julienne Lakes. Iron-formations present here cover an area of approximately 4,000 feet square. The concentrations are very erratic, with bands of rich hematite up to 10 feet wide grading into very lean quartzite. The iron ore also grades in texture from dense lenses of hematite several inches thick to bands of coarse specular hematite in quartzite."*

Boyko informed Melihercsik (1953) of the deposit but Melihercsik concluded "that the showing is nothing more than enriched iron-formation. It is not believed that Boyko No. 1 presents economic possibilites."

By agreement with Nalco, Canadian Javelin Limited first examined and sampled the deposit in 1955. This was followed by geological mapping and magnetometer surveying by Gastil (1956) which formed the basis of a proposal for a drilling program. In 1957 and 1958, Pickands Mather and Company Limited, under contract to Canadian Javelin Limted, drilled nine diamond-drill holes totalling 3,477 feet (Figure 3). In 1959, geological mapping, mineralogical studies and magnetometer surveying by Knowles (1960) produced a detailed 3-dimensional structural and stratigraphic interpretation of the deposit.

In 1960, a mining lease covering an area of 1.29 square miles was issued to Nalco who sub-leased the rights to iron ore to Canadian Javelin Limited. Also in 1960, a 38.5 ton bulk sample was collected from five surface pits (Figure 3) and shipped to Lakefield Research of Canada Limited for concentration tests and subsequent metallurgical tests (Canadian Javelin Limited, 1962a).

In 1962, Canadian Javelin Limited built a road (approximately 20 miles) to the deposit from Wabush. The road was subsequently turned over to the Newfoundland Government for maintenance. Late in 1962, an area across the deposit over 2,000 feet in length was stripped by bulldozer and examined both mineralogically and geologically (Knowles, 1962). Forty to sixty



SURFACE PLAN
JULIENNE LAKE IRON DEPOSIT

Feet 0 700 1400 Feet

SCALE

FIGURE 3

pound composite samples were collected from each 100-foot interval of the trench (Figure 3). The mineralogic, structural and stratigraphic interpretation of the deposit from the 1959 program was revised by Knowles (1963) based on detailed examination of the 1962 trench. Knowles recommended complete re-mapping of the deposit and additional diamond drilling to give a more reliable interpretation of the geology before any further additional metallurgical work be undertaken. In the winter of 1963,extensions of the deposit under Wabush and Julienne Lakes were explored by magnetometer and sounding surveys (Knowles and Blakeman 1963). In the fall of 1963, a 162 ton bulk sample was collected from 12 pits. (11 of the pits were in the 1962 trench) (Knowles 1967a).

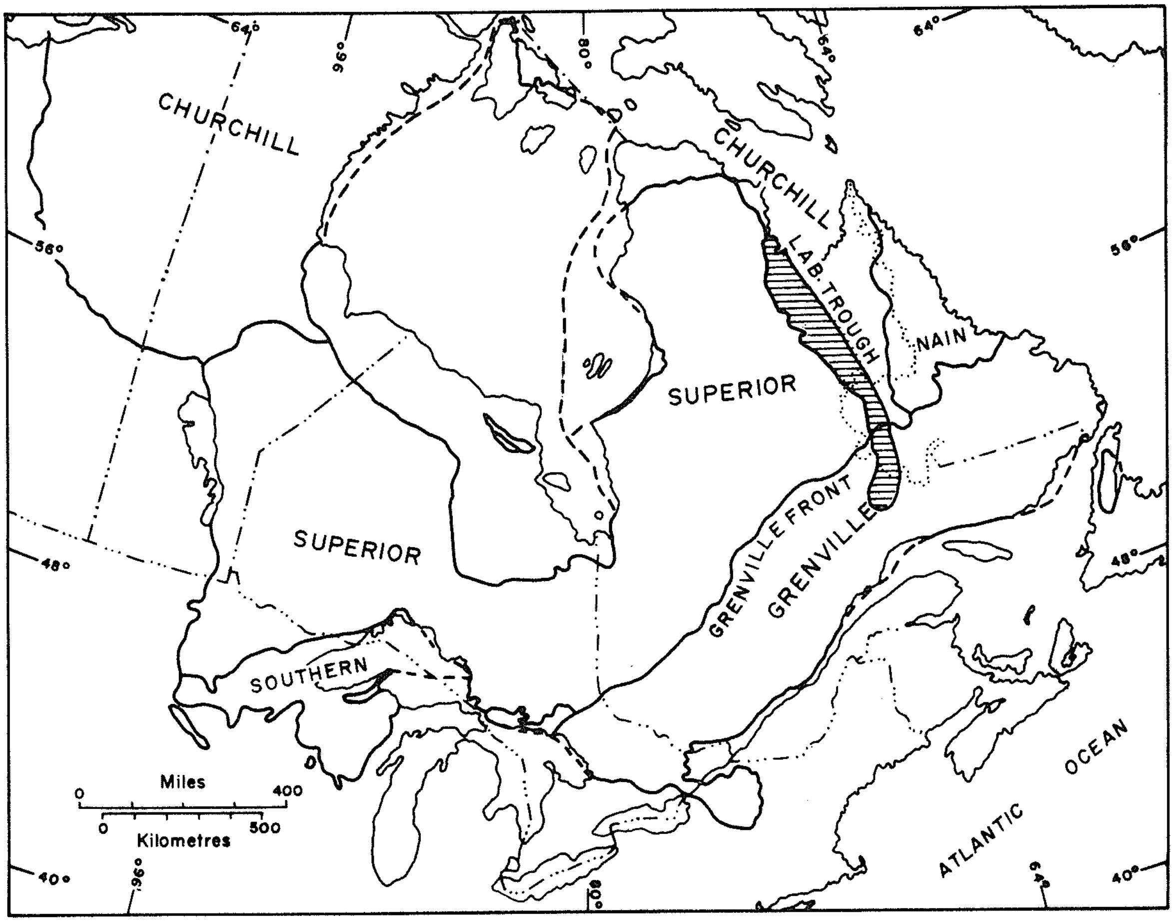
In the spring of 1966, the warehouse in Wabush containing the drill core from the deposit burned down and all core was lost. Later in 1966, an extensive chip sampling program was carried out to determine if titania was present in appreciable quantities. The results showed that the surprisingly high titania values obtained in the 1960 test pits, had been caused by contamination from sample bags previously used for shipping rutile concentrates (Knowles, 1967b). Otherwise, no appreciable titania values are present.

After 1966, Canadian Javelin Limited concentrated their efforts on numerous metallurgical, engineering and marketing studies. A feasibility assessment was made in 1970 by Technical Economists Limited (Magyar, 1970).

LABRADOR IRON RANGES

The iron deposits in the Wabush Lake area are a part of the southern extension of the Labrador Trough. The Trough or the Labrador geosyncline, as it is otherwise known, is a belt of Proterozoic age sedimentary rocks, extending from Ungava Bay southward for more than 700 miles through Schefferville, Wabush, Mount Wright and Gagnon (Figures 1 and 4). The western portion of the Trough contains widespread Lake Superior-type iron-formation (cherty iron-formation) of great economic importance (e.g. Schefferville-Knob Lake area). The Grenville Front (the northern boundary of the Grenville Province of the Canadian Shield, Figure 4), cuts across the Trough a few miles north of the Wabush Lake area. South of the Front, the cherty, hematite-magnetite, iron-formations have been recrystallized into a coarse-grained aggregate of quartz-specular hematite-magnetite iron-formation. The iron content remains about the same as in the deposits north of the Grenville Front, but the great increase in grain size allows the separation of the iron oxides by gravity, magnetic or other methods as is being done in the established operations at Wabush and Labrador City.

A Table of Formations for the Wabush Lake area is given in Table 1. Metasediments of the Proterozoic Kaniapiskau Supergroup overlie the Archaean Ashuanipi Complex of basement gneisses (Fahrig, 1967). The Kaniapiskau consists of metadolomite, quartzite, iron-formation (known as the Wabush Formation) and assemblage of argillites, slates, sandstones, sandy dolomite, schists and gneisses (Figure 5). Three facies of the iron-formation are recognized as quartz-iron oxide (oxide facies), iron silicate (silicate facies) and iron carbonate (carbonate facies). Only the oxide facies is of economic importance. The Wabush Formation has been subdivided into upper and lower iron-formation units. The lower unit consists of silicate and carbonate facies rocks while the upper unit is the oxide facies and includes the Julienne Lake iron deposit. The deposit is underlain by quartzite with some muscovite schist.



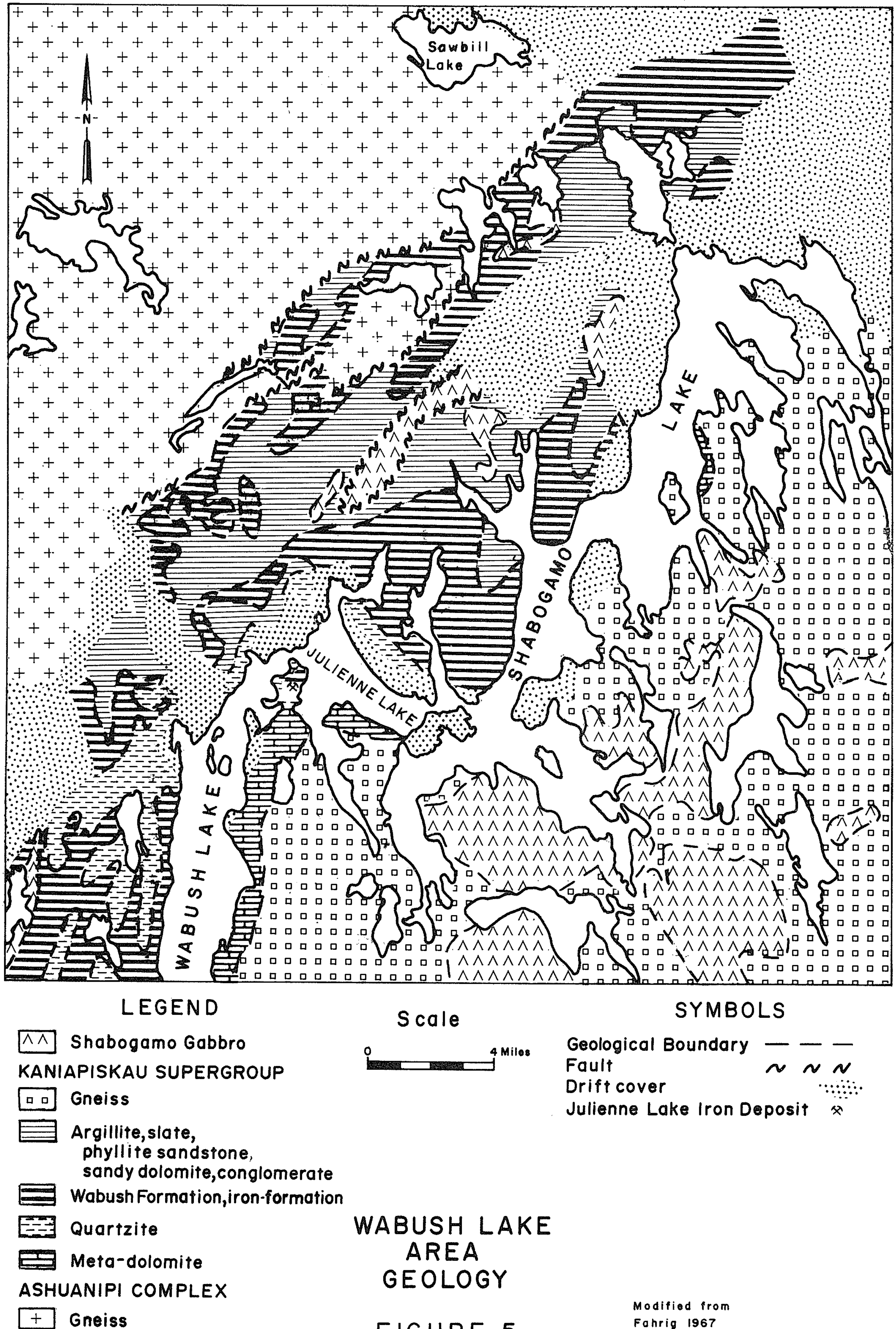
GEOLOGICAL PROVINCES OF THE CANADIAN SHIELD, AND THE LABRADOR TROUGH
FIGURE 4

TABLE 1

Table of Formations

Eon	Era	Formation	Lithology
Proterozoic	Middle Proterozoic (Helikian)	Shabogamo Gabbro	Diabasic meta-gabbro, anorthositic gabbro, amphibolite; derived gneiss
		Intrusive contact	
		Sims Formation	Quartzite, grit, conglomerate
	Unconformity		
	Lower Proterozoic (Aphebian)	Kaniapiskau Supergroup	Basic volcanic rock Argillite, sandstone, sandy dolomite, grit, conglomerate, and allied and derived rocks. Iron-formation Meta-dolomite Paragneiss, biotite granitoid gneiss, muscovite-biotite gneiss, hornblende-biotite gneiss, amphibolite, sillimanite gneiss; may in part be Archaean or Middle Proterozoic rocks.
Unconformity			
Archaean		Ashuanipi Complex	Granitoid and ferromagnesian-rich pyroxene-biotite-hornblende gneiss, locally garnetiferous; locally microclinized

From Fahrig (1967)



WABUSH LAKE
AREA
GEOLOGY

FIGURE 5

Modified from
Fahrig 1967

THE JULIENNE LAKE IRON DEPOSIT

The detailed geology of the deposit has been summarized by Knowles (1966). This report has been used extensively in preparing the following description of the deposit.

The three main minerals present in this deposit are crystalline quartz, specular hematite and magnetite. Very minor and localized amounts of carbonate minerals, anthophyllite, grunerite and seams of fine-grained hematite-manganese are also present. Post-metamorphic leaching removed most of the carbonate minerals and anthophyllite, while oxidation converted most of the magnetite to martite, spread a certain amount of red hematite and limonite throughout the deposit and converted the grunerite schist to siliceous goethite.

The iron oxides occur in three forms:

1. Coarse-grained, platey and bright specular hematite.
2. Medium-grained, dull, granular hematite and martite.
3. Fine-grained, earthy hematite-limonite, or crystalline goethite-hematite.

There are nine basic mineralogic varieties of iron-formation that are visually recognized in this deposit. These mineralogic varieties are distinguised on the basis of the amounts of the forms of iron oxide present, crystalline quartz content, and textural features. The varieties may be traced as mappable units or bands reflecting the internal stratigraphy and original composition of the deposit. The mineralogic varieties are:

1. Quartz-specular hematite, clean, massive or banded.
2. Quartz-specular hematite intermixed with quartz-granular hematite, often thinly banded but massive in bulk, usually accompanied by red hematite or limonite-goethite.
3. Quartz-granular hematite (martite), often massive and accompanied by red hematite or limonite-goethite.
4. Quartz-specular hematite with leached anthophyllite remains or casts, generally schistose and pinkish.
5. Ferruginous quartzite, lean iron-formation, the oxides are generally granular hematite.
6. Blue hematite, hard, nearly aphanitic, banded, brittle.
7. Manganiferous, black variation of the blue hematite above, may be accompanied by secondary pyrolusite, etc.
8. Siliceous goethite, a mixture of silica and secondary material (largely goethite), brown in colour.
9. Small veinlets of intermixed quartz, hematite and limonite-goethite (represents metamorphically migrated material).

The first three varieties probably account for 90% of the material in the deposit. The distribution of these varieties in bands within the deposit suggest that they represent stratigraphic horizons. Based on these nine mineralogic varieties, the Wabush Formation (oxide facies) on the Julienne Peninsula has been subdivided into units termed Lower Iron-Formation, Middle Iron-Formation, and Upper Iron-Formation (Figure 3).

The deposit has undergone at least two periods of deformation. During the first deformation all formations were folded more or less isoclinally with one overturned limb. The axial plane strikes N60°E and dips to the southeast (Figures 3 and 6). The second deformation (probably of the Grenville age) produced cross-folds that plunge to the southeast.

The deposit has been traced across the Peninsula for a strike length of approximately 6,000 feet and the width varies from 1,800 to 3,400 feet. The boundary of the deposit with the underlying quartzite and schist has been approximately determined from outcrop mapping and magnetometer surveying. The maximum thickness of the deposit is suggested to be 600-800 feet as shown in Figure 6, however, it can be readily seen that most of the drillholes failed to intersect the underlying quartzite.

Magnetometer surveying (Knowles and Blakeman 1963) indicates that the deposit may extend 5,000 feet or more, under both Wabush and Julienne Lakes. The mineral rights to these extensions are held by Labrador Mining and Exploration Company Limited.

RESERVES

The average grade of the deposit has been estimated from several sampling programs involving both diamond drilling and surface sampling. The average grade of the deposit is approximately 35% iron. There is reasonably good agreement between the average grade obtained from surface samples and that from drill core. The drilling to date, however, is not sufficient to define the distribution of the variation of the grades both laterally and vertically within the deposit. It is, of course, essential to relate this variation to the metallurgical characteristics of the nine different mineralogic types before a flow sheet for a concentrator can be designed.

Of the nine holes drilled, totalling 3,477 feet, core recovery data is available for only four holes. In the first four holes, the average core recovery was about 50% with one hole reporting a low of 37%. The drilling program encountered excessive caving problems and several holes were stopped short of target depths, finishing within the iron-formation as shown in Figure 6. Table 2 gives a summary of the diamond drilling results obtained during 1957-58. Table 3 gives a summary of the various sampling programs that have been used to estimate the average grade of the deposit.

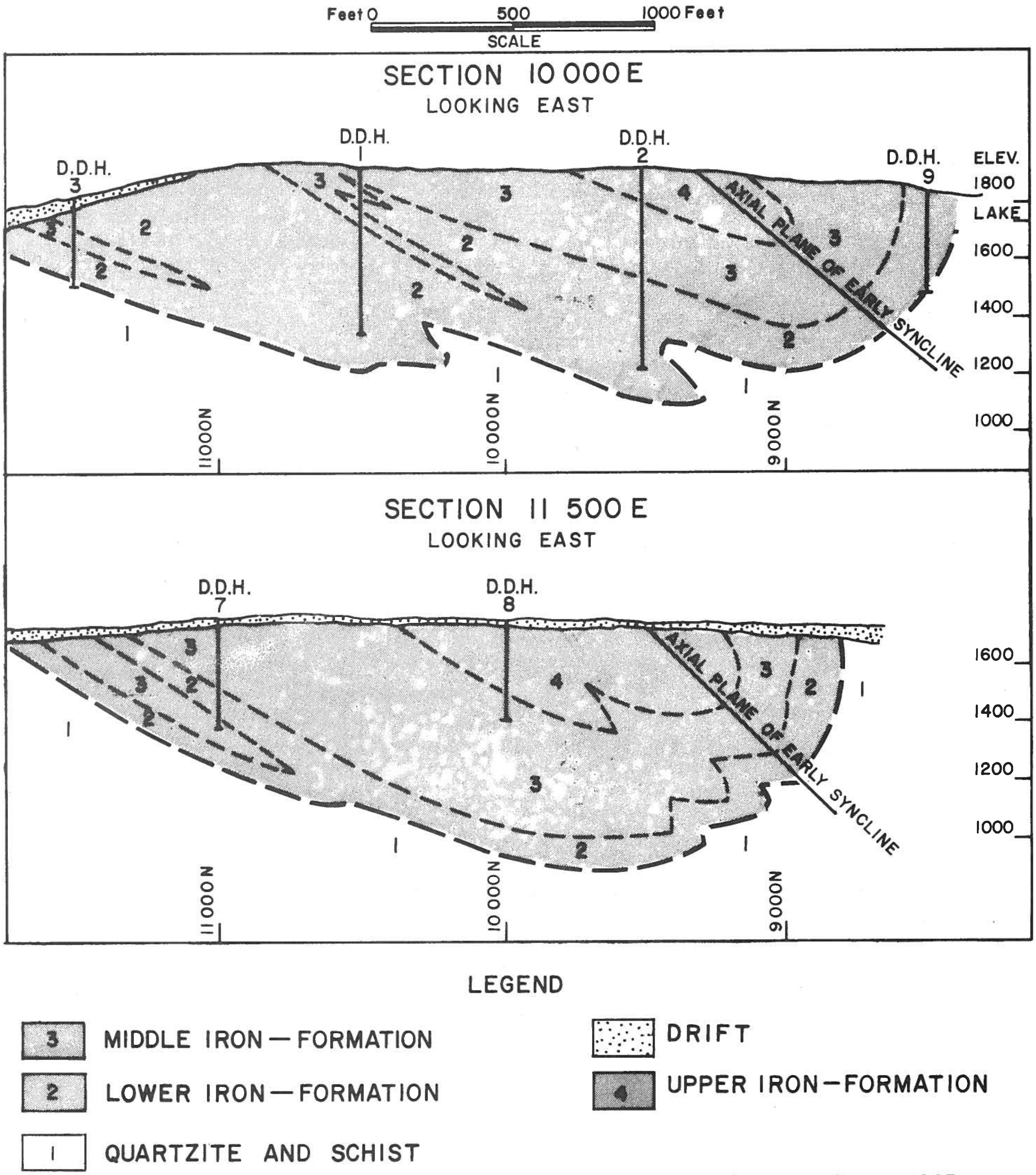
The reserves have been grouped into two classes, indicated and potential. Reserves classed as indicated may be recovered by conventional open pit methods, while the recovery of reserves classed as potential will require the construction of a dam in Julienne Lake.

All reserves below elevation 1,200 feet are also classed as potential. A factor of 12 cubic feet per ton was used in the conversion of volume to long tons.

Canadian Javelin Limited (1962b) stated the reserves as follows:

Indicated reserves (between 7500 E and 13000 E)	416,663,000 tons
Potential reserves (between 10000 E and 13000 E)	83,371,000 tons
Total	500,034,000 tons

CROSS—SECTIONS
JULIENNE LAKE IRON DEPOSIT



Modified from Knowles 1967c

FIGURE 6

It is also stated that 90 million tons of ore are above elevation 1,775 feet and could be recovered by open pit mining without removal of appreciable overburden. In order to mine the indicated ore, approximately 10 million tons of waste rock and 13 million tons of overburden will have to be removed.

TABLE 2
SUMMARY OF DIAMOND DRILLING

Hole No.	Total Depth (feet)	Average % Fe/Footage	%Recovery
1	596	34.7/593 core 34.8/295 sludge	51.6
2	705	36.5/685 core 37.5/340 sludge	54.2
3	318	33.7/254 core 41.1/270 sludge	37.6
4	328	31.5/286 core 37.5/235 sludge	49
5	203	39.3/144 core	
6	330	40.1/313 core	
7	380	35.5/367 core	
8	356	30.6/330 core	
9	261	36.3/123 core	
TOTAL	3477	Average 35.2% (core) weighted by sample length Average 34.2% (core) arithmetically	

TABLE 3
SUMMARY OF AVERAGE ANALYSES

Year	Description	%Iron	%Manganese	%Silica	%Phosphorous	%Sulphur	%Insolubles	%Titania
1956	28 outcrop samples (Gastil 1956)	37.15	0.18	N.A.	0.012	0.004	N.A.	N.A.
1957 -58	Drill core (arithmetic ave.)	34.2	0.32	N.A.	N.A.	N.A.	N.A.	N.A.
1960	38.5 ton sample from 5 pits	36.75	0.09	46.16	0.009	tr.	N.A.	0.21 c
1962	Trench. Average of 21 composite samples (40-60 lbs.) at 100ft. intervals.	35.71	0.32	N.A.	0.008	0.0035	47.52	N.A.
1963	162 ton bulk sample from 11 pits in trench and 1 other pit	32.55	0.12	50.91	0.195	0.0046	N.A.	Nil
1966	35 Chip samples							
	7-Western Bench	41.69	0.053	N.A.	0.007	0.008	38.66	0.035
	12-Trench	35.36	0.52*	N.A.	0.12	0.008	47.03	0.048
	11-Eastern Bench	36.37	0.19	N.A.	0.008	0.007	46.56	0.057
	5-1960 Test pits	40.75	0.11	N.A.	0.010	0.007	40.66	0.060
	1-Composite of above 35 samples	36.75	0.11	N.A.	0.007	0.008	46.20	0.022
	Average of 35 chip samples	37.71	0.26*	N.A.	0.009	0.007	44.30	0.050

N.A. – Not Available

* – Includes 2 samples from manganiferous zones

c – Contaminated

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