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LABRADOR IRON ORE PELLETT PROJECT

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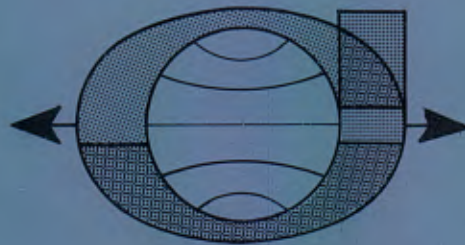
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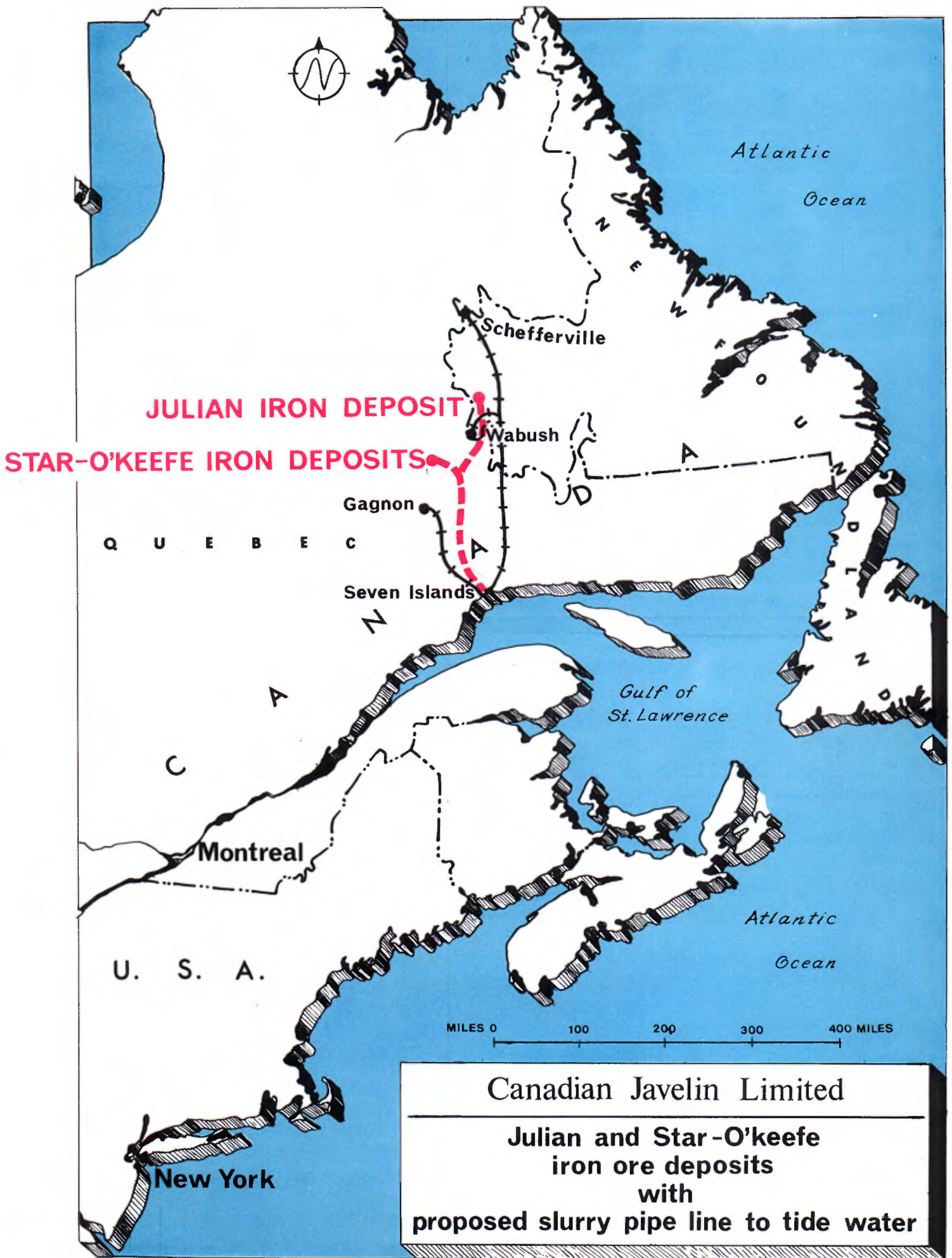
Énergie et Ressources  
naturelles

Québec 

LABRADOR  
IRON ORE  
PELLET  
PROJECT



Canadian Javelin Limited



**JULIAN IRON DEPOSIT**

**STAR-O'KEEFE IRON DEPOSITS**

Canadian Javelin Limited

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Julian and Star-O'keefe  
iron ore deposits  
with  
proposed slurry pipe line to tide water

## PREAMBLE

By perusal of this brochure, the reader is offered some insight that could lead to his purchase of pellets from a major, large scale iron ore project. A total of 12,000,000 metric tons per year of iron ore pellets, grading a minimum of 65% Fe, can be made available to iron ore consumers by 1974. The iron ore is to be produced from two deposits containing 1,200,000,000 tons of crude ore, located in the south portion of the Labrador iron ore trough. As such any purchaser may be assured a secure long term source of high quality blast furnace feed from a proven source located in a politically stable country.

Prices, are of course, competitive and negotiable, subject to scale of purchases, length of sales contract, delivery schedule, maintenance of specifications, shipping arrangements, place of delivery and preservation of costs, etc.

A concise description of the project follows.

# **JULIAN AND STAR - O'KEEFE IRON ORES**

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Lake Deposit, David M. Knowles, May 1967.

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O'Keefe Properties, William B. Blakeman, April 1970.





IRON ORE DEVELOPMENT - LABRADOR



## GENERAL STATEMENT

The pellet project is a development undertaken by Canadian Javelin Limited, a Canadian natural resource company. The Wabush Mines Limited orebody and operation resulted from Javelin's early entry into Canada's iron ore industry.

The iron pellets would be produced from two deposits, one, the Julian, owned by Julco Iron Corporation, a Canadian Javelin wholly owned subsidiary and the second, Star-O'Keefe, owned by Dominion Jubilee Corporation Limited, an affiliated company. These deposits are located at Julian Lake in the Labrador section of the Province of Newfoundland approximately 13 air miles northeast of the town of Wabush, and, in the O'Keefe Lake area in the adjacent portion of the Province of Quebec about 40 miles southwest of Wabush. The properties will supply nine million and three million tons of pellets per year respectively.

The project is particularly attractive since the deposits can be entirely mined by open cast methods, and are located near other large open pit mines, Carol Lake and Wabush (16,000,000 tons per year), the supply of parts and equipment necessary to main-

tain such operations may be kept to the minimum, thereby saving substantial amounts of money.

Of significant economic improvement in transportation, Canadian Javelin Limited is planning to construct a 232 mile slurry pipeline system to carry ore concentrates from the mines and primary preparation facilities at Julian Lake, to the pelletizing and loadout complex, at tide water in the vicinity of Sept. Iles, Quebec. The Newfoundland legislature has passed an Order in Council granting the right of way for the Labrador portion of the pipeline, and applications for additional rights of way and related permits have been submitted to the Quebec and Federal Governments to provide for the pipeline, power and access roads.

Kilborn Engineering of Toronto has served as Canadian consultant for Javelin to date. Their study is based on the Dravo-Lurgi system of pelletizing to produce the pellets.

Metallurgical tests have been completed. Designs of mining, milling and pelletizing facilities are complete.

The feasibility studies for various rates of production have been completed and the finalization shows that 12,000,000



tons per year is the most economic and profitable rate of production. Canadian Javelin Limited will manage, build and be responsible for the financing of the project.

Basically, this proposal has been designed to give the iron ore consuming companies the opportunity to obtain high quality iron ore delivered to the consumers' plants at prices approximately equal to those enjoyed by North American producers.

It is proposed to use the ability of Canadian Javelin Limited, and related companies to qualify under the Export Guarantee Program of the Canadian Government for financing at a low cost. The pellet purchaser would not find it necessary to invest vast sums of capital such as was necessary for the American producer of steel to provide in order to participate in comparable projects. In addition, the Government of Canada is prepared to assist with cash grants non-repayable which may run as high as \$10,000,000.

Canadian Javelin Limited believes that this proposal will merit your immediate consideration. In order to qualify for available Government financing it is important that the pellet consuming companies, to whom this proposal is directed, indicate their willingness to purchase Javelin's pellets as soon as possible.





SILVER MINE - EL SALVADOR



## HISTORY OF CANADIAN JAVELIN LIMITED

Canadian Javelin Limited is a Canadian Company engaged principally in the development of natural resources in the Western Hemisphere.

The company was founded in 1951 under the federal laws of Canada. It is a public company with over 20,000 shareholders. Its shares are traded on the American Stock Exchange in New York.

The head office of the Company is at Javelin House in St. John's, Newfoundland, Canada; the executive and engineering offices of the company are at 100 Bronson Avenue, Ottawa, Ontario, Canada; the European office is at 41 Pall Mall, London, S.W.1, England. The company also maintains offices in Montreal, Quebec; Regina, Saskatchewan; Goose Bay, Labrador; Stephenville, Newfoundland; the Bahamas; Chile; El Salvador and Panama.

The company initiates resource development projects to be carried out through independently financed subsidiaries and associated companies. Canadian Javelin arranges for or provides financial backing for these projects, and its officers and staff participate in the management



of the project and provide technical staff and services as required until the project management is established and financing to bring projects into production is assured.

Two major Canadian natural resource projects initiated by Canadian Javelin during the past 11 years have resulted in capital investment for production facilities in excess of \$500,000,000 which will produce iron ore and paper products having a value in excess of \$112,000,000 per year. These successful operations, both located in remote areas of Canada, resulted from detailed and thorough exploration and development programs undertaken by Canadian Javelin combined with practical planning and securing of the required financing.

The larger of these projects -- The Wabush Mines Project in Labrador -- is one of the world's major iron ore developments. It was initiated by Canadian Javelin in 1953 and brought into production nine years later. It is currently mining and processing iron ore at the rate of 15,000,000 tons per year to produce 6,000,000 tons of iron ore pellets and provides direct employment for over 1,500 people and indirect employment for an additional 6,000 workers.

Canadian Javelin, the owner of the billion ton Wabush Lake iron ore deposit, directed the exploration, development, and planning

of this major mining project. The project required construction of seventy miles of railway, the development of a mine, and construction of a processing plant with a capacity of 50,000 tons of ore per day, the construction of a town with all the municipal services, hospital, recreation and education facilities for 7,500 people, the development of a hydro-electric plant to supply power and the construction of a pelletizing plant and a major ocean shipping port on the Gulf of the St. Lawrence for loading the iron ore into vessels at Pointe Noire, Quebec, for shipment to consumers.

The Wabush Mine has participation in its operations by a consortium of nine international companies -- The Wabush Iron Company Limited; The Steel Company of Canada Limited, (Canada); Dominion Foundries and Steel Limited, (Canada); Youngstown Sheet and Tube Company, (U.S.A.); Interlake Iron Corporation; Pittsburgh Steel Company, (U.S.A.); Inland Steel Company, (U.S.A.); Societa Finanziari Siderurgica Finisider Per Azioni, (Italy); and Pickands, Mather & Company, (U.S.A.); Pickands, Mather & Company is managing the project as agent for the joint venturers. Wabush was brought into production at a cost of approximately \$300,000,000. Marketing for the development was obtained through the participating steel companies. Outside financing was obtained through a group of major Canadian and United States Insurance Companies and Financial Institutions.

The second major project referred to above is the Javelin Paper Corporation Limited complex consisting of wood harvesting facilities in Labrador and a pulp mill and linerboard mill to be constructed at Stephenville, Newfoundland which is now taking shape under Javelin's direction with a talented management team bringing the \$140,000,000 undertaking into production.

Javelin Paper Corporation, one of Canada's most ambitious natural resource ventures, has been 4 years in the planning stage and has required some \$13,000,000 for economic and engineering studies before financing was completed and construction of the plant begun.

The presence of these large resources of timber in Labrador, capable of yielding high quality wood fibres has long been known but it has taken the initiative and perseverance of the Javelin development team of engineers and technicians and financial experts headed by Mr. J.C. Doyle and backed by Javelin's financial resources to devise new and improved methods, putting them to economical use in the production of wood pulp and linerboard.

Javelin's mill has a designed capacity of 1,000 tons per day of high quality linerboard. In addition pulp wood is exported, currently, to Europe. The wood is cut from a tract of 15,099,000 acres



of timber lands near Lake Melville, Labrador.

The engineering firm in charge of designing the Javelin Paper complex is E. and B. Cowan of Montreal, a firm which designed and supervised construction of more than \$1,000 million worth of pulp and paper mills in various parts of the world. The general contractor is Sir Robert McAlpine & Son of England. The linerboard machine, one of the largest in the world, is built by Walmsley (Bury) Limited of England under the designs and specifications of Beloit International of the United States. Contracts for the sale of the linerboard product have been signed with Wilfried Heinzel and Company, with offices in six Western European countries, who will be the European marketing agents for the Javelin Paper project.

The project will give direct employment to about 5,000 people and will add about \$50,000,000 to the industrial production of Canada each year.

The \$140,000,000 capital investment for the paper project was provided by Canadian Javelin Limited through Nesbitt Thompson and Company of Montreal, Lazard Brothers of London, England, and a consortium of British and German banks.

In this development again, Canadian Javelin Limited was the directing force in bringing together an international consortium for development and finance.

In addition to the two major projects outlined above, Canadian Javelin Limited and its subsidiaries have undertaken many other natural resource projects in various stages of development, a few of which are outlined briefly in the following paragraphs:

In El Salvador, the company, through its wholly owned subsidiary, Minas San Cristobal, S. A., is developing the Montecristo Mine. This mine commenced production in early 1970 and plans are already being made for expansion as quickly as further mine development can be completed. This mine now gives direct employment to over 200 persons.

Through its subsidiary, Bison Petroleum and Minerals Limited, Javelin is now drilling new oil wells as part of a long term program to substantially increase production for proven reserves held by that subsidiary in Western Canada. Bison participates in 9,100,000 acres of petroleum permits located offshore from Newfoundland and is the second largest independent oil company in Canada with offices in Regina, Saskatchewan and Calgary, Alberta.

Through its wholly owned Chilean subsidiaries, Canadian Javelin Limited has for many years controlled iron ore deposits in the Province of Atacama, Chile. The operating company for these deposits mines and ships 1,500,000 tons of iron ore per year to Japan through the Port of Chanaral.

The company's exploration teams are also at work in Newfoundland, Ontario and Saskatchewan in Canada, in Chile in South America, Panama and El Salvador in Central America, exploring and evaluating the Company's present holdings and searching for new projects.





TEST PITS TO CONCENTRATES - WABUSH ORE BODY

## LOCATION AND DESCRIPTION OF JULIAN ORE DEPOSIT

The Julian Iron deposit (see location map) owned by Canadian Javelin Limited is situated 220 air miles north of Sept. Iles.

This property is situated in Labrador Newfoundland at the north end of Wabush Lake, or about 13 air miles north of the Wabush-Carol area where large concentrating and pelletizing plants (16,000,000 tons per year) are in operation by the Iron Ore Company of Canada Limited and Wabush Mines Limited.

Present access from the town of Wabush to the property is by provincial road. Railway transportation and electric power with adequate capacity to serve the needs of the property are available through short extensions to existing facilities in the area. Schedule airline service from Montreal is in operation to Wabush and all other necessary facilities are readily available in the area. The property is approximately 268 rail miles from Sept. Iles.

The deposit consists of a large hill of concentrating type iron ore forming the body of a peninsula surrounded on three sides by the shallow waters of Wabush and Julienne Lakes. The deposit trends north-easterly through this peninsula and extends into the lakes on either side.

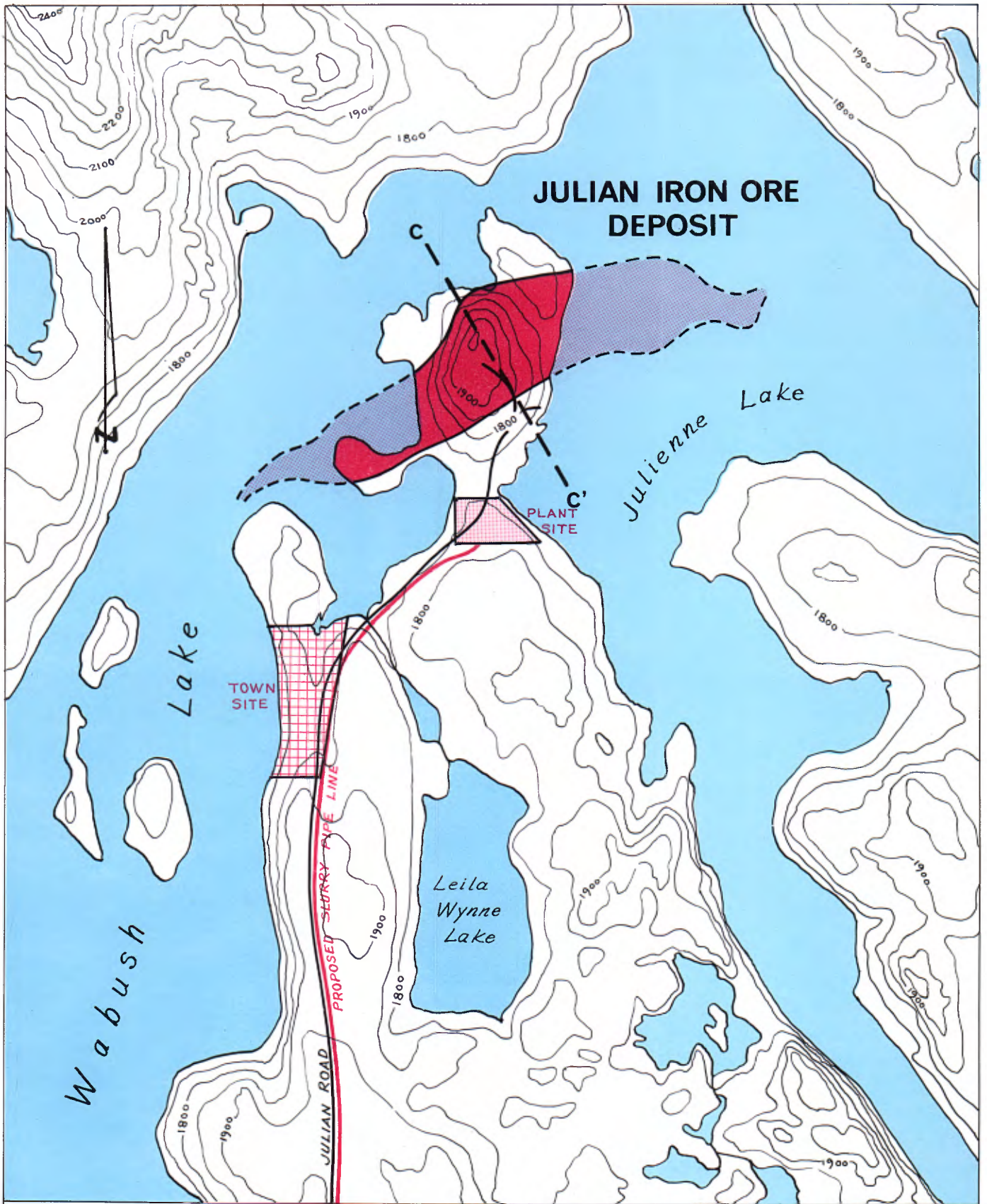
Within the peninsula it has a length of approximately 6,000 feet and widths varying from 1,800 to 3,400 feet. The ore is essentially a uniform friable mass of a coarsely-crystalline mixture of quartz and iron oxide minerals, principally specular hematite.

The portion of the Julian deposit within the peninsula has been explored by trenching and diamond drilling to depths exceeding 800 feet and on the basis of this work, ore reserves have been calculated at 500,000,000 tons containing 34.2% Fe with only traces of impurities. The ore is overlain by a minimum of overburden, and the waste to ore ratio is 1:20. Extensions of the deposit under the shallow waters of Wabush Lake to the west contain 165,000,000 tons, and the east 239,000,000 tons, under Julienne Lake; calculated to a depth of 530 feet. Metallurgical tests have shown that the ore minerals can be readily separated from the quartz through grinding and gravity concentration to give a recovery of 42% by weight, as a high grade specular hematite iron ore concentrate, with an average analysis in excess of 65.0% Fe and less than 5% silica.

While Labrador winters are considered severe, iron ore mines, concentrating, pelletizing, and shipping facilities now being operated during all of the year in this area have a production in excess of 25,000,000 tons per year.

Technical reports from which the above summary was prepared are available from the Canadian Government and Canadian Javelin Limited's files for examination and study.



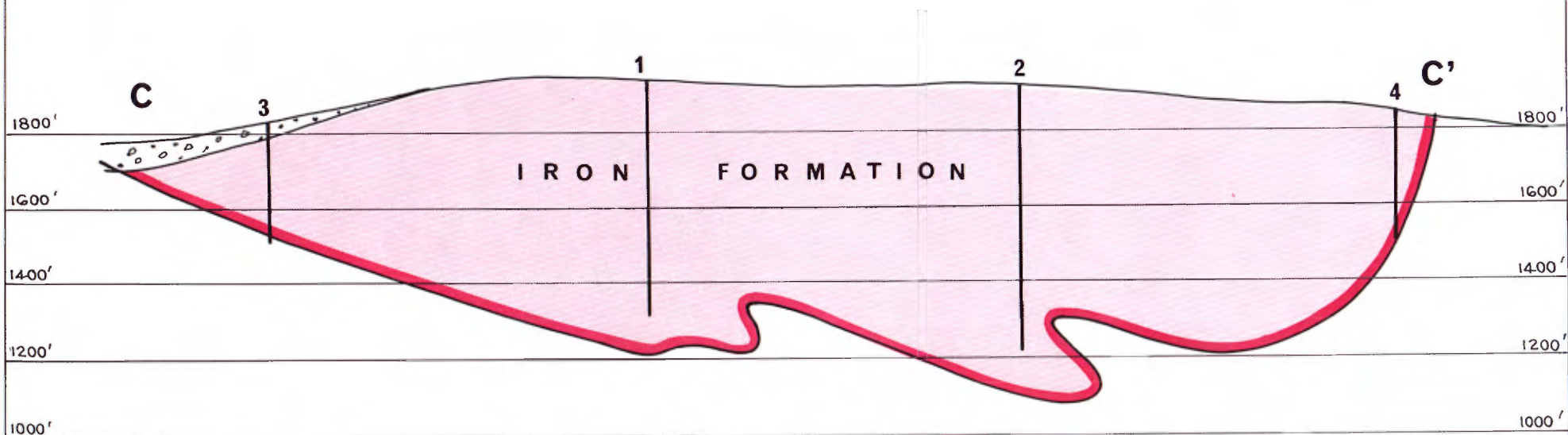


**Julco Iron Corporation Limited**

**JULIAN IRON DEPOSIT**



TYPICAL CROSS-SECTION  
LOOKING N.E.  
JULIAN IRON ORE DEPOSIT



Scale: 1 inch = 400 feet

LOCATION AND DESCRIPTION OF THE STAR-O'KEEFE  
ORE DEPOSIT

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The Star and O'Keefe Lake ore bodies held by Dominion Jubilee Corporation Limited, are situated some 7,000 feet apart in northeastern Quebec. They are 65 miles northeast of Gagnon, Quebec and 40 miles southwest of Wabush Lake, Labrador. Present access to the properties is by float or ski equipped aircraft from Wabush or Gagnon which are served by daily flights from Montreal and Sept. Iles.

Field work on both properties has consisted of aeromagnetic surveys with follow-up detailed geologic and magnetic mapping and diamond drilling. Reports covering all phases of development to date are available in the offices of Canadian Javelin Limited.

The Star and O'Keefe ores are typical of the specular hematite-quartz assemblages being mined in the area, that is, a coarse grained rock in which the bond between the quartz and specularite is relatively weak.

The iron formation at O'Keefe Lake is folded into a syncline plunging east and a total of 4,994 feet of diamond drilling in

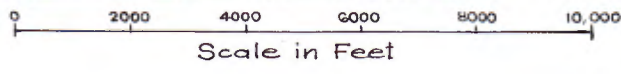
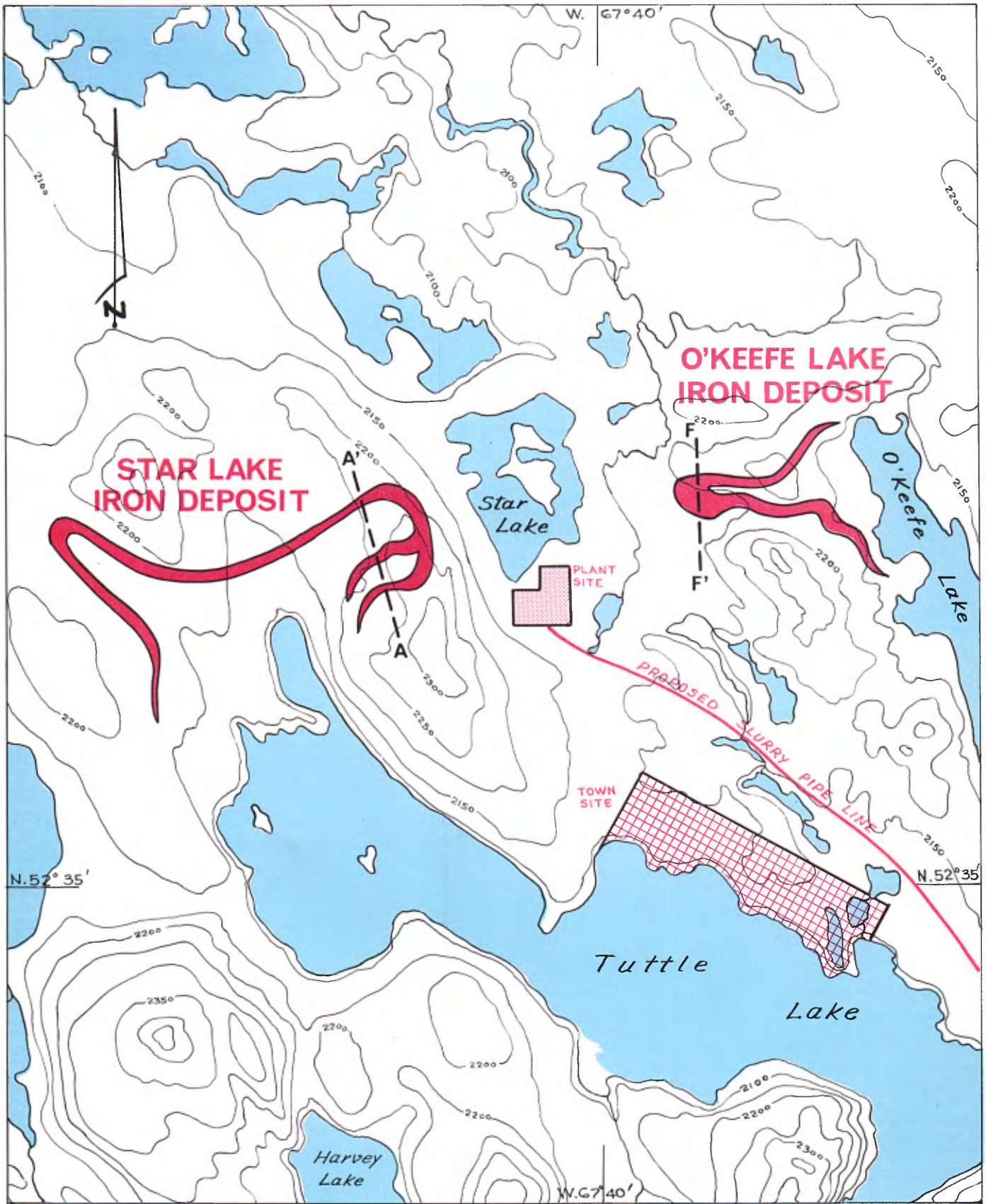
eighteen holes over a strike length of 9,000 feet has tested the formation to a depth of 350 feet.

At Star Lake, magnetic surveys have traced iron formation over a length in excess of 18,000 feet. Eighteen diamond drill holes totaling 6,824 feet were drilled in the anomalous area and have outlined an orebody having the form of a distorted synclinal structure to an average depth of 300 feet.

Diamond drilling and geological studies indicate that ore reserves at Star and O'Keefe Lake are 151,665,000 tons of 32.87% iron and 23,380,000 tons of 35.48% iron respectively, for a total of over 175,000,000 tons in the combined deposits and are expected to be increased substantially by additional drilling.

A weighted average analysis of 2,778 feet of core sampled from Star Lake gives 32.89% iron. An analysis of composite core samples from holes 1 to 6 indicates .003 to .02% phosphorous, .02 to .04% manganese, .001 to .002% sulphur and 47.20 to 56.94% insolubles.

The weighted average of 2,032 feet of samples from O'Keefe Lake is 35.48% iron. Several surface samples were analyzed for impurities and found to contain traces of sulphur and phosphorous with 0.06 to 0.10 manganese.



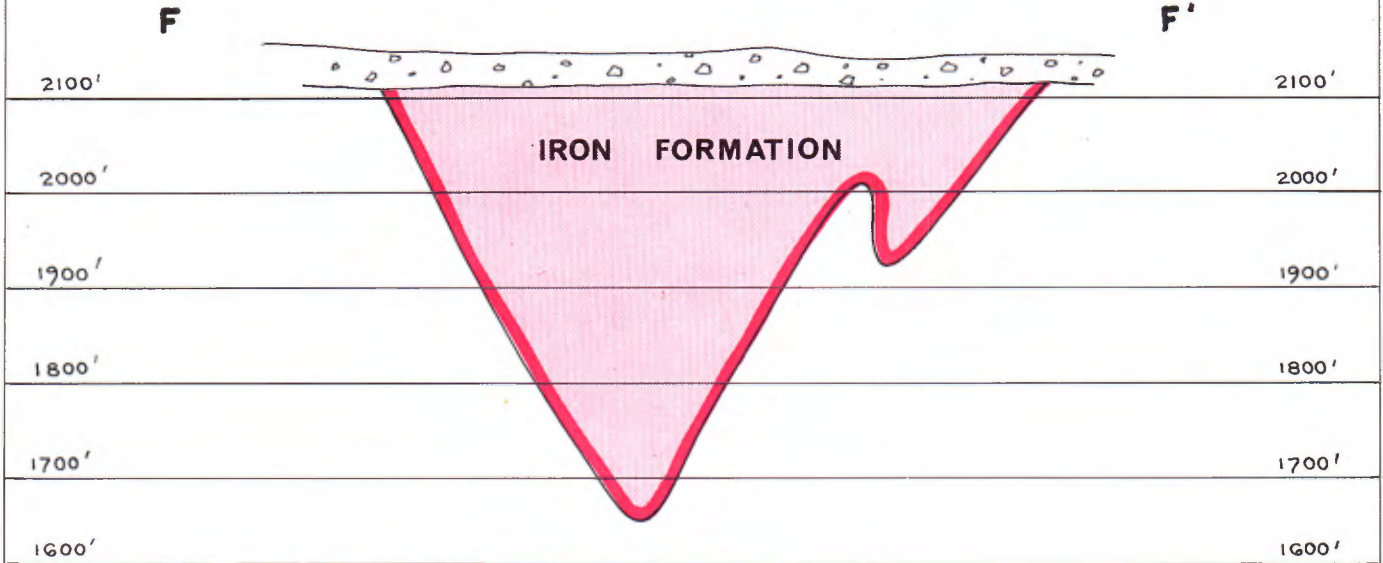
**Dominion Jubilee Corporation Limited**  
**STAR-O'KEEFE IRON DEPOSITS**



TYPICAL CROSS-SECTION  
LOOKING EAST

O'KEEFE LAKE IRON DEPOSIT

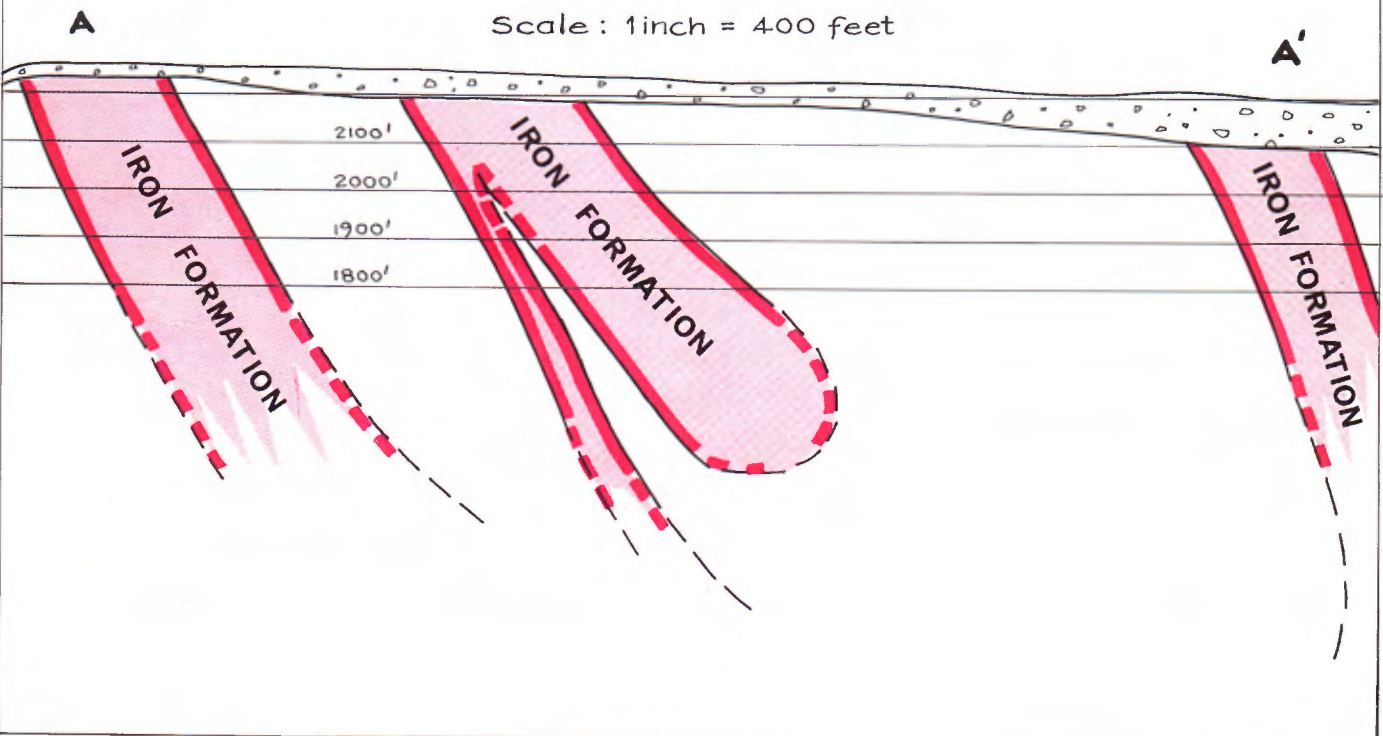
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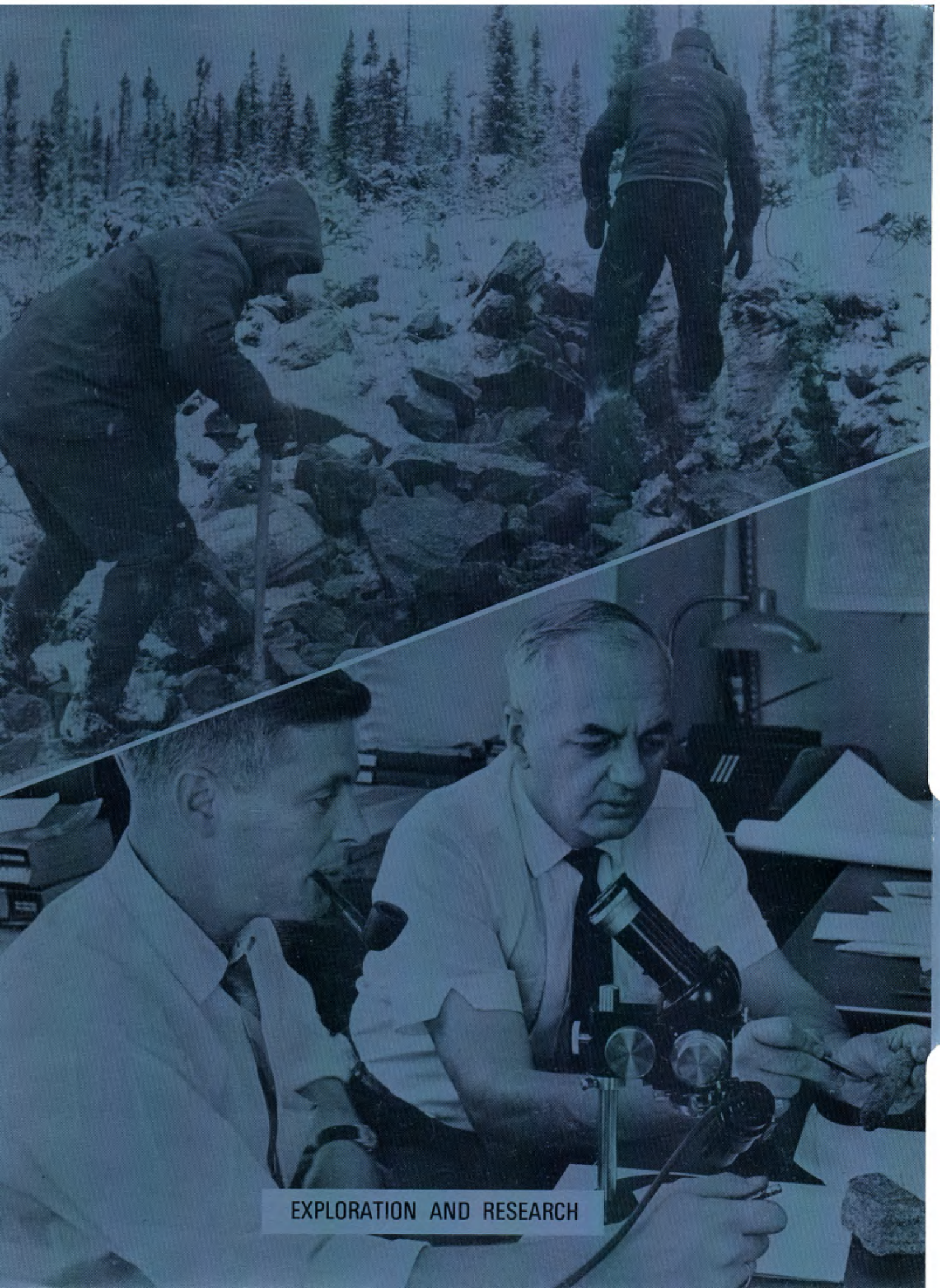
CROSS-SECTION A-A'  
LOOKING SOUTH WEST

STAR LAKE IRON DEPOSIT

Scale: 1 inch = 400 feet







EXPLORATION AND RESEARCH

THE PROCESS



## PRODUCTION PLANS AND TECHNICAL INFORMATION

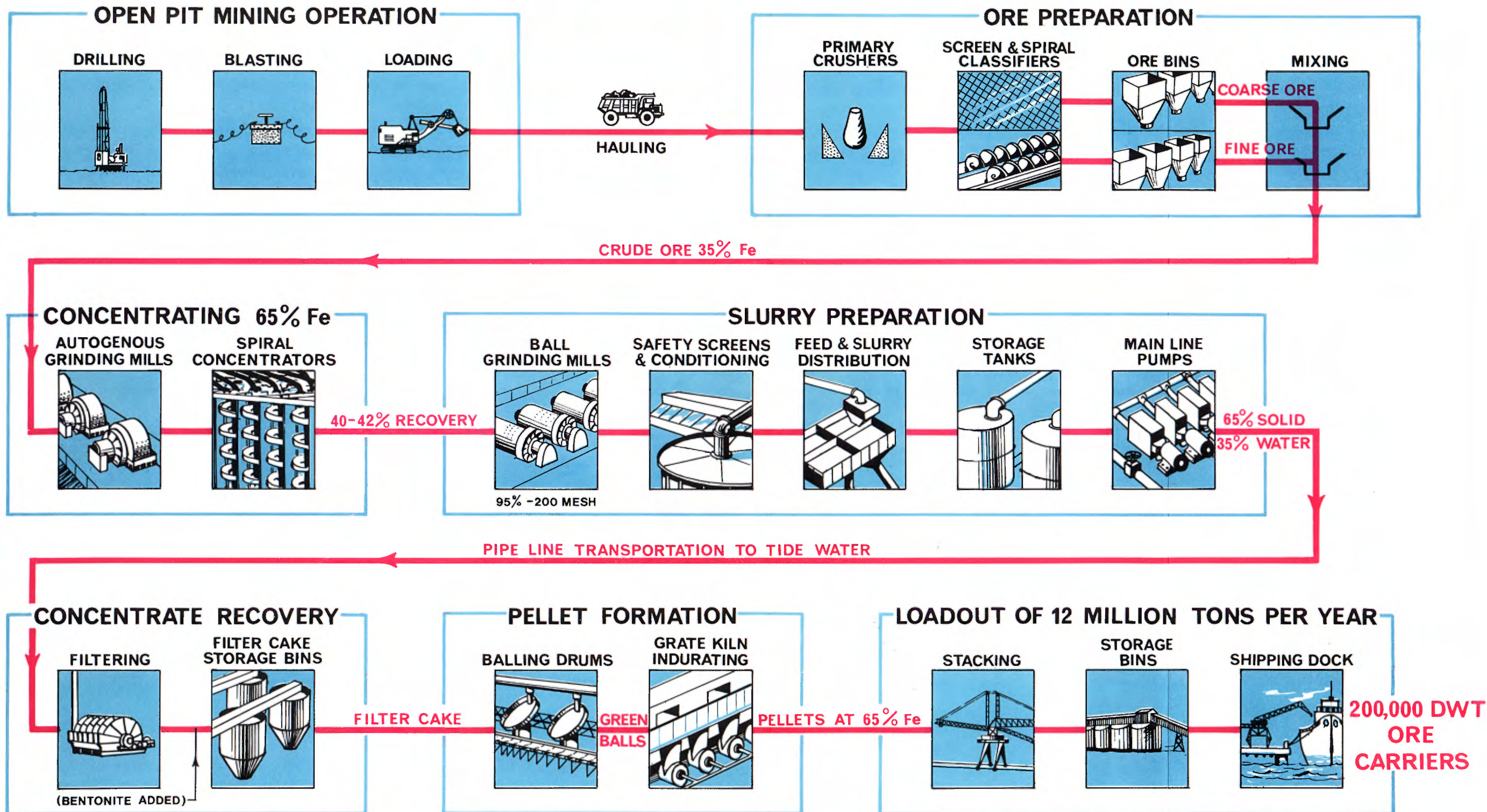
Production plans for the two deposits are related to delivery schedules, which indicate that pellet facilities be built as four units each of 3,000,000 metric tons per year capacity. Three years would be required for construction of power lines, roads, slurry pipeline, railways, townsite, mines, crushers, gravity concentrators, pellet plant, service, storage facilities and shipping facilities.

Technical and feasibility studies for an immediate start on construction of these components have been completed or are underway and are available for reference through Canadian Javelin Limited (see reference list).

Mining of crude ore will employ rotary drills, 10 cubic yard electric shovels and trucks of near 100 to 150 ton capacity operating in conventional benching type surface mines. The product will be delivered to primary crushers outside the final pit outlines, where it will be reduced to -12 inch size, and then conveyed by enclosed conveyor belts to the processing plants.

A simplified flow sheet for the concentration, transportation, pellet plant, storage and loadout facilities is shown on the following page.

# SEMI-SCHEMATIC FLOW DIAGRAM FOR JULIAN and STAR-O'KEEFE IRON ORES



The coarse ore will be reduced to -28 mesh in wet autogenous grinding mills 32' x 8' in size. Two stages of Humphreys spirals will produce concentrates that are then reground to -325 mesh to become pellet feed material. The concentrates will then be transported by the slurry pipeline to the pelletizing facilities at Pointe Noire. Balling drums and grate kiln indurating equipment will process the concentrate into iron pellets having the specifications contained in this proposal. Each pelletizing unit would have an annual capacity of 3,000,000 metric tons.

Year round shipments on a regular tonnage per month basis will be made from a new speciality dock to be constructed near Pointe Noire, Quebec, that would be capable of loading 200,000 ton ships in 18 hours.

Tests have proven that the quality of pellets produced from these deposits, will be amongst the highest quality iron ore blast furnace feed materials, available over a long period, and in large volumes.

The production facilities outlined will be among the three largest iron ore plants operating in North America. Estimates of expenditure for the project are approximately \$400,000,000 in capital and construction costs for two mines, two concentrators,

two new townsites and a major enlargement to another townsite, the slurry transport system, a pelletizing plant and ocean shipping docks. Such facilities will provide for the annual production of 12,000,000 tons of pellets.

Canadian Javelin Limited has carried out extensive engineering studies relating to the technical aspect of this proposal and has engaged and worked closely with the following consultants:

Behre Dolbear and Company,  
Consulting Mining Engineers and Geologists,  
New York, New York.

Canadian Allis-Chalmers Limited,  
Lachine, Quebec.

Canadian Bechtel Limited,  
5640 Pare Street,  
Montreal 307, Quebec.

Dravo Corporation,  
Pittsburgh, Pennsylvania.

Elektrokemisk A/S,  
Oslo, Norway .

Ford, Bacon and David, Incorporated,  
Engineers,  
New York, New York.

Hains Engineering Company Limited,  
Consulting Engineers,  
Toronto, Ontario.  
(Canadian representatives of the  
Lurgi Companies, Frankfurt/Main.)



C.D. Howe Company Limited,  
Consulting Engineering Services,  
4333 St. Catherine Street West,  
Montreal 6, Quebec.

Humphreys Engineering Company,  
Denver, Colorado.

Kilborn Engineering Limited,  
Consulting Engineers,  
Toronto, Ontario.

Lakefield Research of Canada Limited,  
Lakefield, Ontario.

Parsons-Jurden Corporation,  
26 Broadway,  
New York, New York 10004

Pickands, Mather and Company,  
Management Engineers,  
Cleveland, Ohio.

Ramseyer and Miller, Incorporated,  
Consultants to the Iron and Steel Industry,  
New York, New York.

Resources Engineering of Canada Limited,  
931 Yonge Street,  
Toronto 5, Ontario.

Shelpac Research and Development Limited,  
401 Bay Street,  
Toronto 103, Ontario.

Detailed engineering field work and office compilation therefrom is currently being performed, that covers all phases of the project. The responsibilities have been awarded as follows:

A. Kilborn Engineering Limited.

The two open pit mines and concentrator, the two townsites for 13,000 people and the enlargement of another for 5,000 persons, all associated services and the pelletizing plant have been assigned to Kilborn Engineering Limited, Toronto, a group regarded as one of the foremost in the mining and mineral processing industry in Canada. Dravo Corporation, Pittsburgh, pelletizing specialist for the Dravo-Lurgi pelletizing method, confer with Kilborn Engineering Limited.

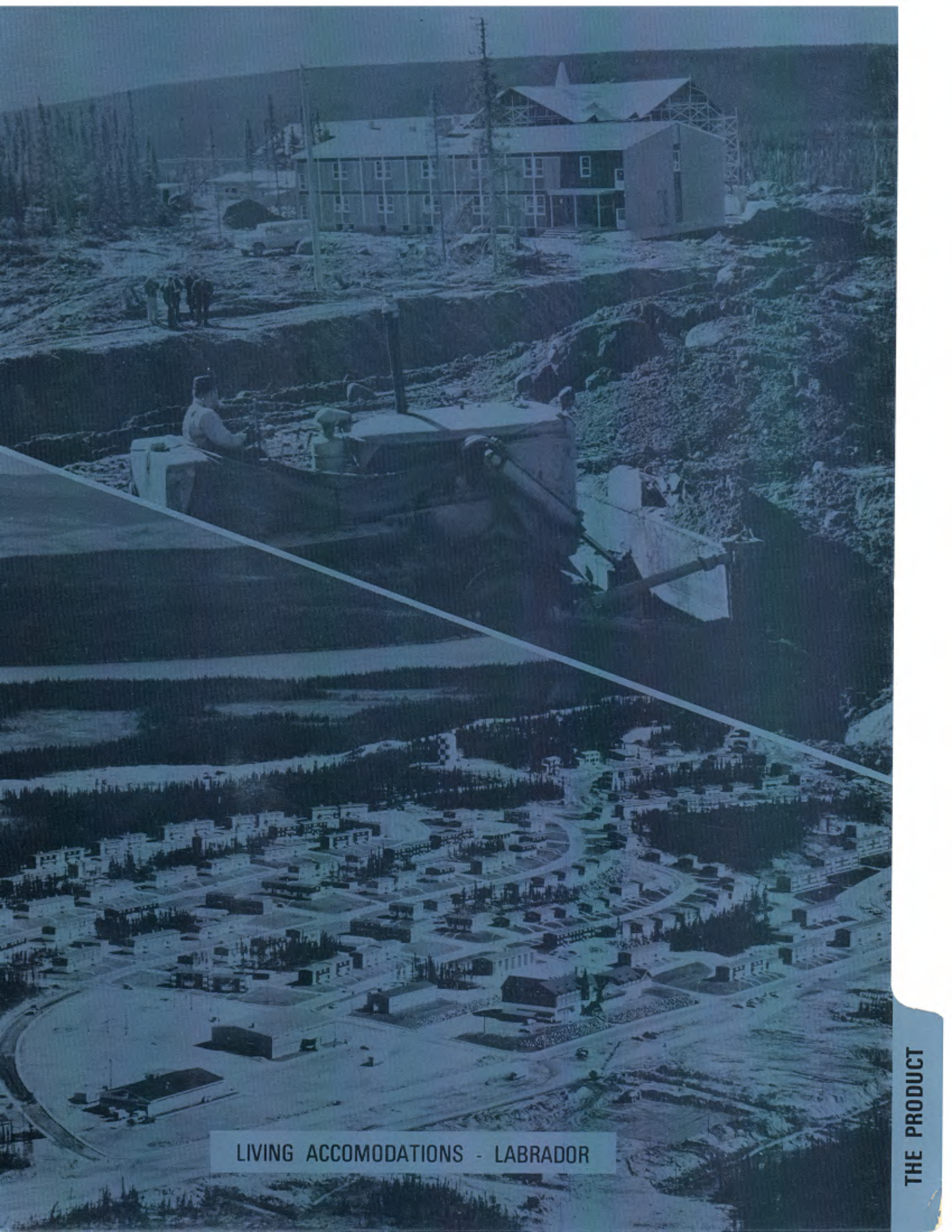
B. Shelpac Research and Development Limited.

The responsibility for land transportation between the concentrators at the northern sites and the pelletizing plant at the southern St. Lawrence site has been assigned to Shelpac Research and Development Limited, Toronto, an organization specialized in bulk commodity transportation via slurry pipelines. Shell Canada Limited and Canadian Pacific Railways, two major concerns equally own Shelpac Research and Development Limited. The scope of this assignment covers the receiving of finely ground concentrates, slurry feed preparation, 232 mile slurry pipeline transport, slurry dewatering and delivery of filter cake to stock pile or pelletizing plant.

C. C. D. Howe Company Limited Canada.

The stockpiling of pellets, recovery therefrom, and the loading into ship phase, has been assigned to C. D. Howe Company Limited Canada. This company, with many years of marine experience has recently completed two iron ore dock projects; one the enlargement of the Iron Ore Company of Canada dock at Sept. Iles, presently capable of loading 150,000 DWT ships with future enlargement; the other, the enlargement of the Quebec Cartier Mining Company dock at Cartier, Quebec, to handle 150,000 DWT ships. C. D. Howe Company Limited Canada is evaluating three dock sites in the general Sept. Iles area, selected by Canadian Javelin Limited, one of which is to be developed to load 300,000 DWT ships initially and provision for 500,000 DWT ships in the future.





LIVING ACCOMODATIONS - LABRADOR

THE PRODUCT



## SPECIFICATIONS

Canadian Javelin Limited guarantees to supply the Purchaser the desired quantity of iron ore pellets having the following specifications:

### Chemical Analysis

Iron	65.60% average
Silica	5.00%
Phosphorus	0.02% maximum
Sulphur	0.02% maximum
Manganese	0.30% maximum
Alumina + Lime + Magnesia	0.50% maximum
Other Elements	Traces
Average moisture content	1.00% maximum

Guaranteed minimum of 64.5% Iron and maximum of 5.5% Silica.

### Physical Characteristics

The iron ore pellets will have the following physical characteristics:

- (i) Size on discharge - 80% in the 3/8" x 5/8" size range - 10% maximum fines under 1/8" in size;
- (ii) Reducibility - over 60%;
- (iii) Swelling - less than 10%;



- (iv) Strength - Minimum average compression strength of pellets in 3/8" x 5/8" size range - 500 pounds per pellet;
- (v) ASTM Coke Tumble Test - 6% maximum fines under 1/8" in a 25 pound sample of the 3/8" x 5/8" size pellets after 200 revolutions.





WOODS AND LINERBOARD OPERATIONS - LABRADOR, NEWFOUNDLAND



## APPENDICES

Appendix I - History of Exploration and Guide to the Literature of  
the Julienne Lake Deposit, David M. Knowles, May 1967.

Appendix II - History of Exploration and Guide to the Literature of  
the Star-O'Keefe Properties, William B. Blakeman, April 1970.

## INTRODUCTION

These outlines of exploration, development work and metallurgical studies concerning the Julian, Star and O'Keefe Lake iron ore deposits have been prepared for general historical information and as a guide to the technical literature of these deposits. The items herein are arranged chronologically and indexed according to the principal subject. Report numbers refer to Canadian Javelin Limited Engineering Report files.



History of Exploration and Guide to the Literature

Julienne Lake Deposit

David M. Knowles

May 1967.

History of Exploration and Guide to the Literature

Julienne Lake Deposit

May 1967

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Chronological Presentation

- 1953 -

1. The Julienne deposit was noted by Boyko during the 1953 Nalco program and received scant mention in "Report on the Wabush Lake Area," Report #7. It was considered of little interest by Melihersik in "General Geology and Economics of the Ashuanipi Lake Area," Report #4.

- 1954 -

Javelin's activities were confined to Wabush this year.

- 1955 -

D. Knowles and W. Roxburgh visited the deposit and concluded that it warranted further investigation.

- 1956 -

2. The deposit was geologically mapped and sampled by the geologic staff of Canadian Javelin Limited while engaged in a regional mapping program. This investigation formed the basis of latter drilling

investigations. "Geologic Report on the Julienne Peninsula Iron Deposit," G. Gastil, 1956, Report #49.

- 1957 -

3. The deposit was drilled for Canadian Javelin Limited by Pickands Mather and Company. Four holes and concentration tests on the core were completed. Efforts were made to maintain the casing at the bottom of the hole. "Report of Exploration - Julian Ore Deposit - 1957," Pickands Mather, 1958, Report #52.

4. Comments and pictures concerning this work will be found in "Progress Report, Wabush - Julian Lakes, September 1957," W. H. Roxburgh, Report #63.

5. Javelin had an observer on the property during the drilling program. His comments and core recovery data are in "Julian Iron Corporation, Diamond Drilling, 1957," H. Mockler, Report #51.

6. Pickands Mather surveyed a preliminary railway location line to the property from Mile 25 of the Wabush Lake Railway. Notes on this are available, but as the route was very rough, a formal report was never prepared.



7. Pickands Mather conducted aerial photography of the region, from which uncontrolled 1-200 topographic maps have been made.

- 1958 -

8. Again on behalf of Javelin, Pickands Mather drilled five more holes for a total of nine widely spaced holes considered sufficient to indicate the potential of the deposit. No effort was made to maintain the casing at the bottom of the hole. Javelin did not maintain an observer, though occasional visits were made. "Report of Exploration - Julian Ore Deposit - 1958," Pickands Mather, 1959, Report #71.

- 1959 -

9. Kilborn Engineering was requested to prepare an estimate of the capital costs for a pilot plant, "Preliminary Estimate - 600 TPD Pilot Plant," Kilborn Engineering, 1959, Report #128.

10. A preliminary estimate of the reserve potential was made in June, "Potential Ore Reserve Calculations," Report #82. W. H. Roxburgh added notes in August and it became Report #103, which is the basis of reserve estimates presented in Item 27, but see Item 41 also.

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11. About six weeks were spent on the property in the summer by a small Javelin staff in an effort to integrate surface and subsurface geologic information. The geologic complexity of the deposit was realized during this investigation. "The Julienne Deposit - A Report of Studies conducted during 1959 to 60," D. Knowles, June 1960, Report #280. Work copies are Report #216.

- 1960 -

12. No work was done until December when  $38\frac{1}{2}$  tons of test pit material was removed for metallurgical investigations. "Julienne Lake Bulk Sample Project," W. MacPherson, May 1963, Report #217.

13. Plans for the testing of this material are contained in "Memorandum re Julian Pilot Plant Tests," W. H. Roxburgh, Report #113.

- 1961 -

14. The test pit material was ground in a Hardinge Mill at Lakefield, Ontario, in January. Two stage spiral tests were made on four runs, the last run made ground ore only. "Report on Grinding and Concentration Tests - Julian Ore," Lakefield Research of Canada, March 1961, Report #118.

15. Humphreys Engineering, Denver, conducted several tests on the Lakefield grind material in 2 and 3 stage spirals. They made two reports which are found in "Humphreys Engineering Co. Spiral Tests," June 27th, 1961, Report #127.

16. About 5 tons of the Lakefield concentrate was smelted to metal in a test by Strategic-Udy. "The Smelting of Julian Concentrates by the Strategic- Udy Process," March 1961, Report #119.

17. Electric smelting tests were arranged for regarding the possibility of direct reduction. Preliminary plans are treated in "Memorandum re Elektrokemisk Electric Smelting Bench Tests," W. H. Roxburgh, 1961, Report #169.

18. Bench tests of both Julian and Wabush concentrates were run so as to demonstrate their similarities, for only Wabush concentrates were available in sufficient quantity to conduct the large scale test. "Report of Testing of Raw Materials," Elektrokemisk, December 1961, Report #191.

19. The large scale test runs were made in Norway in February on 145 tons of Wabush concentrates and Nova Scotia coal. "Smelting Tests of Canadian Javelin Limited," February 1962, Report #215.

20. The tests were observed by Mr. R. Rogers, Head of the Pyrometallurgy and Corrosion Division, Mines Branch, Department of Mines and Technical Surveys, Canada. "Experimental Smelting of Iron Ore Concentrates at Kristiansand, Norway," January 1963, Report #253.

21. H. Ross had been asked to comment upon the relative merits of the several electric smelting processes. "Letter Report on an Electric Iron Smelter and Steel Plant for the Wabush Lake Area, Labrador," January 8th, 1962, Report #193. Another version of this appears under date of January 26th, 1962, Report #267.

22. Beneficiation cost estimates appear in "Preliminary Estimate of Capital and Operating Costs for a Mining and Concentration Plant to produce three million long tons of Concentrate per year at Julian Lake, Labrador," Kilborn Engineering, February 1962, Report #199.

23. Smelting costs using the Strategic-Udy process appear in "Preliminary Estimate of the Cost of Production of Ingots or Billets of Julian Concentrates," Koppers and Company Incorporated, February 1962, Report #206.

24. Smelting costs using the Elkem process appear in "Estimate of Capital and Operating Costs of Pelletizing and Electric Reduction Smelter to Produce 540,000 metric tons of Pig Iron per year at Julian Lake, Labrador," Kilborn Engineering, February 1962, Report #209.



25. Regular pellet plant costs are considered in "Estimate of Capital and Operating Costs for a Pelletizing Plant to produce 2,160,000 long tons of Pellets per year at Julian Lake, Labrador," Kilborn Engineering, April 1962, Report #234.

26. Ramseyer and Miller were retained to evaluate the smelting processes. "Julian Iron and Steel Company Iron Ore Reduction Processes," June 1962, Report #228.

27. A one volume compilation of engineering data concerning the Julian deposit was prepared. "Julian Iron Corporation, Summary Report, Geology, Reserves, Metallurgy," May 1962, Report #222. Additional data regarding development plans has been added from time to time and is generally known as the "Julian Book," Report #247.

28. An estimate of the power requirements appears in "Memorandum re Power Requirements - Julian Ore Body," W. H. Roxburgh, June 6th, 1962, Report #374.

29. Javelin built, under contract, a road to the property during the fall. The only formal report is "Wabush - Julian Road, Foreman's Report," J. Rae, December 1962, Report #254. The road was subsequently taken over by the Newfoundland Government.

30. In anticipation of using the Wabush Pilot Plant for a large scale test of Julian ore, an area extending across the deposit was stripped

in preparation for a trench. "The Julienne Trench Stripping Project," D. Knowles and others, December 1962, Report #249.

31. Soil conditions in potential town and plant areas were investigated with a bulldozer. "Memorandum re Preliminary Ground Examinations, Proposed Townsite Area," W. Blakeman, Report #252.

32. The engineering control survey network was started, the preliminary results appear on the 1-400 topographical maps, but the coordinates are subject to revision when a formal engineering survey is completed. The calculations are on file, Report #282.

33. Concession boundary survey posts were placed in several parts of the area in December. "Memorandum re Survey Reference Posts, Nalco - Javelin - LM & E Boundary Survey," W. Blakeman, January 1963, Report #251.

- 1963 -

34. A brief review of the deposit appears in "Summary Report on the Properties and Holdings of Canadian Javelin Limited," P. Lacombe, January 1963, Report #250.

35. Some of the Lakefield test ore was passed through a three stage spiral at the Ontario Research Foundation in January. This was then pelletized by Dravo. See "Memorandum re Pelletizing Test -

Julian Ore, Dravo, " D. Knowles, January 1963, Report #286.  
Additional information concerning this test is in the correspondence files.

36. A summary of Javelin's mineral and surface rights in the area appears in "Javelin, Julian, Wabush and LM & E Surface Rights and Reservations," W. Blakeman, February 1963, Report #260.

37. Plans for a lake survey program are contained in "Memorandum re Magnetometer Survey and Lake Soundings - Julian Project," W. H. Roxburgh, February 1963, Report #263.

38. The 1959 geologic interpretation was revised in view of the evidence revealed in the trench stripping project, see "Review of the Geology of the Julian Lake Deposit," D. Knowles, April 1963, Report #281.

39. A presentation of the indicated relationships between geology and metallurgy appears in "Geology - Metallurgical Study - Julian," D. Knowles, April 1963, Report #281A.

40. The results of the lake magnetic and sounding program, plus other magnetic interpretative data is given in the "The Julienne Deposit and its Extensions," D. Knowles, May 1963, Report #283.  
The magnetic data included in the original edition of the map covering the land part of the deposit is based upon 1956 and 1959 magnetic work

and has been superceded by the summers magnetic work program .

41. A revised reserve estimate of the deposit, including its extensions, appears in "Julian Deposit - Estimate of Tonnage Potential - Open Pit Mining," D. Knowles, June 1963, Report #285.

42. Several lines of investigation were conducted during the summer of 1963. These included the completion of the grid lines, complete magnetic surveying, new geologic mapping, test pitting and other engineering investigations. The 1-100 magnetic and geologic maps and sections are based upon this work and supercede all other older maps.

43. The lake sounding program showed that a causeway across Julienne Lake was feasible, accordingly a railway route east of Julienne Lake was investigated. "Memorandum re Julienne Railway Reconnaissance Survey," D. Knowles, July 1963, Report #296.

44. Potential survey sites were cleared and marked for aerial photography. The sand plain four miles east of Julienne was examined as a possible townsite area; no formal report covers this examination.

45. The revised geologic interpretation of the deposit is presented in "The Julian Deposit, A Geologic Summary Report," D. Knowles, July 1966, Report #439.

46. Twelve test pits, from which 162 tons of material were



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removed for metallurgical investigations, were made in the fall.  
"Report Concerning the 1963 Bulk Sample Project," D. Knowles, May  
1967, Report #463.

- 1964 & 1965 -

Other exploration activities prevented further investigations of the deposit during these years.

- 1966 -

47. Surface samples were collected from composite areas across the east, central and western portions of the deposit in an effort to compare composition and mineralogy. "Report Concerning the 1966 Sample Project, Julienne Lake Deposit," D. Knowles, Report #464.

The core from the drill holes had been stored in a commercial warehouse in Wabush; this burned during the spring, accordingly all core from the deposit was destroyed.

48. The structural geology of the deposit is the subject of one chapter in "The Structural Development of Labrador Trough Formations in the Grenville Province, Wabush Lake Area, Labrador," D. Knowles, 1967, Report #465.

49. The mineralogy of the deposit is the subject of a M. Sc. Thesis by W. Blakeman entitled "A Study of the Mineralogic and Magnetic Characteristics of Metamorphosed Iron Formation, May 1968, Report #568.

The preceding outline of activities and reports covers nearly all aspects of the significant engineering investigations that have been conducted to date concerning the deposit. There are some investigations not included as they are but indirectly related to the project, or are ideas for future work. These include a reserve estimate based upon the horizontal slab method, drilling and gravity surveying plans, column flotation work, water supply ideas and other miscellaneous items.

It is concluded that most lines of useful exploration have been investigated and completed and that the future endeavours should be an integrated development program.

David M. Knowles  
Chief Geologist  
CANADIAN JAVELIN LIMITED

History of Exploration and Guide to the Literature

Star-O'Keefe Properties

William B. Blakeman

April 1970.

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## Chronological Presentation

- 1957 -

The Star-O'Keefe claim groups in the Mt. Wright area of Northeastern Quebec, were located and staked by the exploration staff of Canadian Javelin Limited during July. Deposits of a beneficiating type of iron ore, similar to nearby deposits in Labrador and Quebec were indicated by surface showings and reconnaissance magnetometer surveys. The initial work is covered in "Exploration Report O'Keefe - Audrea Lake Claim Group, Quebec," Geology Department, Canadian Javelin Limited, August 30th, 1957, Number 64.

During September, a 9,500 pound bulk ore sample was taken from the O'Keefe deposit and during November grinding and spiral concentration tests were conducted by Aerofalls Mills Limited of Toronto and Humphreys Engineering Company of Denver, Colorado. This above project is reported in "Grinding Report on Jubilee Mine Ore - Canadian Javelin Limited," by Aerofalls Mills, November 1957, Number 123; "Humphreys Spiral Tests Jubilee Mine Ore - Canadian Javelin Limited," by Humphreys Engineering,

- 3 -

Javelin Limited. This survey accurately located and delineated the iron formation in the area, and is discussed in: "Aerial Magnetic Survey of the Harvey - Star - Audrea - East Lake Areas," by Canadian Javelin Limited, 1959, Number 69.

- 1959 -

Staff activities were confined to the Julian deposit during the field season.

- 1960 -

The field work consisting of geologic mapping, magnetometer surveying and diamond drilling concentrated on the Star Lake deposit this year. However, reconnaissance magnetometer surveys and mapping were conducted on a number of the smaller, outlying claim groups. These groups have since lapsed. Seven holes totaling 2,779 feet were drilled on the Star Lake property, and the results are presented in: "Summary Report - Star Lake Drill Program," by D. M. Knowles, May 1961, Number 188, Parts 1 & 2.

In addition to the Company report, two independent engineers reports on the Jubilee properties in the area were submitted by Dr. J. A. Retty, based upon the work up to and including the 1960

November 1957, Number 65; and "Jubilee Iron Corporation Bulk Sample Number 1-1957," and "Metallurgical Tests O'Keefe Lake Claim Group," by Canadian Javelin Limited, December 1957, Number 67.

In December, an independent engineers report on all of the Jubilee properties in Northeastern Quebec was written by H. J. Bergmann. This report is entitled: "Report on the Properties of Jubilee Iron Corporation Saguenay County, Quebec," H. J. Bergmann, December 16th, 1957, Number 68.

- 1958 -

During the summer, exploration and development work consisted of grid surveying, ground magnetic surveying, mapping and diamond drilling. Eighteen holes totaling 4,994 feet were drilled in the northwestern portion of the O'Keefe deposit, and magnetometer lines were run over the Star Lake group. The 1958 field work is reported in: "Exploration Report O'Keefe Lake Property," by Canadian Javelin Limited, June 1959, Sections 1 & 2, Numbers 89 and 81; and "Exploration Report, Star Lake," by Canadian Javelin Limited, June 1959, Number 93. In addition to the above work, an aerial magnetic survey was conducted in the area by Aero Magnetic Surveys Limited under contract to Canadian

field season. These reports are entitled: "Property Report of Jubilee Iron Corporation," by J. A. Retty, July 11th, 1960, Revised February 16th, 1961, Number 117; and "Field Work, Jubilee Iron Corporation, July 10th, 1960 to December 31st, 1960," by J. A. Retty, February 9th, 1961, Number 100.

- 1961 -

Field work in 1961 consisted of additional drilling at Star Lake, new drilling at Javelin Lake, and an exploratory X-Ray drilling program on the outlying claim groups. Twelve new holes were completed at Star Lake, totaling 4,025 feet, to bring the final footage for the 1960 and 1961 programs up to 6,824 feet.

The following reports cover the development programs of this year: "Summary Report Star Lake Deposit," by Jubilee Iron Corporation, October 31st, 1961, Number 183; "Jubilee Field Report 1961," Staff, Number 220; "Jubilee Iron Corporation Canadian Javelin Limited Star Lake Ore Reserve Calculations," D. M. Knowles, November 1961, Number 284 (Note: Subsequent Revision, Number 298.) "Jubilee Iron Corporation Geology of the Star Lake Deposit Quebec," Parts 1 & 2, D. M. Knowles, April 1962, Numbers 218 & 219; and "Jubilee Iron Corporation Exploration Report O'Keefe - Purdy - Audrea Lake Zone, Quebec," W. B. Blakeman, May 1962, Number 226.

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- 1962 -

No field work was conducted on the Jubilee ground this year. However, effort was devoted to metallurgical studies and cost estimates, which are covered by a letter report concerning an "Electric Iron Smelter and Steel Plant for the Wabush Lake Area," by H. U. Ross, January 26th, 1962, Number 193; "Jubilee Iron Corporation Summary Report, Revised December 1st, 1962,"\* Number 248; and "Jubilee Iron Corporation Cost Estimate O'Keefe - Star Lake Development," by W. H. Roxburgh, March 1st, 1962, Number 208. H. J. Bergmann also submitted an independent outside report entitled: "Report on the Properties of Jubilee Iron Corporation Mt. Wright Area, Quebec," dated January 31st, 1962, Number 204.

- 1963 to 1968 Inclusive -

Field work during this period concentrated on Javelin properties in other areas, however, office and metallurgical studies were conducted resulting in the following Company originated reports: "Memorandum re Soft Iron Piglets," by Canadian Javelin Limited, December 1963, Number 297; "Jubilee Iron Corporation, Mining Properties Central America and Northeastern Quebec," by W. S. Hegler, April 1st, 1964, Number 302; "Jubilee Iron Corporation Corrections to O'Keefe-Star Reserve - Grade Calculations," by

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\* This is also known as the "Jubilee Book."



D. M. Knowles, 1965, Number 298; "Jubilee Iron Corporation Summary Report, Star and O'Keefe Lake Iron Ore Deposits," May 1965, Number 394; and, "Grade and Reserve Calculations Star and O'Keefe Lake Deposits," by D. M. Knowles, May 1968, Number 548.

During this period the following independent engineers reports were submitted to the Company: "Report on the Properties of the Jubilee Iron Corporation Mt. Reid - Mt. Wright Area, Northern Quebec, Canada," by Pierre LaCombe, March 1963, Number 275; "General Report on the Properties of Jubilee Iron Corporation," by Pierre LaCombe, August 12th, 1963, Number 287; "Jubilee Iron Corporation Report on Properties in Northwestern and Northeastern Quebec," by Pierre LaCombe, February 26th, 1964, Number 304.

- 1969 -

During the late summer and fall of this year, five holes totaling 1,680 feet were drilled in the iron formation northeast of O'Keefe Lake. All of the previous drilling has been concentrated northwest of O'Keefe Lake, however, the new drilling has not added appreciable tonnage to the total ore reserves. The report covering the new work is entitled: "Northeast O'Keefe Lake Diamond Drilling Report August - September 1969," by Peter LaRush, October 1969, Number 579.

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- 1970 -

There had not been any field work conducted on the Jubilee properties as of late April 1970. An independent engineers report was submitted to the Company however, by H. J. Bergmann, January 23rd, 1970. This report is entitled: "Report on the Mining Properties of Dominion Jubilee Corporation Limited," Number 583.

William B. Blakeman