23G/2 (110)

JULIAN IRON CORPORATION
SUMMARY REPORT
SECTION. I GEOLOGY
SECTION. II ORE RESERVES
SECTION.III METALLURGY
MAY,1962

3 222

SECTION I. GEOLOGY

Canadian Javelin Limited
JULIAN IRON CORPORATION

SUMMARY GEOLOGICAL REPORT

JULIAN LAKE ORE BODY

May, 1962

SCANNED IMAGE

CONTENTS

JULIAN IRON CORPORATION

Julian Lake Ore Body
Summary Geological Report

INTRODUCTION

This report is a consolidation of the geological reports on Canadian Javelin's Julian iron ore deposit. It combines the information in exploration and diamond drilling reports for the years 1956, 1957 and 1958, prepared by the Canadian Javelin staff and Pickands Mather & Co., with the results of a detailed geological and mineralogical study of the property, undertaken by Canadian Javelin in 1959-60. It also presents the geology of the deposit in a form for use in evaluation of the deposit and estimation of its ore reserve tonnage.

The presence of quartz-specular hematite rocks on the Julian Peninsula was first noted in 1953. It was not until 1956, after a thorough examination of the occurrence, that the importance of the deposit was realized. The 1956 exploration program indicated a synclinal shaped body of concentrating iron ore extending some 6,000 feet across the Julian Peninsula, and having widths of from 1,800 to 3,400 feet. Sampling of 28 outcrop areas gave an indicated grade of about 37% iron, with very low sulphur, phosphorus and manganese.

In 1957, 1,904 feet of diamond drilling, in four holes, was completed. The results were favorable and in 1958 an additional 1,573 feet of drilling, in five holes, was completed, a total of 3,477 feet in nine holes.

In 1959 and 1960, a detailed mineralogical and geological study of the deposit was made by Javelin geologists and correlation of this work, with the previous information, has given a clear understanding of the geology of the deposit.

The original reports are available in Canadian Javelin's files for the detailed information used in this consolidated report.

LOCATION

The Julian Lake deposit is situated in Labrador-Newfoundland at the north end of Wabush Lake, about twelve miles north of the Wabush-Carol area, where concentrating plants are being built by Wabush Iron Co. and Iron Ore Company of Canada. (Location Map - Exhibit A - attached)

The deposit consists of a 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 iron ore deposit trends northeasterly through this peninsula for some 6,000 feet, from shore-to-shore, and has a width of from 1,800 to 3,400 feet.

REGIONAL GEOLOGY

The iron ore deposits in the Wabush-Julian Lake area of Labrador-Newfoundland lie within the Canadian "precambrian shield" and are associated with a belt of metamorphosed rocks of sedimentary origin, known as the "Labrador Trough". This lithological unit has been traced for a distance of over 700 miles from Ungava Bay, in the north, through the Knob Lake-

Wabush Lake-Mount Wright and Mount Reed areas, to Lac Jeannine and beyond in southeastern Quebec.

The "Labrador Trough" group of younger precambrian rocks lies unconformably upon an older "Archean" gneiss complex; however, metamorphism has changed the shales of the younger sediments to the extent that they are indistinguishable from the underlying gneiss complex, south of latitude 53° 20' north.

The "iron formation", consisting of quartz-silicate or iron oxide rock, the "quartzite" and the "marble", consisting of calcium-magnesium carbonate rock, are the only remaining recognizable units of the original sedimentary formations of the "Labrador Trough". The known iron ore deposits in this area of Quebec and Labrador are found within the iron formation. The geological relation between the iron formation, "quartzite", and marble has been established and these three, readily recognizable, rock units have become the "markers" used in exploration for iron ore deposits in the area.

Within the length of the "Labrador Trough", the "iron formation" shows a wide variation in physical and mineralogical characteristics; these variations are the result of variations in original composition, degree of metamorphism and extent and complexity of the folding or deformation to which the original sedimentary beds have been subjected. There is evidence that the iron formation has been subjected to a very low degree of metamorphism in the Knob Lake area where secondary hematite and goethite are the ore minerals. The degree of metamorphism increases to the north, where magnetite is the important ore mineral, and to the south specular hematite is the principal iron ore mineral.

The bulk of the widespread iron formation is a quartz-silicate rock of little commercial interest, containing only small percentages of oxide ore minerals. Under these conditions, it is of little interest.

At irregular intervals, within the formation, a favorable combination of oxide iron concentration, metamorphism and folding have combined to produce large bodies of iron formation, containing iron oxide ore minerals suitable for commercial utilization.

The Julian deposit, at the north end of Wabush Lake, is the only exposed part of that belt of iron formation which runs under Wabush Lake from Wabush Mountain to Julian and continues on into Shabogamo Lake. The characteristic association in the Wabush Lake area of quartzite and iron formation, containing predominately iron oxide minerals, is found in the deposit.

The primary synclinal fold controls the shape and depth of the deposit and is related to the regional overturned isoclinal folding characteristic of the Wapussakatoo Mountains to the west.

DETAILED GEOLOGY

Julian Lake Ore Body
(Geologic Plan and Cross-Sections, Exhibit B, Attached)

A. INTRODUCTION

Over 270 outcrops have been opened and mapped on the deposit. Each of these has been carefully studied for mineralogical, structural and stratigraphic information. In addition, the core from 3,477' of diamond drilling in nine drill holes has been similarly studied.

This work has resulted in recognition of certain mineralogical features which have been correlated within the ore body, and in the recognition of the seven stratigraphic sub-members within the ore body, as shown on the attached geologic map and cross-sections. This, and other data, led to the identification of the cross-folded synclinal form of the deposit.

B. MINERALOGY

The mineralogy of the deposit is essentially simple, the ore being a friable, coarsely-crystalline mixture of quartz and iron oxide ore minerals. The iron oxide minerals occur in the five recognizable forms below:

Coarsely-crystalline	platey, specular hematite, shiney
Medium-grained	granular (non-specular) hematite
	granular martite (oxidized magnetite)
Fine-grained	granular magnetite
Fine-grained	goethite
Earthy	limonite

Although the iron oxide mineral content of the ore body is relatively uniform throughout, the combination of crystalline quartz, with variations in one or more of these types of iron oxide minerals, plus other observable physical and mineralogical variations, has led to the recognition of seven varieties of iron formation, as listed below:

1) Coarse-grained, generally friable, quartz-specular hematite, well foliated, massive to banded.

2) Coarse to medium-grained, quartz-granular hematite, massive to banded, often hard, probably contains martite.

3) Coarse to medium-grained, quartz-specular hematite with cream-colored leached, bladed or lath-like vugs which have the appearance of a leached amphibole mineral, often strongly foliated. This distinctive material is called "leached silicate" in this report as a manner of identification only, because the actual presence of any silicate minerals has yet to be determined.

4) Fine grained, hard, chert-blue colored hematite.

5) Brown sponge-like material, a mixture of quartz and granular hematite with additional goethite and limonite, porous.

6) Yellow-brown, completely altered, chert and mixed goethite-limonite.

7) Mottled quartzite containing variable amounts of granular hematite and limonitic stain.

Generally, only one of the above varieties of the iron formation will be found at an outcrop area or drill hole interval. The distribution of these varieties within the deposit led to the recognition of seven stratigraphic sub-members within the deposit, each sub-member characterized by a particular appearance as determined by the various proportions of the mineralogic varieties within the stratigraphic sub-member.

Details regarding the occurrence of the varieties of iron formation in various parts of the deposit are given in the discussion of stratigraphy and the logs of the diamond drill holes, which follow.

C. DIAMOND DRILLING AND SURFACE SAMPLING

Diamond drilling has been laid out on a grid system and has been designed to give a cross-section of the deposit, as well as to fit into a planned drilling pattern.

CANADIAN JAVELIN LIMITED
Summary of Diamond Drill Hole Log
JULIAN DEPOSIT

Hole No. J-1	Depth 596 ft. Inclination vertical Direction	Location N 10500 E 10000

Footage Interval	% Fe	Sub-Member	Description
0-3			Overburden
3-60	34.41	E	Weakly-banded, fine-medium grained quartz-granular hematite, fractured vertically, goethite cement, some specular hematite after 28, some blue variety at 20-42, manganese oxides at 15-21.
60-93	35.87	F	Quartz martite variety (60-65) followed by quartz-specular with leached silicates.
93-132	35.58	E	Quartz-specular (93-100) followed by fine-grained quartz-granular hematite, manganese oxides present 104-111, blue variety 114.
132-166	27.82	F	Quartz-specular hematite, friable, some leached silicates.
166-298	38.19	E	Quartz-specular sections mixed with quartz-granular hematite sections, considerable goethite, fine to medium-grained, locally manganiferous, blue variety at 198.
298-596	34.01	F	Quartz-specular and quartz-granular hematite intervals, leached silicates common, considerable goethite-limonite in places, limonitic quartz and sericite mud (410-423), fairly uniform quartz-granular hematite with silicates below 423.

Remarks: No core 280' - 290' - Average sludge analysis, 15-310, 34.82% Fe.
Average core analysis, 3-596, 35.33% Fe.

SCANNED IMAGE

CANADIAN JAVELIN LIMITED
Summary of Diamond Drill Hole Log
JULIAN DEPOSIT

Hole	Depth 705'	Location
No. J-2	Inclination vertical Direction	N 9500 E 1000

Footage Interval	% Fe	Sub-Member	Description
0-18			Overburden
18-61	43.28	B	Disseminated, quartz-granular hematite (martite), leached and limonitic, considerable goethite and introduced specular hematite (sponge-like variety), brecciated.
61-118	21.28	A	Quartzite with little iron except 69-84, which is goethitic quartz-martite.
118-160)		B	Quartz-martite with introduced hematite, leached and oxidized, considerable goethite-limonite.
)	34.47		
160-177)		C	Medium-grained, quartz-specular hematite, some seams of solid specular hematite, occasional martite.
177-245	39.40	D	Disseminated, fine-medium grained, quartz-specular and quartz-granular hematite, brecciated and recemented with specular hematite, specular hematite rich after 215.
245-277	32.45	E	Disseminated, quartz-granular hematite, banded, leached and goethitic, specular hematite zone 258-263, lean zone 247-252, blue variety 260.
277-327	42.67	E-F	Disseminated and banded, fine to medium-grained, quartz-granular hematite, locally limonitic, locally specular hematite bearing.
327-705	34.81	F	Intermixed sections of quartz-specular hematite and quartz-granular hematite, occasional leached silicates toward top, more below 645, locally limonitic and leached.

Remarks: Average core analysis 20-705, 33.37% Fe.
Average sludge analysis 20-360, 37.50% Fe.

CANADIAN JAVELIN LIMITED

Summary of Diamond Drill Hole Log

JULIAN DEPOSIT

Hole No. J-3	Depth 318' Inclination vertical Direction	Location N 11500 E 10000

Footage Interval	% Fe	Sub-Member	Description
0-42			Overburden
42-300	34.65%	F	Medium to coarse grained, quartz-specular hematite with leached silicates, banded and foliated, quartz martite and granular hematite 113-129, mixed varieties 129-169, occasional limonitic bearing sections.
300-305	4.71	G	Quartzite with red hematite mud.
305-318			Sericite mud, altered mica schist.

Remarks: Average core analysis 47-301, 34.65% Fe.
Average sludge analysis 30-300, 4[illegible].13% Fe.

CANADIAN JAVELIN LIMITED
Summary of Diamond Drill Hole Log
JULIAN DEPOSIT

Hole No. J-4	Depth 328' Inclination vertical Direction	Location N 8500 E 1000

Footage Interval	% Fe	Sub-Member	Description
0-16			Overburden
16-125	33.52	F	Medium grained, quartz-specular hematite with some granular hematite intervals, locally leached and limonitic, also some sponge-like variety.
125-163	35.71	G	Fine grained, leached and limonitic, quartz martite and goethite.
163-255	29.22	F	Intermixed quartz-specular and quartz-granular hematite varieties, disseminated and banded, bedding vertical at 165 and 183, considerable limonite in leached zones locally, lean zone 238-255.
255-302	27.92	G	Goethitic quartzite, quartz martite 255-270, considerable limonite, some sericite.
302-328			White quartzite with some micaceous intervals.

Remarks: Average core analysis 16-302, 31.10% Fe.
Average 20-255, 37.49% Fe. (sludge analysis)

SCANNED IMAGE

CANADIAN JAVELIN LIMITED
Summary of Diamond Drill Hole Log
JULIAN DEPOSIT

Hole	Depth	Location
No. J-5	Depth 203' Inclination 50° Direction N	N 10161 E 9000

Footage Interval	% Fe	Sub-Member	Description
0-12			Overburden
12-50	54.29	E	Quartz-specular hematite and granular hematite intermixed, hard blue variety hematite (13-25), mostly friable, weakly banded, occasional sericite seams.
50-144	33.35	F	Schistose quartz-specular hematite with leached silicates, medium to coarse-grained, banded, only slightly altered.
144-152	35.17	G	Red mud and quartz seams.
152-196			Muscovite and sericite mud, altered schist.
196-203			Quartzite, white, muscovite-bearing.

Remarks: Average core analysis 12-154, 39.34% Fe; 12-37, 63% Fe. Below 37' normal range of assays.

CANADIAN JAVELIN LIMITED
Summary of Diamond Drill Hole Log
JULIAN DEPOSIT

Hole No. J-6	Depth 330' Inclination vertical Direction	Location N 9500 E 8000

Footage Interval	% Fe	Sub-Member	Description
0-10			Overburden
10-247	42.48	D	Intermixed quartz-specular and quartz-granular hematite varieties, limonitic down to 100, generally medium-grained, banded and disseminated.
247-299	36.54	E	Quartz-specular hematite, coarse-grained, banded, friable, blue variety at 266.
299-330	36.85	F	Quartz-specular hematite, leached silicates 316-319, friable.

Remarks: No core: 295'-308'-Average core analysis 10-323', 35.58% Fe.

SCANNED IMAGE

CANADIAN JAVELIN LIMITED
Summary of Diamond Drill Hole Log
JULIAN DEPOSIT

Hole No. J-7	Depth 385' Inclination vertical Direction	Location N 11000 E 11500

Footage Interval	% Fe	Sub-Member	Description
0-12			Overburden
12-35	38.82	C	Coarse grained, quartz-specular hematite, banded, a few leached silicates.
35-175	30.79	D	Mostly quartz-granular hematite, disseminated and banded, fine to medium-grained, both hard and friable sections, occasional seams of quartz-specular hematite, sericite mud (41-43), badly leached zone 47-108 showing considerable red hematite stain.
175-261	42.41	E	Quartz-granular hematite, fine to medium-grained, some quartz-specular sections, blue variety in thin seams (193-199), generally banded, hard, fine-grained disseminated quartz hematite (247-261).
261-385	38.63	F	Coarse, medium-grained, quartz-specular hematite with leached silicates, sericite mud at 308, some limonite in leached intervals.

Remarks: No core: 245'-257', 278'-297', 321'-342'.
Average core analysis 12-379, 35.58% Fe.

Canadian Javelin Limited

SCANNED IMAGE

CANADIAN JAVELIN LIMITED
Summary of Diamond Drill Hole Log
JULIAN DEPOSIT

Hole No. J-8	Depth 356' Inclination vertical Direction	Location N 10000 E 11500

Footage Interval	% Fe	Sub-Member	Description
0-26			Overburden
26-113	34.57	B	Quartz-granular hematite, very little specular, medium to fine-grained, banded and disseminated, sericite seam (78-80) occasionally limonitic.
113-145	21.18	A	Quartzite, contains a little granular hematite, limonitic.
145-273	30.96	B	Quartz-granular hematite, occasional quartz-specular hematite, disseminated and banded, friable and semi-friable sections, some limonite-goethite below 164, sericite seam (150-151, 272-273), breccia zone 205-218.
273-356	34.76	C	Coarse to medium-grained quartz-specular, slightly limonitic, some
?		D	Quartz-granular hematite after about 320, gradational change.

Remarks: No core: 26'-46', 66'-105', 125'-165', 185'-225', 245'-265', 285'-322' - Average core analysis 26-356', 30.65% Fe.

Canadian Javelin Limited

SCANNED IMAGE

CANADIAN JAVELIN LIMITED
Summary of Diamond Drill Hole Log
JULIAN DEPOSIT

Hole No. J-9	Depth 261' Inclination vertical Direction	Location N 11000 E 13000

Footage Interval	% Fe	Sub-Member	Description
0-138			Overburden
138-210	34.16	D	Quartz-granular hematite, banded and disseminated fine to medium-grained, quartz-specular occurs (145-168), limonitic and hematitic stain common.
210-261	39.11	E	Coarse grained, quartz-specular hematite, disseminated and banded, some quartz-granular hematite intervals.

Remarks: Average core analysis, 138-261, 36.67% Fe.

SCANNED IMAGE

A total of 3,477 feet of diamond drilling has been done on the deposit in nine holes. Locations for these holes were carefully chosen to obtain a maximum of information from limited drilling footage. (See map Exhibit B)

The first four holes were drilled on a cross-section of the ore body, to confirm the internal structure. The remaining five holes were located to provide information on the grade and structure on either side of this central cross-section.

Core samples were analyzed for iron, manganese, sulphur, phosphorus and silica. Iron analysis only is shown on the summary drill logs, on the following pages, as manganese, sulphur and phosphorus content of the ore were below significant values.

In addition to this chemical analysis, a detailed mineralogical examination and classification was made of the drill core samples, followed by bench scale metallurgical tests to determine the concentrating characteristics of the ore. These tests gave a recovery of 42% by weight, as a 63% iron concentrate.

Metallurgical studies on the ore are discussed in detail in a separate report.

Extensive surface outcrop sampling was undertaken in 1956 in connection with detailed geological mapping, covering 28 areas of outcropping iron ore. The average analysis of these samples was:

Iron	37.15%
Manganese	0.18%
Phosphorus	0.012%
Sulphur	0.004%

Details of these samples are given in 1957 geological reports.

A 40 ton bulk sample, believed to be representative of the ore body, was taken from five test pits in 1960 for use in metallurgical tests. The average analysis of this sample was:

Iron	36.75%
Manganese	0.09%
Silica	46.16%
Sulphur	Trace
Phosphorus	0.009%
Titania	0.21%

Details of this sampling are given in the 1960 Bulk Sample Report.

D. STRATIGRAPHY

Three formations, associated with the Labrador Trough sequence, have been identified on the Julian Peninsula. These are in sequence of age:

1) The Underlying Quartzite Formation

The underlying "Wapussakatoo quartzite" is found in outcrop in several places south of the deposit and as rubble north of hole 5 (see Geologic Plan, fig. 1). Its micaceous phase (transitional into the overlying schist) was cut in hole 4 (302-328), hole 5 at 196 and possibly at the bottom of hole 3 (see Geologic Cross-Sections, fig. 2). The typical material is white coarsely crystalline quartz with occasional muscovite flakes.

2) The Mica Schist Formation

The mica schist lies immediately above the quartzite, but does not outcrop. Material from this formation is found in hole 3 below 305, hole 5 (152-196) and hole 4 around 300 feet. The recovered material is micaceous, sericitic and talcose clay and quartzose schist.

3) The Iron Formation

This formation forms the ore body and consists of the seven recognizable sub-members, described below:

Sub-Member G

Unit G is the lowest unit of the iron formation and has been found in six outcrops,in hole 3 (around 300), hole 4 (125-163, 255-302), hole 5 (144-152); it appears to have a thickness of around 50 feet.

The most descriptive term for this unit is siliceous goethite. It consists of remnants of quartz-martite in a matrix of brown, cherty goethite with many vugs and other alteration features. This unit is commonly found as the basal unit of the iron formation in the Wabush Lake area and represents the leached and altered silicate-carbonate iron formation member.

Sub-Member F

Unit F is the most readily recognizable unit in the deposit because of the presence of altered silicate-like vugs in the quartz-specular hematite rock. Only a few silicate casts are found in the south limb in a seam about a foot thick, but on the north limb the zone or zones are much thicker (tens of feet) and contain enough leached silicate casts such that the rock is quite schistose and distinctively cream-colored. No identification of the leached mineral is possible on the altered remains, but it was not grunerite. It probably was an aluminous amphibole, either edenite or anthophyllite, both of which have been petrographically identified in the specular hematite members of the iron formation at other places.

Below the silicate zone, which is near the top of Unit F, the material is predominately quartz-specular hematite. The unit is found in numerous outcrops on both the north and south limbs, and in holes 7 (261-EOH), 3 (42-

300), 1 (60-93, 132-166, 298-EOH), 2 (277-EOH), 5 (50-144), hole 6 (299-EOH), and 4 (16-125, 163-255). It is in the order of 100 feet thick.

Sub-Member E

This unit is characterized by quartz-granular hematite, probably in part martite derived from oxidized magnetite. There is very little specular hematite and the rock is generally massive. It grades upward into the mixed martite-specular material of Unit D, such that its identification is sometimes difficult.

There is one characteristic feature which marks a thin zone within the unit's 50-100 foot thickness. This is a zone, or perhaps individual lenses, a few feet thick consisting of a fine-grained blue hematite matrix which may or may not exhibit 1/4 - 1/2 inch plates of crystalline hematite. Quartz is rarely seen in these zones, but secondary manganese is observed.

The seam is found in outcrop in both limbs and in holes 7 (175-261, blue hematite at 200 and 235), 1 (3-60, 93-132, 166-298, blue at 20, 42, 114, 198), 2 (245-277, blue 260), 5 (12-50, blue 13-25), 6 (247-299, blue 266).

Sub-Member D

There are no distinctive features about this unit. It consists of both quartz-specular hematite and quartz-granular hematite materials, but there appears to be more specular hematite towards Unit E. The identification of the unit in most instances is made by the recognition of Units E and C on either side. On the south limb, in the area of intense folding between holes 1 and 2, this unit exhibits a considerable amount of the sponge-like texture variety, consisting of a mixture of coarse-grained quartz and granular

SCANNED IMAGE

hematite shot through with veinlets of quartz and hematite, all considerably altered to goethite-limonite. The origin of this material is not understood, but it appears to be related to the folding of the body.

The indicated thickness of Unit D is somewhere around 100-200 feet and it is found in holes 7 (35-175), 2 (177-245), 6 (10-247), and in outcrops on both limbs.

Sub-Member C

This unit is quite distinctive because it consists almost wholly of brilliant, coarse grained, quartz-specular hematite, usually schistose. It is, unfortunately, also so friable that outcrops are not plentiful and it also has suffered the most deformation, such that its continuity through the deposit is somewhat in doubt.

The unit appears to be 30-50 feet thick. In addition to outcrops, it has been found in holes 7 (12-35), 8 (273 to about 320) and 2 (160-177).

Sub-Member B

This unit is similar to Unit D, consisting of a mixture of quartz-granular hematite and quartz-specular hematite. However, there is a distinct gradation from essentially all quartz-granular hematite near Unit A to all quartz-specular hematite near Unit C. This unit locally contains thin seams of the blue hematite variety and occasionally leached silicate casts.

The unit is between 100 and 175 feet thick and in addition to outcrops is found in holes 8 (26-113, 145-273) and 2 (18-61, 118-160).

Sub-Member A

This unit is easily recognized because it is a very quartzose material, consisting of white quartz with irregularly distributed patches of darker ferruginous materials, granular hematite and goethite.

It forms the central unit in the deposit and marks the axial plane of the syncline. Indicated thicknesses are in the order of 50 feet and it has been seen in outcrop and in holes 2 (61-118) and 8 (113-145).

The indicated "total stratigraph thickness" of the iron formation sub-members is between 500 and 600 feet. This thickness of iron formation has been folded back against itself to form the Julian ore body. The surface expression, as mapped, is between 2,000 and 3,400 feet in width.

The primary structure in the Wabush Lake area is large scale folding, which is characteristically nearly isoclinal and is overturned towards the northwest. Foliation is essentially parallel with the bedding on the limbs where the limbs are nearly parallel to the axial plane, but in the nose of the folds the foliation is across the bedding and nearly parallel to the axial plane.

The north limb of the syncline dips on an average 20-30 degrees south. The south limb, on the basis of magnetic and structural evidence, stands nearly vertical near the surface even though the foliation dips to the southeast. The synclinal axial plane, as represented by Unit A, dips about 50 degrees SE on the western end and about 30 degrees SE on the eastern end of the deposit. The axis of the syncline is nearly horizontal on both ends of the deposit, but plunges towards the central area. In the central part of the deposit, intense cross-folding has modified the synclinal form of the deposit.

Other than the over-all synclinal shape of the body, as shown by the sub-members, only a few small-scale folds have been found which can be identified with the syncline. One of these is from outcrop where the specimen illustrates the near horizontal axis, the overturned axial plane and the low dipping north limb and near vertical dipping south limb characteristic of the major folding.

The relation between the attitudes within the ore body structure and the regional structure has been carefully studied and found to be essentially similar. The relationships between the two primary preferred attitudes of foliation, the limbs and axial plane of the syncline, and secondary folding, have been identified in areas of minor cross folding. These relationships are still recognizable in the area of intense cross folding across the center of the deposit.

Cross-sections AA, BB, DD and EE illustrate the shape of the syncline, as determined from stratigraphic and structural evidence which indicates that the body on these sections has not been appreciably affected by cross folding, other than to develop a lineation on the foliation surface. These sections are essentially at right angles to the axis of the ore body structure.

Cross-section CC, and the area near hole 5 on Section BB, illustrates the effect of cross-folding on the deposit where the primary syncline has been highly modified by the secondary cross-folding. The sections are nearly parallel to the axis of cross-folding, such that Section CC cuts the deposit nearly parallel to the trend of the stratigraphic sub-members. As a result of this cross-folding, sub-members E and F stand nearly vertical north of hole 2, and a more representative cross-section of the deposit, in this area, is given on Section FF.

The effects of the cross-folding are also seen on the geologic plan, where the sinuous pattern of the sub-members in the central part of the deposit of iron formation is the result of the cross-folding.

The structural interpretation of the ore body in this center area of the ore body is complicated by the cross-folding. However, the over-all shape of the ore body has been projected to depth through a correlation of surface magnetic and geological information with a detailed study of the relation between bedding, cross-folding and attitude of foliation.

Bedding and foliation are found to be essentially parallel on the north limb, such that the north contact may be taken to depth at dips of about 30 degrees on the west and probably 20 degrees on the east. The south limb is near vertical to steeply north dipping, which when projected down, and allowing for expected curvature, would intersect the synclinal axial plane and the north limb at elevations ranging from 1,000 to 1,200 feet. This results in an indicated minimum depth to the bottom of around 700 feet. The area under the cross fold zone appears to go even deeper. A projection of the northern footwall from around hole 3 to the center of the body, using the indicated 40 degree plunge of the cross fold, suggests depths exceeding a thousand feet. A case very similar to this occurs at the Wabush Lake deposit, where a drill stopped in the iron formation at a depth of over 900 feet.

SUMMARY AND CONCLUSIONS

The ore body, as such, consists of seven identifiable sub-members, of essentially similar mineralogical composition, which vary in thickness within the deposit. These sub-members have been folded together to form a massive body of ore; however, the extent and type of folding varies greatly within the deposit.

When considered in relation to commercial utilization of the ore in a recovery plant, the slight variations within these seven sub-members are of a minor nature, being mainly in physical appearance. Mineralogical studies and concentration tests have indicated that sub-members B, C, D, E and F, which make up over 90% of the bulk of the ore body, are essentially alike insofar as their iron ore mineralogy and concentration characteristics are concerned.

The average iron content of the whole ore body is somewhat over 34%, of which 85% is in the form of coarse-grained crystalline specular hematite which, in concentration tests, has been shown to be recoverable by simple gravity concentration methods. The remaining 15% of the iron is in the form of goethite and limonite and fine iron ore minerals, not recoverable by these methods.

Using the information summarized in this report, the reasonably indicated tonnage and grade of the ore body has been estimated as 500,000,000 tons, having an average analysis of 34.2% iron. This calculation is shown in a separate report on ore reserve tonnage.

SCANNED IMAGE

SCANNED IMAGE

Canadian Javelin Limited
JULIAN IRON CORPORATION

EXHIBIT B

To

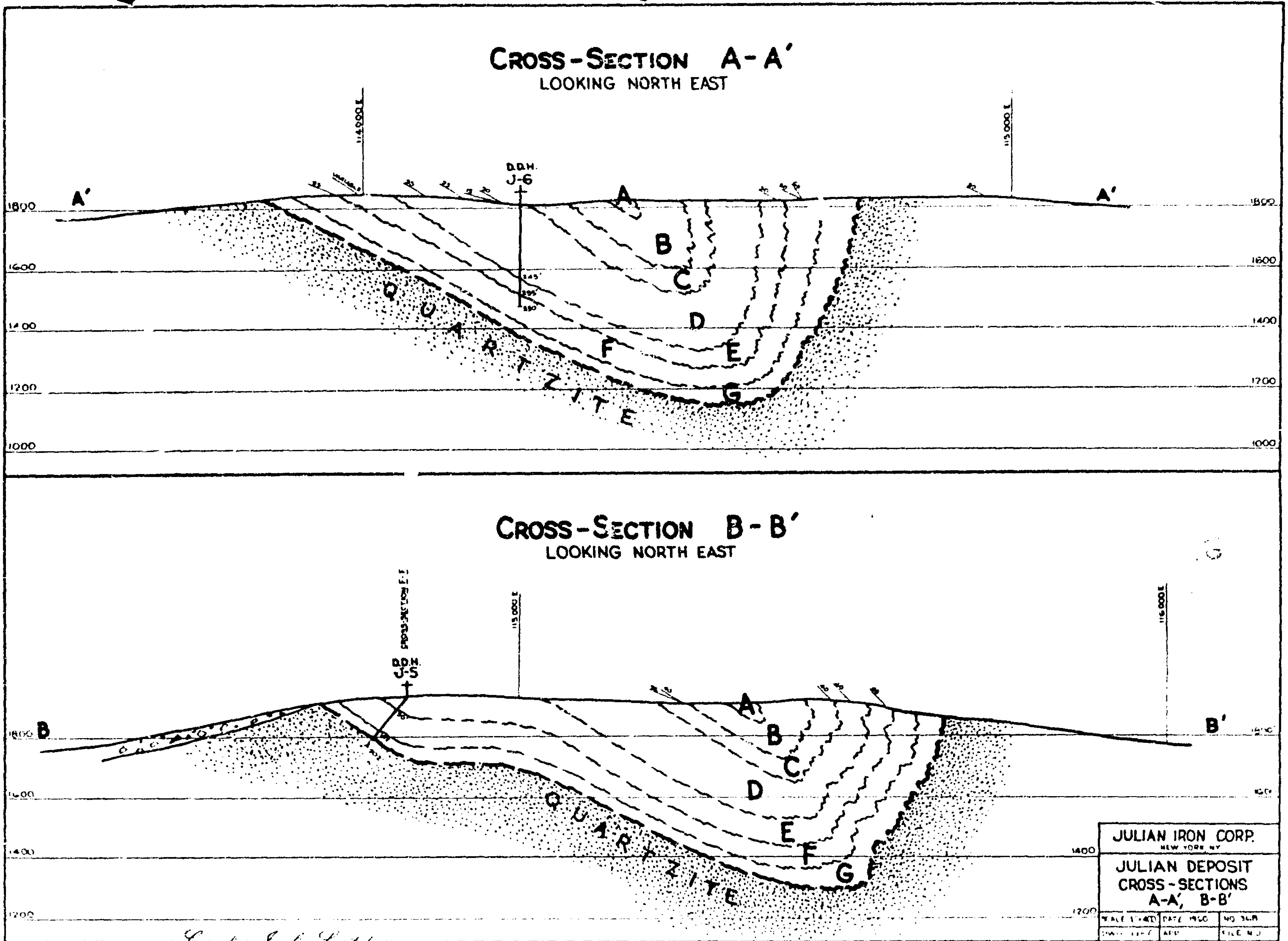
Summary Geological Report

Julian Lake Ore Body

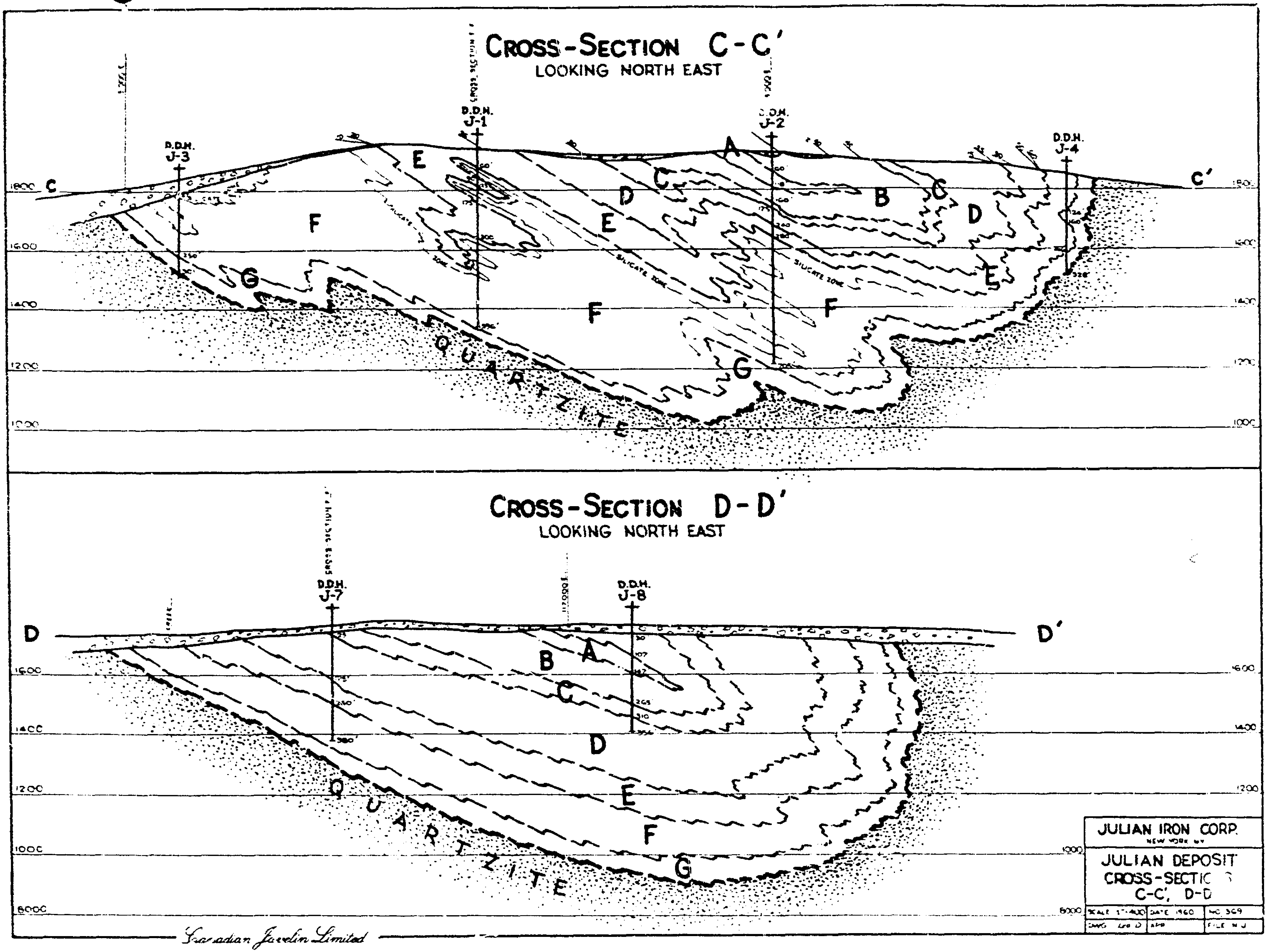
GEOLOGIC PLAN

GEOLOGIC CROSS-SECTIONS

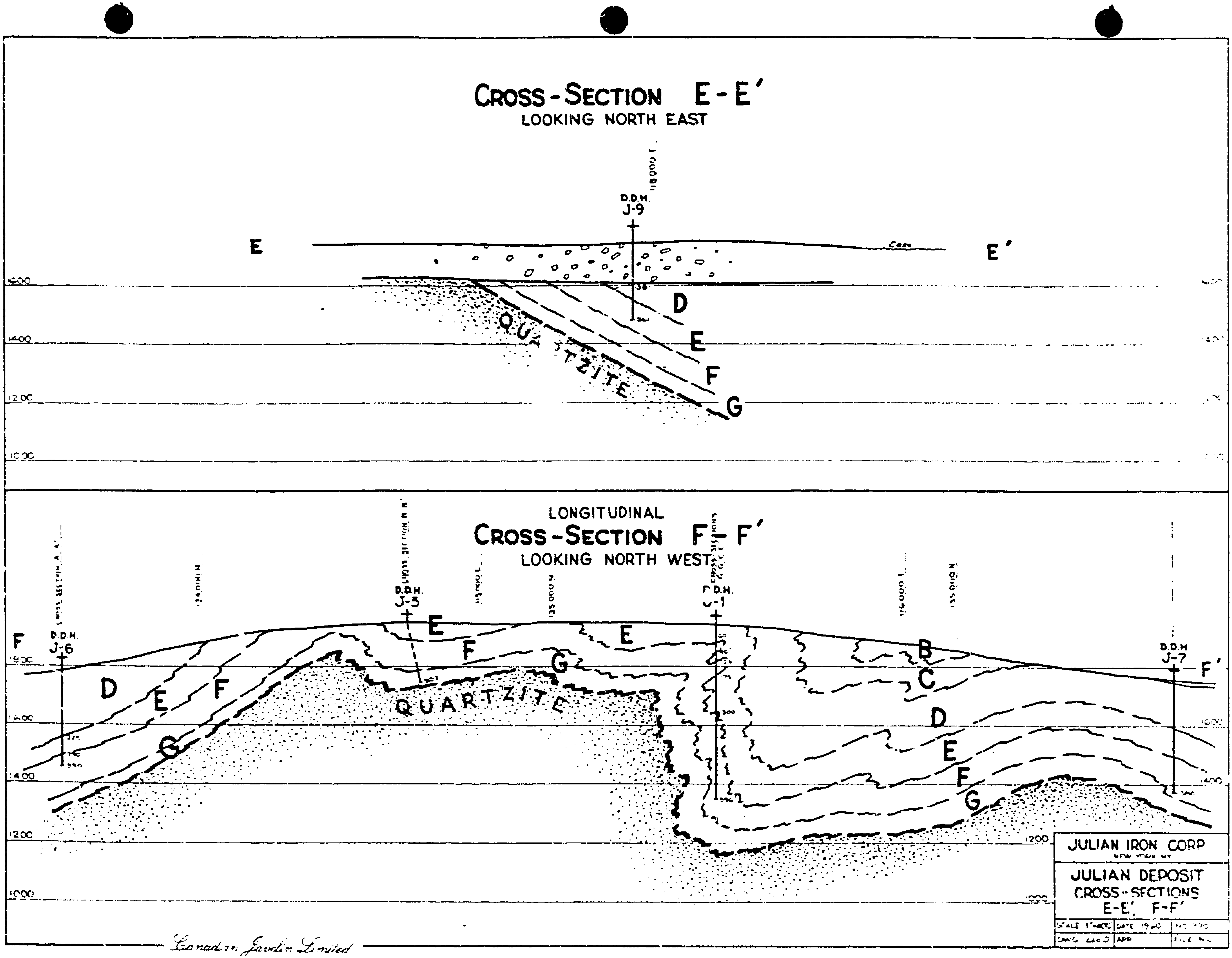
May, 1962


CROSS-SECTION A-A'
LOOKING NORTH EAST
D.D.H. J-6
A'
A'
A
B
C
D
E
F
G
QUARTZITE
1800
1600
1400
1200
1000
CROSS-SECTION B-B'
LOOKING NORTH EAST
CROSS-SECTION F-F
D.D.H. J-5
B
B'
A
B
C
D
E
F
G
QUARTZITE
1400
1200
JULIAN IRON CORP.
NEW YORK, N.Y.
JULIAN DEPOSIT
CROSS-SECTIONS
A-A', B-B'
Canadian Javelin Limited

SCANNED IMAGE



SCANNED IMAGE



SECTION II. ORE RESERVES

Canadian Javelin Limited

JULIAN IRON CORPORATION

JULIAN LAKE ORE BODY

ORE RESERVE TONNAGE

May, 1962

SCANNED IMAGE

JULIAN IRON CORPORATION

Julian Lake Ore Body

Ore Reserve Tonnage

Working under the policy laid down by Management, exploration of the Julian ore body has been carried only to the point where the presence of a major ore body has been confirmed.

It was decided that, insofar as possible, detailed work was to be deferred until after development and production plans were completed, at which time it would be undertaken in cooperation with financial and consumer groups interested in the ore body.

Geological and magnetometer surveys and mineralogical studies of surface outcrop and diamond drill and core from Julian, combined with the experience and knowledge of the Canadian Javelin staff in the Wabush-Julian area, have been used to arrive at the estimate of the ore tonnage in the Julian deposit, summarized on the following page, Table I Summary of Potential Ore Reserves, Julian Lake Ore Body.

The following qualifications are presented, covering preparation of this estimate:

1) The surface outline of the ore body has been arrived at by interpretation from magnetic and geological surveys of the deposit. This interpretation has been confirmed along the south contact by outcrops and by Hole J5, drilled to check the position of the north contact.

Experience, under almost identical conditions, on the Wabush deposit has shown that this method of locating the surface ore waste contact is accurate within acceptable limits.

TABLE I

Summary of Potential Ore Reserves
Julian Lake Ore Body

1. Indicated ore (a) 416,663,000 tons.

Potential ore (b) 83,371,000 tons.

Total 500,001,000 tons.

Average grade indicated ore:

Iron	34.2%
Manganese	0.32%
Sulphur - less than	0.05%
Phosphorus " "	0.05%

2. Stripping (waste rock and overburden) to be removed in recovery of indicated ore by open pit mining (45 degree wall slopes).

Stripping -	
Waste rock -	10,170,000 tons
Overburden -	12,935,000 tons (1 ton = 1 cu.yd.)
	23,105,000 tons

3. Ore/waste ratio = 1.0:0.05 that is mining of one ton of ore requires removal of 1/20 tons of stripping and waste rock, using open pit mining methods. The 90,000,000 tons of ore above elevation 1,775 can be recovered without appreciable stripping, other than removal of a few feet of overburden between outcrops.

(a) Indicated ore - ore recoverable by open pit mining with pit limits within property boundary - bottom of pit at elevation 1,200.

(b) Potential ore - ore recoverable by open pit mining - pit limits extended beyond property boundary and ore below elevation 1,200.

2) It was desirable to obtain the most information from a strictly limited expenditure; therefore, drill holes were spaced to give the most necessary information while still using locations which fitted into the over-all pattern of drilling, laid out for the completed drilling program.

3) The sub-surface outline of the ore body, used in the ore reserve calculation, was arrived at by interpretation of the internal stratigraphy of the deposit. This interpretation has been checked in holes J-3 and J-4, which penetrated through the ore body into the underlying quartzite.

4) Diamond drill core sample analysis, weighted on the basis of footage length drilled and sampled, has been used to calculate the average grade of the body for ore reserve purposes.

Calculations, reflecting a weighted average of samples on the basis of sub-member distribution, have been made which indicate a grade about 2% higher than the average grade based on diamond drill samples. This calculation, together with the average of surface sampling and analysis of the bulk sample, indicates that the average analysis can be expected to be somewhat higher than the 34.2% iron, calculated from diamond drilling.

5) Metallurgical tests have established that the ore is readily amenable to concentration. On the samples tested, better than 40% by weight was recovered as a high-grade iron concentrate containing over 65% iron, using simple gravity concentration methods now in commercial use.

Large scale metallurgical tests, on carefully chosen representative bulk samples, will be required for detailed plant design. These tests would have the most value when done in cooperation with interested financial and consumer groups and have been planned to coincide with the initial stages of discussion with these groups.

6) The quantity of stripping and waste rock, to be removed, has been estimated on the basis of 45 degree pit wall slope and 8% road grades.

7) The classification of ore, as "indicated ore" and "probable ore", is made on the following basis:

A. Indicated Ore - ore which may be recovered by open pit mining methods with pit limits entirely within the property limits, which is the shore line of the lake. Pit slopes were taken at 45 degrees in rock, 30 degrees in overburden material.

Conservative open pit outlines were used to demonstrate clearly that the ore body, as presently outlined, can readily be mined, using low cost open pit mining methods without moving excessive quantities of waste.

B. Probable Ore -

1) Ore which lies between the pit limit, as set for indicated ore, and the property boundary. The extraction of this ore could be undertaken by construction of shallow dams using stripping material and extension of the pit limits into the shallow sections of the lake, whenever its recovery is desired.

2) All ore below elevation 1,200.

8) The factor of 12 cubic feet per ton used in the conversion of volume to long tons, is based on experience at the Wabush ore body where, in limited mining for pilot plant tests, volumes and tonnage have been checked for an

essentially similar ore at an average of about 11.5 cubic feet per ton of ore in place.

Details of the ore and waste calculation are given in Tables 2 to 5 on pages 6 to 9 of this report.

The ore reserve plan and sections (reduced in scale to 400' to the inch) used in calculation of these quantities are attached as Exhibit A to this report.

SCANNED IMAGE

JULIAN IRON CORPORATION
Julian Lake Ore Body
Ore Reserve Tonnage

TABLE 2

Section	Interval Feet	Section Area Sq. In. (1) Indicated	Section Area Sq. In. (1) Potential	Ore Tonnage x 1000 (2) Indicated	Ore Tonnage x 1000 (2) Potential	Total
7500	25	6.25		5,208		5,208
8000	500	14.60		24,332		24,332
8500	500	15.70		26,166		26,166
9000	500	14.11		23,516		23,516
9500	500	24.25		40,415		40,415
10000	500	45.35	3.20	75,580	5,333	80,913
10500	500	45.07	6.02	75,116	10,033	85,149
11000	500	35.72	6.00	59,533	9,999	69,532
11500	500	26.42	6.50	44,033	10,833	54,866
12000	500	15.60	13.14	25,999	21,899	47,898
12500	500	6.24	11.28	10,399	18,799	29,198
13000	250	7.60	7.77	6,333	6,475	12,808
TOTAL		-	-	416,630	83,371	500,001

For details, see reduced plans and sections attached (1"=400')

(1) Area on 200 scale plan.

(2) Indicated ore - within 45° slope from lake shore boundary.
Potential ore - between 45° slope and lake shore boundary.
Factor - 12 cu.ft. = 1 long ton ore.

JULIAN IRON CORPORATION

Julian Lake Ore Body
Summary Overburden and Waste Removal Calculation

TABLE 3

Section	Interval Feet	Section Area Sq. In. (1) Rock	Section Area Sq. In. (1) Overburden	Tons Rock (2) Stripping	Cu. Yds. (2) Overburden
7500	250	0.30	0.95	214,000	352,000
8000	500	0.80	0.80	1,143,000	593,000
8500	500	0.85	0.65	1,214,000	482,000
9000	500	0.50	0.65	714,000	482,000
9500	500	0.72	0.90	1,028,000	667,000
10000	500	0.60	0.90	857,000	667,000
10500	500	0.90	0.45	1,286,000	333,000
11000	500	1.30	0.62	1,857,000	459,000
11500	500	1.30	2.00	1,857,000	1,482,000
12000	500		4.07		3,013,000
12500	500		4.27		3,164,000
13000	250		3.35		1,241,000
TOTAL				10,170,000	12,935,000

(1) Areas on 200 scale sections. For details, see reduced ore reserve sections attached (400 scale) Factor - Rock 14 cu.ft. = 1 ton.

(2) For recovery of 416,000,000 tons of indicated ore by open pit mining methods.

Canadian Javelin Limited

JULIAN IRON CORPORATION

Julian Lake Ore Body
Average Grade Calculation (1)

TABLE 4

Drill Hole No.	Footage From	Footage To	Ore Length Feet	Analysis (2) Iron	Analysis (2) Manganese	Feet x % Iron	Feet x % Manganese
J1	3	596	593	35.33	1.08	20,950.69	640.44
J2	20	705	685	33.37	0.14	22,858.45	95.90
J3	47	301	254	34.65	0.10	8,801.10	25.40
J4	16	302	286	31.10	0.07	8,894.60	20.02
J5	12	154	142	39.34	0.37	5,586.28	52.54
J6	10	323	313	35.58	0.16	11,136.54	50.08
J7	12	379	367	35.58	0.16	13,057.86	58.72
J8	26	356	330	30.65	0.12	10,114.50	39.60
J9	138	261	123	36.67	0.10	4,510.41	12.30
TOTAL			3093	34.2	0.32	105,910.43	995.00

(1) Based on diamond drill core sample analysis.

(2) Sample interval 10 feet arithmetic average.

SCANNED IMAGE

JULIAN IRON CORPORATION

Julian Lake Ore Body
Distribution of Indicated Reserves by Elevation

TABLE 5

Elevation	Tonnage in 100' Interval	Cumulative Tonnage	Remarks
+1900	13,130,000	13,130,000	(Above
1800 - 1900	39,904,000	53,034,000	(lake
1700 - 1800	70,482,000	123,516,000	(level
1600 - 1700	83,638,000	207,154,000	(
1500 - 1600	72,961,000	280,115,000	(Below
1400 - 1500	58,541,000	338,656,000	(lake
1300 - 1400	43,032,000	381,688,000	(
1200 - 1300	29,153,000	410,481,000	(level

Indicated ore recoverable by open pit mining to elevations shown.

NOTE: 90,000,000 tons of ore above elevation 1775 can be recovered by open pit mining without removal of appreciable overburden, other than vegetation and a few feet of soil between and on slopes of outcrops.

SCANNED IMAGE

Canadian Javelin Limited
JULIAN IRON CORPORATION

EXHIBIT A

To

Julian Lake Ore Body

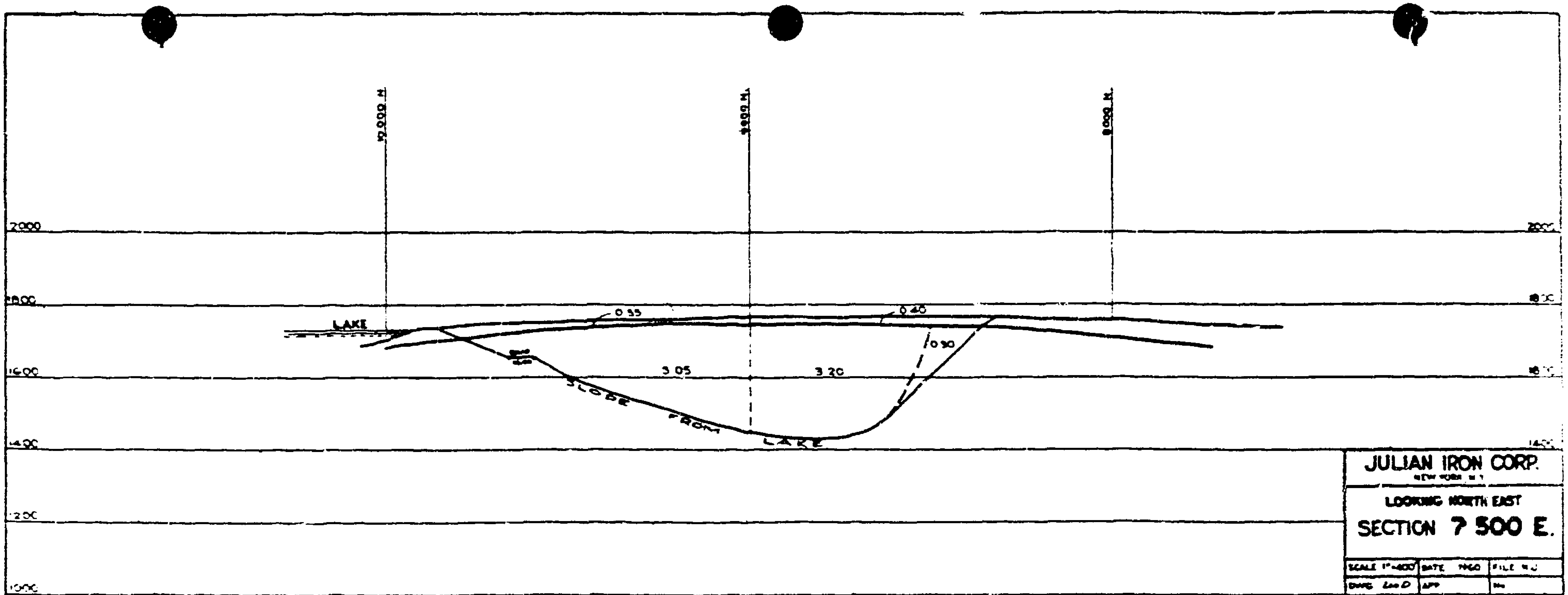
Ore Reserve Tonnage

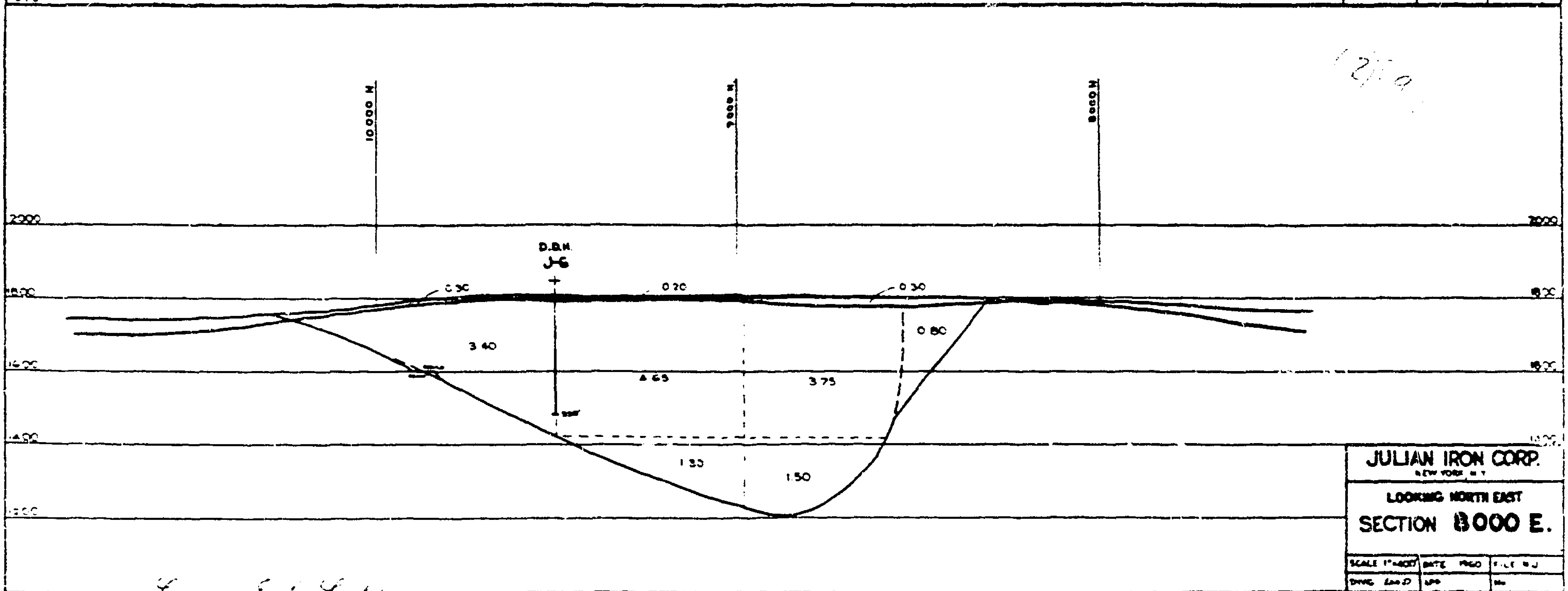
ORE RESERVE PLAN

ORE RESERVE SECTIONS

May, 1962

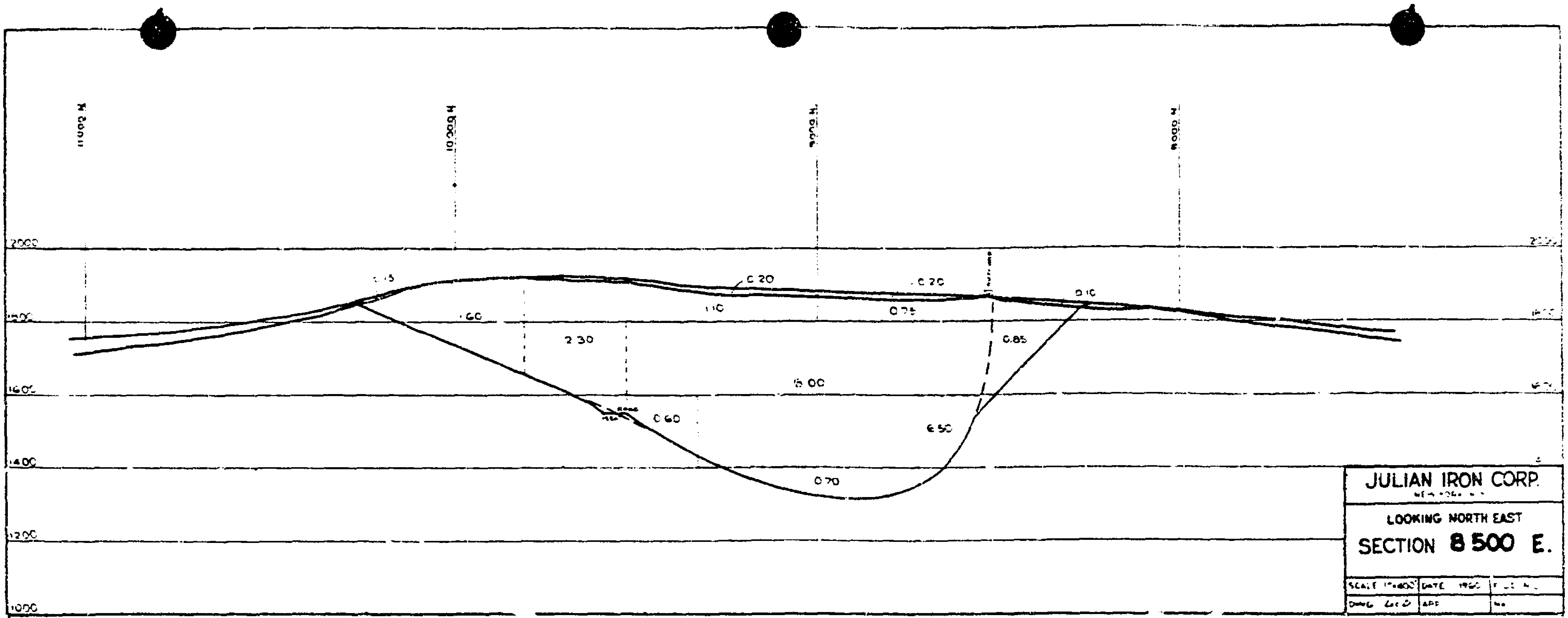
Canadian Javelin Limited

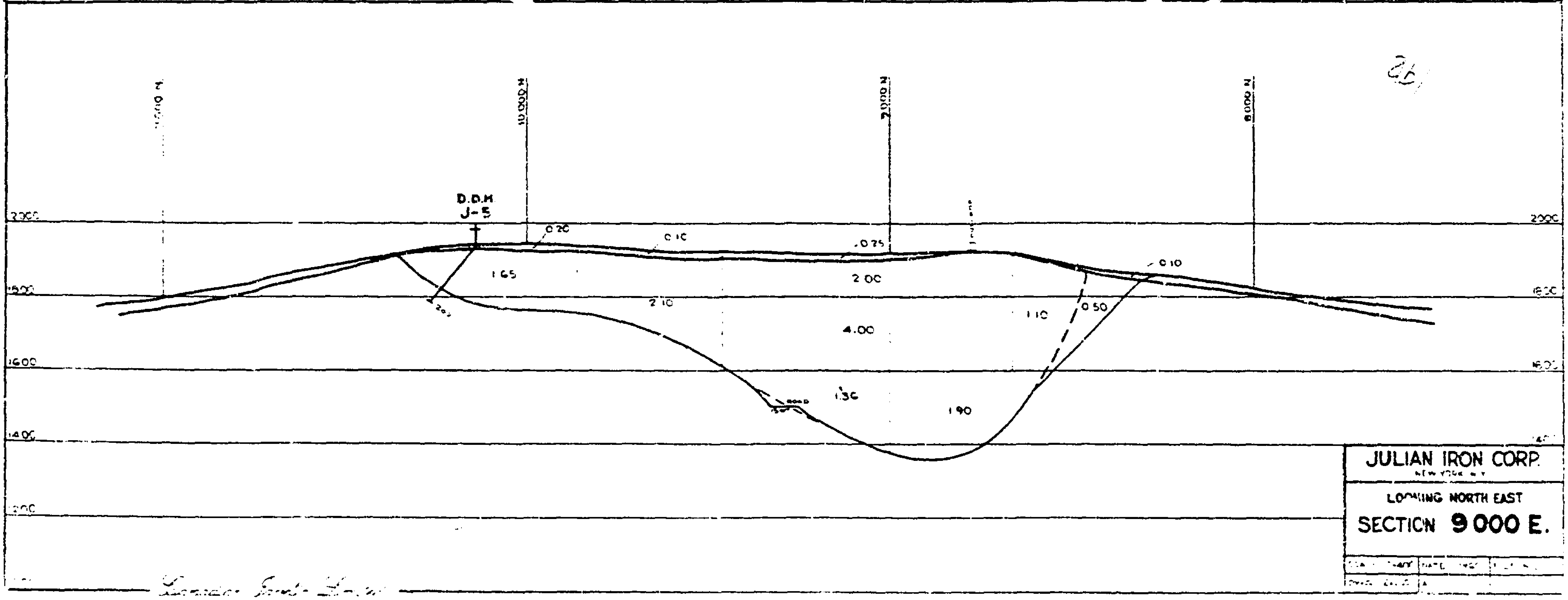




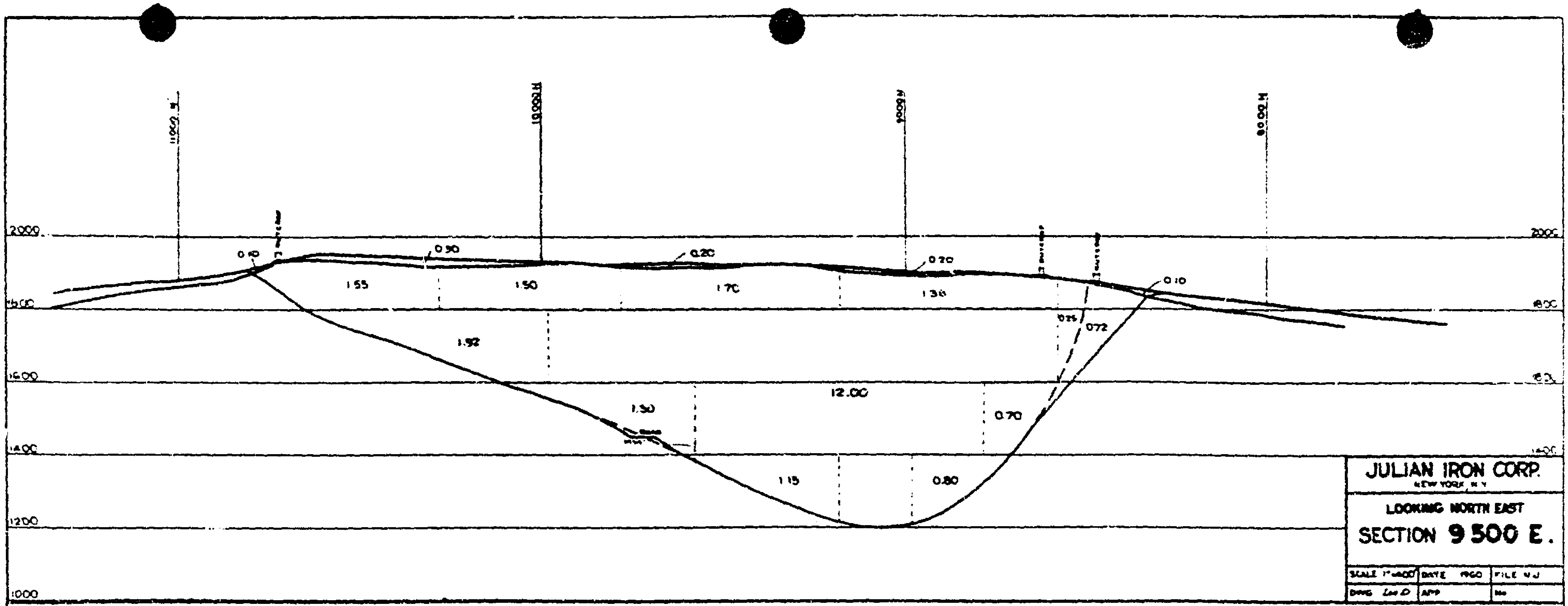
Canadian Javelin Limited

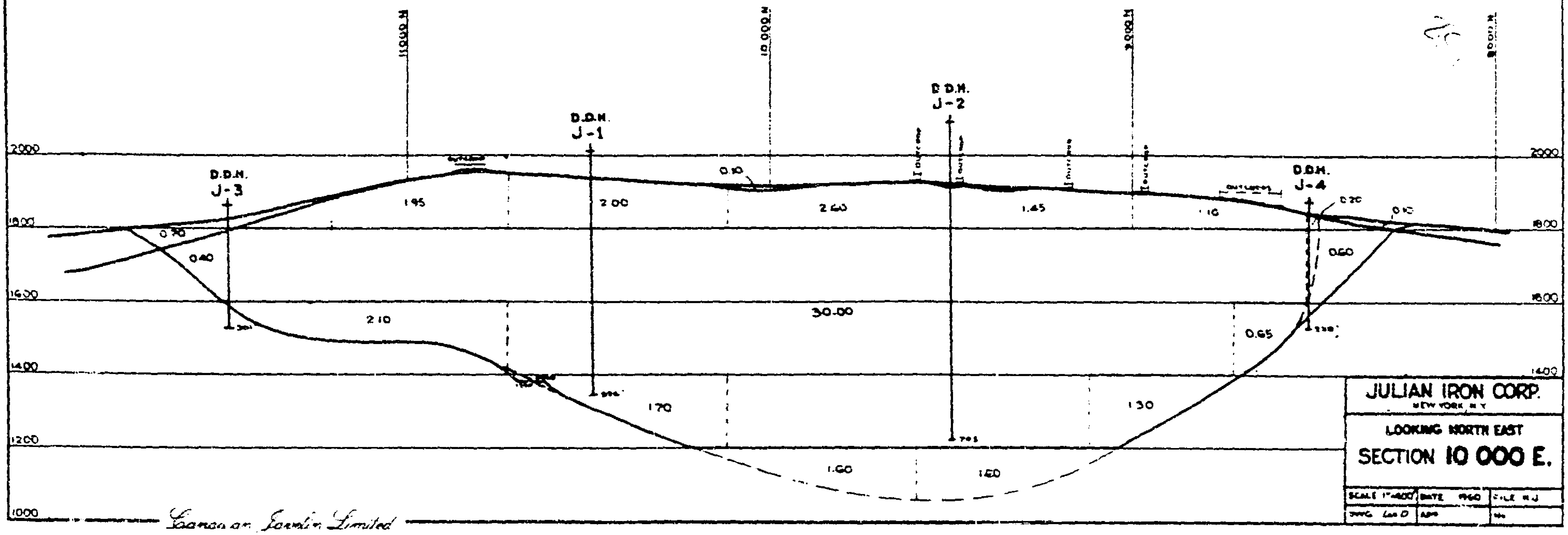
SCANNED IMAGE



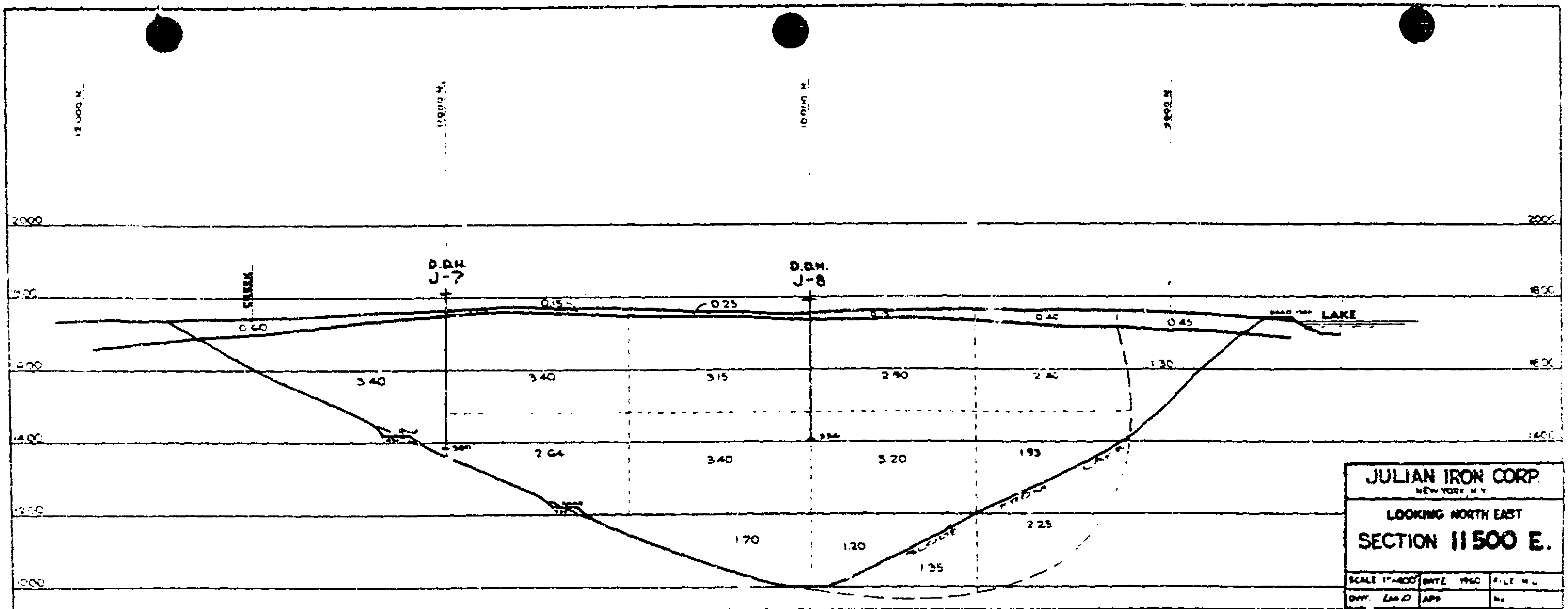


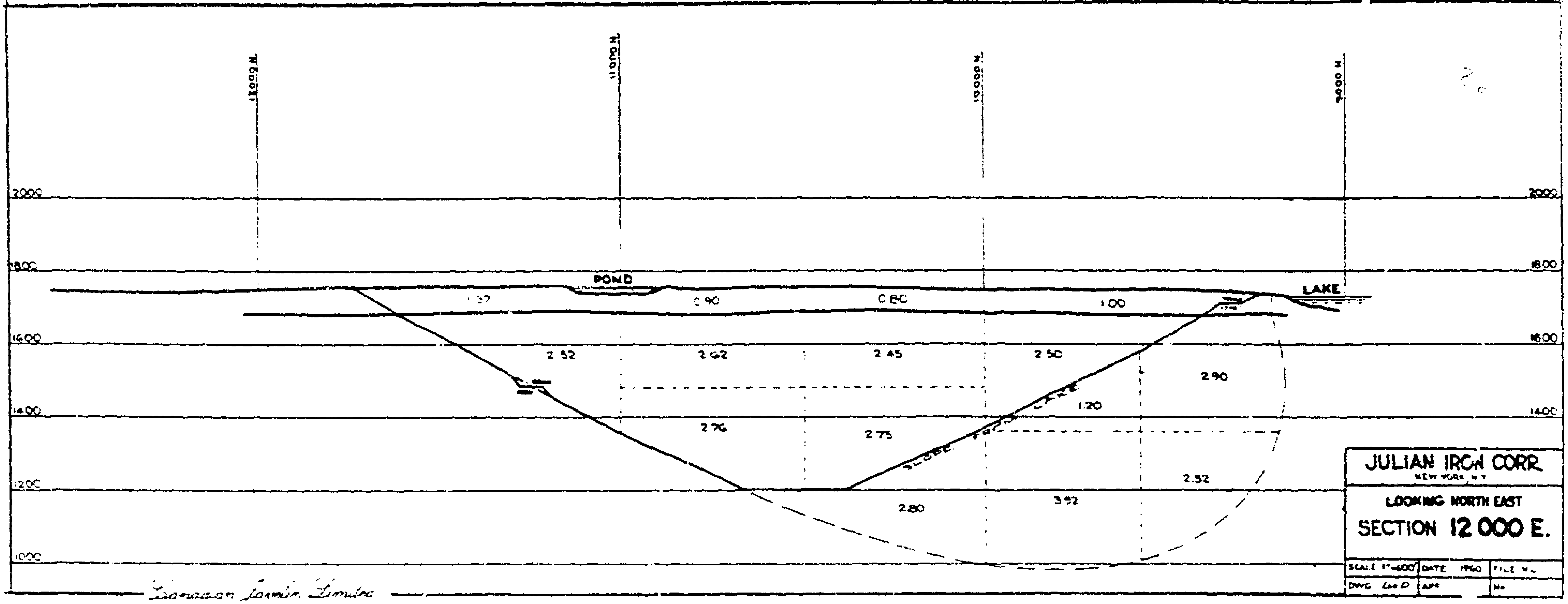
SCANNED IMAGE

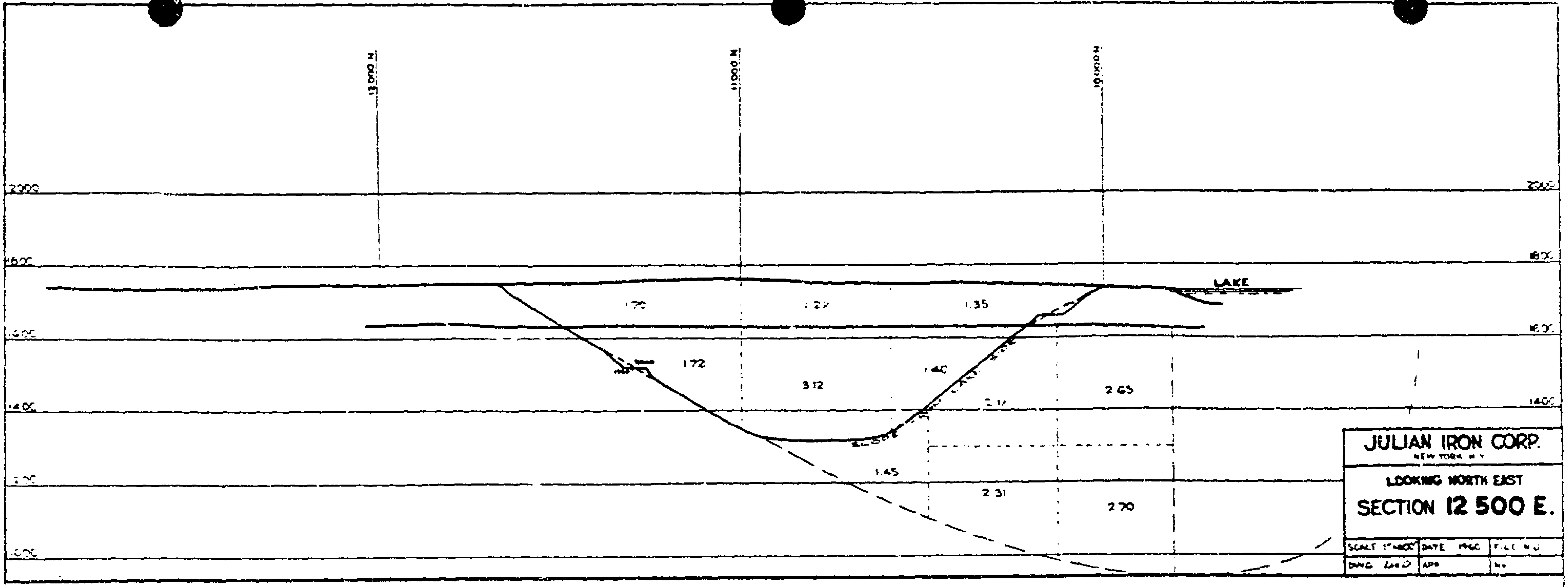




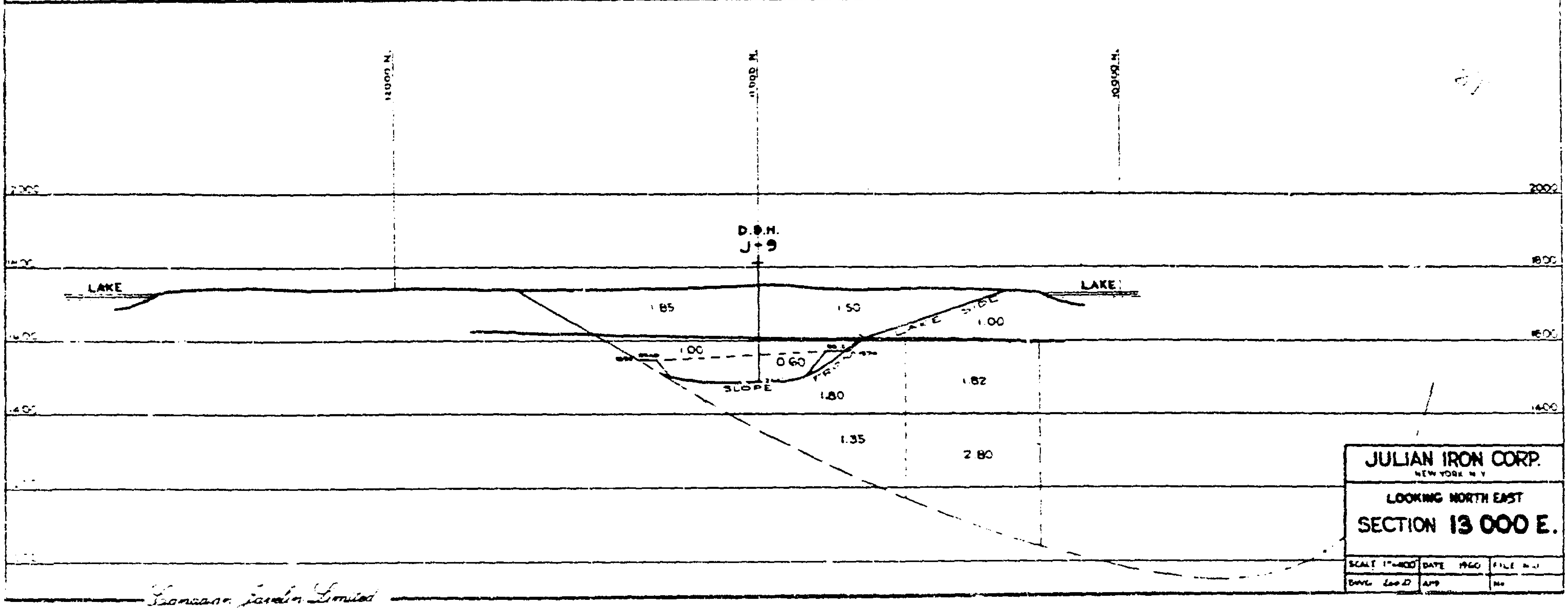
SCANNED IMAGE







2000
1800
1600
1400
LAKE
1.70
1.27
1.35
1.72
3.12
1.40
2.65
SLOPE
1.45
2.31
2.70
JULIAN IRON CORP.
NEW YORK N.Y.
LOOKING NORTH EAST
SECTION 12 500 E.
SCALE 1"=400'
DATE 1960



2000
1800
1600
1400
D.D.H.
J-9
LAKE
LAKE
1.85
1.50
LAKE SIDE
1.00
1.00
0.60
1.82
SLOPE
1.80
1.35
2.80
JULIAN IRON CORP.
NEW YORK N.Y.
LOOKING NORTH EAST
SECTION 13 000 E.
SCALE 1"=400'
DATE 1960

SECTION III. METALLURGY

Canadian Javelin Limited
JULIAN IRON CORPORATION

Julian Lake Ore Body

SUMMARY REPORT

On

PILOT PLANT GRINDING

And

METALLURGICAL TESTS

May, 1962

SCANNED IMAGE

CONTENTS

SCANNED IMAGE

JULIAN IRON CORPORATION

Julian Lake Ore Body
Pilot Plant Grinding and Concentration Tests

Approximately 38 tons of Julian ore were sent to Lakefield Laboratories in December, 1960, to be used in a pilot plant test involving grinding in a Hardinge "Cascade" mill and concentration by means of Humphreys spirals.

This ore sample was obtained from 5 test pits located to give a representative sample of the ore body. Details of test pit location, sampling procedure and analyses are given in Exhibit A to this report, "Julian Test Pit Sample".

The purposes of the investigation were:

1) To demonstrate the suitability of Julian ore for treatment in a commercial plant, using autogenous wet grinding, followed by gravity concentration using two stages of Humphreys spirals.

2) To obtain data for preliminary concentrating plant layout and cost estimates.

3) To produce about 10 long tons of high-grade iron concentrate.

4) To produce about 4 tons of ground ore as a reserve for further concentration tests by Humphreys Engineering.

5) To produce one or two tons of spiral tailings for possible testing for recovery of iron.

The grinding and concentration tests were commenced on January 6th and completed on January 11th, 1961. Those present during part or all of this period included:

Mr. W. H. Roxburgh, Vice President Engineering, Canadian Javelin Limited;

Mr. B. S. Crocker, Vice President, Kilborn Engineering Limited;

Messrs. H. Snedden and D. Ennis, of Humphreys Engineering Company;

Mr. W. J. Mix, of the Hardinge Company, Incorporated.

The helpful advice and assistance given by Messrs. Mix, Snedden and Ennis is gratefully acknowledged in setting up and operating the Hardinge mill and the spiral concentrators.

Five pilot plant runs were made. The final (no. 6) run with the "Cascade" mill was made to produce ground ore only. This ore was sent to Humphreys Engineering, Denver, Colorado, for testing in their spiral pilot plant.

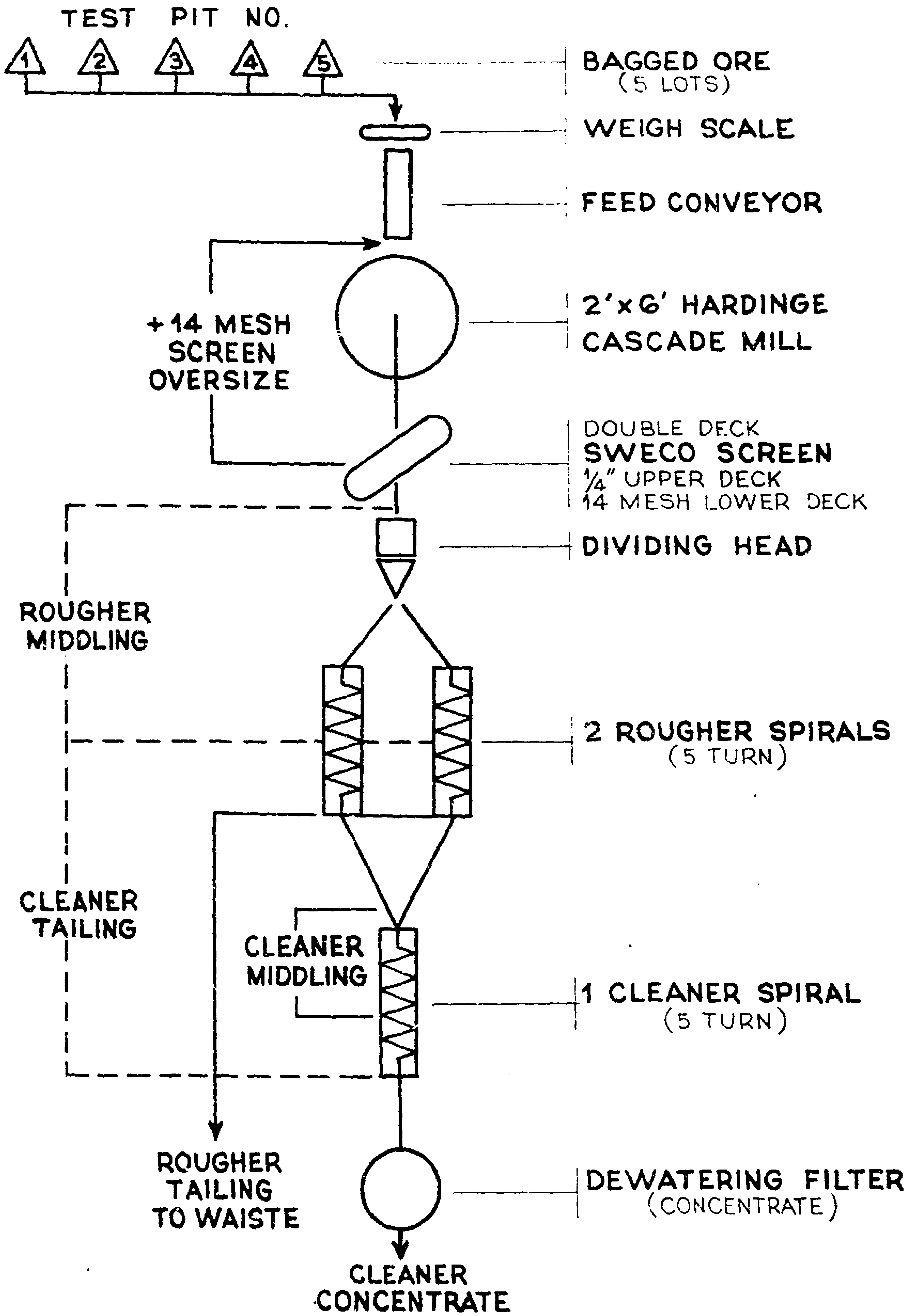
The Humphreys Engineering test results, on their pilot plant testing of this ore, is attached as Exhibit B to this report.

PILOT PLANT FLOW SHEET AND EQUIPMENT

A simplified flow sheet of the pilot plant is shown on the following page. The same circuit was used in all test runs, with some variations in feed rate and pulp densities.

The choice of equipment for the pilot plant test was based on (1) the favorable results of bench scale gravity concentration tests on diamond drill core samples, made in the Pickands Mather Research Laboratory, and summarized in Exhibit C to this report; and (2) the results of concentration tests on Wabush ore, using similar equipment in large-scale pilot plant operations, summarized in Exhibit D to this report.

SCANNED IMAGE



LAKEFIELD RESEARCH
PILOT PLANT TEST
FLOW SHEET

JAN. 1961

SCANNED IMAGE

The physical characteristics of the ore clearly make autogenous grinding the logical choice for preparation of the ore before gravity concentration. The ore is a friable, coarsely-crystalline mixture of quartz and specular hematite, in which the bond between the quartz and specular hematite crystals is relatively weak. The desired product is a "grain size" separation of quartz from specular hematite along the grain boundaries. The typical grinding action of the autogenous grinding mills in which rock grinds rock without addition of metallic grinding elements tends to produce such a product.[1]

DESCRIPTION OF GRINDING CIRCUIT

Ore, as received, was sorted into test pit batches and fed without further crushing to the grinding circuit, by means of a belt conveyor, at a predetermined feed rate.

The mill used in the test was a 6' x 2' Hardinge "Cascade" mill arranged for wet grinding and operated in closed circuit with a double deck screen. Raw ore was fed to the mill by belt conveyor and screen oversize was returned to the mill by a second conveyor.

The mill was equipped with grates mounted on top of filler plate castings on the discharge head of the mill in such a way that the product passing through the grates was scooped upwards and then discharged by gravity through the trunnion. There were two rows of grate liners, and each row has five 3/4" slots arranged circumferentially.

The mill drive consisted of a 25 h.p. electric motor, three C-section V-belts and two vari-pitch sheaves, a speed reducer and a single chain drive

[1] Reference-Rock on Rock Grinding, Engineering and Mining Journal, April, 1962.

to the mill. Power consumed by the mill drive motor was measured with a power-demand kilowatt-hour meter which included a ratemeter as well as a cumulative meter. The ratemeter is useful in regulating the feed to the mill while the cumulative meter readings are taken to determine the total power consumption for each test.

Product discharges from the mill by gravity to a 30" diameter double deck Sweco screen. For these tests a 1/4" scalping screen was used on the top deck, and a screen with a square opening of 0.0445" (Tyler standard 14 mesh opening is 0.046") on the lower deck. Oversize from both screens was combined and returned by conveyor to the feed belt. Undersize from the finishing screen was discharged to the rougher spirals feed pump.

Water was added to the mill circuit at a constant rate adjusted to maintain the required pulp density in the mill, which operated at about 70% solids.

The undersize from the screen was discharged to the rougher spiral feed pump. Wash water on the screen lowered the pulp density of the screen undersize to about 50% solids, which is further diluted by recirculating load and additional water at the pump to give a rougher spiral feed containing about 25% solids.

The two-stage Humphreys concentrating spiral circuit consisted of two 5-turn rougher spirals in parallel, feeding a "rougher concentrate" to a single 5-turn cleaner spiral.

Rougher middlings and cleaner tailings were recirculated through the rougher spiral feed pump and cleaner middling was recirculated to the cleaner spiral.

The feed to the rougher spiral was equally split in a dividing head and a constant head device made from a 4" pipe "Cross" and standard pipe fittings, designed by Humphreys Engineering for use in spiral circuits.

The rougher feed pump was a 2"x 2" S.R.L. pump; recirculating pumps were Denver Horizontal Sand Pumps. These pumps were all driven by constant speed motors and it was necessary to regulate flow rates by using restrictions in the discharge lines. This caused a surging in the spiral circuit which was never completely eliminated.

Rougher spiral tailings were discharged to waste.

Cleaner concentrates were dewatered in a pan filter and barreled for shipment and storage.

TEST PROCEDURE

The test procedures used, following the flow sheet on page 3, are outlined below. There was some variation in feed rates and auxiliary equipment between runs in an attempt to improve recovery, as noted in the discussion of individual runs.

The bagged ore was weighed in batches and fed to the mill continuously over predetermined intervals. To ensure mixing of the ore and also to maintain the correct proportion of ore from the various pits, the batches were fed as follows:

1) Ten batches of 5 bags, each batch including 1 bag from each of the 5 pits.

2) One batch of 3 bags, including one bag from each of pits 2, 3 and 4.

This sequence was maintained throughout the tests, except for the sixth run, when ore from pits 1 and 5 were depleted about 1/2 hour before the end of the run.

Water was added to the "Cascade" mill to give a mill pulp density of about 70% solids.

3) The mill was filled with about 1,200 lbs. of raw ore, over a short period with limited water addition, and then at predetermined feed rates. About one-half hour at the beginning of each run was allowed for the circuit to come to equilibrium before sampling was started.

4) The objective was to attain six two-hour runs, which was substantially achieved. However, mechanical difficulties in pump operation caused a shut-down at the end of runs 3, 4 and 5, which accounts for the irregular tonnage and timing shown for the various runs.

5) Power calculations were made according to methods used by the Hardinge Company. Total power consumption is that registered by the Sangamo kilowatt-hour meter. Gross mill input is the calculated power imparted to the mill, which is equal to the total power multiplied by the efficiency of the motor and drive. (This includes the drive motor, sheaves, reducer and chain drive. The chain drive efficiency is assumed to be 90%). Net no-load power was determined by making a 3 hour run with no load on November 16th, 1960.

6) The calculated weight of ore milled for each run was based on the feed to the mill plus or minus the change in load in the mill during the run. Volumes of the mill load at various levels were taken from a graph prepared by Mr. W. J. Mix and the bulk density of the load was taken as 156 lb./cu.ft.

This figure was determined by weighing the load in the mill after the final run. Excluding the first run, the mill load varied from 18" below centerline (8 cu. ft. or 17% of the mill volume) to 14" below centerline (11 cu. ft. or 24% of mill volume). Total mill volume is 46 cu. ft.

SAMPLING

The following sampling procedure was used. Regular sampling commenced with the second run. The following samples were taken from the grinding circuit:

Mill discharge - exactly one litre taken at 1 hr. intervals for density determination.

Screen oversize (recycle) - 30 second cut taken at 30 minute intervals for tonnage rate. Returned to circuit after weighing.

Screen oversize (recycle) - 5 second cut taken at 30 minute intervals. Composited for each run for screen analysis.

Screen undersize (see below).

In the spiral circuit all samples were taken for 10 seconds from the whole stream in each case. Samples from the two rougher spirals were combined. The following were sampled at 20 minute intervals on each run:

Head sample (screen undersize)
Rougher concentrate
Rougher tailing
Cleaner concentrate
Cleaner tailing

The following were sampled at hourly intervals:

Rougher feed
Rougher middling
Cleaner feed
Cleaner middling

Spiral samples were composited for each run and the volume of pulp, weight of pulp and weight of dry solids were determined (see table 11).

Each dried sample was broken up, mixed and riffled to obtain one sample of approximately 500 grams and one sample of 400 grams. The remainder of each was bagged and retained.

Each 500 gram sample was riffled into two portions (A and B). Each portion was wet screened on a 325 mesh screen and the oversize was screened on the following sieves: 20, 35, 48, 65, 100, 150, 200, 270 and 325 mesh. (The +150 was combined with the +200 and the +270 with the +325). All screen fractions were weighed and retained.

The 400 gram samples were each split by riffling once. One-half was retained while the second half was ground in a Braun pulverizer, mixed and sampled for assay. One-half of the pulverized material was also retained.

DESCRIPTION OF TEST RUNS

General

Some surging occurred in all runs in the spiral circuit. This was caused by the fluctuation in flow rates produced by sampling. The tailings sand pump also caused some difficulties and was the cause of premature stoppages (which show in the results as the irregular test periods).

For the first runs the dividing head over the rougher spirals did not split the feed evenly. This was improved considerably after the third run by replacing the original 4' length of vertical feed line with a 6' length and by leveling the cross carefully. Some changes were made at the same time in the water distribution lines to increase the amount of water available at the cleaner spiral.

During the first run an attempt was made to filter the concentrate on a Dorrco filter, but difficulty was encountered due to ca e failing to adhere to the cloth. Whether this was due to the inherent nature of the material itself or to some fault in the filter was never established due to the limited amount of ore available for initial experimentation. A pan filter was substituted although it did not have sufficient capacity to yield a dry cake.

Run No. 1

The first run was a 2 hour preliminary test. Ore was fed to the mill at a rate of 3.6 long tons per hour for the first hour and 2.8 long tons per hour for the second hour. During this run the load level in the mill built up to 17% of the mill volume (18" below center line) and it appeared that there would be no difficulty in maintaining a grinding rate of at least 3 tons per hour. Adjustments were made to the spirals during this run. The concentrate from the first part of the run was pumped to tailings. The balance was reserved and was run through the spirals a second time. Several mechanical improvements were made following this run, and the finishing screen was changed from a 20 mesh to a 14 mesh screen.

Satisfactory operation was only attained at the end of this run and all concentrate obtained was recleaned after Run 6, before use in smelting tests.

Runs 2 and 3

Runs 2 and 3 were made to obtain concentrate and obtain operating information. The "Cascade" mill was fed at the rate of 3.0 long tons per hour for both runs and the operation was continuous except for a brief shut-down a few minutes after starting up. The total operating time of 3.95 hours was split evenly into the two runs for sampling purposes only. Mechanical trouble in the tailing pump terminated the third run.

Runs 4 and 5

The fourth and fifth runs were made under similar conditions to the two previous runs except that the grinding rate was reduced to 2.7 long tons per hour and some minor changes were made in the spiral circuit. Both runs were terminated by mechanical trouble with the tailing pump after 1.77 hours and 2.25 hours for runs 4 and 5 respectively.

Run 6

The sixth run was made to produce ground ore only. No change was made in the feed rate. The production rate was too high to handle the product with the pan filter so the pulp was run into drums and allowed to settle for about 1/2 hour. The water which was relatively clear was decanted from each drum and the solids were transferred into fewer drums. Additional water was drained off by placing the closed drums on their sides. Rougher tailings were collected during Runs 2 to 5 inclusive in the same manner. In each case, a small loss of slime occurred.

Several interruptions resulted from air locking of the SRL pump during the sixth run. For this reason, and since the run was very short, the power consumption was not recorded.

Two tons of ground ore from Run No. 6 was sent to Humphreys Engineering for concentration tests in their spiral test plant.

SCANNED IMAGE

LAKEFIELD GRINDING & CONCENTRATING TEST RESULTS

Results from Runs 2 to 5 are summarized in Tables 1 to 5 on the following pages.

Table 1	Hardinge Mill Grinding Data
Table 2	Metallurgical Results
Table 3	Feed and Product Analyses
Table 4	Screen Analysis - Spiral Feed, Concentrate and Tailing
Table 5	Spiral Circuit Tonnages, Flow Rates and Densities

Run 1 is not included as it was a "start-up run". Run 6 was a grinding test only, to produce ore for concentration tests at the Humphreys Engineering spiral test plant. The original test data is available from Javelin files.

JULIAN IRON CORPORATION

Julian Lake Ore Body
Lakefield Pilot Plant Test

	Run No. 2 + 3	4 + 5	6
Product screen, mesh size	16 *	16 *	16 *
Duration of run, hr.	3.95	4.02	1.58
Feed to mill, lb.	26,599	24,444	9,454
Mill load level, in. below C.L., start	18	14	16
" " " " " " finish	14	16	16
Change in mill load, lb.	+468	-234	-
Calc. weight of material ground, lb.	26,131	24,678	9,454
Calc. milling rate, long tons/hr.	2.97	2.74	2.67
Circulating load, long tons/hr.	1.86	1.78	-
" " %	63	65	-
Calc. pulp density, % solids **	71	71	est. 70
Total power consumed, k.w.hr.	54.0	53.0	-
" " " H.P.	18.3	17.7	-
Motor and drive efficiency, %	72.5	72.5	-
Gross mill power input, H.P.	13.3	12.8	-
Net no load power, H.P.	4.6	4.6	-
Net power input, H.P.	8.7	8.2	-
" " " H.P.-hr./long ton	2.93	2.99	-
" " " kw. hr./long ton	2.19	2.23	-

For all runs Full grate discharge used. Mill speed 23.0 r.p.m. = 71.5% of critical speed.

* Equivalent to Tyler standard 14 mesh opening.

** Calculated density of mill discharge, excluding recycle portion.

January, 1961

Note: Run No. 1 - Start-up conditions unstable.

Run No. 6 - Data incomplete.

Hardinge Mill Grinding Data
Table 1

SCANNED IMAGE

JULIAN IRON CORPORATION

Julian Lake Ore Body
Lakefield Pilot Plant Test

Run No.	Product	Tonnage Long tons/hr.	Weight %	Assay % Sol. Fe.	Recovery % Iron
2	Cleaner concentrate	1.30	47.8	63.55	78.5
	Rougher tailing	1.42	52.2	15.82	21.5
	Head (calc.)	2.72	100.0	36.68	100.0
	Head (screen undersize)	2.54		39.64	
	Calc. milling rate *	2.97			
3	Cleaner concentrate	1.49	51.7	63.46	80.6
	Rougher tailing	1.39	48.3	16.36	19.4
	Head (calc.)	2.88	100.0	40.73	100.0
	Head (screen undersize)	2.70		39.10	
	Calc. milling rate *	2.97			
4	Cleaner concentrate	1.42	48.5	64.55	77.5
	Rougher tailing	1.51	51.5	17.64	22.5
	Head (calc.)	2.93	100.0	40.37	100.0
	Head (screen undersize)	2.68		39.28	
	Calc. milling rate *	2.74			
5	Cleaner concentrate	1.16	44.4	64.55	75.7
	Rougher tailing	1.45	55.6	16.55	24.3
	Head (calc.)	2.61	100.0	37.88	100.0
	Head (screen undersize)	2.71		39.20	
	Calc. milling rate *	2.74			

* From corrected feed rate to Hardinge mill; runs 2 to 3 combined and runs 4 and 5 combined.

Metallurgical Results
Table 2

JULIAN IRON CORPORATION

Julian Lake Ore Body
Lakefield Pilot Plant Test

	Run No. 2		Run No. 3		Run No. 4		Run No. 5	
	Sol.Fe. %	Insol. %	Sol. Fe. %	Insol. %	Sol. Fe. %	Insol. %	Sol. Fe. %	Insol. %
Mill discharge	39.64	44.04	39.10	43.42	39.28	42.48	39.20	43.22
Cleaner conc.	63.55	9.22	63.46	9.04	64.55	6.94	64.55	7.36
Rougher tailing	15.82	77.88	16.36	75.38	17.64	74.78	16.55	74.90
Rougher feed	36.00	47.02	37.32	48.82	38.00	44.92	40.13	42.08
Rougher middling	23.37	66.84	25.82	62.68	35.37	48.88	36.91	46.68
Rougher conc.	56.10	19.16	57.55	17.52	58.19	16.86	57.94	17.38
Cleaner feed	59.10	21.38	55.90	20.00	58.45	16.10	58.79	15.84
Cleaner middling	50.82	28.42	45.28	33.84	61.35	11.94	61.18	13.88
Cleaner tailing	24.18	64.74	25.99	61.54	30.16	56.20	29.14	58.44

Note: Two stage spiral concentration circuit.
Final products - cleaner concentrate - rougher tailings to waste.
Run No. 6 - mill discharge 38.86% Fe.

Feed and Product Analyses
Table 5

JULIAN IRON CORPORATION

Julian Lake Ore Body
Lakefield Pilot Plant Test

Tyler Mesh	Feed				Weight % Retained Concentrate				Tailing			
	Run 2 (U/S)	Run 3	Run 4	Run 5	Run 2	Run 3	Run 4	Run 5	Run 2	Run 3	Run 4	Run 5
+ 20	0.4	0.4	0.5	0.5	0.6	0.5	0.6	0.4	0.2	0.3	0.2	0.3
35	10.9	10.3	11.4	11.2	17.7	17.4	19.1	17.6	7.1	6.2	6.1	6.4
48	14.2	13.5	14.7	14.2	17.0	17.2	18.7	17.8	12.7	11.3	11.5	11.3
65	18.7	18.2	18.7	18.3	18.6	19.0	19.7	19.3	18.6	17.6	18.2	17.9
100	18.4	18.6	18.2	18.3	21.6	21.9	20.8	21.4	15.4	15.1	16.1	16.0
200	18.4	19.2	18.0	18.4	19.5	19.1	17.3	19.1	16.6	17.3	17.3	17.8
325	8.6	8.9	8.1	8.6	4.3	4.1	3.3	3.8	10.7	12.0	11.4	11.6
325	10.4	10.7	10.4	10.5	0.7	0.8	0.5	0.6	18.7	20.2	19.2	18.7

Feed = mill discharge ("Sweco" screen undersize)

Screen Analysis
Spiral Feed, Concentrate and Tailing
Table 4

JULIAN IRON CORPORATION
Julian Lake Ore Body
Lakefield Pilot Plant Test

Product		Dry Solids Long Tons/hr. Run 2	Dry Solids Long Tons/hr. Run 3	Pulp Long Tons/hr. Run 2	Pulp Long Tons/hr. Run 3	Pulp Flow Rate Imp. Gals./Min. Run 2	Pulp Flow Rate Imp. Gals./Min. Run 3	Pulp Density % Solids Run 2	Pulp Density % Solids Run 3
New feed (Screen U.S.)	(1)	2.54	2.70	4.95	4.58	11.33	9.95	51.3	59.0
Cleaner concentrate	(2)	1.30	1.49	2.04	2.34	3.86	4.37	63.9	63.8
Rougher tailing	(3)	1.42	1.39	11.35	12.43	44.02	43.88	12.5	11.2
Rougher feed	(4)	3.33	3.56	14.34	13.26	43.50	40.05	23.2	26.9
Rougher middling	(5)	0.17	0.25	0.37	0.49	0.93	1.20	46.0	49.6
Rougher concentrate	(6)	2.65	1.47	3.92	2.44	7.19	4.97	67.6	60.3
Cleaner feed	(7)	1.62	1.61	3.74	3.74	8.97	9.33	43.2	43.3
Cleaner middling	(8)	0.08	0.12	0.11	0.19	0.21	0.33	65.7	67.1
Cleaner tails	(9)	0.28	0.33	4.92	5.71	18.78	20.72	5.7	5.8
Calculated new feed	(2+3)	2.72	2.88						
Calculated rougher feed	(1+5+9)	2.99	3.28	10.24	10.78	31.04	31.87	29.2	30.5
Calculated cleaner feed	(6+8)	2.73	1.59	4.03	2.63	7.40	5.30	67.6	60.5

Product		Dry Solids Long Tons/hr. Run 4	Dry Solids Long Tons/hr. Run 5	Pulp Long Tons/hr. Run 4	Pulp Long Tons/hr. Run 5	Pulp Flow Rate Imp. Gals./Min. Run 4	Pulp Flow Rate Imp. Gals./Min. Run 5	Pulp Density % Solids Run 4	Pulp Density % Solids Run 5
New feed (Screen U.S.)	(1)	2.68	2.71	5.33	4.60	11.50	9.64	50.3	59.0
Cleaner concentrate	(2)	1.42	1.16	2.13	1.98	4.14	3.67	66.6	58.5
Rougher tailing	(3)	1.51	1.45	13.16	12.67	46.44	44.27	11.5	11.4
Rougher feed	(4)	3.54	3.36	14.26	14.06	43.41	44.49	24.8	23.9
Rougher middling	(5)	0.26	0.17	0.46	0.30	1.02	0.66	56.4	58.1
Rougher concentrate	(6)	1.59	1.56	2.59	2.52	5.87	5.35	61.2	61.8
Cleaner feed	(7)	1.80	1.37	6.27	3.50	19.32	9.78	28.7	39.1
Cleaner middling	(8)	0.07	0.08	0.10	0.13	0.15	0.24	75.0	62.6
Cleaner tails	(9)	0.35	0.32	6.87	6.59	24.80	23.44	5.0	4.9
Calculated new feed	(2+3)	2.93	2.61						
Calculated rougher feed	(1+5+9)	3.29	3.20	12.66	11.49	37.32	33.74	26.0	27.9
Calculated cleaner feed	(6+8)	1.66	1.64	2.69	2.65	6.02	5.59	61.7	61.9

Spiral Circuit Tonnages, Flow Rates and Densities
Table 5

SCANNED IMAGE

DISCUSSION

An examination of the test results shows that recovery and grade of concentrate, comparable to that expected from a commercial plant, were achieved. These results are remarkable when it is considered that this was the first continuous pilot plant test on Julian ore.

1. Grinding

The test showed that autogenous grinding techniques are applicable to the Julian ore for production of a ground product feed for a spiral concentrating plant.

The mill used was a standard Hardinge test mill and the data obtained was taken according to standard procedures used by Hardinge in test work.

This information can be used within reasonable limits in estimating capacity and power requirements for grinding in plant design studies.

Power consumption, of about 2.2 k.w. per ton of ore ground, is comparable to results obtained on Wabush ore in their large pilot plant.

There appeared to be some overgrinding of ore minerals in the mill reflected by the 20% of -200 material in the product. Heavy media separation, screen sizing, chemical analysis and microscopic examination of the ground ore indicate some locked particles in the coarser screen sizes. These locked particles explain the 64.5% iron grade in the concentrates, which was somewhat lower than expected. A finer screen (-20 mesh) in the mill circuit and a higher circulating load have been suggested to improve grade and recovery.

2. Concentration

The spiral results at Lakefield were confirmed by the Humphreys test results, as below:

(a) In the Lakefield spiral circuit 48% by weight of the ground ore was recovered as a 64.5% iron concentrate, representing 76.6% of the iron in the feed in runs number 4 and 5.

(b) In the Humphreys spiral test plant 48% by weight of the ground ore (from run number 6-Lakefield) was recovered as a 63.95% iron concentrate representing 78.5% of the iron in the feed. (Exhibit B)

Sink float tests by Humphreys Engineering and microscopic examination of feed and products of the spiral circuits by Javelin's staff indicate that improvements in grinding will, if achieved, result in greater recovery of iron and higher grade concentrate through better liberation and reduction of "over-grinding" of ore minerals.

The Wabush pilot plant has produced concentrates containing over 66% iron in a continuous semi-commercial test and similar improvements in grade might be expected in respect to Julian concentrate in a longer test program.

3. Comparison - Julian and Wabush Pilot Plant Test Results

The essential similarity between Wabush and Julian ores is again demonstrated by the similarity between pilot plant test results on Wabush and Julian ore, when using similar grinding and concentration equipment. A comparison of test results is given in the table below:

Mesh Size	Julian Test	Wabush Test *
+20	0.5	0.1
+200	95.4	92.6
-200	4.1	7.3
Raw ore % iron	39.2	38.0
Concentrate % iron	64.5	64.0
" % silica	7.15	5.5
Weight recovery %	46.4	44.0

This similarity in metallurgical results, from comparable tests, combined with the geological and mineralogical similarity between the ores, justifies the general acceptance of Wabush pilot plant test data as applicable to Julian ore.

CONCLUSIONS

1. Julian ore is readily amenable to treatment to produce high-grade iron ore concentrate.

2. Preparation of Julian ore for concentrating, using wet autogenous grinding mills (Hardinge Cascade Mill), gives satisfactory liberation of the iron ore minerals from the quartz gangue.

3. Two stages of gravity concentration, using Humphreys spiral concentrators, will produce a high-grade iron ore concentrate with good recovery from Julian ore ground in an autogenous grinding mill.

4. There are no apparent difficulties in making improvements in grade and recovery, which will give a premium-grade iron ore concentrate product

* Exhibit D

from such a commercial installation, similar to the 65 to 66% iron product from the Wabush pilot plant.

5. Continuation of the exploration development program, for the Julian Lake deposit with a view to commercial production and marketing of iron ore concentrates, is warranted by test results.

6. That data obtained from these tests, combined with manufacturers recommendations, based on experience with similar ores, can be used to prepare preliminary estimates for a commercial treatment plant to concentrate the Julian ore by wet grinding in Hardinge Cascade Mills, followed by concentration in Humphreys spirals.

7. A series of pilot plant runs will be required for final plant design and cost estimates. They would be designed to determine, in detail, the operating conditions to be expected in a commercial plant for treatment of Julian ore.

SCANNED IMAGE

EXHIBIT A

To

Julian Lake Ore Body
Pilot Plant Grinding and Concentration Tests

Julian Test Pit Sample
December, 1960

JULIENNE LAKE

BULK SAMPLING PROJECT

SCANNED IMAGE

CONTENTS

SCANNED IMAGE

JULIENNE LAKE

BULK SAMPLING PROJECT

INTRODUCTION

In the period between November 17th and December 10, 1960, 38.5 tons of crude iron ore was shipped from the Julienne Lake Deposit.

This shipment of ore from the Julienne property was as nearly as possible a representative sample to be used in concentrating tests at Lakefield Research and to produce concentrates for metallurgical tests in a small scale electric smelting demonstration required for further study of the suitability of this process for use in the production of metallic iron in Labrador.

A crew of six men was employed on the project. Living accommodations were provided at Wabush Lake by the Wabush Iron Company. Transport to and from the Julienne property was by helicopter.

LOCATION OF THE SAMPLE

Five areas designated as pits 1 to 5 were chosen from which to obtain (as shown on the enclosed map) the sample. Location, weight and number of bags from each pit is shown in Table No. 1. Results of analysis of composite samples, from each pit, are shown in Table No. 2.

JULIAN IRON CORPORATION

Julian Lake Ore Body
Bulk Sample Data

TABLE I

Test Pit No.	Location		No. of Bags	Estimated Weight Pounds	Tons	Avg. Wt. Per Bag
1	135125N	116700E	146	15165	7.50	103
2	135900N	116400E	166	16040	8.02	96
3	136375N	116175E	166	17175	8.50	103
4	136615N	116025E	166	16655	8.30	100
5	136660N	115600E	148	12180	6.09	82
TOTAL			792	77215	38.41	96

NOTE:

One bag of "composite sample" was made up for each pit for analysis (see Table 2).

JULIAN IRON CORPORATION

Julian Lake Ore Body
Bulk Sample - Composite Analysis

TABLE 2

Test Pit No.	1	2	3	4	5	Weighted Average
Sample Wt. (lbs)	15165	16040	17175	16655	12180	77215
Lab Reference	107621	107622	107623	107624	107625	
Analysis %						
Iron - Fe	34.56	27.54	45.02	42.86	31.61	36.75
Silica - SiO_2	50.07	58.97	35.09	36.47	53.33	46.16
Manganese - Mn	0.02	0.08	0.16	0.14	0.02	0.09
Sulphur - S		Trace Only				
Phosphorus - P	0.003	0.008	0.016	0.012	0.005	0.009
Titania - TiO_2	0.30	0.15	0.15	0.30	0.15	0.21

SCANNED IMAGE

The pits were chosen so as to give a representative cross-section of the ore body. They are located in an almost continuous belt of outcrop which crosses the strike of the ore body in a NW direction. This outcrop belt not only provides an excellent location for a representative sample, but is extremely helpful in geological correlations, as all sub-members of the iron formation are exposed here.

METHOD OF OBTAINING THE SAMPLE

The pits were located from the baseline cut in 1959, which was used for detailed geologic mapping.

A lightweight Copco Cobra drill was used for drilling blast holes, and electric caps were used for setting off the charges.

Due to an almost continual fall of snow each day, the drilling, blasting and bagging was carried out at the same time, that is, ore to fill 40 to 50 bags would be blasted then bagged; this kept the sample relatively free of snow and dirt.

A representative portion of each section blasted was kept as the bagging was done, as a sample of each pit. The number of bags taken from each pit and their weight is shown in Table No. 1 "Composite Sample".

Each bag was securely fastened with wire. A tag with the pit no. on it was placed inside each bag and a duplicate tag was placed on the outside.

MAKEUP OF THE SAMPLE

The sample was taken to give a weighted average from the geological

SCANNED IMAGE

sub-members of the iron formation. However, it should be remembered that these sub-members are classed into only two varieties of iron formation, which make up nearly all the deposit. These are quartz-specular hematite and quartz-granular hematite. Sub-members within these varieties represent recognizable variations in quantity and size of minerals.

Following is a description of the pits and the sub-member in which they are located:

Pit No. 1

Is 15' x 3' x 2' deep, the 15.0" length is across the strike of continuous outcrop.

This pit is located in sub-member "C" which is a friable, coarse grained, strongly foliated quarts-specular hematite with a sparkly black and rich appearance. The ore when blasted looked quite similar to the silicate "F" member. Irregular milky white quartzose material is seen within the foliation planes, as was considerable minute folding. Almost all of the bulk sample obtained here was in the form of fines.

Pit No. 2

23'.0" x 4'.0" x 2'.0" deep across the strike of continuous outcrop ledges.

The pit is located in sub-member "B" which is predominately quartz-granular hematite. Here, the material was quite fragmental and hard.

Pit No. 3

12'.0" x 4'.0" x 3'.0" deep.

SCANNED IMAGE

Pit No. 3 is located in the central portion of sub-member "D" which is a massive hard quartz-granular hematite rock. The material obtained here was the same as Pit 2 in form.

Pit No. 4

23'.0" x 3' 0" x 3'.0" deep. This pit was blasted across a ledge which ran at right angles to the strike. Pit No. 4 was also located in the "D" sub-member; however, in this particular portion of "D" there is a slight increase in specular hematite content, where it nears the contact, with the "E" sub-member.

It should be noted that both Pit 3 and 4 are from the same sub-member; however, as a difference exists within the sub-member and also due to its wider occurrence in relation to the other sub-members, it was felt that two pits in this sub-member was necessary.

Pit No. 5

10 to 12 feet across strike over an area of 80 square feet, depth approximately 2-3 feet.

This pit was blasted across a ledge protruding from the side of a hill.

The pit was located in the "F" member which is a cream colored "silicate" variety of the quartz-specular hematite member. The material here was in the form of slabby fragments due to breakage along shear planes.

TRANSPORTING THE SAMPLE

The sample was flown out from the Julienne property to the Wabush airstrip by a Sikorsky S-55 helicopter using a net; it was loaded aboard a box-car at the Wabush siding for transport to Seven Islands. Transportation from Seven Islands to Lakefield Ontario was by trailer truck.

It was necessary for the helicopter to hover about 2-3 feet from the ground as the net was being hooked up and then take off on almost a flat flight pattern. Large areas had to be cleared at each pit for this type of takeoff.

It was at first planned to take 1500 lbs. (14 to 15 bags) straight from the pit to the airstrip. However, the helicopter was only able to take 800 to 900 lbs. out of the pit areas. To save time and total flying hours, it was decided to fly 800 lb. loads to a small island just north of the Julienne Camp, and stockpile it there. These short trips between the islands and pits took approximately two minutes each. The bags were then flown from the islands where the helicopter could take a longer run with a 1500 lb. load. However, conditions had to be near perfect as to wind and temperature before a full 1500 lbs. could be taken in one load. Thus, 12-1300 lb. loads were often flown to the airstrip.

Photographs of the operation are available in Javelin files.

EXHIBIT B

To

Julian Lake Ore Body
Pilot Plant Grinding and Concentration Tests

Humphreys Engineering Test Data
Julian Lake Ore Sample
Run No. 6
Lakefield Pilot Plant Test
June, 1961

HUMPHREYS ENGINEERING COMPANY
810 AMERICAN NATIONAL BANK BUILDING
DENVER 2 COLORADO

CABLE ADDRESS "HUMPHREYS"

June 2, 1961

OUR REF. G-7972-HEC
YOUR REF. Lot 1508

JUN 5 1961

Mr. W. H. Roxburgh
Canadian Javelin Ltd.,
680 - 5th Avenue
New York City, N. Y.

Dear Bill:

I enclose tables summarizing the results of spiral tests made on the sample of Javelin ore ground at Lakefield when we were there last January. Our tests consisted of a 2-stage spiral test made on a small sample without cleaner tailing recirculation; a 2-stage spiral-sizer test also made on a small sample without cleaner tailing recirculation, and, a 3-stage continuous test in which the bulk of the sample was treated and all middling products were recirculated.

In the 2-stage spiral test we recovered 78.5% of the iron in a concentrate assaying 63.95% Fe and .21% Mn. In the spiral-sizer test we recovered 79.5% of the iron in a concentrate assaying 62.87% Fe and .29% Mn. In the 3-stage spiral test we recovered 85.4% of the iron in a concentrate assaying 62.76% iron and .30% Mn.

We believe that the higher Fe recovery for the 3-stage test is in part due to the fact that middlings could be recirculated during the test run, and, in part due to the relatively low concentrate grade. This test is somewhat comparable to the tests made at Lakefield in which Fe recovery was approximately 80% in a concentrate assaying between 63-64% Fe - the better recovery for our test being largely attributable to use of three stages of concentration.

Use of the Humphreys counterflow sizer apparently offers no advantage in the treatment of this ore.

The fact that +65% Fe concentrates were difficult to obtain - both at Lakefield and in our Denver tests - is quite largely explained if you examine our Table 4, which gives screen and sink-float data on the head sample as received. These data indicate that over 50% of the iron in the ore reports as sink product which is lower in grade than 64% Fe, and nearly 40% lower in grade than 60% Fe. Failure to make a higher grade is largely a matter of incomplete liberation at the grind which was as shown by Table 5 - essentially 100% through 20 mesh (Tyler).

I am expecting to leave town next week but will arrange for Tom to forward tables giving complete test data including feed rates and water flow rates.

Best personal regards.

Very truly yours,

HUMPHREYS ENGINEERING COMPANY

Metallurgical Engineer

hs/g

encls - 5 tables
cc-Lab

Table No. 1

HUMPHREYS LABORATORY TEST

Date: 5/11/61 Lot No.: 1508 Test No.: H-J-K

Customer: Canadian Javelin Limited

Ore: Julian iron ore wet ground to -20 mesh in a Hardinge Cascade Mill at Lakefield, Ontario.

Object of Test: A pilot plant run made to determine probable iron recovery and concentrate grade for three stages of concentration.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION	Fe		Mn			
			Assay	Distribution	Assay	Distribution	Assay	Distribution
		%	%	%	%			
K-2	Re-cleaner spiral conct.	54.8	62.76	85.4	0.30			
H-4	Rougher spiral tail	45.2	13.02	14.6				
	Calculated Head	100.0	40.28	100.0				
*H-1	Assay Head		41.51					
**A-1	Assay Head		41.25					

Remarks: *H-1 head was a sample taken off the feed belt at intervals during the test run.

**A-1 head was split out of the sample when received. During this test a rougher middling, and both cleaner and recleaner tailings were recirculated.

Rougher feed rate - new ore - 3330 #/Hr.
Cleaner " " - Ro.Conc.only - 2514 #/Hr.
Recleaner " " Cl. " " - 2256 #/Hr.

Test Engineers: H. Snedden
T. J. Ferree

Lab. Form 4—282—12-64—R.F.P.Co.

Table No. 2

HUMPHREYS LABORATORY TEST

Date: 4/20/61 Lot No.: 1508 Test No.: D-F-G

Customer: Canadian Javelin Limited

Ore: Julian iron ore wet ground to -20 mesh in a Hardinge Cascade Mill at Lakefield, Ontario

Object of Test: To determine if the Humphreys counterflow sizer offers an advantage in concentration of this ore at this grind.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe Assay	Fe Distribution		Composite Assay	Composite Distribution		Mn Assay	Mn Distribution	
			%	%		%	Fe	Wgt	Fe	%		
F-2	Sizer U'flow		22.0	64.6		34.8	)			.20		
							)62.87	51.6	79.5			
G-2	Cl.Sp.Conct.		29.6	61.6		44.7	)					
G-4	" " Tail		13.1	25.55		8.2	25.55	13.1	8.2			
D-4.1	Ro.Sp. Sand Tail		24.7	9.85		6.0	)					
							)14.14	35.3	12.3			
D-4.2	Ro.Sp. Slime Tail		10.6	24.15		6.3	)					
Calculated Head.			100.0	40.78		100.0	40.73	100.0	100.0			
A-1	Assay Head			41.25			41.25					

Remarks: Rougher feed rate (new ore) 3502 #/Hr.
Cleaner sizer-spiral feed rate 1537 #/Hr.

If G-4, the cleaner spiral tailing, could have been recirculated the overall spiral iron recovery would have been increased to about 85%.

Test Engineers: H. D. Snedden
T. J. Ferree

Lab. Form 4_ 1M- 3 54 R.F.F.Co.

Table No. 3

HUMPHREYS LABORATORY TEST

Date: 4/18/61 **Lot No.:** 1508 **Test No.:** D-E

Customer: Canadian Javelin Limited

Ore: Julian iron ore wet ground to -20 mesh in a Hardinge Cascade mill at Lakefield, Ontario.

Object of Test: To permit estimation of iron recovery and concentration grade to be expected from two stages of spiral concentration.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe			Composites			Mn		
			%	Assay %	Distribution	Distribution %	Assay Fe	Distribution Wgt	Distribution Fe	Assay %	Distribution	
E-2	Cl.Sp.Cpnct.		48.9	63.95		78.5	63.95	48.9	78.5	.21		
E-4	Cl.Sp.Tail		15.8	22.70		9.0	22.70	15.8	9.0			
D-4.1	Ro.Sp. Sand Tail		24.7	9.85		6.1)						
D-4.2	Ro.Sp. Slime Tail		10.6	24.15		6.4)	14.14	35.3	12.5			
Calculated Head			100.0	39.85		100.0	39.85	100.0	100.0			
A-1	Assay Head			41.25			41.25					

Remarks: Rougher feed rate (new ore) 3307 #/Hr.
Cleaner " " 1849 #/Hr.

If E-4, the cleaner spiral tail, could have been recirculated the overall spiral iron recovery would have been increased to about 85%.

Test Engineer: H. Snedden
T. J. Ferree

Lab. Form 4—1M—3-54—R.F.P.Co.

Table No. 4

HUMPHREYS LABORATORY TEST

Date: 3/31/61 Lot No.: 1508 Test No.: B

Customer: Canadian Javelin Limited

Ore: Julian ore wet ground in a Hardinge Cascade Mill at Lakefield, Ontario

Object of Test: Heavy liquid separation with screen analysis on the sink to permit estimation of mineral liberation.

Sample No.	Products	Weight Distribution		Fe Assay	Fe Distribution		Assay	Distribution		Composite Assay	Composite Distribution %	
			%	%		%				% Fe	Wgt	Fe
B-2.3	-14+20 sink		0.2	55.75		0.3)						
4	-20+28 "		2.7	58.75		4.0)						
5	-28+35 "		6.7	62.00		10.5)						
6	-35+48 "		10.4	60.60		15.9)						
7	-48+65 "		11.2	63.25		17.8)						
8	-65+100 "		8.6	64.85		14.0)	Composite	sink		62.87	60.6	96.0
9	-100+150 "		6.9	65.45		11.4)						
10	-150+200 "		5.2	66.15		8.7)						
11	-200+325 "		4.8	65.30		7.9)						
12	-325 "		3.9	56.45		5.5)						
B-4	Float		39.4	3.98		4.0		Float		3.98	39.4	4.0
Calculated Head			100.0	39.67		100.0				39.67	100.0	100.0
A-1	Assay Head			41.25								

Remarks: The test indicates that enough iron mineral is still tocked with gangue to prevent making a high grade concentrate except at a sacrifice in recovery.

Test Engineer: T. J. Ferree

Canadian Javelin Limited

Lab. Form 4—1M—3-53—R.P.F.Co.

Table No. 5

HUMPHREYS LABORATORY TEST

Date: 3/31/61 Lot No.: 1508 Test No.:

Customer: Canadian Javelin Limited

Ore: Canadian Javelin's Julian ore received from Lakefield Research

Object of Test: Screen analysis of a split of the head sample, made by wet screening on 325 mesh followed by dry screening in Tyler Rotap.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION											
			%	Assay	Distribution		Assay	Distribution		Assay	Distribution		
A-1.1	+10 mesh		-										
A-1.2	-10+14		-										
A-1.3	-14+20		0.2										
A-1.4	-20+28		2.5										
A-1.5	-28+35		8.4										
A-1.6	-35+48		15.4										
A-1.7	-48+65		20.1										
A-1.8	-65+100		17.0										
A-1.9	-100+150		12.3										
A-1.10	-150+200		8.9										
A-1.11	-200+325		7.3										
A-1.12	-325 mesh		7.9										
	Head		100.0										

Remarks: None of these screen products were assayed for iron.

Test Engineer: T. J. Ferree

HUMPHREYS ENGINEERING COMPANY
SUITE 910-818 SEVENTEENTH STREET
DENVER 2, COLORADO

CABLE ADDRESS
"HUMPHREYS"

June 27, 1961

OUR REF. G-8041-HEC
YOUR REF. Lot 1508

JUN 29 1961

Mr. W. H. Roxburgh
Vice President, Engineering
Canadian Javelin Limited
680 Fifth Avenue
New York 19, N. Y.

Dear Bill:

Please refer to our letter of June 2, 1961, which includes a summary of a continuous three stage spiral test made in our laboratory. Complete data from that test has been compiled and is listed in the enclosed tables.

All samples taken were timed weight-volume samples, and flow rates were calculated directly from the individual samples. Therefore, slight differences in accumulated figures exist, as you will note when checking the material balance sheets. That is, the sum of the weights of products going into a feed sump does not necessarily check the feed rate listed at the top of the spiral where the feed rates were measured.

We listed all rates as they were calculated. Due to the small amount of material available for the test, the differences could either be from an error in timing, or lack of sufficient time for the circuit to get in balance.

Samples of all products were shipped to you via Railway Express. The specific samples may be identified by the sample numbers listed in the enclosed tables. If there is any question concerning the identification of the samples or procedure of sampling, please let us know.

Very truly yours,

HUMPHREYS ENGINEERING COMPANY

Metallurgical Engineer

tjf/g
encls - Tables
2 cys this ltr

Table No. 1

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 5/11/61 **Lot No.:** 1508 **Test No.** H **Stage:** Rougher **Spiral Model:** 24A5 MRL 124

Customer: Canadian Javelin Limited

Ore: Julian Ore **Grind Used:** As rec'd. (-20)

Object of Test: Continuous test - rougher spiral adjusted to pull 65% of the feed weight to concentrate assaying about 50% Fe.

Conc. Outlets: 2,3,4,5,6,8,11,12,14 **Midd. Outlets:** 15 **Circulating Midd. Dry Pounds/hr.:** 221 **Ratio of Wt. Concentration:** 1.6:1

Wash Water Volume GPM: Total: 5 **Excess:** 0.5 **Feed Pulp Volume GPM:** 21.0 **Feed Pulp % Solids:** 29.5 **Feed Rate per Spiral Dry Pounds/hr.:** 3330

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
		Dry Lbs/Hr	%	Assay %	Distribution	Distribution %	Assay	Distribution	
H-2	Concentrate	2510	63.4	46.57		86.1			
H-3	Middling	221		11.90					
H-4	Tailing	1448	36.6	13.02		13.9			
Calculated Feed		4179	100.0	34.30		100.0			
H-5	Rougher Feed	3849		33.46					
H-1	New Feed	3330		41.51					
	New Feed)								
	Cleaner Tail)	4471		34.59 (Calculated)					
	Rougher Mids)								

Remarks:

Rougher Concentrate = 4.9 GPM @ 64.7% solids
" Tailing = 21.1 " " 12.4% "
" Middling = 0.6 " " 50.2% "

Rougher stage feed was composed of new feed, plus cleaner tailing and recirculated rougher middling. Difference in weights is the result of calculations of time-weight samples of all products.

HUMPHREYS ENGINEERING CO. LABORATORY
2919 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden
T. Ferree

Canadian Javelin Limited

... A—500—9-60—R.F.F.Co.—615

Table No. 2

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 5/11/61 **Lot No.:** 1508 **Test No.** J **Stage:** Cleaner **Spiral Model:** 24A5 MRL 124

Customer: Canadian Javelin Limited

Ore: Rougher spiral concentrate H-2 **Grind Used:** ------

Object of Test: Pump fed cleaner stage, to make a ±57% Fe concentrate which will be gravity fed to a recleaner spiral stage.

Conc. Outlets: 2,3,4,5,6,8,12,15 **Midd. Outlets:** None **Circulating Midd. Dry Pounds/hr.:** -- **Ratio of Wt. Concentration:** 1.4:1

Wash Water Volume GPM: Total: 4.5 **Excess:** 0.5 **Feed Pulp Volume GPM:** 20.1 **Feed Pulp % Solids:** 25.3 **Feed Rate per Spiral Dry Pounds/hr.:** 3266

SAMPLE No.	PRODUCTS	WEIGHT DISTRIBUTION Dry Lbs/Hr	%	Assay	Distribution		Fe Assay %	Distribution %	Assay	Distribution	
J-2	Concentrate	2346	71.8				55.82	90.5			
J 4	Tailing	920	28.2				14.98	9.5			
Calculated Feed		3266	100.0				44.30	100.0			
J-5	Cleaner Feed	3074					45.63				
H-2	Rougher Conc.	2955					44.83	(Calculated)			
K-4	Recleaner Tail										

Remarks: Cleaner concentrate = 3.9 GPM at 61.1% Solids
" tailing = 22.2 GPM at 7.5% "

Test Engineer: H. Snedden
T. Ferree

Lab. Form 3-A--50C--0-03--H.F.F.Co.--515

Table No. 3

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 5/11/61 Lot No.: 1508 Test No. K Stage: Re-Cleaner Spiral Model: 24A3 MRL 124

Customer: Canadian Javelin Limited

Ore: Cleaner stage concentrate J-2 Grind Used:

Object of Test: Gravity fed re-cleaner stage to make a +65% Fe finished concentrate.

Conc. Outlets: 1,2,3,4,5,6,9 Midd. Outlets: None Circulating Midd. Dry Pounds/hr.: None Ratio of Wt. Concentration: 1.25:1

Wash Water Volume GPM: Total: 8 Excess: 1.4 Feed Pulp Volume GPM: 11.8 Feed Pulp % Solids: 29.7* Feed Rate per Spiral Dry Pounds/hr.: 2201

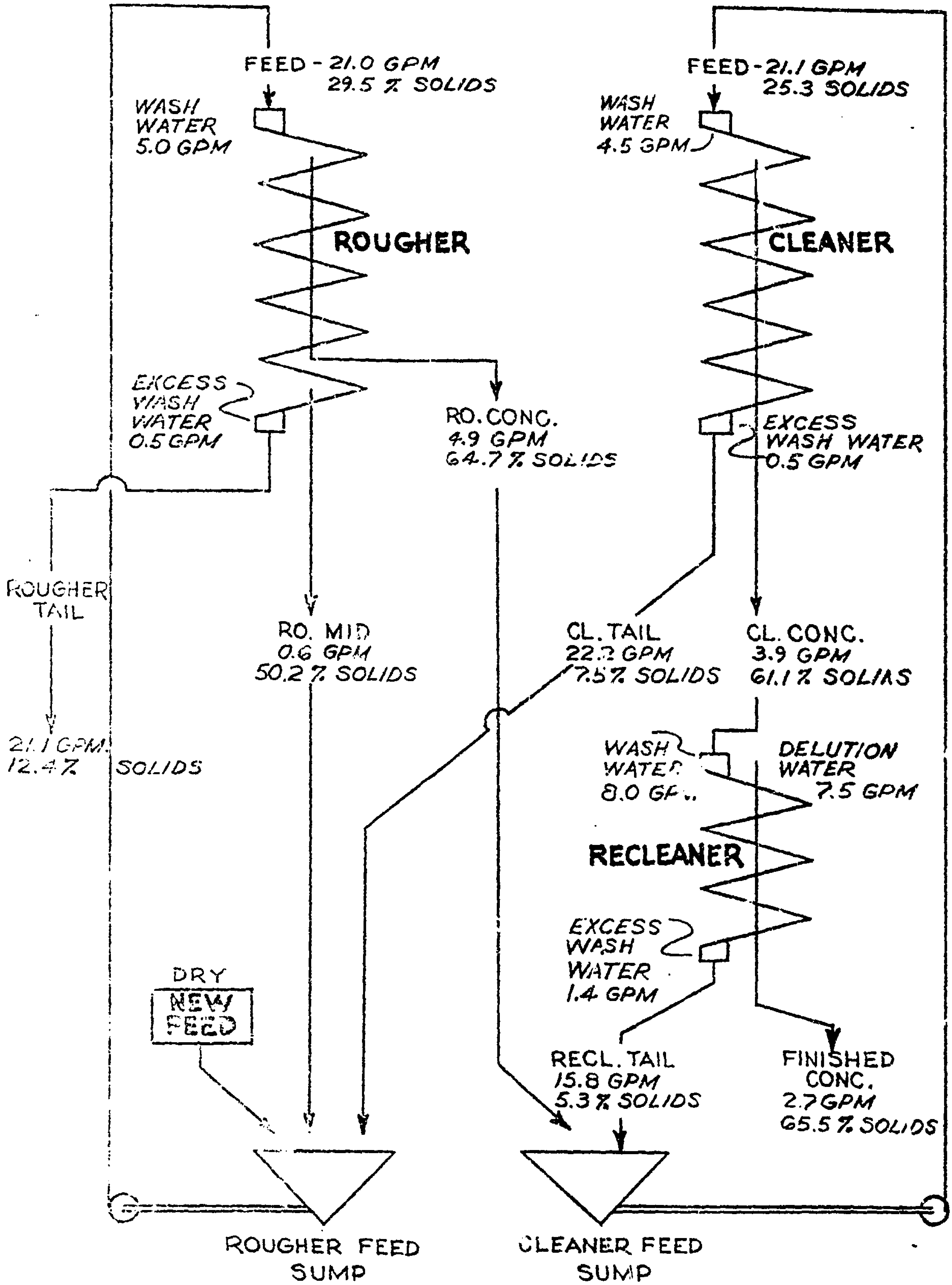
SAMPLE No.	PRODUCTS	WEIGHT DISTRIBUTION Dry Lbs/Hr	%	Fe Assay %	Distribution	%	Assay	Distribution		Assay	Distribution	
K-2	Concentrate	1756	79.8	62.76		88.0						
K-4	Tailing	445	20.2	33.66		12.0						
Calculated Feed		2201	100.0	56.88		100.0						
J-2	Cleaner Conc. (Recleaner Feed)	2346		55.82								

Remarks:
Recleaner concentrate = 2.7 GPM @ 65.5% Solids
" tailing = 15.8 " " 5.3% "
Dilution water = 7.5 " "

* % solids of feed was calculated on basis of cleaner concentrate plus dilution water.

Test Engineer: H. Snedden & T. Ferree

SCANNED IMAGE

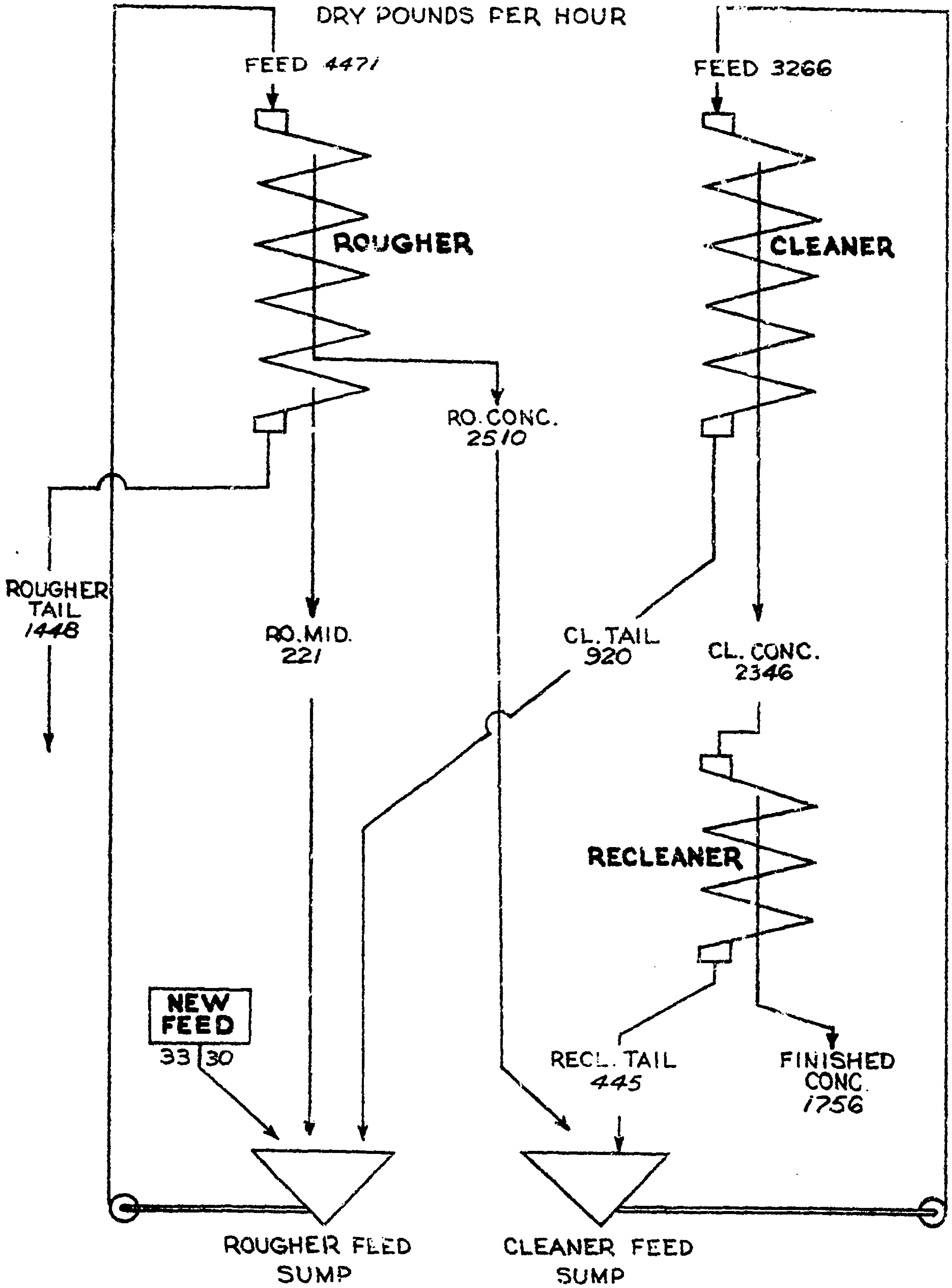


PULP BALANCE

HUMPHREYS ENGINEERING CO.
Pilot Test-Lot 1503 For Con. Javelin Ltd.

Canadian Javelin Limited

SCANNED IMAGE



MATERIAL BALANCE

HUMPHREYS ENGINEERING CO.
Pilot Test - Lot 1508 For Can. Javelin Ltd.

Canadian Javelin Limited

SCANNED IMAGE

EXHIBIT C

To

Julian Lake Ore Body
Pilot Plant Grinding and Concentration Tests

Laboratory Concentration Tests
Diamond Drill Core Samples
Julian Lake Ore Body
January, 1958

JULIAN IRON CORPORATION

Julian Lake Ore Body

Summary of
Metallurgical Tests
Diamond Drill Samples
Holes J-1, J-2, J-3, J-4

SCANNED IMAGE

CONTENTS

SCANNED IMAGE

JULIAN IRON CORPORATION

Julian Lake Deposit

Summary of Laboratory Metallurgical Test,
Diamond Drill Core Sample

1957 Drilling Program

INTRODUCTION

The Julian ore has physical characteristics and mineralogical composition essentially similar to the Wabush ore. The bench scale tests, described herein, were conducted on Julian diamond drill core to demonstrate the feasibility of employing the same gravity type concentration methods for treating the ore to produce a salable iron ore concentrate, as had been developed for the treatment of the Wabush ore.

Under the terms of the Canadian Javelin-Pickands Mather exploration agreement, bench scale concentration tests were conducted on diamond drill core samples from drill holes J-1, J-2, J-3 and J-4, by Pickands Mather in their Hibbing, Minnesota laboratories.

These tests had been developed and correlated with pilot plant operations in a long series of tests on Wabush ore.

As the core provides a representative sample of the ore, in place, it has been considered to be a reliable source of test material for evaluation of the ore body metallurgy.

Although tests were run on the sludge, for comparison, the results of tests performed on the sludge samples were not considered in this report for the following reasons:

1) Due to the friability of the quartz specular hematite members of the ore body, the specular grains tend to wash down the drill hole at a greater rate than the grains of the less friable members, thus introducing the possibility of "salting" certain intervals of the sludge sample.

2) Due to inconsistency of water return, there is a strong possibility of losing sludge and not recovering a representative sample of a given interval of the hole.

3) There is a strong possibility of contaminating the sludge with grease, and other extraneous material, during the course of the drilling.

In the test procedure, a magnetic separation preceded the gravity concentration to determine whether or not a combination magnetic-gravity method should be used.

The gravity type of concentrating process was found to be the most efficient, as the weight recovery for this process averaged 42.2%, whereas the weight recovery for the magnetic separation averaged less than 1%.

TESTING PROCEDURE

The core samples representing 20 feet of drilling were crushed to 1/4" and head samples were cut and assayed for iron, silica, manganese and phosphorous by Lerch Brothers, a laboratory in Hibbing, specializing in iron ore analyses.

Upon receipt of the assay results, the samples were examined under a microscope and composites, representing up to fifty feet of drill hole length, were made up based on chemical analysis and mineralogical description.

A 1500 gram sample of the core composite was crushed to 35 mesh and run over a two-stage, drum type wet magnetic separator. If recovery was satisfactory, the magnetics were re-ground to 100 mesh in a wet laboratory ball mill and reconcentrated on the magnetic separator.

The tails from both stages of the magnetic separator were mixed and run over a wet laboratory scale concentrating table, as a gravity concentrating test. The first stage concentrates were cleaned by means of a second pass over the tables. These two stages of table concentrating represent the two stages of Humphreys spirals, which might be used for the treatment of the ore in a commercial beneficiation plant.

As stated above, the average weight recovery obtained during the laboratory tests on the concentrating tables was 42.2% for the core samples from the four holes, J-1 to J-4. The average analysis of the concentrates recovered during the tables tests on these core samples was 63.45% Fe. The weight recovery and concentrate analyses for each hole are presented in the included tables.

The percentages of silica, phosphorous and manganese in the table concentrates of samples from each of the drill holes have been calculated and presented in the included tables. A weighted average analysis calculated for the four holes is presented below:

Iron - Fe	64.54%	Silica	6.86%
Phosphorous	.012%	Manganese	.29%
Sulphur	Trace	Wt. Recovery	43.28%

The high manganese recovery for three short segments of hole J-1 (100'-120', 179'-200', 200'-213') has increased the manganese percentage for the sample of that hole and the average for the four holes.

These three high manganese contents are also indicated in the crude ore, but are undoubtedly isolated lenses as all of the other samples ran less than 1% manganese. This is also indicated by surface and additional drill hole information.

CONCLUSION

The results of these tests were comparable to similar tests performed on Wabush ore and clearly indicate that this ore body is suitable for the production of high-grade iron ore concentrates.

On the basis of these tests, and detailed geological studies, the continuation of the exploration and development of this ore body is recommended, with the view of bringing it into production.

JULIAN IRON CORPORATION

Laboratory Results
D.D.H. No.J-1

CORE		Crude				Table Conc.				
From	To	Iron	Silica	Phos.	Mang.	% Wt.	Iron	Silica	Phos.	Mang.
3	15	38.19	41.75	.025	.37	43.80	64.78	6.25	.024	.27
15	25	35.45	41.35	.020	.79	39.96	67.19	3.14	.021	.34
25	45	36.80	45.35	.010	.10	45.07	65.91	5.05	.013	.06
45	60	30.13	56.02	.006	.12	36.76	63.23	8.25	.009	.17
60	80	31.52	54.08	.010	.15	38.71	66.78	4.05	.008	.10
80	100	40.23	41.06	.019	.14	49.10	68.64	2.02	.012	.12
100	120	39.41	31.00	.03	7.31	49.98	58.84	3.68	.017	7.19
120	136	31.75	53.30	.037	.25	37.23	66.94	2.86	.037	.43
136	157	27.82	58.65	.004	.20	15.73	66.29	4.88	.006	.10
157	179	30.95	54.96	.0[illegible]	.08	39.36	66.40	5.76	.031	.10
179	200	46.25	27.26	.067	2.20	49.37	64.69	5.80	.039	1.26
200	213	41.07	23.01	.021	11.20	63.09	57.14	5.67	.011	7.23
213	248	39.16	42.94	.021	.20	49.55	67.10	3.33	.017	.23
248	280	35.40	48.26	.025	.14	47.03	59.91	13.19	.019	.27
280	290	No Sample								
290	311	36.36	45.80	.006	.15	42.06	66.89	3.84	.005	.12
311	329	31.00	54.45	.007	.08	36.26	65.90	5.50	.008	.21
329	377	30.16	56.73	.006	.12	38.75	60.39	12.23	.008	.15
377	418	31.05	51.88	.008	.10	32.97	60.63	11.09	.009	.12
418	479	31.81	51.27	.008	.17	37.83	63.47	9.00	.011	.12
479	497	43.08	37.87	.024	.14	56.35	60.92	12.51	.025	.11
497	516	30.21	56.00	.022	.26	37.43	61.03	12.15	.030	.06
516	546	40.03	39.66	.089	.44	51.50	60.38	11.70	.034	.74
546	596	34.75	49.00	.014	.15	45.68	62.17	10.40	.025	.07

Note; Recovery of magnetics less than 1% by weight.

Canadian Javelin Limited

JULIAN IRON CORPORATION

Laboratory Results
D.D.H. No. J-2

CORE

From	To	Crude Iron	Crude Silica	Crude Phos.	Crude Mang.	Table Conc. % Wt.	Table Conc. Iron	Table Conc. Silica	Table Conc. Phos.	Table Conc. Mang.
20	40	42.36	37.84	.006	.25	57.94	65.99	5.20	.008	.08
40	61	44.21	35.25	.006	.15	59.13	65.26	6.05	.008	.15
61	69	14.28	78.74	.006	.10	20.28	58.95	12.77	.021	.14
69	84	42.82	38.78	.017	.20	62.85	62.42	9.27	.024	.27
84	94	22.77	66.94	.017	.10	30.83	61.93	9.25	.034	.18
94	102	11.94	74.04	.011	.12	17.70	50.88	21.67	.055	.25
102	118	14.61	68.00	.011	.06	12.69	64.23	6.70	.028	.12
118	180	34.47	48.21	.008	.09	42.71	65.42	5.79	.008	.08
180	242	39.40	43.40	.007	.09	49.31	65.43	5.98	.007	.08
242	291	32.45	47.97	.012	.13	37.45	65.33	5.60	.013	.16
291	300	49.18	26.58	.099	.20	50.40	67.27	2.70	.045	.14
300	343	36.20	47.89	.013	.11	49.80	62.11	10.21	.011	.17
343	379	34.60	50.01	.014	.10	46.22	63.57	8.68	.010	.14
379	409	42.40	38.68	.020	.12	52.96	65.33	6.10	.019	.15
409	455	36.50	47.16	.010	.15	45.55	66.58	3.75	.008	.15
455	474	31.64	53.51	.010	.32	39.76	65.62	5.40	.005	.16
474	477	30.91	55.33	.011	.12					
477	489	32.12	53.49	.007	.10	42.93	62.40	8.06	.005	.14
489	505	37.53	45.54	.011	.13	48.78	64.68	8.45	.008	.12
505	510	17.20	74.68	.008	.13	20.30	59.24	14.55	.014	.08
510	566	45.33	35.30	.008	.15	62.85	66.06	5.30	.008	.06
566	625	35.63	48.51	.007	.17	46.84	64.28	7.55	.007	.05
625	705	39.06	44.45	.009	.15	53.57	64.11	7.87	.009	.06

Note: Recovery of magnetics less than 1% by weight.

JULIAN IRON CORPORATION

Laboratory Results

CORE

D.D.H. No. J-3

		Crude				Table Conc.				
From	To	Iron	Silica	Phos.	Mang.	% Wt.	Iron	Silica	Phos.	Mang.
47	60	38.74	44.32	.008	.13	52.34	65.63	5.53	.009	.14
60	108	31.67	53.95	.008	.12	42.57	66.11	5.13	.006	.08
108	190	35.43	49.05	.007	.10	48.95	65.30	6.16	.009	.07
190	301	32.79	52.68	.012	.08	40.08	65.31	6.34	.010	.08
301	318	4.71	82.51	.038	.07					

D.D.H. No. J-4

From	To	Crude Iron	Crude Silica	Crude Phos.	Crude Mang.	Table Conc. % Wt.	Table Conc. Iron	Table Conc. Silica	Table Conc. Phos.	Table Conc. Mang.
16	69	30.19	56.66	.010	.06	34.70	65.97	5.37	.006	.06
69	99	36.85	46.77	.012	.05	45.48	67.03	3.62	.005	.12
99	190	35.71	48.58	.011	.06	46.46	66.27	5.02	.007	.08
190	256	29.22	57.71	.016	.09	25.25	65.16	5.97	.011	.08
256	281	27.92	59.64	.020	.10	17.16	67.27	2.95	.011	.10
281	285	5.52	88.65	.030	.05					

Note: Recovery of magnetics less than 1% by weight.

JULIAN IRON CORPORATION

Diamond Drill Core - Concentration Test -

Summary - Hole J-1

From	To	Ft.	Table Wt. Recovery	Ft. x %	Conc. Analysis	Ft. x % x %
3	15	12	43.80	525.6	64.78	34048
15	25	10	39.96	399.6	67.19	26849
25	45	20	45.07	901.4	65.91	59411
45	60	15	36.76	551.4	63.23	34865
60	80	20	38.71	774.2	66.78	51701
80	100	20	49.10	982.0	68.64	67404
100	120	20	49.93	998.6	58.84	58757
120	136	16	37.23	595.7	66.94	39876
136	157	21	15.73	330.3	66.29	21895
157	179	22	39.36	865.9	66.40	57496
179	200	21	49.37	1036.8	64.69	67070
200	213	13	63.09	820.2	57.14	46866
213	248	35	49.55	1734.3	67.10	116372
248	280	32	47.03	1505.0	59.91	90164
290	311	21	42.06	883.3	66.89	59084
311	329	18	36.26	652.7	65.90	43013
329	377	48	38.75	1860.0	60.39	112325
377	418	41	32.97	1022.1	60.63	61969
418	479	61	37.83	2307.6	63.47	146463
479	497	18	56.35	1014.3	60.92	61791
497	516	19	37.43	711.2	61.03	43404
516	546	30	51.50	1545.0	60.38	93287
546	596	50	45.68	2284.0	62.17	141996
Total		583		24201.2		1536106
Average			41.5		63.4	

Magnetic recovery under 1% weight - average grade (core samples) 35.33% iron.

SCANNED IMAGE

JULIAN IRON CORPORATION

Diamond Drill Core - Concentration Test -

Summary - Hole J-2

From	To	Feet	Table Wt. Recovery	Ft. x %	Conc. Analysis	Ft. x % x %
20	40	20	57.94	1158.8	65.99	76469
40	61	21	59.13	1241.7	65.26	81033
61	69	8	20.28	162.2	58.95	9562
69	84	15	62.85	942.7	62.42	58843
84	94	10	30.83	308.3	61.93	19093
94	102	8	17.70	141.6	50.88	7205
102	118	16	12.69	203.0	64.23	13039
118	180	62	42.71	2648.0	65.42	173232
180	242	62	49.31	3057.2	65.43	200032
242	291	49	37.45	1835.0	65.33	119880
291	300	9	50.40	453.6	67.27	30514
300	343	43	49.80	2141.4	62.11	133002
343	379	36	46.22	1663.9	63.57	105774
379	409	30	52.96	1588.8	65.33	103796
409	455	46	45.55	2095.3	66.58	139505
455	474	19	39.76	755.4	65.62	49569
474	477		-		-	
477	489	12	42.93	515.2	62.40	32148
489	505	16	48.78	780.5	64.68	50483
505	510	5	20.30	101.5	59.24	6013
510	566	56	62.85	3519.6	66.06	232505
566	625	59	46.84	2763.6	64.28	177644
625	705	80	53.57	4285.6	64.11	274750
Total		682		32362.9		2094091
Average			47.4		64.7	

JULIAN IRON CORPORATION

Diamond Drill Core - Concentration Test -

Summary - Hole J-3

From	To	Ft.	Table Wt. Recovery	Ft. x %	Conc. Analysis	Feet x % x %
47	60	13	52.34	680.4	65.63	44655
60	108	48	42.57	2040.0	66.11	134864
108	190	82	48.95	4013.9	65.30	262108
190	301	111	40.08	4448.9	65.31	290558
Total		254		11183.2		732185
Average			44.0		65.5	

Summary - Hole J-4

From	To	Ft.	Table Wt. Recovery	Ft. x %	Conc. Analysis	Feet x % x %
16	69	53	34.70	1839.1	65.97	121325
69	99	30	45.48	1364.4	67.03	91456
99	190	91	46.46	4227.9	66.27	280183
190	256	66	25.25	1666.5	65.16	108589
256	281	25	17.16	429.0	67.27	28859
Total		265		9526.9		630412
Average			35.9		66.2	

JULIAN IRON CORPORATION

Hole J-1
Table Conc., Silica, Phos., and Manganese

From	To	Feet	% SiO_2	% SiO_2 By Ft.	% Phos.	% Phos. x Ft.	% Mn.	% Mn. By Ft.	Remarks
3	15	12	6.25	75.0	.024	.288	.27	3.24	
15	25	10	3.14	31.4	.021	.210	.34	3.40	
25	45	20	5.05	101.0	.013	.260	.06	1.20	
45	60	15	8.25	123.7	.009	.135	.17	2.55	
60	80	20	4.05	81.0	.008	.160	.10	2.00	
80	100	20	2.02	40.4	.012	.240	.12	2.40	
100	120	20	3.68	73.6	.017	.340	7.19	140.38	
120	136	16	2.86	45.8	.037	.592	.43	6.88	
136	157	21	4.88	102.5	.006	.126	.10	2.10	
157	179	22	5.76	126.7	.031	.682	.10	2.20	
179	200	21	5.80	121.8	.039	.819	1.26	26.46	
200	213	13	5.76	74.9	.011	.143	7.23	93.99	
213	248	35	3.33	116.5	.017	.595	.23	8.05	
248	280	32	13.19	422.1	.019	.608	.27	8.64	
280	290	No	Core	-	-	-	-	-	
290	311	21	3.84	80.6	.005	.105	.12	2.52	
311	329	18	5.50	99.0	.008	.144	.21	3.78	
329	377	48	12.23	587.0	.008	.384	.15	7.20	
377	418	41	11.09	454.7	.009	.369	.12	4.92	
418	479	61	9.00	549.0	.011	.671	.12	7.32	
479	497	18	12.51	225.2	.025	.450	.11	1.98	
497	516	19	12.15	230.9	.030	.570	.06	1.14	
516	546	30	11.70	351.0	.034	1.020	.74	2.22	
546	596	50	10.40	520.0	.025	1.250	.07	3.50	
Total		583		4633.8		10.161		388.07	
Average			7.95		.017		.665		

JULIAN IRON CORPORATION

Hole J-2
Table Conc., Silica, Phos., and Manganese

From	To	Feet	% SiO_2	% SiO_2 x Ft.	% Phos.	% Phos. By Ft.	% Mn.	% Mn. By Ft.	Remarks
20	40	20	5.20	104.0	.008	.160	.08	1.60	
40	61	21	6.05	127.0	.008	.168	.15	3.15	
61	69	8	12.77	102.2	.021	.168	.14	1.12	
69	84	15	9.27	139.0	.024	.360	.27	4.05	
84	94	10	9.25	92.5	.034	.340	.18	1.80	
94	102	8	21.67	173.4	.055	.440	.25	2.00	
102	118	16	6.70	121.6	.028	.448	.12	1.92	
118	180	62	5.79	359.0	.008	.496	.08	4.96	
180	242	62	5.98	370.8	.007	.434	.08	4.96	
242	291	49	5.60	274.4	.013	.637	.16	7.84	
291	300	9	2.70	24.3	.045	.405	.14	1.26	
300	343	43	10.21	439.0	.011	.473	.17	7.31	
343	379	36	8.68	312.5	.010	.360	.14	5.04	
379	409	30	6.10	183.0	.019	.570	.15	7.50	
409	455	46	3.75	172.5	.008	.368	.15	6.90	
455	474	19	5.40	102.6	.005	.095	.16	3.04	
474	477	No	Core	-	-	-	-	-	
477	489	12	8.06	96.7	.005	.060	.14	1.68	
489	505	16	8.45	135.2	.008	.128	.12	1.92	
505	510	5	14.55	72.7	.014	.070	.08	0.40	
510	566	56	5.30	296.8	.008	.448	.06	3.36	
566	625	59	7.55	445.4	.007	.413	.05	2.95	
625	705	80	7.87	629.6	.009	.720	.06	4.80	
Total		682		4774.2		7.761		79.56	
Average			7.00		.011		.116		

Canadian Javelin Limited

JULIAN IRON CORPORATION

Hole J-3

Table Conc., Silica, Phos., and Manganese

From	To	Feet	% SiO_2	% SiO_2 By Ft.	% Phos.	% Phos. x Ft.	% Mn.	% Mn. By Ft.	Remarks
47	60	13	5.53	71.9	.009	.117	.14	1.82	
60	108	48	5.13	246.2	.006	.288	.08	3.84	
108	190	82	6.16	505.1	.009	.738	.07	5.74	
190	301	111	6.34	703.7	.010	1.110	.08	8.88	
Total		254		1526.9		2.253		20.28	
Average			6.01		.009		.08		

Hole J-4

From	To	Feet	% SiO_2	% SiO_2 By Ft.	% Phos.	% Phos. x Ft.	% Mn.	% Mn. By Ft.	Remarks
16	69	53	5.37	284.6	.006	.318	.06	3.18	
69	99	30	3.62	108.6	.005	.150	.12	3.60	
99	190	91	5.02	456.8	.007	.637	.08	7.28	
190	256	66	5.97	394.0	.011	.726	.08	5.28	
256	281	25	2.95	73.7	.011	.275	.10	2.50	
Total		265		1317.7		2.106		21.84	
Average			4.97		.008		.08		

JULIAN IRON CORPORATION

Summary of
Diamond Drill Core Concentration Tests
Holes J-1 - J-4

Hole No.	Footage Sampled	Concentrates % Fe.	% SiO_2	% Phos.	% Mn.	% Wt. Recov.
J-1	583	63.4	7.95	.017	.665	41.5
J-2	682	64.7	7.00	.011	.116	47.4
J-3	254	65.5	6.01	.009	.080	44.0
J-4	265	66.2	4.97	.008	.080	35.9
	1784					
AVERAGE:		64.54%	6.86%	.012%	.29%	43.28%

SCANNED IMAGE

EXHIBIT D

To

Julian Lake Ore Body
Pilot Plant Grinding and Concentration Tests

Wabush Pilot Plant
Engineering and Mining Journal
April, 1961

Reprinted from

ENGINEERING AND MINING JOURNAL

April 1961

The Wabush Pilot Plant:

Stepping Stone To $200-million Development

K. E. MERKLIN
F. D. DEVANEY

Mr. Merklin is chief metallurgist, Hibbing laboratory, and Mr. DeVaney is director of metallurgy and research, Pickands Mather & Co.