

A REPORT  
ON THE  
BEAR RIVER IRON ORE PROJECT  
OF  
PACIFIC GIANT STEEL ORES LTD.

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Whitchorse, Yukon

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## LOCATION AND ACCESS

### Location

The Bear River iron ore property, consisting of 16 mineral claims (826.40 acres) in good standing, is located on the east side of the Bear River in the Yukon Territory, at 64°50' North Latitude and 134°15' West Longitude. The Bear River is the main tributary of the Wind River and is located in the Wernecke Mountains, which are, in turn, part of the Selwyn Range.

The property is situated 70 air-miles, or 120 road-miles, northeast of Elsa, Yukon, main mining camp of United Keno Hill Mines, Canada's largest silver producer. Elsa is connected by 285 miles of all-weather highway to Whitehorse, capital of the Yukon. Whitehorse, in turn, is connected to the Pacific port of Skagway, Alaska, by the 110-mile White Pass and Yukon Route narrow-gauge railroad and to the western Canadian highway system by the all-weather Alaska Highway.

### The Property

The Bear River property consists of 16 mining claims, 1,500 feet by 1,500 feet, located and recorded under the Yukon Quartz Mining Act. They are as follows:

| <u>Name of Claim</u> | <u>Record Number</u> | <u>In valid standing (by representation work done) until:</u> |
|----------------------|----------------------|---|
| Giant Steel #1       | 82283                |   |
| to                   | to                   |   |
| Giant Steel #6       | 82288                | July 31, 1972   |
| G.S. #7 to           | 83546 to             |   |
| G.S. #16             | 83555                | July 31, 1971   |

### Access

Present access to the property is gained by direct helicopter flight from Mayo, which is 30 miles southeast of Elsa by all-weather road. The distance from Mayo to the property is 100 air-miles. Float-equipped aircraft are able to land at Gillespie Lake, 10 miles southeast of the property, and from the lake helicopter transportation to the property is most suitable.

A winter road, beginning at Elsa and known as the Wind River Road, passes within 15 miles west of the property. This road follows the McQuesten River Valley, Beaver River Valley, Braine Pass, and finally the Wind River

north to the Pecl Plateau, and passes by the mouth of the Bear River. Easy access to the property is possible from this road over frozen ground in the winter. The distance from Elsa to the mouth of the Bear River is approximately 100 miles by this route. During the summer tracked vehicles can be used on the road. In the winter of 1959-60, the road was used as the supply route to an oil-gas drilling operation further to the north at Bell River. Consequently, the road could be readily reconditioned for year-round truck travel if required. Most of the road is upon good, gravelly ground, and the river and creek crossings are narrow.

H I S T O R Y

In 1905, Dr. Charles Camsell (now deceased), later to become Canada's Deputy Mines Minister, discovered float hematite at the mouth of the Bear River where it flows into the Wind River. He also spoke with a man who had seen similar float along the Bear River in 1898, during the Gold Rush, and who also said that it became more common upstream. Dr. Camsell identified the float hematite, much of it massive, highgrade ore, as being of sedimentary origin, and predicted the occurrence of a large iron ore deposit somewhere in that general area.

In 1950, Dr. H.S. Bostock, recently awarded the Governor General's Medal for outstanding geological work in the Yukon, confirmed Dr. Camsell's prediction. Basing his study on published and unpublished reports, and on the similarity between the float found in the Bear River - Wind River area and the iron ore produced from the sedimentary iron formations of the Lake Superior area in eastern Canada and the United States, he predicted the possibility of a major iron ore producer being established in the area north-east of Mayo, linked to the sea by a 500-mile railroad (almost exactly the length of the proposed railroad from Bear River to either of the Pacific ports of Skagway or Haines, Alaska).

In 1962, Art Jellinek and Pete Runer, local prospectors, staked the Bear River iron ore deposit, which they had discovered in 1960. After a period of preliminary economic studies, they turned the property over to Pacific Giant Steel Ores Ltd. for development in 1964. This discovery constituted the first discovery in the Yukon of a potentially economic major iron ore deposit that has been brought to an advanced stage of development.

G E O L O G Y

The deposit under consideration contains the mineral hematite, which is the highest oxide of iron ( $Fe_2O_3$ ). Hematite is the most common ore mineral of iron. The hematite is a steely, blue-grey colour, is massive and hard. It shows signs of recrystallization in that minute crystals are visible.

The hematite originated as a sedimentary deposit and the deposit has been upgraded in iron content through the migration of iron from regions of high pressure to a region of low pressure, i.e. from the limbs into the trough of a syncline. This process is known to have occurred in other deposits of a similar type.

The host rock consists of interlayered black slate and quartzite. No thermal metamorphism is evident in the deposit - only kinetic metamorphism, i.e. mechanical deformation that caused the formation of slate from the original mudstones and siltstones. The occurrence is typical of iron formations.

The iron formation is overlain by conglomerate that contains hematite as a cement and also contains fragments of hematite, as well as larger lenses, that originated from previous erosion of the iron formation. Pebbles, cobbles and boulders within the conglomerate show various degrees of rounding, from angular to well-rounded, indicating that the source materials were generally close by at the time of deposition. The hematite particles are primarily angular, which indicates erosion of a nearby iron formation. The conglomerate indicates a unconformity at this particular horizon.

Dolomite overlies the conglomerate. The dolomite is grey to black in colour but weathers to a bright orange on the surface, due to a weathering of iron molecules within the dolomite. The iron molecules replaced magnesium within the dolomite during deposition.

The Geological Survey of Canada identified all formations in this area, up to and including the dolomite, as being of Precambrian origin. There are no fossils evident in any of the formations. At a distance of about four miles northwest of the property, paleozoic limestone, grey-white in colour, and possessing a hydrogen sulfide content (rotten egg smell upon breaking the rock), is in contact with the orange-weathering dolomite. The contact is an unconformity and, as evidenced by numerous other rock types overlying the

dolomite further to the east, but not present in this location, a considerable amount of erosion must have taken place before deposition of the limestone directly upon the dolomite.

The area about the property was subjected to probably more than one period of strong folding and as a result, a synclinal fold appears to occur on the property.

The concentration of hematite is within the syncline and the fold appears to widen, plunge slightly and strike in a direction nearly perpendicular to the Bear River. The concentration of hematite is likely to lie within an area approximately four claims long (6,000 feet) and one claim wide (1,500 feet). This type of occurrence is similar to that of other large iron ore deposits such as in northern Quebec, where an ore body, mined at the rate of 20 million tons per year and producing therefrom 8 million tons of concentrates, covers an area of 6,600 feet in length and 600 feet in width, and will be mined to a depth of some 1,300 feet. Mining at this location is carried out over an area of 60 acres, slightly larger than one claim.

At Iron Hill, the lateral limits of the concentration are visible both on the east and west sides within the property. On the south side of the Bear River, although the iron formation is still present, only a very small amount of hematite, and also magnetite, occur. Magnetite does not occur with the massive, highgrade hematite on the north side of the Bear River at Iron Hill. Therefore, it is apparent that the concentration lies within the area between Iron Hill and Bear River.

The massive, highgrade hematite is exposed over a width of 750 feet and a length of 300 feet. From this zone, toward the treeline 1,000 feet southward, several trenches also expose highgrade hematite, so as to indicate that the concentration continues toward the Bear River. Between this treeline and the Bear River, no further outcrops are visible as the area is covered by glacial till and river gravel. The depth of this overburden is not known but is probably around 50 feet to 100 feet deep, judging by the type of glacially eroded valley the Bear River occupies.

The elevation difference between the lowest exposure, in trenches just north of the treeline, and the top of the large, highgrade exposure on Iron

Hill is approximately 300 feet. This indicates a depth continuity of massive, highgrade hematite. The highgrade hematite contains approximately 65% iron. Within the main exposure, variations in iron content occur.

ORE RESERVES

Highgrade Massive Hematite Zone

The deposit is exposed on the surface in a wedge-shaped form as shown in Figure 1, within an area of 750 ft. (the width of the nearly vertically dipping iron formation) by 1,100 ft. (along the strike of the iron formation, where it disappears below overburden near the treeline). Along the strike of the iron formation, the first 300 ft. contains the massive highgrade hematite outcrop (the surface of Block A). The following 800 ft. along the iron formation (the surface of Block D) contains trenches in which highgrade ore is exposed. Most of the surface of Block D is covered with a thin veneer of moss and, consequently, the average grade of Block D will be considered as one-half that estimated in the first 300 ft. in order to be on the conservative side in the estimation of the potential ore reserves.

For the purposes of calculations, the ore in Block A can be considered to average 60% iron content although sections in excess of 65% occur. Therefore, the average grade of Block D would be 30% iron content.

As Blocks A and D are, in fact, exposed in three dimensions, ore reserves of approximately 10 million tons in Block A and 7½ million tons in Block D can be considered to exist. Converting both the direct-chipping ore (Block A) and the ore in Block D into pellet-equivalent (68% iron content), the respective tonnages are 8½ and 3½ million tons of pellet equivalent.

The minimum ore reserves required for a 15-year, direct-chipping, highgrade mining operation, including a Company-owned transportation system, are approximately 15 million tons. 10 million tons of direct-chipping ore can be considered to be producible from Block A. And, taking 50% of the ore reserves in Block D to be highgrade, a further 4 million tons, approximately, can be considered. Therefore, the ore reserves contained in Blocks A and D approximately equal the required minimum reserves required for an economic mining operation, including a Company-owned transportation system.

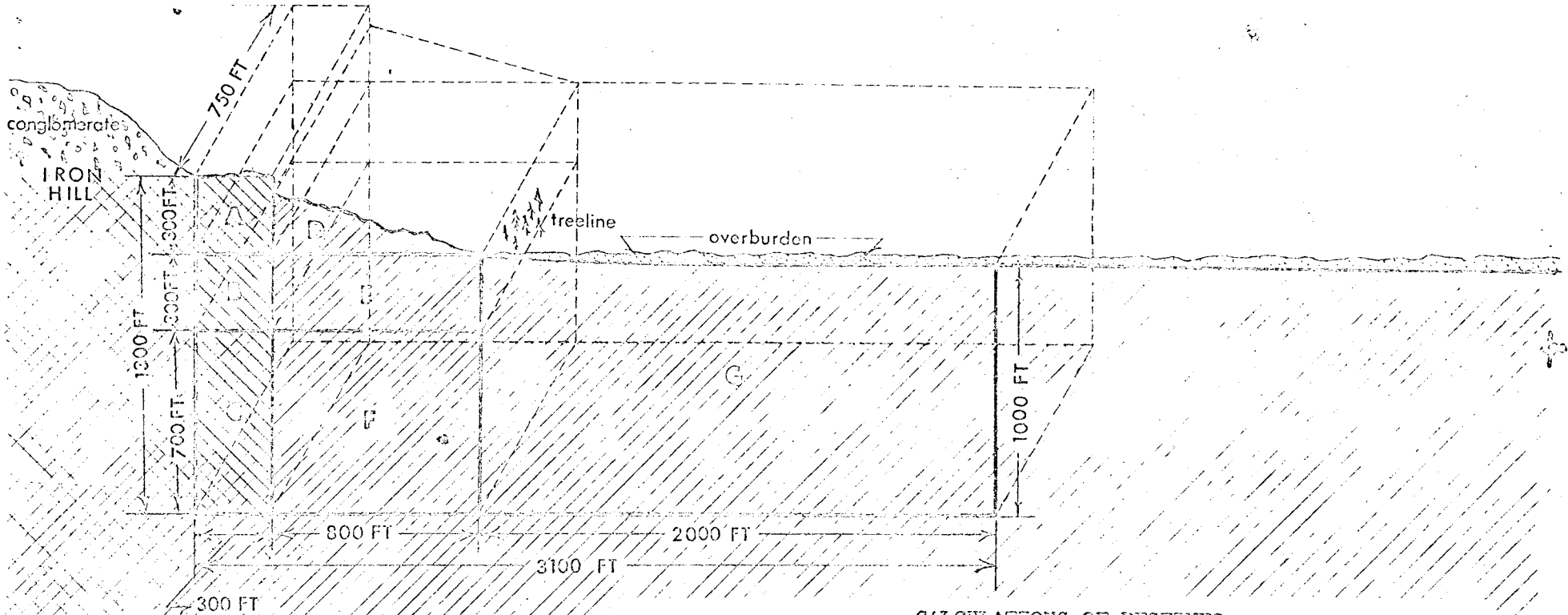
Ore Reserves Considered to Be Available

As the exposure of the deposit extends to a height of 300 ft. above the valley floor (bottom of Blocks A and D), it can be assumed that the deposit exists to an equal depth below the valley floor, because of the nearly vertical attitude of the iron formation. The total ore reserves of this

(FIGURE 1)

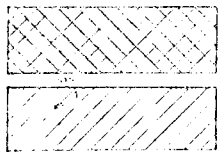
CROSS SECTION OF BEAR RIVER IRON ORE FORMATION (PROJECTED)

(View looking southeast)



CALCULATIONS OF RESERVES

| BLOCK | % IRON CONTENT | TONS OF ORE    | PELLET EQUIVALENT (TONS) |
|-------|----------------|----------------|--------------------------|
| A     | 60             | 10 million     | 8 1/2 million            |
| B     | 60             | 10 million     | 8 1/2 million            |
| C     | 60             | 22 1/2 million | 20 million               |
| D     | 30             | 7 1/2 million  | 3 1/2 million            |
| E     | 30             | 20 million     | 9 million                |
| F     | 30             | 46 million     | 20 1/2 million           |
| G     | 30             | 180 million    | 80 million               |
| TOTAL |                | 296 million    | 150 million              |



60 % IRON CONTENT

30 % IRON CONTENT

5/000

depth extension would be approximately 10 million tons (Block B) and 20 million tons (Block E). Considering for Blocks B and E the same iron contents as were considered for Blocks A and D, respectively, the pellet equivalent of Block B would be approximately  $8\frac{1}{2}$  million tons, and of Block E would be approximately 9 million tons, for a total of  $17\frac{1}{2}$  million tons of pellet equivalent.

The total pellet equivalent of Blocks A, B, D & E is, therefore, approximately 30 million tons, or equal to the minimum reserves required for a 30-year, pellet-producing mining operation, including a Company-owned transportation system, even if all the highgrade ore were pelletized rather than being shipped directly in lump form.

If the reserves were calculated to a depth of 1,000 ft., which is less than the open pit mining depth of some major iron ore mines having a similar geological structure (for example, an open pit iron ore mine in northern Quebec is designed to be mined to a depth of 1,300 ft.), the ore reserves of Blocks A, B & C would be approximately 42 million tons of direct-shipping ore, and the reserves of Blocks D, E & F would be approximately 74 million tons of ore (30% iron content). Block C, the average grade of which is taken in the calculations as being the same as Blocks A and B (60% iron content), contains, then, approximately  $22\frac{1}{2}$  million tons of direct-shipping ore, and, considering the grade of Block F to be the same as Blocks D and E, Block F would contain approximately 46 million tons of ore (30% iron content). The pellet-equivalent of Blocks C and F is 20 million and  $20\frac{1}{2}$  million tons, respectively, totaling approximately 40 million tons. Therefore, the total pellet equivalent of Blocks A, B, C, D, E & F is approximately 70 million tons (sufficient to produce almost 5 million tons<sup>8</sup> of pellets for a period of 15 years if all the highgrade ore were made into pellets rather than being shipped directly as lump ore). To date, the single largest iron ore contract has been made between Japan and Western Australia (through C. Itoh and Mitsui) at the Mt. Newman iron ore project, which will cost some \$300 million to put into production, including mine, pellet plant, railroad and port facilities. The contract calls for 100 million tons of lump ore and pellets to be shipped to Japan over a 15-year period.

#### Maximum Reserves

The general aim should therefore be to establish sufficient ore reserves

on the property to fill the foreseeable markets in Japan for Bear River iron ore and/or pellets. Reserves to support a 30-year period of production at an annual production of 5 million tons of highgrade iron ore and/or pellets - 150 million tons - would therefore be the immediate target.

If Block G, in Figure 1, is considered of the same grade as Blocks D, E & F (30% iron content), and would be mined to a depth of 1,000 ft., by calculation it would have a surface area of 750 ft. (the exposed width of the iron formation on the surface of Block D) by approximately 2,000 ft. (along the strike of the iron formation). Block G would then contain 180 million tons of ore (30% iron content), which is equivalent to 80 million tons of pellets (68% iron content).

Therefore, the total ore reserves contained in Blocks A to G would be sufficient for the production of 150 million tons of pellets. The surface area of these reserves (Blocks A to G) would be 750 ft. by 3,100 ft. A summary of the calculations of reserves is shown in the following table.

CALCULATIONS OF RESERVES

| <u>Block</u>  | <u>% Iron Content</u> | <u>Tons of Ore</u> | <u>Pellet Equivalent (Tons)</u> |
|---------------|-----------------------|--------------------|---------------------------------|
| A             | 60                    | 10 million         | 8½ million                      |
| B             | 60                    | 10 million         | 8½ million                      |
| C             | 60                    | 22½ million        | 20 million                      |
| D             | 30                    | 7½ million         | 3½ million                      |
| E             | 30                    | 20 million         | 9 million                       |
| F             | 30                    | 46 million         | 20½ million                     |
| G             | 30                    | 180 million        | 80 million                      |
| <b>TOTALS</b> |                       | <b>296 million</b> | <b>150 million</b>              |

As the ore concentration within the iron formation is not present on the south side of the Bear River, the maximum length over which the concentration could occur, i.e. between the Bear River and Iron Hill, is 6,000 ft. Therefore, the total area in which the concentration of iron can be considered to occur is 6,000 ft. by 750 ft., although the formation appears to expand in width toward the River (the area of Quebec Cartier's iron ore deposit, presently being mined, in northern Quebec covers 350 acres, i.e. 600 ft. by 6,600 ft., and the mine produces 8 million tons of concentrates per year).

The surface area of Blocks A to G is approximately half of the surface area of the formation in which the concentration can be considered to occur.

The geology of the deposit supports the likelihood that many areas of highgrade ore (64% iron content, or higher) would be located throughout the hematite zone. As the cutoff ore grade for economic beneficiation is 13% iron content, and the minimum average grade of hematite being mined throughout the world in large open pit mines is approximately 22% iron content, large tonnages of highgrade ore could be shipped for direct feed for the Japanese blast furnaces and the remainder of the ore upgraded and shipped in the form of iron ore concentrate pellets.

#### Geomagnetic Anomaly

As a result of the airborne geomagnetic survey conducted over the Bear River property by Harvey H. Cohen Engineering Ltd., a large anomaly was found to exist on the property.

Geological interpretation of the anomaly indicated that it could be a medium-to-highgrade deposit of magnetite ore. Magnetite and hematite can be seen on the south side of the Bear River starting at the foot of the mountain along the strike of the iron formation. But already at that point there is no ore-grade material as only small lenses (a few inches wide by a foot long, or less) appear infrequently (grade well under 5% iron content, even over a few feet). Thus, where outcrops are visible southwest of the anomaly the ore content of the iron formation has petered out. The anomaly, therefore, represents the southernmost possible extension of ore-grade material. The anomaly may represent a high content of magnetite. Hematite may, of course, be associated with the magnetite, but because of its non-magnetic and non-conductive properties (unlike magnetite) it would be undetectable as a magnetic anomaly. It therefore remains for drilling to test the anomaly in order to determine whether or not the material is of ore grade. The area of the anomaly is covered with overburden having an undetermined depth but probably ranging between 50 and 100 feet.

From the size of the anomaly, indicated by its gamma intensity, H. H. Cohen Engineering states that the area above 3,000 gammas covers approximately 5 million square feet. Were this shown to be of ore grade, and assuming an iron content of only 30%, to a depth of 300 feet, ore reserves would total 150 million tons. To a depth of 1,000 feet, considering the same average

grade, the reserves could be 500 million tons of ore (30% iron content). This would be equivalent to 220 million tons of iron ore concentrate pellets (68% iron content).

This, of course, remains to be proven, both as to grade and as to depth, as no outcrops are visible in or about the center of the anomaly.

This potential magnetite (and possibly, hematite) reserve will be explored after the reserves of the massive, highgrade hematite zone are known and further tonnages of ore may perhaps be required.

### Conclusions

- a. Iron ore reserves, as explained with the use of Figure 1, presently can be considered to exceed the minimum required for an economical mining operation, including a Company-owned transportation system, for a 15-year mining operation producing highgrade, lump direct-shipping ore. For a highly profitable operation, well past the break-even point and filling the available market, a total of some 150 million tons of highgrade ore and/or pellet-equivalent, low grade ore should be drill-proven.
- b. Possible ore reserves greatly exceed the reserves required to supply the Japanese market for Dear River blast furnace feed for a period of 30 years at an annual production of 5 million tons of highgrade ore and/or pellets.
- c. Large tonnages of highgrade, direct-shipping ore (64% iron content, or higher) are indicated. Thus, the shipment of raw ore may be possible before the beneficiation and pelletizing plant need be constructed to treat lower grades of ore for the production of iron ore concentrate pellets (68% iron content).
- d. Primary emphasis is to be placed on drill-proving the depth extension of the massive highgrade hematite deposit within, and southwest of the area of the outcrops. Secondly, the major geomagnetic anomaly should be tested to determine the existence of ore-grade material because of the high magnetic intensity recorded by the survey in that area.

M I N I N G

The iron ore deposit is situated on the north side of the Bear River Valley floor, which is wide and flat. The deposit begins at Iron Hill and extends almost perpendicular to the Hill into the valley. The location is ideal for open pit mining and plenty of flat space is available for the location of ore stockpiles, gangue rock and tailings piles, mill, pelletizing plant, camp and railroad loading yards.

Surface exposures of the deposit indicate that the open pit will have a minimum size of approximately one-third of a claim (17 acres) and a maximum size of approximately four claims (207 acres) at its bottom.

The Bear River contains sufficient water for plant operations and runs directly alongside the proposed open pit site.

The deposit, being situated on the south side of the mountain range that forms the north side of the Bear River valley, receives many more hours of sunlight than the opposite side of the valley. Therefore, snowcover leaves earlier in the spring.

## BENEFICIATION & AGGLOMERATION

### Beneficiation

Beneficiation tests, utilizing the procedures of gravity separation, high intensity wet magnetic (H.I.W. magnetic) separation and separation by flotation, or a combination of these, have produced results that show that there is a choice of several methods of beneficiating the Bear River hematite iron ore. These are all standard methods presently employed by the iron ore industry.

### Mines Branch Tests

Tests were conducted by the Department of Energy, Mines and Resources (formerly called the Department of Mines and Technical Surveys), Mines Branch, Mineral Processing Division, of Ottawa. Results were obtained on: (a) gravity separation, (b) high intensity wet magnetic separation, (c) separation by flotation, (d) separation by gravity combined with flotation, and (e) separation by gravity combined with H.I.W. magnetic separation. The results produced are summarized as follows:

|   | Mesh Size<br>(Tyler) | Concentrate<br>Analysis (%) |                  | Recovery<br>Soluble<br>Fe (%) |
|---|----------------------|-----------------------------|------------------|-------------------------------|
|   |                      | Soluble Fe                  | SiO <sub>2</sub> |                               |
| Gravity Separation                            | - 65                 | 67.0                        | 2.8              | 78.7                          |
| High Intensity Wet Magnetic<br>Separation     | - 250                | 67.2                        | 2.9              | 90.7                          |
| Silica Flotation                              | - 150                | 66.6                        | 3.0              | 95.3                          |
| Combination of Gravity and<br>Flotation       | - 65 &<br>-150 *     | 67.2                        | 2.4              | 94.5                          |
| Combination of Gravity and<br>H.I.W. Magnetic | - 65 &<br>-150 *     | 66.8                        | 3.4              | 94.4                          |

\* In these two cases, the ore was ground to minus 65 mesh for the gravity separation and the tailing was ground to minus 150 mesh for the flotation and H.I.W. magnetic separation of the tailing.

The best test results were obtained by the flotation method but the costs for large volume production would likely be higher than by gravity and H.I.W. magnetic separation. For the most economical method of beneficiation, the combined gravity and H.I.W. magnetic separation appears to be the best choice. (This is the process being used on hematite ore at the

Wabush iron ore mine in Labrador, one of the major Canadian producers.) Chemical analysis of the concentrates produced from each of these beneficiation tests showed that a high quality concentrate is producible and that the steelmaking impurities will be much lower than the specified maximum set by the steelmakers.

Ferro-Magnetics Ltd. Tests

High intensity wet magnetic separation tests, utilizing the Jones Magnetic separator, were conducted by Ferro-Magnetics Ltd. on the Bear River iron ore samples submitted, and the following concentrate was found to be obtainable:

| Recovery Soluble Fe (%) | Tyler Mesh Size | Concentrate Analysis (%) |                  |       |       |       |
|-------------------------|-----------------|--------------------------|------------------|-------|-------|-------|
|                         |                 | Fe                       | SiO <sub>2</sub> | P     | S     | Ti    |
| 90.2                    | - 48            | 65.1                     | 3.85             | 0.039 | 0.132 | 0.055 |

The results of these tests were quite similar to the results of the magnetic separation tests conducted by the Mines Branch.

Eriez Magnetics Tests

Other H.I.W. magnetic separation tests were carried out on Bear River iron ore by Eriez Magnetics, Erie, Pennsylvania. These tests showed that the following concentrate could be obtained on ore ground to between minus 100 and minus 200 mesh, utilizing the Humphrey Spiral for primary gravity separation and the H.I.W. magnetic separator to produce the final concentrate:

| Recovery Soluble Fe (%) | Fe   | Concentrate Analysis (%) |      |      |                  |      |      |      |                                |  |
|-------------------------|------|--------------------------|------|------|------------------|------|------|------|--------------------------------|--|
|                         |      | SiO <sub>2</sub>         | P    | S    | TiO <sub>2</sub> | Mn   | CaO  | MgO  | Al <sub>2</sub> O <sub>3</sub> |  |
| 90.3                    | 64.8 | 7.10                     | 0.06 | 0.11 | 0.07             | 0.02 | 0.26 | 0.22 | 0.13                           |  |

The results of the foregoing beneficiation tests show that a high quality iron ore concentrate can readily be produced by any one of several methods and that a high recovery of soluble iron is obtainable.

The worldwide average iron ore concentrate being produced is approximately 62-64% iron content and plants are being constructed to produce concentrates of up to 66% iron content to keep up with the demands of steelmakers for higher grade and higher quality (respecting impurities) concentrates. The Bear River iron ore, therefore, is well suited to meet even the future requirements of the steelmaking industry.

Agglomeration

Tests were conducted on the Bear River iron ore samples and produced results from which the suitability of the ore can be assessed for the production of iron ore concentrate pellets, self-fluxing iron ore concentrate pellets, and reduced or metallized iron ore concentrate pellets. These tests were conducted by the Ontario Research Foundation and the Mines Branch, Extraction Metallurgy Division.

Iron Ore Concentrate Pellets

The Ontario Research Foundation concluded that pellets with the following physical properties can be obtained from the Bear River iron ore concentrate, using 0.75% (by weight) Bentonite as a binder and a grind of 84.4% minus 325 mesh:

|                    |   |                        |            |
|--------------------|---|------------------------|------------|
| Moisture           | - | 8.1%                   |            |
| Green strength     | - | 12" drops:             | +10        |
|                    |   | Compression:           | 3.45 lbs.  |
| Dry strength       | - | 12" drops:             | 2.9        |
|                    |   | Compression:           | 12.87 lbs. |
| Fired strength     | - | 1 hour at 2350° F      |            |
|                    |   | Compression:           | 684 lbs.   |
| Dravo Tumble Index | - | 0.68% at minus 28 mesh |            |

The Mines Branch tests confirmed the suitable pellet quality obtainable from the Bear River iron ore and showed that the fired strength increased as the percentage of the concentrate of minus 325 mesh is increased.

Industry standards place emphasis upon the fired strength and the abrasive resistance (Dravo Tumble Index) of the pellets. The minimum fired strength acceptable is 350 lbs. and the maximum Dravo Tumble Index allowable is 6.0%. Therefore, the Bear River iron ore will produce a premium quality iron ore concentrate pellet.

Reduced Iron Ore Concentrate Pellets

Although present market demands are for highgrade lump iron ore and iron ore concentrate pellets, market demands are steadily increasing for iron ore products containing higher iron content. A very high iron content is obtainable in the form of reduced or metallized iron ore concentrate pellets.

Because natural gas is available from the Eagle Plain, some 100 miles northwest of the Bear River property, tests on the Bear River iron ore were conducted by the Ontario Research Foundation to obtain reduced iron ore concentrate pellets, using natural gas as a reducing agent. Further testing would be required to obtain pellets with the maximum iron content attainable, although, as high as 87.4% iron content was obtained in the tests.

#### Self-Fluxing Iron Ore Concentrate Pellets

Large deposits of limestone, which is the agent used during steel-making for fluxing out the gangue material from the iron ore, are located near the Bear River property. Because of the potential value of self-fluxing pellets, the Company arranged for testing of the quality of this product using Bear River iron ore. The Ontario Research Organization conducted the tests and produced self-fluxing pellets containing 5% limestone flux and 0.75% bentonite binder. Physical tests on the self-fluxing pellets produced gave the following results:

|                    |   |
|--------------------|---|
| Moisture           | - 8.3%  |
| Green strength     | - 12" drops: +10<br>Compression: 3.58 lbs.    |
| Dry strength       | - 12" drops: 2.0<br>Compression: 9.75 lbs.    |
| Fired strength     | - 1 hour at 2350° F<br>Compression: 1265 lbs. |
| Dravo Tumble Index | - 0.32% at minus 28 mesh                      |

In comparison with acceptable standards, the quality of these pellets is very high, and there are many advantages to the self-fluxing pellet as a blast furnace feed:

- a. Limestone, added during pelletizing, is in direct contact with every particle of hematite in the pellet. Thus, the silica-limestone reaction to produce the slag takes much less time, resulting in important cost reductions to the steelmakers.
- b. Handling of limestone is eliminated at the steel plant, and this results in savings in time, space and costs in making steel.
- c. A much higher fired index is obtainable on self-fluxing pellets than is obtainable on standard pellets. Loss due to abrasion is significantly reduced.

- d. Very good recovery of soluble iron is attainable by grinding the ore to minus 150 mesh size. The usual grind for the production of pellets is minus 325 mesh. Therefore, as a superior pellet is obtainable in self-fluxing form, a coarser grind may be utilized, resulting in further cost savings.
- e. Because of the very minimal abrasion index of the self-fluxing pellets, better prices could be obtained from the steelmakers.

The conclusions to be drawn from the agglomeration tests conducted on the Bear River iron ore are:

- a. The ore is suitable for the production of iron ore concentrate pellets with high iron content (approximately 68%) and with good physical properties for shipping and handling.
- b. Extremely high quality self-fluxing iron ore concentrate pellets can be produced from the Bear River iron ore, utilizing the abundant supplies of limestone available in the vicinity of the deposit.

H E A T   A N D   P O W E R

Sources of heat and power for the Bear River iron ore project are several. To the northwest of the Bear River, approximately 100 miles, on the Eagle Plain, are three natural gas wells belonging to Western Minerals. One has a capacity of 10 million cubic feet per day (the capacity of the others has not yet been published). Oil is also present in the wells. Western Minerals is, by present indications, intending to continue proving up the field. At a requirement of 1,000 cubic feet of gas for every ton of concentrate pellets produced, one 10-million-cubic-foot-per-day, and one 5-million-cubic-foot-per-day well would suffice for the plant at a production capacity of 5 million tons per year.

Oil and gas exploration has been, and is expected to continue to be, carried on within the immediate area of the Bear River. Additional sources of power may thus become available.

Because there is a requirement for a railroad in the development of the Bear River iron ore project, oil and liquified gas can be obtained from the Kenai Peninsula in Alaska (a major producing oil-gas field) and economically transported by rail backhaul to the Bear River site for heat and power.

The capital cost for constructing a plant to generate power through gas or diesel units is approximately one-sixth of the cost of hydro power generating plants. The gas, of course, for this purpose, can likely be obtained also from the Eagle Plain wells. Presently, petroleum exploration is being conducted by major oil firms on the Peel Plateau, east of the Eagle Plain and approximately 50 miles north of the Bear River, and northward. Well drilling has been conducted about 100 miles north of the Bear River.

Near the town of Mayo, the Northern Canada Power Commission has a dam on the Mayo River from which it is generating electric power. The plant presently has an output of 3,600 Killowatts and its capacity can be increased to 7,600 Killowatts. A transmission line from there to the Bear River would be less than 100 miles long and could supply ample power for the operation of the mine plant and mining machinery. Also, 40 miles to the northeast of Mayo, on the Stewart River, a site has been selected by the Canada Power Commission that will be suitable for the construction of a dam and power station capable of supplying 25,000 Killowatts of power.

RAILROAD TRANSPORTATION

Transportation has long been considered a major problem in the establishment of producing mines in the Yukon because of the distances between most mineral prospects and the sea. Technological advances in the transportation of large tonnages by highly automated, standard-gauge industrial railroads have changed the picture.

The feasibility of a railroad for transporting Bear River iron ore was first indicated in a proposal to the Company by the consulting firm of T.J. Kauffeld, of New York, recognized worldwide experts in large-tonnage, bulk transportation. Their proposal stated that a rail rate of as little as 2 to 3 mills per ton-mile may be obtainable for transporting Bear River iron ore.

In 1966, Pacific Giant Steel requested LeTourneau-Westinghouse Company, of Peoria, Illinois, leading worldwide manufacturers of railroading equipment, to calculate the cost of transportation by railroad of Bear River iron ore from Bear River to the Pacific ports of Skagway and Haines, Alaska. Their report to the Company showed that very low rail rates are obtainable, using a highly automated, industrial railroad system.

The approximate Canadian average railroad rate for the transportation of iron ore over longer distances is 0.75¢ per ton-mile. The railroads on which this rate is common were built several years ago and are not as highly automated as are the railroads being built today for the transportation of large tonnages in bulk form, such as iron ore. Construction costs for these latest types of railroads are often much lower than were the costs of railroads built in Canada several years ago, as a great deal less labour and more heavy equipment is used in the construction methods of today. The operational cost is also considerably lower as few operating personnel are required compared to the number necessary on older railroads.

The LeTourneau-Westinghouse studies of the proposed rail routes between Bear River and the ports of Skagway and Haines included construction and operating cost of railroad and port, from which it was possible to derive projected rail rates. The rail rates achievable with these new transportation systems can be compared to the present average Canadian rail rates for shipping iron ore over similar distances (0.75¢ per ton-mile) on older and not highly automated lines. The achievable rates for the Bear River railroad, including

amortization of the construction costs and also including the operating costs, are as follows:

| <u>Annual Shipping Tonnage</u> | <u>15-Year Operation</u> |                     | <u>30-Year Operation</u> |                     |
|--------------------------------|--------------------------|---------------------|--------------------------|---------------------|
|                                | (in cents per ton-mile)  |                     |                          |                     |
|                                | <u>Skagway Route</u>     | <u>Haines Route</u> | <u>Skagway Route</u>     | <u>Haines Route</u> |
| 1,000,000 tons                 | 1.76                     | 1.37                | 1.30                     | 0.96                |
| 2,000,000 tons                 | 1.00                     | 0.73                | 0.76                     | 0.53                |
| 3,000,000 tons                 | 0.74                     | 0.52                | 0.59                     | 0.39                |
| 4,000,000 tons                 | 0.63                     | 0.41                | 0.50                     | 0.31                |
| 5,000,000 tons                 | 0.54                     | 0.34                | 0.45                     | 0.26                |

Shipping costs, equivalent to the Canadian average (0.75¢ per ton-mile) are obtainable over these routes at annual tonnages as follows, as can be seen from the foregoing projected rail rates:

|               | <u>15-Year Operation</u> | <u>30-Year Operation</u> |
|---------------|--------------------------|--------------------------|
| Skagway Route | 3,000,000 tons           | 2,000,000 tons           |
| Haines Route  | 2,000,000 tons           | 1,500,000 tons           |

However, annual tonnages much lower than the foregoing can still be economic if the railroad is Company-owned and the profits from the mining operation are used to subsidize a portion of the transportation costs.

At annual tonnages greater than those required on the Bear River railroad to make the ton-mile rate equivalent to the Canadian average, the cost of transportation is reduced significantly. The total transportation cost for transporting iron ore from the minesite to the Pacific Ocean is \$1.70 per ton (Skagway route) and \$1.30 per ton (Haines route) at an annual production of 5,000,000 tons over a 30-year period, as compared to the equivalent Canadian average cost of \$3.75 per ton for the same distance.

Conclusions

- a. The potential ore reserves of the Bear River iron ore property and the markets assured in Japan indicate that a mining operation, shipping approximately 5,000,000 tons of lump highgrade iron ore and/or iron ore concentrate pellets annually, is feasible. Therefore, it is considerably more profitable for the Company to own the Transportation system, at such volume, and operate it as an integral part of the mining operation.

- b. The railroad, in itself, should easily prove to be even more profitable, in that it would form a trunkline into the heart of the Yukon, where no railroad presently exists, and would pass through some of North America's most highly mineralized areas. Existing mines and mines that have announced production dates are shown as follows:

| * Location                          | Annual Tonnage | Approximate distance to: |                     |
|-------------------------------------|----------------|--------------------------|---------------------|
|                                     |                | <u>Skagway Route</u>     | <u>Haines Route</u> |
| <u>Existing Mines</u>               |                |                          |                     |
| United Keno Hill                    | 25,000 tons    | nil                      | nil                 |
| Cassiar Asbestos                    | 90,000 tons    | nil *                    | 80 miles *          |
| <u>Mines Coming into Production</u> |                |                          |                     |
| New Imperial (1967)                 | 30,000 tons    | nil                      | 80 miles            |
| Clinton Creek (1968)                | 60,000 tons    | 180 miles                | 180 miles           |
| Anvil Corp. (1969)                  | 370,000 tons   | 110 miles                | 110 miles           |

\* Cassiar Asbestos production is presently moved from Cassiar, B.C., to Whitehorse, where it is shipped by the White Pass railroad. Distances shown are from Whitehorse.

Many other properties of indicated potential and proven reserves are awaiting more economical transportation than presently exists in the Yukon and will provide considerably more freight for the proposed Bear River railroad. In addition, backhaul freight to the Bear River property would provide more revenues for the railroad and at a higher rate than that obtainable from the outward shipments of iron ore and/or pellets.

P O R T S

Access to the Yukon is presently gained through either the port of Skagway, Alaska, or the port of Haines, Alaska. Both ports are presently in use and are located on the Pacific Coast.

Port of Skagway

The year-round-ice-free, deep sea port of Skagway is linked to Whitehorse by the narrow-gauge, 110-mile White Pass and Yukon Route's railroad. The majority of the Yukon's incoming and outgoing freight presently moves over this route. The White Pass also owns a container ship (6,900 tons capacity), which operates between the port of Vancouver, British Columbia, and the port of Skagway on a schedule of approximately 25 round trips per year. Outgoing freight consists mostly of asbestos fibre (90,000 tons per year) and silver-lead-zinc concentrates (25,000 tons per year). Shipments of copper concentrates (30,000 tons per year) will begin in 1967.

The largest deep-sea ships may be accommodated at the port because of the deep water which drops off sharply from the shore at an angle of approximately 45 degrees. At a distance of 100 feet from shore, the water reaches a depth of approximately 100 feet, and gets deeper as the distance from the shoreline increases. The harbour is protected from storms because it is located at the end of the Lynn Canal, which is approximately 75 miles long.

Port of Haines

The year-round-ice-free, deep-sea port of Haines is linked to the Alaska Highway in the Yukon by a 150-mile, all-weather road, the Haines Road, which meets the Alaska Highway 100 miles northwest of Whitehorse. Haines is home port for a deep-sea fishing fleet and is a port of call for Japanese ships taking on cargoes of timber destined for Japan.

This port also has great depths of water, similar to Skagway, and, in addition, more space is available for the construction of stockpiling sites and dock facilities than is readily available in Skagway (although this can be acquired in Skagway, as well).

An additional advantage to the selection of the port of Haines is that no such steep grades and sharp curves are encountered at the end of the line near Haines as is the case of that near Skagway for the railroad. Therefore, fully loaded, large unit trains can readily reach the port.

Conclusions

Both the port of Haines and the port of Skagway are suitable ports to handle bulk freight to be loaded in the largest deep-sea ships, for the following reasons:

- a. Stockpiling sites and dock facilities can be constructed at either port.
- b. A railroad can be constructed from Bear River to either port.
- c. Both ports have deep water and are sheltered from the open sea.

The port of Haines appears to be a better selection because the cost of constructing and operating a railroad between the Bear River and Haines is lower than it is between Bear River and Skagway and more flat areas for the construction of stockpiling sites and dock facilities are available in Haines than are available in Skagway.

From the LeTourneau-Westinghouse Company transportation studies, the cost of port construction would be approximately \$5 million.

MARKETS

Japanese steel production has increased from 3 million tons per year in 1949, to an estimated 58 million tons to be produced in 1967 (production in Japan at the height of World War II was only 7½ million tons per year). Japan is now ranked as third in world production of steel, after the United States and Russia. Predictions by the Japanese Iron and Steel Federation foresee Japanese production of steel exceeding 80 million tons per year by 1975.

The United States and Japan together produce 53% of the basic oxygen steel produced in the world (30 million tons per year, each). Iron ore feed for the blast furnaces at present, on the average throughout the world, has an iron content of approximately 60% and the immediate aim is to increase the iron content to approximately 64% - 66% in order to increase blast furnace capacity to make pig iron. Iron ore concentrate pellets, feed for the same furnaces, at present contain 62% - 64% iron and the trend is to increase the iron content to approximately 66% by developing more efficient beneficiation processes. Overall, the trends are to upgrade the feed products as high as possible in order to increase the rate of production of pig iron. Thus, the present blast furnaces will be partially able to offset the increasing demand for pig iron, but even at that, several new blast furnaces are being built in Japan (four in 1967, and two in 1968). The final step in marketing the ore will be the production of prerduced (metallized) pellets of 75% iron content, to be increased later to as much as 95% iron content. Considerable research work is being done internationally by the steel industry on determining the economics of producing such a product. At the present time, new plants being erected, and in the plans for construction in the short term, are for the production of concentrates, i.e. oxide, pellet plants.

As the Bear River iron ore is equal in quality to the finest ores available in the world, and these ores are in increasing demand in Japan, market agreements with the Japanese steelmakers will ensure a continued demand at ever increasing volume. Also, specifications on iron ores as to steelmaking impurity content have become more stringent lately because of the larger number of basic oxygen furnaces being built to take the place of the open hearth steelmaking furnaces, and the new furnaces require pig iron

feed of higher purity in order to produce a heat of steel in 20 to 30 minutes instead of the former 8 to 10 hours. The Bear River iron ore has been found by the Japanese steelmakers to be suitable feed for the new furnaces.

Although huge iron ore reserves exist in many countries, few of these countries can offer very large markets for return trade. Canada, however, is Japan's third largest trading partner and can offer large return purchases. In addition, the Japanese have announced their intention to increase trade with Western Canada and are actively seeking sources of supply for raw materials. British Columbia presently exports approximately 2 million tons of iron ore to Japan. The deposits from which this is mined are relatively small and cannot offer the long-range, large-tonnage advantage desired by the Japanese steelmakers. The Bear River deposit is one of the few potentially economic major iron ore deposits that can offer this advantage and it therefore gains an advantage from this over the smaller deposits. Also, up to \$200 million worth of equipment in the form of plant, railroad and port facilities are required to put the property into large-scale production. This represents major sales to the Japanese industry and gives the Bear River project another advantage in negotiating contracts for the supply of iron ore and/or pellets to the Japanese steelmakers.

Early establishment of the markets for Bear River iron ore was arranged in an agreement signed on October 2, 1966, between Pacific Giant Steel and C. Itoh & Co., Ltd., one of the three largest trading companies in Japan. The agreement calls for C. Itoh to establish markets for Bear River iron ore and iron ore products with the Japanese steelmakers, and to provide technical assistance in the development of the Bear River deposit. In return, C. Itoh is given the right to be the sole and exclusive channel for the sale of Bear River iron ore in Japan. Since signing the agreement, C. Itoh has stated that it can place 5 million tons of iron ore and/or iron ore pellets annually in Japan. As a result of this agreement, Pacific Giant Steel has acquired a preferential position within the Japanese market, and it now remains for Pacific Giant Steel to establish the exact ore reserves and grade so that C. Itoh's customers may know what annual shipments they could expect from the property.

However, markets for Bear River iron ore are not restricted to Japan, alone. The preliminary railroad survey submitted to the Company by T.J. Kauffeld

Consulting suggested that sufficiently economic rail rates should be attainable, in shipping large tonnages, to profitably market the Bear River iron ore in the Chicago-Pittsburg markets. Because prices paid for iron ore and pellets are approximately one-third higher in this market than the prices paid in the Japanese markets, most, or all, of the additional transportation costs incurred in reaching this market would be recovered. This market, the largest in the world, absorbs about 70% of Canadian iron ore production (23.8 million tons were shipped from Canada to this market in 1965) already, and it is seeking new sources of quality iron ores and iron ore concentrate pellets.

#### Conclusions

- a. Markets for at least 5 million tons annually of iron ore and/or pellets are assured in Japan for long-term supply of Bear River iron ore, as the quality desired by the Japanese steelmakers is present in the Bear River ore whereas it is not present in many of the ores available from elsewhere in the world.
- b. Because of the rapid increase in the steelmaking capacity of Japan, larger markets will be created for quality ores. The agreement between C. Itoh and Pacific Giant Steel will give the edge in supplying these markets to Pacific Giant Steel.
- c. The Bear River property is within reach of two of the three largest users of iron ore, the United States and Japan. This advantage is not enjoyed by many major iron ore mines.

SENIOR FINANCING

The Company maintains representation throughout Europe and North America for the purpose of acquiring major international financial groups as partners with whom the Company can develop the Bear River Iron Ore - Railroad Project. The Company's representatives have made the project well known within the iron and steel industry, firms manufacturing railroad equipment and major financial consortiums from Europe and the United States. In these circles, the Company's representatives have met with excellent response in discussing senior financing for the project because of the favourable economics and good profit potential of both the mining operation and the railroad operation.

The requirement for the construction of a railroad in conjunction with the Bear River project has had a significant effect in stimulating interest within groups not normally involved in mining projects. From the point of view of the railroad, the Bear River mining project is the catalyst that makes it possible to construct a profitable railroad. This is, of course, because the Bear River mining operation would provide sufficient freight for the operation and amortization of the railroad even without considering the additional outgoing and incoming freight that would be available for an industrial railroad that would be the main transportation artery through the Yukon, from south to north.

It is now assured that construction financing will be available upon the complete outlining of the required tonnage and grade of the deposit, in view of the fact that the economics of the project have been shown, to the satisfaction of major financial concerns, to be favourable. As C. Itoh Co., Ltd. stated in its announcement to the international iron and steel community, it is prepared to aid in the formation of a consortium for the financing of the construction required to put the mine into operation.

P R O F I T   P R O J E C T I O N S

For the purpose of determining the profitability of the Bear River Iron Ore - Railroad Project, and for the purpose of establishing the minimum ore reserve that would be required for a profitable mining operation on the Bear River, the Company has prepared profit projections for the project. These projections are attached, as Annexes A and B, and show the profits obtainable from the project both for a railroad route from Bear River to the Pacific port of Skagway (Annex A) and of Haines (Annex B), Alaska.

The mining, milling and pelletizing costs used for the projections were obtained by taking a high average of the costs encountered in several major iron ore producing mines operating under similar conditions to the conditions to be encountered in the Bear River iron ore mining operation. These operating costs are applicable to methods presently used throughout the industry. Of course, mining, milling and pelletizing costs as well as transportation costs have been decreasing in proportion to the increasing rate of technological advancement in open pit mining, iron ore beneficiation and bulk transportation.

Transportation costs are based on preliminary transportation studies completed for the Company by LeTourneau-Westinghouse Company, of Peoria, Illinois, leading worldwide manufacturers of railroad equipment. The transportation system planned is a highly automated, industrial railroad capable of hauling large tonnages over long distances. Included in the study were the port construction and operating costs.

For the purpose of planning, C. Itoh & Co., Ltd., the Japanese trading company that is to market the Bear River iron ore in Japan, stated that the prices payable for highgrade lump iron ore would be similar to those paid for the Australian ore (between U.S. \$9.16 and U.S. \$9.60 per ton, f.o.b. Skagway or Haines, Alaska, with an iron content of 64%), and U.S. 18.5¢ per unit, f.o.b. Skagway or Haines, Alaska, for iron ore concentrate pellets (iron ore concentrate pellets with a 68% iron content would be worth U.S. \$12.58 per ton). Recently, in Australia, contracts have been signed with Western Australia for highgrade lump iron ore at a price of U.S. \$9.80 per ton for shipment to Japan. For the purpose of the profit projections, however, the lower prices quoted have been used so as to be conservative on the profit projections,

although the high-quality product obtainable from the Bear River iron ore and the influence of the favourable trade pattern between Canada and Japan could bring higher prices. Of course, as is standard in iron ore contracts, the final, exact price to be paid, the exact annual tonnage to be delivered and a number of other delivery specifications can only be put into contract form at the time Pacific Giant Steel can state upon what date it can begin deliveries to the purchasers.

The profits obtainable from the operation are shown in two ways in the Profit Projections:

- a. The net profits obtainable from the operation, amortizing the mine, mill and pelletizing plant and the transportation system.
- b. The profits obtainable from the operation including the profits to be earned by the sale of recoverable assets, i.e. the transportation system, which could be sold at the end of the mining operation for at least the cost of its construction.

Also available from the Profit Projections are the minimum ore reserves required for an economical mining operation, including amortizing the transportation system, mine, mill and pelletizing plant.

Not included in the Profit Projections are the revenues obtainable from the transportation of freight going out of, and coming into the Yukon, other than Bear River iron ore and/or pellets. The cost of transportation of the Bear River iron ore and/or pellets would be reduced as a result of freight other than Bear River iron ore and/or pellets being carried on the railroad. This additional freight would have a significant effect in reducing the annual tonnages of iron ore that would have to be shipped to make the combined mining-railroad operation profitable and would thus reduce the minimum reserves that would have to be established.

#### Conclusions

- a. An iron ore reserve of only 14,955,000 tons of highgrade iron ore is the minimum required for a 15-year, economic mining operation, including a Company-owned transportation system. An iron ore reserve of only 24,195,000 tons of pellet-equivalent ore is the minimum required for a 15-year, economic pellet operation.

- b. At larger annual production (3 to 5 million tons) of lump highgrade iron ore and/or pellets, the profits obtainable from the operation are very high.
- c. Additional profits, becoming significantly larger as new mining properties within reach of the railroad go into production, will be earned by the railroad and will result in a reduction of the cost of transporting Bear River iron ore and/or pellets.
- d. It is apparant that a Company-owned transportation system is an increasing advantage to the Bear River iron ore project as annual production increases.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The economic phases of the Bear River Iron Ore - Railroad Project have been completed and the following conclusions can be made:

- a. Access to the property can be readily provided by upgrading the Wind River Road and by the construction of a 15-mile road from the Wind River Road along the Bear River to the property.
- b. Bear River iron ore can be readily beneficiated by employing methods that are standard and are presently in use.
- c. The Bear River iron ore concentrate is suitable for the production of iron ore concentrate pellets, self-fluxing iron ore concentrate pellets and reduced (metallized) pellets. Particular value can be attached to the self-fluxing pellets as this form of blast furnace feed has advantages over non-self-fluxing pellets in the smelting process and limestone is readily available near the mine site.
- d. The location of the Bear River project provides an ideal site for the construction of an open pit iron ore mine.
- e. The requirement for a railroad in connection with the project is, in fact, an added advantage because of the additional revenues that the railroad could provide. The most economical transportation of the Bear River ore would be provided by a Company-owned industrial railroad which is highly automated and is designed specifically for transporting large tonnages.
- f. Several choices exist for the provision of heat and power to the proposed minesite. All fuel can be backhauled by railroad to the minesite as is usual in other major iron ore mines. Gas and oil exploration to the north and northwest of the Bear River is likely to provide an even wider choice of very inexpensive heat and power.
- g. Substantial markets exist for the sale of Bear River iron ore and ore products in Japan under the agreement with C. Itoh & Co., Ltd. The project also has an additional market potential to exploit in

the Chicago-Pittsburg area.

- h. The potential ore reserves of the Bear River deposit indicate that reserves may be established that are sufficient for an annual production capacity of 5 million tons of iron ore and/or pellets for a 30-year period of operation. Reserves in excess of 300 million tons may be present at a grade suitable for the economic production of iron ore concentrate pellets.
- i. High profits are projected for the mining project if annual production of between 3 and 5 million tons is reached. There is a significant increase in profits if the Company itself constructs and operates the transportation system. Also, an important source of additional revenue, not included in the Company's Profit Projections, would likely be generated from the transportation of products of other mines and backhaul freight.
- j. \$2 million should be adequate for sufficient drilling to prove reserves large enough to meet the available Japanese markets and to complete design plans for the mine, mill, pelletizing plant and transportation system.
- k. Senior financing for the project should be readily available when it is required for the construction of the mine, mill, pelletizing plant and transportation system because of the high profitability of the project and because large international capital is primarily interested in large projects with a good profit potential.

#### Recommendations

As all of the economic phases of the development of the project are satisfactorily completed, Pacific Giant Steel should concentrate all of its efforts on the physical development of the property itself. When the initial drilling program has been completed and more detailed structural and geological information is obtained, plans should be to continue drilling on the property until sufficient ore reserves are outlined to ensure that the markets presently available in Japan for Bear River iron ore and/or pellets will be filled.

DEVELOPMENT PLANS

The total cost estimated for the development of the Bear River Iron Ore - Railroad Project is approximately \$2 million. Included in this are the costs for drilling the deposit to prove sufficient tonnages of ore to supply a mining operation which would produce 5 million tons per year of highgrade iron ore and/or pellets for a 30-year period of operation. Also included are the costs for design studies for the construction of the mine, mill, pelletizing plant, railroad and port facilities, as well as the cost for the administration of the project and the consulting engineering required.

A \$200,000.00 drilling program forms the first step in the development plans. This program is presently underway and is designed to begin proving the ore reserves by testing for ore to a depth of at least 1,000 feet and to provide structural and geological data on the deposit from which to plan further drilling.

Also included in this program is the exploration of the geomagnetic anomaly that was detected on the property by an airborne geomagnetic survey carried out in 1965.

As the economics of the project have been favourably established, concentrated effort can now be directed toward proving the ore reserves of the property. When this is done, all efforts may be directed toward the construction phase.

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R E P O R T  
ON THE  
AIRBORNE GEOPHYSICAL SURVEY  
OF THE  
BEAR RIVER IRON DEPOSIT  
YUKON TERRITORIES

PACIFIC GIANT STEEL ORES LTD.

Whitehorse, Yukon

HARVEY H. COHEN ENGINEERING LTD.

CONSULTING ENGINEERS

TELEPHONE: BUS.: 684-6711  
RES.: 266-8169

1264 WEST PENDER STREET  
VANCOUVER 1, B. C.

October 12, 1965


Pacific Giant Steel Ores Ltd,  
P.O. Box 1039,  
Whitehorse, Yukon Territories.

Airborne Geophysical Survey,  
Bear River Iron Deposit,  
Yukon Territories, Canada.  
File: 65-103

Dear Sirs:

Pursuant to your instructions, we have carefully conducted an airborne geophysical survey over an area 6300 feet by 8000 feet of your iron deposit along the Bear River in Northern Yukon and submit herewith a map together with our report on the results of that investigation.

Respectfully submitted,

  
Harvey H. Cohen,

Professional Engineer.

HHC/ft

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# AIRBORNE GEOPHYSICAL SURVEY

## BEAR RIVER IRON DEPOSIT

### YUKON TERRITORIES

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#### INTRODUCTION

The G.S. 1-16 mineral claims are held by Pacific Giant Steel Ores Ltd. of Whitehorse, Yukon. The period September 6th to September 11th, 1965, was spent in the Yukon preparing and conducting an airborne geophysical survey employing a newly designed instrument based on a modified fluxgate magnetometer capable of continuous recording of data during flight. In the field, an East-West base line was surveyed and well marked by flagging at 300 foot intervals. The grid lines were flown on a magnetic North-South heading 500 feet above ground and at

a constant air speed of 60 miles per hour.

The report and map are compiled from the results of this fieldwork.

The purpose of the geophysical survey was to detect, measure, and record any magnetic influences other than the natural vertical component of the earth's magnetic field on the property - plotting any observed anomalies which would indicate the presence or absence of magnetic minerals or metallics of low impedance which would give rise to a magnetic field as a result of the telluric field passing through the better conductive rocks.

An anomaly located by this geophysical survey would indicate an area deserving detailed attention and investigation, for, hematite and magnetite mineralization have been well exposed in the area by your company, and due to overburden, the possible extent of the mineralized zone is unknown.

The geophysical survey is capable too, of outlining structural features and geologic contact zones as well as magnetics and rocks of greater electrical conductivity.

Location and Access:

The Bear River Iron property consisting of sixteen

located mineral claims, is located on the North side of Bear River in the Wernecke Mountains, part of the Selwyn Range, at  $64^{\circ} 50'$  North Latitude and  $134^{\circ} 15'$  West Longitude.

The area lies 70 miles Northeast of Keno, which is situated 220 miles North of Whitehorse, the capital of the Yukon Territories.

Access to the property was gained from Whitehorse by road to the United Keno Hill Mine at Calumet, a distance of 280 miles. A Hiller helicopter was used from this point directly to the property. A camp had been previously established at the site, and was supplied by fixed wing aircraft to Gillespie Lake, some 15 miles Easterly, with helicopter transport from the lake to the campsite.

The Wind River Road - a supply road used during the exploratory work in the Peel Plateau Area, passes within 15 miles of the property, and links the area to Elsa, Yukon Territories, the location of United Keno Hills silver mine. Mayo, the nearest town lies 34 miles Westerly from Elsa and 254 miles Northerly from Whitehorse. A good highway connects both areas.

Transportation from Whitehorse to the nearest seaport - Skagway, Alaska, is via the White Pass and Yukon Railroad - a distance of 95 miles. Skagway is a regular

port of call for deep sea vessels from Japan and ore carriers from Vancouver, B. C., and Tacoma, Washington.

Whitehorse has a daily scheduled air service supplied by Canadian Pacific Airlines to Vancouver and Edmonton, a regular bus service, and is situated at mile 918 on the Alaska Highway.

Physiography:

The property of Pacific Giant Steel Ores Ltd. lies within the Northern extremities of the Selwyn Mountain Range which forms the divide between the Yukon and the Northwest Territories. The area covers the Wernecke Mountain Range just south of the Peel Plateau.

Drainage of the area is to the North; the Bear River joins the wide Wind River and flows Northerly into the Peel some 25 miles North of the conflux of the Arctic Red River and the MacKenzie River. The entire system flows into the MacKenzie Bay, a part of the Arctic Ocean.

The main area is in a wide flat valley of the Bear River with moderate relief. The mountains to the north and south rise to elevations up to over 8000 feet, while the valley floor is at an elevation of 3000 feet, approximately. The area of interest is covered by a shallow layer of overburden and light undergrowth. Sparse stunted

timber growth is limited to the odd copse of trees.

Timberline is within a hundred feet of the valley floor.

## GENERAL PROCEDURE AND FIELDWORK

The area selected for the survey lies to the north of the Bear River for a length in an east-west direction of approximately one mile.

A point was established along the Bear River and set at 100 + 0 station. From there, a base line running magnetic east was surveyed and chained. At each 300 foot interval, long pickets were set up flagged with fluorescent flagging, and marked.

The instrument coils, mounted in a plastic sphere dampened in oil, were mounted by clamps to an aluminum pole 15 feet in length. This pole was affixed to the carriage on the right side of the Hiller helicopter with the instrument 5 feet ahead of the aircraft.

A battery supply was used to energize the central core to a definite frequency with the surrounding coils behaving as the secondary coil of a transformer. The input voltage was 12 volts D. C., and the output voltage  $2\frac{1}{2}$  millivolts. The output signal was received and amplified 1000 times to  $2\frac{1}{2}$  volts. This signal was fed directly to the chart recorder running at 5" per minute.

Flight lines were magnetic north and south, flown at air speed of 60 miles per hour and 500 feet above ground.

The aircraft was oriented to fly directly over a marker at which time a signal was used to imprint a mark on the chart recorder. At the end of the run, the instrument was "shorted out" during the turn and continued after re-orientation on the next flight line.

Precautions against side slip were made by the pilot and corrections made by visible tabs taped to the aircraft bubble.

The entire traverse was done during a calm period before noon, and the operation was continuous. A monitoring meter was used to observe signals received on the recorder during flight.

The final profiles from the chart recorder were transposed on an expanded scale, plotted on the accompanying map directly in gamma readings and isogamols plotted as the vertical component of the magnetic field at the 500 foot elevation. The contour interval used was 250 gammas.

## RESULTS OF GEOPHYSICAL INVESTIGATIONS

The prime purpose of the geophysical survey was to determine, rapidly and economically, the extent of the magnetic and conductive anomalies, and relate the size and intensity to that area exposed and known to contain hematite ore.

The instrument actually measured the vertical component of the earth's magnetic field caused by induction. With a saturated core, any changes in the intensity of the vertical component of the earth's field will add or subtract to the saturation of the coil and is transmitted to the amplifier and recorder. Thus, the variation in vertical magnetic intensity is the plotted result, and these variations are due to causes other than the normal magnetic field of the earth. An anomaly detected by this type of survey would result from the presence or absence of magnetic minerals such as magnetite or conductive minerals in the rock being investigated.

A resulting anomaly would comprise an area of interest in the search for iron ore bodies and certainly indicate areas worthy of more detailed attention as potential areas containing extensions of known ore zones.

Factors which produce variations in vertical mag-

netic and conductive intensity are:

- (1) A concentration of magnetic minerals (magnetite) possibly associated with hematite.
- (2) A variation in amount of accessory magnetite in granitic or volcanic bedrock.
- (3) A variation in amount of magnetite distributed through or connected with the overburden.
- (4) A variation in depth of non-magnetic overburden on caprock over bedrock having a constant vertical magnetic intensity.
- (5) Variation in amounts of magnetic minerals in adjacent bands of volcanic and sedimentary and/or intrusive rocks which produce elongated highs and lows parallel to the strike of the formation. These variations are not expected to be great.
- (6) Any combination between variations in magnetic or conductive minerals in the rock and variations in the thickness of the overlying magnetic or non-magnetic overburden or caprock.
- (7) Variations between areas of high vertical magnetic intensity and areas of significant magnetic intensity (above background) to indicate zoning of magnetite - hematite - sedimentary bands.

- (8) Plunging, dipping or change of attitude of magnetic or non-magnetic bodies to produce contour spacing indicative of increase or decrease of vertical magnetic intensities with strong definition of direction of plunge of the magnetic body.

It will be seen from the above factors that the magnetic variation, depending upon intensity, can serve to indicate zones or areas structurally favorable to ore deposition and are worthy of further geological investigation.

## ACKNOWLEDGMENTS

The writer wishes to express his gratitude to the directors of Pacific Giant Steel Ores Ltd. for the opportunity to investigate the Bear River Iron deposit, and to employ the newly designed instrumentation for this purpose; also to Mr. A. Jellinek, Mr. Bruce Baker and Mr. Jack Doyle for their assistance and cooperation in the field.

## ANALYSIS OF RESULTS

Structures of interest and anomalous zones found to occur on the area investigated are described as follows:

The total area surveyed measures 6300 feet east-west and 8000 feet north-south.

Intensities recorded during the traverse ranged from a low of 900 gammas to a high of 5000 gammas (off scale). The background or normal reading with a saturated input coil was set at 1250 gammas. (It must be kept in mind that the readings were taken 500 feet above ground, and consequently vary as the inverse cube). Readings of 5000 gammas to 3500 gammas are due definitely to high magnetite content; readings in the range of 3500 gammas to 2000 gammas indicate the hematite zone with possible magnetite in the high range; readings from 1250 to 2000 could be indicative of hematite magnetite ore under overburden; while readings below 1250 are non-magnetic and non-conductive.

- (1) It will be seen from the accompanying map, an area south of Bear River, measuring approximately 2500 feet in width (east-west) and at least 2000 feet in length to the south boundary (where it enters the north slopes and was not flown) showing intensities of 3000 gammas to 5000 gammas. This area is centered

by grid line 55 + 0. The anomaly striking north-south shows a dip to the west indicated by the wider spacing of contours to the west and decreasing in magnetic intensity. Further east, for an additional 3000 feet in length by approximately 800 feet in width, the area records intensities of 3000 to 2000 gammas, and it is likely that this zone plunges to the west to give this result.

The general trend of the structure is northeast to southwest, and, the anomalous zones indicate a pattern of banding in this direction.

- (2) The main working on the bluff or outcrop near the northeast section of the map was crossed by grid line 55 + 0 and 52 + 0. As shown on the map, the readings over 3000 gammas cover a zone triangular in shape and measuring approximately 700 feet by 200 feet with the surrounding area in the range of 3000 to 2000 gammas. This is indicative of possible continuation of the main hematite zone with increase in thickness of overburden. Stripping of the overburden in a southeasterly direction could add appreciably to the known extent of the hematite ore zone. This hematite zone shows a plunge westerly for a distance of approximately 5000 feet with an average width of 500 feet.

Two possibilities exist here:

- (1) The character of the iron content remains constant and overburden increases or;
- (2) the hematite content decreases.

It is the writer's opinion that there exists a definite relationship between this zone and the high intensity magnetite zone described earlier. The two zones are separated by a band of low magnetic and low conductivity rocks which appears to widen to the east.

The combined area of the two zones indicated as existing at greater depth than surface outcropping excluding the low intensity band could be estimated at 5000' x 2000' equivalent or 10 million square feet.

This area is one over which the magnetic and conductive properties were recorded as well above average of the surrounding sedimentary formations.

While a tonnage or reserve calculation is not possible without indicating metal content, it can be described best as follows:

Zone or area above 3000 gammas = 5,000,000 square feet.

Zone or area 2000-3000 gammas = 5,000,000 square feet.

Total area of significant intensity =  
10,000,000 square feet. Should this area be exposed by stripping it could reclassify the iron bearing

possibilities from "possible" to "probable" and further reclassified to "proven" reserves by subsequent drilling.

For the time being, for your company to achieve its desired minimum goal of 300 million tons of iron ore, a depth of 300 feet would have to be proven up over the selected area to provide such a reserve picture - during which time the metal content can be determined. In order to conduct this study, the following program is recommended.

## RECOMMENDATIONS

The program outlined below includes work following results of the geophysical survey, and includes stripping and trenching of the anomalous areas to test the continuity and extensions of the known hematite zone together with studying the causes of the main anomalous zone - its metal content - its extent. Subsequently, a program of diamond drilling to test the deposit at depth would be in order.

Detailed geological mapping and calculations of the drill core sections would then provide the data required to thoroughly analyze the possibilities of the property with a view towards production.

It is suggested that a feasibility study should be continued to include marketing, transportation, economics and production costs. This will not be detailed here as it lies beyond the scope of this report.

### (1) Preparation of Site and Camp:

A bulldozer, a D-7 or equivalent should be "walked in" from Elsa - a distance of 124 miles - prior to break-up. It may take two sleds with sufficient fuel for the trip and for construction of a landing strip on the Bear River property. A quantity of plywood and lumber may be taken to

provide frames and walls for a tent camp for 6 to 8 men. Adequate supplies can be taken along to provide for the crew until completion of the air strip and camp construction.

(2) Bulldozer Stripping:

Conduct a stripping program to cut the anomalous zones at intervals of 300 feet crossing the structures in a north-south direction and exposing bedrock for mapping and sampling purposes as well as preparation of drill sites. In all likelihood, at least 20 to 30 trenches 500 feet in length would be required. Fuel may be brought in by aircraft to service the operation.

(3) Sampling and Mapping:

The trenches cut on the significant anomalous zones will provide ideal sections for cutting representative samples for further study, assays, etc. This is an important item and it cannot be too strongly urged to have this done as accurately and as carefully as possible. The mapping of geology exposed by the bulldozer may be plotted on 200 scale with regional mapping on 1000 scale.

(4) Testwork:

Only after the entire zone has been opened to an extent where 300 million tons is "possible" should testwork commence. This may be done during the drilling phase.

(5) Economics and Transportation:

Continue this study to completion as suggested earlier. (Report dated January, 1965).

(6) Diamond Drilling:

A pattern drilling program of at least 8000 feet would be required as a minimum to test the area outlined as significant.

ESTIMATES

|  |              |
|--|--------------|
| Bulldozer at \$5,500.00 per month -        |              |
| - Campsite                                 |              |
| - Trenching                                |              |
| - Airstrip                                 | \$ 16,500.00 |
| Camp supplies, materials                   | 8,000.00     |
| Sampling and Mapping - 3 month period      | 2,500.00     |
| Diamond Drilling (approximately 5000 feet) |              |
| Including transportation                   | 80,000.00    |
| Testwork, metallurgical studies            | 2,000.00     |
| Feasibility study                          | 5,000.00     |
| Management and Overhead                    | 5,000.00     |
| Engineering, supervision, reports          | 4,000.00     |
| Aircraft charter, communications, etc.     | 10,000.00    |
| Contingencies                              | 7,000.00     |
|  | <hr/>        |
|  | \$140,000.00 |

With careful planning, this program can be completed during one field season.

HARVEY H. COHEN ENGINEERING LTD.  
CONSULTING ENGINEERS

TELEPHONE: BUS.: 684-6711  
RES.: 266-8169

1264 WEST PENDER STREET  
VANCOUVER 1, B. C.

January 13th, 1965.

Pacific Giant Steel Ores Ltd.,  
P.O. Box  
WHITEHORSE, Yukon Territories.

Dear Sirs:

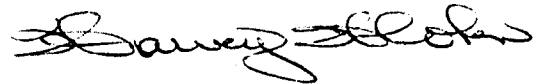
File: 65-103

Bear River Hematite Deposit

Pursuant to your request, the writer has carefully examined your hematite deposit in the Bear River Area, Yukon Territories, during the period October 8th - 14th, 1964, and submits herewith a report thereon.

Respectfully submitted,

HARVEY H. COHEN ENGINEERING LTD.



Harvey H. Cohen.

Encl.

HHC:sm

R E P O R T

ON THE

BEAR RIVER HEMATITE DEPOSIT

YUKON TERRITORIES

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PACIFIC GIANT STEEL DRES LTD.

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R E P O R T  
ON THE  
BEAR RIVER HEMATITE DEPOSIT  
YUKON TERRITORIES

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PACIFIC GIANT STEEL ORES LTD.

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INTRODUCTION

1. LOCATION AND ACCESS:

The Bear River Hematite Property, consisting of sixteen mineral claims, is located on the east side of Bear River in the Wernecke Mountains, part of the Selwyn Range, at  $64^{\circ} 50'$  North Latitude and  $134^{\circ} 20'$  West Longitude.

The area lies one hundred miles northeast of Mayo, and Mayo is situated two hundred miles north of Whitehorse, the capital city of Yukon Territories.

Access to the property is gained by flying via helicopter from Mayo, the nearest airstrip, directly to the showings. Float equipped aircraft are able to land at a lake fifteen miles from the property.

A winter road, known as the Wind River Road, passes within fifteen miles of the showings, and is linked to Elsa, Y.T. - the location of United

Keno Hills silver-lead-zinc mining camp. The town of Mayo lies thirty miles westerly from Elsa and two hundred and fifty-four miles northerly from Whitehorse, being connected by highways to both areas.

Transportation from Whitehorse to the nearest seaport of Skagway, Alaska, is via the White Pass and Yukon Railroad - a distance of ninety-five miles. Skagway is a regular port of call for deep-sea vessels from Japan and ore carriers from Vancouver, B.C. and Tacoma, Washington.

Whitehorse is serviced by daily scheduled aircraft from Vancouver and/or Edmonton, a regular bus service, and is on the Alaska Highway. Canadian Pacific Airways maintain a scheduled flight service from Mayo to Whitehorse.

## 2. PHYSIOGRAPHY:

The Pacific Giant Steel property lies within the northern extremities of the Selwyn Mountain Range which forms the divide between the Yukon and the Northwest Territories. The area contains Wernecke Range just south of the Peel Plateau.

Drainage of the area is to the north; the Bear River joins the wide Wind River which flows into the Peel twenty-five miles north of the conflux of the Arctic Red River and the MacKenzie River. The entire system flows into MacKenzie Bay, a part of the Arctic Ocean.

## 3. SIZE OF AREA AND EXPOSURES:

The Pacific Giant Steel Ores Ltd. property consists of sixteen located mineral claims, covering some eight hundred acres, on the east slope of Bear River. The valley, itself, contains little or no outcrops except perhaps on

one or two low hills and on isolated rock drumlins. The valley floor and lower slopes are mantled with unconsolidated deposits of glacial, glaciofluvial, alluvial and lacustrine material. The present river is a broad, shallow valley void of natural outcrops. The main hematite showing outcrops as a rather prominent rock bluff below and to the west of the western peaks of the mountain range.

4. PURPOSE OF INVESTIGATION:

The area was examined primarily to evaluate the ground from a mining standpoint, and to determine the merits and possibilities of the area with a view to further exploration of the zones of more favorable geology. A test shipment of some three hundred pounds of ore was shipped to Ottawa for testwork of iron recovery, processing, impurities present, etc.

5. METHOD OF INVESTIGATION:

The field trip to Whitehorse was carried out on October 8, 1964 with the helicopter trip to Bear River on October 9 - 10. The tent camp at Bear River was used as a base. The weather proved a hardship, with early snows almost completely covering the area, however the main showing and immediate area was examined, sampled, and a test shipment gathered for furtherance to Ottawa.

6. ACKNOWLEDGMENTS:

The writer wishes to express his gratitude to the Directors of Pacific Giant Steel Ores Ltd. for the opportunity to investigate the Bear River Hematite deposit, and to Mr. A. Jellinek for his assistance and co-operation in the field.

SUMMARY AND CONCLUSIONS

It is the writer's opinion that the Pacific Giant Steel Ores Ltd. property at Bear River, Yukon, is worthy of an exploratory program of geophysical work in conjunction with stripping and trenching to test for continuity and extensions of the hematite iron zone, followed by a program of diamond-drilling to test the nature of the deposit at depth. Detailed geological mapping of the exposures and systematic prospecting of area determined as anomalous may be carried out simultaneously with the above program.

Following this work, a feasibility study should be undertaken with a view to market studies not only of hematite ore, but also of its related products. The possibilities of a pig iron plant in the north, to service the Crest and Snake River deposits, as well as the Bear River deposit, is no longer a remote possibility - it must be treated in the light of present day economics and with a view to future possibilities and potential markets based on economic trends.

The exploratory work may be carried out during the 1965 - 1966 field season, with the economic study to commence after certain preliminary field work has established grade and reasonably assured quantities of ore.

RECOMMENDATIONS1. PREPARATION OF SITE AND CAMP:

Employ a bulldozer to construct an airstrip approximately eighteen hundred to twenty hundred feet in length on the gravel esker along the Bear River to provide landing area for wheel equipped aircraft. The bulldozer may be "walked in" from Elsa, a distance of one hundred and twenty miles - in which case a D7 or equivalent may be used. The bulldozer would have to "haul" its own fuel on a "sleigh" - sufficient for the trip and to complete the airstrip.

The initial supplies for the "Cat" trip should include a basic tent camp adequate for four to six men. Other equipment required may be flown in at a later date and any emergency supplies may be brought in by helicopter. It is suggested that a radio transmitter be provided at the camp; one that is monitored on the forestry service frequency so that messages may be passed to the office, and also in case of emergency.

2. STRIPPING AND BULLDOZING:

Initially, confine the stripping operation to the main hematite outcrop area westerly to the "lower showing". The stripping should include narrow trenches across the structure to expose bedrock, and at intervals of from one hundred to two hundred feet. This distance would be decided from results of the first exposures. The overburden is not expected to be great in this area.

3. GEOPHYSICAL WORK:

Simultaneously with the initial airstrip construction, a geophysical survey could be carried out on a grid four hundred by one hundred feet. A

preliminary magnetometer survey employing an A3 Sharpe or equivalent may be conducted rapidly to yield any magnetic differences in the area, and to measure the magnetic influence from accessory magnetite in intrusive masses; magnetite associated with volcanics; lack of magnetics in sedimentary bands; variation in amount of magnetite distributed through or connected with the overburden; variations in depth of non-magnetic overburden on bedrock having a constant vertical magnetic intensity; and, most important, the variations in adjacent bands of volcanics and sedimentary rock or intrusive rock, such as may be found in this area - this latter variation is not expected to be great, and would produce elongated magnetic highs and lows parallel to the strike of the formation. This structural information would be a useful guide in subsequent stripping work.

A second geophysical method that may provide useful data on the nature and extent of the deposit is the electromagnetic method. This is the most favored of all methods; it is somewhat slower than equipotential methods, but more precise and does yield greater information regarding the size and shape of the hidden body. The E.M. system is based on the principle that a current passing along a conductor sets up an induced current around the conductor. If an ore body lies within the induced field, it sets up a secondary induced current around it, which can be measured.

#### 4. SAMPLING:

The surface stripping conducted on the anomalous zones should provide suitable surfaces from which representative samples may be cut with a view to further testwork along the lines of a pelletizing plant. The results of this work in conjunction with the results of the testwork presently being carried

out at Ottawa by the Department of Mines should dictate the milling and smelting requirements of the Bear River iron ore.

5. GEOLOGICAL MAPPING:

A geological reconnaissance over the area with mapping on a scale of 1 inch = 1000 feet is recommended, with detailed geological mapping of the immediate ore zones on a scale of 1 inch = 200 feet.

6. TESTWORK:

This work should be carried out by processes of mineral dressing and pelletizing. The project would be classified under the feasibility study and the results incorporated into a final economic study prior to, and as a prerequisite for major financing. In the marketing study, the writer has communicated with various interested firms and has delegated a Mr. Arai - a competent individual who is familiar with the Japanese markets, the firms actively engaged in iron production, and the leading personnel heading the smelters in Japan. It is suggested that Mr. Arai be given a reasonably free hand to pursue the final result on behalf of Pacific Giant Steel Ores Ltd. and as compensation, arrangements - if the marketing is successful, to have Mr. Arai direct the company's export of materials and possibly participation financing by major interests of his acquaintance.

7. TRANSPORTATION:

A study of access routes to the property - by proposed road and railroad, the cost comparison, and advantages of each, and an estimated cost per ton to the nearest seaport. This preliminary study could only be completed when adequate reserves have been proven up, and at that time,

Federal assistance may be enlisted with a view to construction of a northern transportation system. Included in this proposal should be the Crest Iron transportation route of their proposed railroad.

8. ECONOMICS:

This study, too, cannot be completed until reserves have reached a minimum level. However, consideration and costs may be commenced on a pelletizing and/or sponge iron plant, power facilities required (utilizing the Eagle Plains - Peel Plateau oil and gas reserves), together with a market study.

9. ESTIMATES:

The cost of the preliminary fieldwork is estimated as follows for a three to four month period:-

|   |                     |
|---|---------------------|
| Bulldozer at \$5,500. per month   | \$ 16,500.00        |
| - airstrip construction,<br>stripping and bulldozing                            |                     |
| Camp site, supplies   | 8,000.00            |
| Equipment, drill steel, dynamite, tools   | 6,500.00            |
| Geophysical survey )  |                     |
| Bulk sampling )   | 5,000.00            |
| Geological mapping and engineering)   |                     |
| Feasibility studies, mill tests, market studies,<br>transportation routes, etc. | 5,000.00            |
| Management, overhead  | 5,000.00            |
| Aircraft charter, communications and<br>miscellaneous transportation            | 10,000.00           |
| Contingencies - 15%   | <u>8,000.00</u>     |
| <u>Total</u>  | <u>\$ 63,100.00</u> |

An additional sum should be provided for the Company to investigate other properties and interests.

The estimates do not include the costs that may be incurred by the Company as expenses in financing or general promotion.

GEOGRAPHY1. RELIEF AND ELEVATION:

The Giant Steel and G.S. mineral claims occupy a wide glaciated valley in the Wernecke Mountains approximately one hundred air miles northeast of Mayo. This area is part of the Selwyn Mountains which rise to elevations of over eight thousand feet above sea level. The valleys are wide U-shaped with timberline at three thousand, five hundred feet elevation. The general relief is from four thousand to six thousand feet above sea level, with the main showing at the elevation of the valley floor of four thousand feet. The region to the east is rugged in the extreme with the highest peaks at eight thousand, seven hundred and fifty feet.

North of the main showings (downstream of Bear River), small copses of stunted timber growth exist. The underbrush is light. The main timber growths are pine, spruce and poplar. The valley bottom is swampy and supports a mossy and peaty vegetation.

2. CLIMATE:

The climate of the Yukon consists of harsh winters and generally pleasant summers. During the period June and July daylight lasts for twenty hours.

The rivers open during May and stay open until late October and sometimes November. Average annual precipitation is estimated to be fifteen inches.

Extremely low temperatures are not uncommon, but seldom persist for more than four to five days at a time. Temperatures during the winter may average  $0^{\circ}\text{F}$ . while during the summer -  $50^{\circ}\text{F}$ .

Snow covers the ground from November till May.

The mosquitos during the June to July period, and black flies during the August to September period, cause discomfort to both humans and animals.

GEOLOGY

The area in general is underlain by Pre-Cambrian rocks (mapped regionally by Green and Roddick, 1961, G.S.C.) which are classified as sediments and their metamorphic derivatives; dark grey, thin bedded argillites, slates, phyllites, minor grey quartzite, dolomite, conglomerate and limestone. This is adjacent to a younger dolomite zone, while further north is yet a younger band of limestone characterized by the color of the weathered surfaces - the former being orange, the latter a grey and buff color.

Locally, the hematite ore is characterized by its banded appearance with jasper. The hematite veins contain, in the lower sections, bands of quartzite and slate; the quartzite being partly replaced by hematite. The trenching has exposed sections of massive, fine-grained hematite with few intercalated rocks - showing signs of metamorphism, possibly originating as an alteration product of limonite, siderite and/or magnetite. The hematite is a fine-grained, dark, steel grey, carrying 70% Fe. Occurrences of this nature usually produce hematite beds of great thickness, and are classed as the most important ore of iron.

The knoll or ridge exposing the hematite, and known as the main showing, is a prominent feature on the east side of Bear River along the foothills of the mountains. The general strike of the ridge was  $110^{\circ}$  (magnetic), with the structure cutting it at an oblique angle at  $185^{\circ}$ : The dip varied from westerly to near vertical. The ridge has a vertical difference of five hundred feet from its peak to the valley floor and measures approximately sixteen hundred feet along its major axis and eleven hundred feet across the minor axis, with a general "V" shaped plan and section.

The general features, geologically, of the ridge reveal a gradient in hematite content of the rock mass from a brecciated jasper at the top of the ridge, through a jasper cemented by hematite, through banded hematite and jasper, to massive hematite. This is indicative of the deposit and it is expected the features bear relationship to the possibilities of a trough-like structure, folded and subsequently mineralized. This would afford an appearance of "zoning effect" and is actually a series of strata more or less competent which provided favorable conditions for the mineralizing processes.

The hematite is again exposed one thousand feet in a southwesterly direction, intermittently across a one thousand feet width. It is this area over which initial stripping is recommended. A typical section was sampled to give the following results:

|             |       |
|-------------|-------|
| Iron        | 57.4% |
| Silica      | 5.84  |
| Lime        | 4.16  |
| Gold        | Tr.   |
| Silver      | --    |
| Titanium    | --    |
| Phosphorous | .09   |

During the 1964 field season, several hundred pounds of hematite ore were shipped by Pacific Giant Steel Ores Ltd. to Ottawa for metallurgical testwork. The results of this work, at the time of writing, are not yet available.

GENERAL

The economics of the Bear River hematite deposit depend upon several factors: Possibility of proving up sufficient tons of iron ore of sufficient grade to warrant a mining operation, milling plant, pelletizing plant, and assistance by the Federal Government in construction of a transportation system. The program proposed for the 1965 field season is a primary step in this direction. The drilling to explore the nature and extent of the deposit, together with studies on marketing and transportation and feasibility studies, should produce a decision by the Company on its ultimate direction.

From offhand observation and judgement (not mathematical calculation) it appears that the possible reserves point to 300,000,000 tons. This would have to be "proven" by subsequent exploratory work, but is based on the extent over which hematite has been located by trenching.

A railroad from the property to Elsa, the nearest settlement, is **\*\*** estimated to cost approximately seventy-five million dollars. Freight over such a system would cost 0.8 cents per ton per mile. These figures are based on comparative operations in northern Quebec and Labrador. The final analysis should be made with a view to a sponge iron plant or smelter in the near proximity.

WATER POWER:

Gillespie Lake, situated fifteen miles from the deposit, is at an elevation fifteen hundred feet above the deposit. The Bear River is one of the major tributaries to the Wind River and flows within one mile of the deposit. For immediate water requirements other than power, a small creek flows from the cirque to the east of the ridge.

HARVEY H. COHEN, P.ENG.

**ERRATA: \*\* Elsa, the nearest settlement should read Skagway, the nearest Pacific coastal port.**

CREST EXPLORATION HEMATITE DEPOSIT: \*

Crest Exploration hematite deposit at Snake River extends over an area of one hundred and fifty square miles, and has a thickness varying between one hundred and eighty and three hundred feet. It is located fifty miles northeast of the Giant Steel property. The Crest deposit is a flat lying sedimentary deposit in Upper Cambrian strata.

Crest Exploration have completed a feasibility survey for a railroad from Mayo to the Snake River, and this system appears likely. For the most part, the projected railroad passes through major valley systems keeping rock work at a minimum. The anticipated cost is comparable to that of the newly constructed Great Slave Lake Railroad.

A spur line could be extended from this projected railway to the Giant Steel property, a distance of approximately fifty miles. From Mayo to the Snake River property, the railroad would be within two hundred miles in length and to the Giant Steel property, one hundred and fifty miles in length.

It is now considered possible that if railroad transportation be used, the iron ore from the Snake River deposit could economically be taken to tidewater at Skagway if railroad transportation costs per ton/mile could be kept in a range similar to that of the four hundred mile railroad shipping iron ore from northern Quebec - Labrador. The railroad distance from the Snake River deposit to tidewater at Skagway would be within six hundred miles.

January, 1965.

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