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RIVER JORDAN

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The River Jordan Lead Zinc Deposit, Revelstoke Mining Division, B. C.

*By CHRISTOPHER RILEY**

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SUMMARY

A relatively unexplored lead zinc deposit lies about 12 miles northwest of Revelstoke, B.C., in the highly metamorphosed Monashee Group of rocks of the Shuswap Terrane, Precambrian in age. Host rocks are of sedimentary origin and consist of gneisses, schists, marbles and quartzites with intermediary types. The marbles and quartzites provide good horizon markers.

Using these it is possible to interpret the controlling structure which is a syncline overturned to the north, dipping south at about 45°, and plunging east at about 12°. The syncline is truncated at about halfway of its length on a peak on the west side of which a partial cross section together with superimposed minor folds may be seen. The quartzites and the two marble beds may be traced over much of the structure.

There are two lodes, above the marble and below the quartzite, which converge eastward and which are the exposed edges of the same host bed — an impure limestone. The south or No. 1 lode is the thicker and is considered to be the chief potential ore source. This lode is exposed at intervals for 7,200 feet from an elevation of 5,800 to 7,900 feet and has an average thickness of 5 feet.

Due to freshness of exposures, surface sampling was carried out on four separate sections of the No. 1 lode for a total length of 3500 feet without preliminary surface work of any kind.

This sampling, together with the cross sectional exposures at the west end, permitted grade and rough tonnage estimates to be made of No. 1 lode, not counting the potential tonnages of the superimposed folds. This was 2,873,000 tons having a grade of 1.1 ounces of silver, 5.1 per cent lead and 5.6 per cent zinc.

There is evidence of zoning, particularly of the lead, zinc and local barite gangue with suggestions of a zinc envelope at the extremities of the lode. The syncline appears to have been truncated by erosion at about halfway of its length to the west. This, with the strength of mineralization at this place, suggests that it could have formed a lode originally 14,000 feet long and if it maintained its original width of 5 feet, which it could well have done, it would have been an almost unique deposit. Erosion appears to have removed over three million tons from the present No. 1 lode so that the original tonnage could have been 12,000,000 tons. Other deposits of great length in relation to their widths are known in the Shuswap Terrane in both the Revelstoke and Kamloops Mining Divisions.

The ease of preliminary evaluation is compensated for in difficulties presented to secondary stages of development due to paucity of good drill locations and length of cross cut tunnel to the lode. However, some drilling can be done in the central part and second steps should be taken at an early date so that production should not be unnecessarily delayed in case of an increase in lead and zinc prices.

Figure 1. View of lode area looking west. (Lode in syncline plunging east).

Introduction and History

THE River Jordan property was discovered in the late 90's by two prospectors who did some work prior to leaving it for the Yukon Gold rush. As it was not mentioned in the B.C. Minister of Mines reports, it remained unknown except in Revelstoke, some of whose residents staked it at intervals. The early owners drove three short tunnels and an operator from the United States completed a well cut out trail to it in the 1940's. It was discovered independently by Alfred Brewer in 1955 while it was still staked. He waited till the claims lapsed, re-staked it and in the fall optioned it to American Standard Mines Limited.

This paper is based on work done in 1956, at which time the writer employed geologist J. S. Ives to map and sample the deposit. Circumstances limited available time so that the plans and sections presented do not represent mapping of every outcrop.

Location, Accessibility and Topography

The property is situated twelve miles northwest of Revelstoke, a divisional point on the main line of the C.P.R. It may be reached by road and trail up the Jordan River for ten miles, thence up Copeland

*Consulting Geologist.

Creek to a branch creek le g to the showings. The last part of the route up the branch rises 2800 feet in about one and one half miles so requires switchbacks. The lode is exposed at elevations from 5800 feet to 7900 feet in a rugged area above timberline. As it is on the northern slope of Copeland Mountain, it is covered in two parts by glaciers and another part is snow covered until August.

With the development of sufficient tonnage to warrant the cost, the deposit could be exploited by means of a low level tunnel from Copeland Creek and a raise to the ore bodies. The steep part of the route up the branch could thus be avoided.

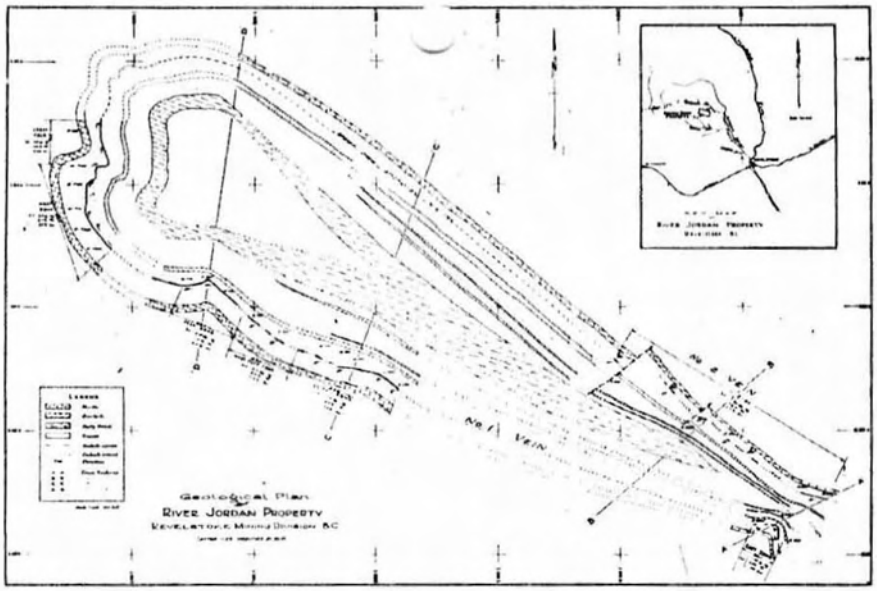

Figure 2. Geological plan, River Jordan property.

Geology

The area has not yet been mapped by government surveys which extend only to the 51st. parallel, 12 miles to the south. However, there is every indication that the geology described in that location can be extended to cover the property. The area to the south is described in the recently published Memoir 296 of the Geological Survey of Canada, which makes an intensive study of the rocks of the Shuswap Terrane, the bedrock geology of this part of British Columbia.

Assuming the above projection is correct, the Jordan River rocks belong to the Monashee Group which lie at the base of the Shuswap of Archean or later Pre-cambrian age. There are three groups in the Shuswap — the Monashee with a thickness of 50,000 or more feet, the overlying Mount Ida group with at least 60,000 feet and the topmost Chapperton group with 5,000 feet. All are highly metamorphosed, the Monashee more intensely than the later Shuswap group.

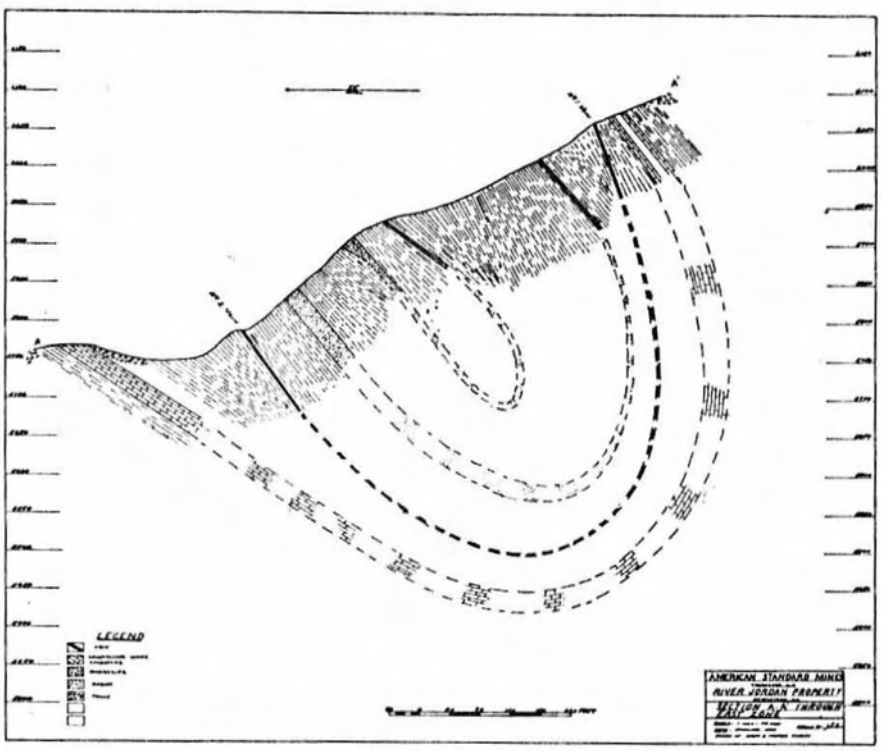

Figure 3. Cross-section through A-A'.

The rocks on the Jordan River property consist of gneisses, schists, marbles, quartzites and transitional types. The gneisses occur in beds from 20 to 100 feet thick with one prominent bed of rusty gneiss 150 feet thick. The schists are interbedded with the gneisses. There are two lime beds, both underlying the lode, one is a thin, fetid lime, the other is a marble much thicker up to 40 feet. There are two main quartzite beds from 20 to 100 feet thick overlying the lode. Both lime and quartzite form good horizon markers, the white marble in particular is prominent and may be traced around the main structure and so has provided a means of its interpretation. A thin bed of impure lime forms the host rock for the ore. It was an incompetent bed and its close folding and brecciation provided access to the mineralizing solutions.

One main structure forms the host for the lodes, which is a syncline overturned at an angle of about 45° to the north. This syncline is closed to the east but is truncated at about one half its length to the west where a partial cross section may be seen on the steep slope of Copeland Mountain, the marble bed being especially well defined. The syncline strikes about N. 62°W., has a general dip of 45° southward and an eastward plunge of 12°. The western cross section shows a strong superimposed fold on the southern flank near the bottom of the fold and there are indications of a keel-like structure at the base. In addition, there are numerous

minor drag and cross folds. [illegible] the eastern and on the north [illegible] there are several normal faults with a horizontal displacement of about 80 feet, but are largely marked by small depressions.

The Lode

The potential ore deposits consist of two zones which are convergent eastward and which are here considered to be the same bed in either limb of the syncline, No. 1 being the southerly. Tracing No. 1 from east to west, the first outcrop, called the East Section, is exposed for 290 feet over a transverse saddle or north-south rock ridge at an elevation of 5800 feet. From this place westward it is covered by 3080 feet of talus and ice of which the first 750 is talus. It emerges from the iice and is then exposed for 2200 feet to the western side of Mount Copeland at 7900 feet. Here follows 400 feet of glacier from which it emerges, dipping vertically, thence dipping easterly more flatly, till at 500 feet it is nearly flat. It continues through two rolls to a bend into a keel where it again dips almost vertically. This part around the cross sectional end of the syncline has an exposed length of 1200 feet and is called the West Section.

The West Section is different in that it consists of two parallel zones in the host bed separated by about ten feet of brecciated and silicified rock, the whole averaging 15 to 20 feet. No. 1 lode lies at the top of the bed and consists chiefly of galena with minor sphalerite, the gangue is barite, not seen elsewhere in the lode. The parallel zone is mostly sphalerite and iron pyrites, and lies on the footwall of the host bed.

The thickness of the No. 1 lode varies in accordance with its position in the syncline. It is narrow at the eastern closed end, at the Peak Section near its probable original top, and at the western end in those parts where it becomes nearly flat. It widens on the flanks particularly where it changes in dip from southerly to northerly and also in superimposed minor folds. It has been sampled over minimum thicknesses of 1.0 feet and 1.8 feet at the East and West ends to a maximum of 12 feet in the Cliff section. A probable average width throughout would be 5 feet.

The possible original extent and volume of No. 1 lode forms an interesting subject for speculation. At least one half of the original length of the syncline is missing due to erosion. The veins are strong at the truncated western end and could easily have extended throughout the structure. If this had been so, the total length of the lode would have been 14,000 feet. If the average thickness were five feet throughout as seems likely, it would have formed an unusual deposit. However, it is a remarkable fact that there already exists 7200 feet of that average width. In addition to the loss of tonnage of the eroded western half, about one-half of the eastern part has been lost by the same agency. This may be shown by projecting the Peak Section at 7900 feet elevation at the plunge of 12° to the East Section. At least 3,000,000 tons have been lost. Double this tonnage would have been lost to the Western half. In such a case, the

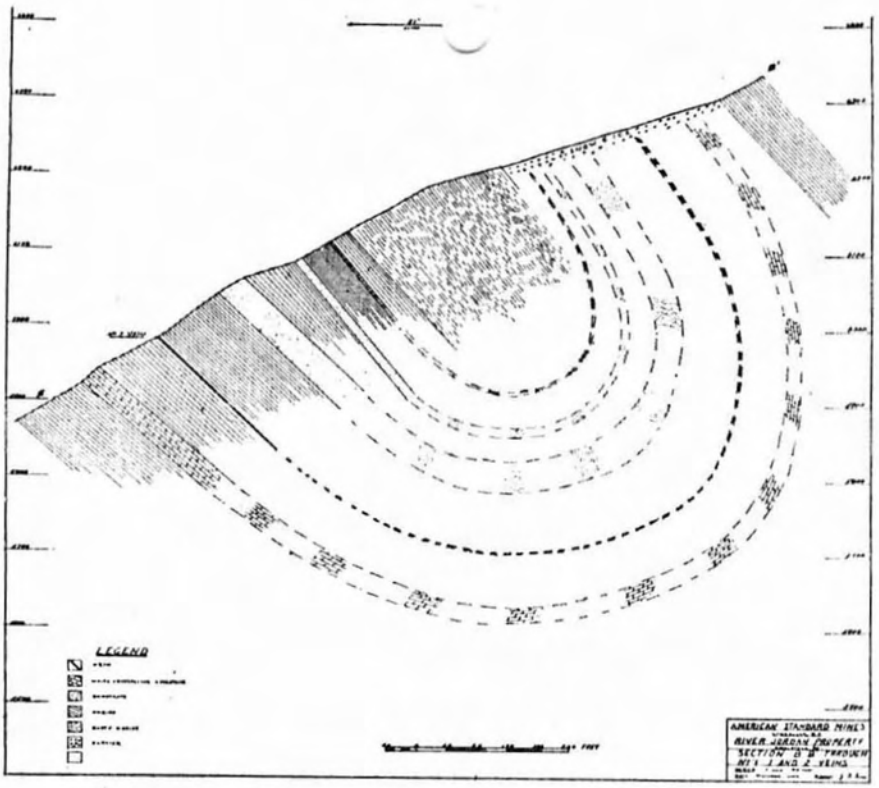

Figure 4. Cross-section through B-B'.

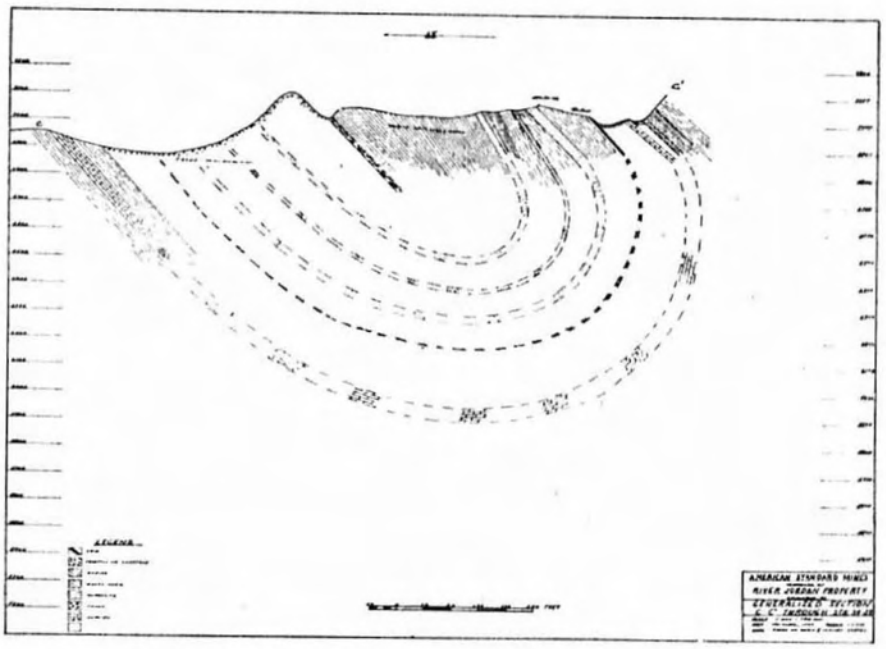

Figure 5. Cross-section through C-C'.

total original tonnage of No. 1 lode would have been 12 million tons.

The mineralogy is simple. The metallic minerals are galena, sphalerite, minor chalcopyrite, pyrite and pyrrhotite. Gangue minerals are quartz and calcite and at the west end barite. All these minerals replace an incompetent, impure lime bed which has been drag folded and brecciated. There is a good deal of associated silicification.

Zoning is in evidence. The Peak Section which may be near the original top of the zone, is narrow and consists largely of sphalerite. The parallel zone of high iron sphalerite at the Western Section may also represent the same thing. Galena is dominant at the eastern end and much more plentiful at the dilated central parts down the dip of the vein, especially where it turns into a northerly dip. Here also at the Western Section barite appears as the greater part of the vein. The envelope of the deposit may therefore be sphaleritic and the inner parts with predominant galena.

No. 2 Lode

No. 2 lode lies above the two lime beds in the same relative position stratigraphically as No. 1 and no doubt is the northern limb of the same replaced bed. Its mineralogy is about the same, but it is narrow throughout. Near the eastern and there is a 2,100 foot length which averages 1.8 feet wide. West of this it appears as a small stringer at intervals between pinch-outs for several hundreds of feet which is the limit to which search was made.

Sampling

Another remarkable feature of the deposit is that a good preliminary evaluation could be made upon it without any sort of work such as stripping or rock trenching, except at the East Section of No. 1 where some old work remained in good enough condition to permit sampling. Otherwise the exposed surface was unoxidized and sampling could be carried out at once. Later, when surface blasting and re-sampling was done, the results were not significantly different. Singularly enough, no easy and effective secondary exploration could be carried out except for a few diamond drill holes in the covered part west of the East Section. Otherwise drilling would be difficult and costly and a crosscut of 1300 feet would be required to intersect the lode.

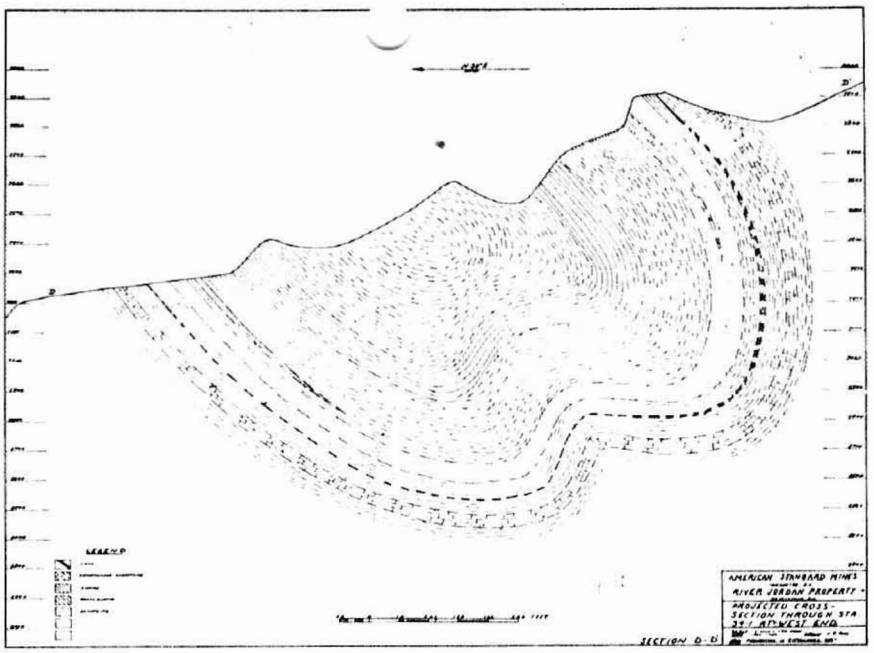

Figure 6. Cross-section through D-D'.

Plans show the weighed averages of sampling. In the calculations, narrow widths have been expanded to a width of 3 feet in the steeper parts of the zone and 4 feet in the flatter. The results are shown in Table I.

No. 2 Lode

The No. 2 Lode was sampled at intervals over a distance of 2100 feet. Much of the vein is covered in this distance but where exposed is narrower than No. 1. Recalculated average values for this vein give an average width of 3.0 feet at 1.28 oz. of silver, 3.2 per cent lead and 4.3 per cent zinc.

Potential Ore Reserves

Due to the clear cut structural character of the deposit, it is possible to make a preliminary estimate of the potential tonnage to be expected from the No. 1 lode. This has been done by taking only the south half of the fold down to the center of the trough as shown in the accompanying diagram. To do this, surface widths and values have been projected downward where the lode is exposed, and where covered, values and widths have been projected horizontally and vertically and weighted with the adjoining exposed sections.

All narrow samples in the trough of the syncline have been brought to a minimum of 4 feet and recalculated, using 8 cubic feet per ton for ore and 12 cubic feet per ton for waste. Narrow samples in the steeper portions of the vein have been recalculated to a minimum width of 3 feet using 8 cubic feet per ton for ore and 12 cubic feet per ton for waste. In estimating tonnage, a value of 10 cubic feet per ton was used.

Ore reserves have been divided into blocks as shown in the figure A, B, C, D, E, F, G, and H. Block "H" which is the thin, zinc-iron portion of the limb is not considered to be economic and is not included in the estimates. All estimates are on

Table 1.— The River Jordan Lead Zinc Deposit

Section	Length Ft.	Average Width	Recalculated Values		
			Oz. Ag.	% Pb.	% Zn
East	290	3.0	1.48	6.2	1.5
Cliff	890	6.7	1.0	5.3	7.4
West Cliff	530	4.0	0.5	2.0	11.3
Peak	550	3.0	0.49	1.0	6.8
West					
(1) Main Structure	920	5.3	2.0	6.7	3.2
(2) Cross fold	300	3.0	0.2	4.0	3.3
	3480				

TABLE II

THE FOLLOWING TABLE SHOWS THE ESTIMATED TONNAGE OF THE VARIOUS BLOCKS

Block	Estimated Undiluted Tonnage	Width	Undiluted Oz. Ag.	Undiluted % Pb.	Grade % Zn.	*Estimated Diluted Tonnage	Diluted Oz. Ag.	Diluted % Pb.	Grade % Zn.
A	172,000	5.3	2.0	6.7	3.2	189,420	1.82	6.1	3.0
B	885,200	5.0	1.2	5.6	6.7	973,720	1.1	5.1	6.1
C	603,500	6.7	1.0	5.3	7.4	663,850	0.9	4.9	6.7
D	548,000	5.0	1.0	5.3	7.4	602,800	0.9	4.9	6.7
ABCD	2,208,900		1.2	5.6	6.7	2,429,800	1.1	5.1	6.1
E	260,400	4.0	1.2	5.6	4.4	286,400	1.1	5.1	4.0
F	53,500	3.0	1.5	6.2	1.5	58,800	1.4	5.6	1.4
G	88,800	3.0	1.5	6.2	1.5	97,700	1.4	5.6	1.4
EFG	402,700		1.3	5.8	3.4	442,900	1.2	5.3	3.1
A to G	2,611,600		1.2	5.6	6.2	2,872,700	1.1	5.1	5.6

Blocks A, B, C, and D, therefore contain an estimated 2,429,800 tons of ore.
Blocks A to G inclusive contain an estimated, 2,872,700 tons.
*A dilution factor of 10% has been used to obtain the final estimated diluted tonnage and grade.

the conservative side and it is probable that both grade and tonnage will be found to be substantially greater during mining operations. Additional tonnages will probably be found in the lower limb of the structure and in possible cross folds.

Conclusions

The River Jordan deposit possesses several uncommon features, the chief of which is its unusual length in relation to its breadth, and in particular to its probable original length. This phenomenon appears to be a characteristic of the Shuswap Terrane deposits. The writer knows of three other localities where this is found. On the Adams Plateau, the Lucky Coon group consists of three narrow lead-zinc replacement zones of about 3 feet width which extend en echelon for 15,000 feet, and the Mosquito King zone has a similar character. Another is the Mount Seymour Mines lead-zinc veins near Seymour Arm of the Shuswap Lake and the other the J and L deposit on Carnes Creek north of Revelstoke.

Another unusual feature of the deposit is its probable U-shape in which the Nos. 1 and 2 lodes form one and the same mineralized bed. Other features are the type of exposures which permit of immediate sampling and approximate estimate of reserves. It is also strange that a zone of this size should remain unknown for so long a time and that it should be so close to transport that it should remain undeveloped. Both the latter are largely due to the fact that it is relatively inaccessible.

This and the difficulty of easy preliminary underground examination has prevented its exploration since 1955. This is unfortunate because nothing is known of the actual keel of the syncline except for the nearly vertically dipping limb exposed for a short distance to the west prior to its disappearance under talus cover. Nothing is known either of the potentiality of the superimposed minor folds that are likely to occur throughout, with consequent increase in reserves. It is hoped that the second steps in exploration could be undertaken in the near future so that production plans could be finalized quickly in case of improvement of base metal prices.

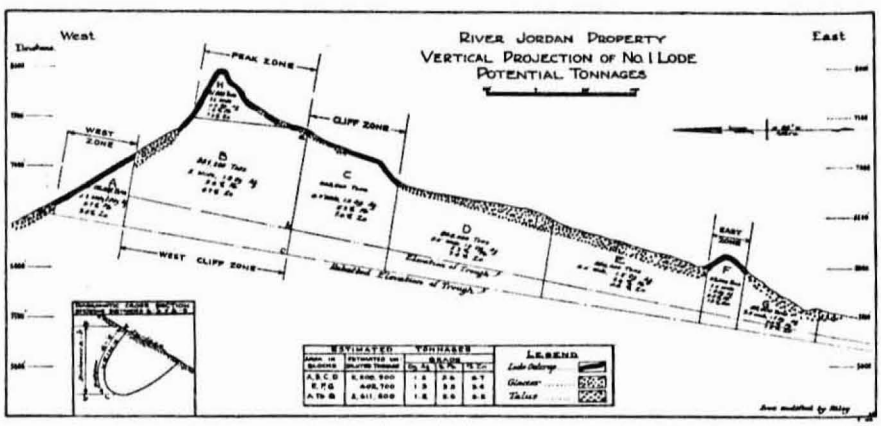

Figure 7. Vertical projection of No. 1 lode.