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GEOLOGICAL REPORT

1955 EXPLORATION PROGRAM

SILBAK PREMIER MINES LIMITED, N.P.L.

STEWART, B.C.

W. N. PLUMB, P.Eng.

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SUMMARY AND CONCLUSIONS

The 1955 exploration program lasted 105 days, from June 19th to October 1st, inclusive. Fifty two days were spent on the Premier Border examination, which was concluded on August 9th. Most of August was required to prepare for the anomaly drilling, which took place in September. During August and September, the Silbak underground reserves were examined and the camp buildings prepared to withstand one more winter of heavy snowfall. Each phase of this program is reported separately, with its own summary.

Silbak Premier and Premier Border ore reserves are detailed in the appendix to this report and shown on the accompanying maps. Combined, they amount to slightly more than 110,000 tons averaging 0.16 oz. gold, 2.45 oz. silver, 3.5% lead and 5.1% zinc per ton. This represents about two years' milling at 200 tons per day. Of this, about 30,000 tons are tied-up in pillars, which should not be mined until the remaining reserves are investigated more fully. There is a possibility of obtaining between 10,000 and 25,000 additional tons in the Silbak mine and at least some additional ore in the Premier Border area. It is recommended that a thorough study of all the mine development maps, assay plans and diamond drill records be made by an experienced mining engineer, followed by underground examination, re-sampling and drilling if necessary, to eliminate the unproductive areas and develop indicated additional reserves.

The Premier Main Ore Zone and the West Ore Zone have been quite exhaustively explored, both in lateral extent and in depth, within the limits of known geological controls. The best chance of extending the life of the mine seems to lie in the discovery of new orebodies beyond the present limits by the evolution of a new approach to the search for ore. There is a good possibility that a thorough re-examination of the mine geology will

result in the discovery of a controlling tectonic pattern that could be applied to the exploration for ore at depth. It would be necessary to find and apply such a new "control" within the first year of operation in order to preclude the stripping of the mine by pillar extraction. Although it is obviously impossible to re-examine 46 miles of workings in this short time, most of the major geological features are plotted on the mine maps and it is, therefore, recommended that a competent geologist be engaged to make a thorough correlation-study of the geologic mapping to date, especially of the fault pattern and its relation to ore shoots, dykes and rock-types. This should be supplemented by underground mapping and followed by deep drilling as soon as the study had become well advanced.

Surface exploration to date, although it consisted mainly of reconnaissance mapping and diamond drilling, has effectively eliminated most of the claim-area immediately to the southeast of the mine, which is underlain by the unproductive green and purple tuffs. The northern part of the area, however, is underlain partly by the Premier Porphyry (in which most of the orebodies were found) and the northerly limits of this formation are unknown. Records exist showing the results of drilling and sampling on the Premier Border claims and drilling on the Silbak claims to the northeast of the mine. There are known to be mineralized outcrops on the Northern Light claims. The mine should not be abandoned before all these northern claims, as well as outside properties in the near vicinity, have been examined for their base-metal possibilities.

INTRODUCTION

For the purpose of this report, familiarity with the historical and financial background of Silbak Premier Mines Limited is assumed. Events leading to the 1955 exploration program should, however, be reviewed.

Mining operations at Premier ceased in February 1953, and the camp was abandoned to the care of watchmen in May of that year. Among reasons mentioned for closure were adverse metal prices, high operating costs and unfavorable location of the mill in relation to the orebodies. Operating losses were sustained in 1952 and 1953. No attempt has subsequently been made to reopen the mine.

Following a re-organization of the directorate early in 1955, Henry L. Hill, P. Eng., Consulting Mining Engineer, was retained to assess the remaining economic potential of the property with a view either to the eventual reopening of the mine or to liquidation of the company. The author, as Chief Geologist, and Mr. R.J. Willox, as General Superintendent, were subsequently engaged to conduct an exploration program under the direction of Mr. Hill.

PREMIER, B.C.

The Silbak Premier property consists of 85 Crown-Granted mineral claims, twenty two of which are occupied by the mine and surface plant. Adjoining to the northwest are the eleven Crown-Granted claims of the Northern Light Group, owned by Premier Border Gold Mining Company Limited. One of these, the Northern Light No. 1, contains the downward extension of Silbak's "West" orebody, which has been partially mined by Silbak Premier under an agreement with Premier Border. As a large part of the remaining ore reserves are on this claim, most of the underground exploration was concentrated here.

Camp 4, officially known as "Premier, B.C.", is situated 800

feet above Cascade creek at elevation 1330, on the precipitous lower western slope of Bear River Ridge, seventeen miles north of Stewart, B.C. The living quarters, designed to accommdate about 400 persons, are closely contiguous to the mill (rated at more than 400 tons per day), which is 100 feet from the portal of No. 4 Level. The office, compressor-house, warehouse and maintenance shops are also grouped around the mill. Diesel-electric and hydroelectric power were supplied from 13-Mile Camp, which is 600 feet lower down the mountainside and connected to Camp 4 by one and one-half miles of tortuous mountain road. This road continues down the Salmon River valley for 13 miles to Hyder, Alaska, then skirts the Portland Canal for two miles to Stewart. It is generally in good repair in midsummer, and is the only means of access to the mine. Radio-telephone communication was maintained with Stewart when the mine was operating. Above Camp 4 the road, barely passable in midsummer, winds up the mountainside for 4000 feet to "Camp 1" and a further 1000 feet to the"B.C. Silver Camp." Both camps are now derelict. An old spur from this road runs southerly for 1000 feet from the B.C. Silver camp to the old Premier "Glory Hole." A connection was made this summer from the end of the spur to an old pack-horse trail that leads easterly toward the crest of Bear River Ridge.

There are approximately 46 miles of underground workings, consisting of 13 levels and sub-levels, 5 short internal shafts and several vertical ore-passes, extending over a horizontal distance of 9000 feet and a vertical range of 1650 feet. There are 7 adits, only 4 of which were in recent use. The "Glory Hole", where the ore was stoped to the surface, is about 600 feet long by 200 feet wide. The major ore-shoots (described in more detail later) extend northeasterly at irregular intervals from the Glory Hole and do not again reach the surface. They

have been largely stoped and are generally inaccessible above the main haulage level. Northwesterly from the "Glory Hole", a smaller "string" of ore-shoots have been stoped to the erosion surface. This "open-V" pattern is related to rock structure and is repeated on a smaller scale in the "West Ore Zone", 600 feet west of the Main Zone. Whereas the ore shoots in the Main Zone bottom a short distance below the main haulage level, the ore in the West Zone extends 750 feet below this elevation. As the mill is situated at the horizon of the main haulage level, and the remaining ore reserves are at progressively greater depths, economic transportation of ore is a major problem.

Silbak's reserves (expanded estimate) as of April 30th, 1953, were shown at 34,425 tons assaying 0.35 oz. Au, 3.41 oz. Ag, 1.9% Pb and 2.6% Zn. These comprise four small stoping areas, totalling 7,004 tons, and fifteen separate pillar areas totalling 27,421 tons. At present metal prices, these reserves are considered to be commercial despite the known high cost of production. However, extracting these pillars would mean rendering most of the mine inaccessible for future exploration. In recent years considerable additional ore has been developed in lower-grade zone marginal to stoped areas. This would no longer be possible if the pillars were extracted. Therefore, it was decided that these pillars would be examined for accessibility only, as phase II of the program, while the main emphasis would be placed upon developing more primary ore.

Silbak's estimates of Premier Border reserves, as of April, 30th, 1953, were shown as 49,346 tons assaying 0.08 oz. Au, 2.50 oz. Ag, 6.0% Pb and 8.1% Zn. Of this, 4,346 tons is shown as pillars, while 45,000 tons represented the continuation downward from 6-level of the West orebodies. This block was not fully outlined and represented the best immediate chance of increasing the reserves. It was, therefore, decided to concentrate on

this area first.

OBJECTIVES

The principal objective of the 1955 exploration program was to develop enough ore of commercial grade to enable the Silbak Premier mine to reopen. This required (a) an analysis of the ore potential and (b) a careful study of the cost of rehabilitating the camp as well as the costs of mining, milling and marketing the ore.

The author and Mr. Willox undertook part (a). This was subdivided into three phases. The object of Phase I was to determine the location, extent, shape and grade of the Northern Light orebodies below 6-level, together with any other potential ore in this area. This pre-supposed the continuation of the present arrangement with Premier Border Mines Limited. The work took the form of diamond-drilling from the Northern Light shaft, which required dewatering the shaft for 300 feet to 8-level. All administrative and technical details were handled by Mr. Willox, while the layout, location and logging of drill holes; the geological mapping and channel sampling; the plotting and the calculation of results were directed by the author.

It was considered that Phase II would only be required if insufficient ore was developed in the Northern Light area to permit reopening. This would consist of examining each block of ore and each pillar area shown on the Silbak Premier reserves with respect to its location, accessibility, physical condition and mining possibilities. Also, where practicable, a search would be made for possible expansions or areas that might have been overlooked. Due to the extent and condition of the mine workings, the distribution of the pillars, and the pressure of Phase III, a thorough search for "expansions" was found to be impracticable.

Phase III was to consist of geological and geophysical prospecting of the selected surface areas for potential new orebodies. It was

anticipated that this would be largely geological reconnaissance work, but the early discovery of a geophysical anomaly resulted in an intensive and arduous diamond drilling program high on the western slopes of Bear River Ridge, two and one-half miles east of Camp 4. This part of the program was concluded on September 28th, when the early arrival of winter conditions forced the cessation of diamond drilling.

Respectfully submitted,

W. N. PLUMB, P.Eng.

PART I

NORTHERN LIGHT EXAMINATION

SUMMER, 1955

by

W. N. PLUMB, P. Eng.

CONTENTS

1. SUMMARY:

An examination of the underground workings of Premier Border Gold Mining Company, Limited, was undertaken by Silbak Premier Mines Limited, N.P.L., from June 19th to August 9th, 1955, for the purpose of determining tonnage and grade of the orebodies below 6-Level. The Northern Light shaft was de-watered and 2,752 feet of diamond drilling was conducted from 7 and 6 Levels. Concurrently, the geology was mapped and samples taken for the purposes of grade calculations and metallurgical testing. The condition of the stopes and pillars in the area was also examined.

As of September 21, 1955, reserves are estimated at 71,146 tons of unbroken ore assaying 0.07 oz. gold, 1.98 oz. silver, 4.25% lead and 6.36% Zinc, in 2 blocks below 6-level and 5 pillar areas above 6-Level, in addition to 3000 tons of broken ore. The Northeast ore block extends 94 feet below the Level and contains 22,560 tons; the Northwest block extends 200 feet below the Level and contains 44,240 tons. The latter terminates 60 feet below 7-Level in a low grade silicified zone. Pillar reserves are unchanged from previous estimates at 4,346 tons. Additional tonnages could probably be obtained by further exploration in the vicinities of 788 A stope and 782 D raise.

The essential geological features believed to have influenced the ore deposition are a zone of basic dykes and three sets of intersecting faults. One set of faults has had a limiting effect on the solutions forming the Northeast orebody, while the other two have created channels that controlled the position and extent of the Northwest orebody. The Northwest orebody is confined to the footwall side of the belt of dykes, which may be related to the source of the mineralization.

Subject to economic factors, there is sufficient ore in the combined reserves of Premier Border and Silbak Premier to support a limited mining operation. More ore would very probably be developed in the course of mining.

Deep underground diamond drilling and surface exploration are suggested to fully develop the potential of the Premier Border claims.

NORTHERN LIGHT EXAMINATION

SUMMER, 1955

2. INTRODUCTION:

Between June 19th and August 9th, 1955, a thorough exploration program was conducted by Silbak Premier Mines Limited, N. P.L., on the Northern Light No. 1 mineral claim, owned by Premier Border Gold Mining Company, Limited. The examination was undertaken on the preliminary understanding that the previous mining and milling agreement with Premier Border Mines would remain in force. The examination was confined to the underground workings and was directed towards the twofold objectives of (a) determining the limits, size, shape and grade of the downward extension of the "Northern Light" orebodies and (b) discovering whether or not any geological controls exist that might aid in the search for more ore. The program was directed by Mr. Henry L. Hill, Consulting Mining Engineer, and was jointly conducted by Mr. R.J. Willox, Superintendent, and Mr. W. N. Plumb, Geological Engineer.

3. DEVELOPMENT HISTORY:

The downward extension of the Premier "West" ore zone enters the southeast corner of the Northern Light No. 1 claim at an elevation of 940 feet, 660 feet below the surface, and continues downward to the northwest. By August, 1941, this zone had been undercut on No. 6-Level, elevation 790 feet, and found to consist of two ore shoots; a northeast-striking body about 160 feet long by 15 feet wide, dipping gently northwest; and a northwest-striking body about 160 feet long by 7 to 10 feet wide, dipping steeply to the northeast. Both ore shoots rake strongly to the west-northwest. The junction of these two orebodies is 5000 feet from the portal of 6-Level. The "Northeast" orebody was developed by 782 N drift and mined upward to 940-Level in 781 A and 782 A stopes. The "Northwest" orebody was developed by 782 N drift and mined upward in 782 N stope for 60 feet, where it terminated. In 1950 and 1951, drifting

was continued 425 feet to the northwest, a crosscut 140 feet long was driven to the northeast, and 3,954 feet of diamond-drilling was done to explore the orebodies at depth. This drilling indicated that the Northeast orebody bottomed a short distance below 6-Level, but that the Northwest orebody persisted for at least 200 feet below the level. Accordingly, the "Northern Light" shaft was sunk in 1952 to develop this ore. This 3-compartment vertical shaft is 369 feet deep, extending from elevation 796 at 6-Level, to elevation 427 at the bottom of the sump. Stations were cut at 7-Level, elevation 650, and 8-Level, elevation 498. Development of 7 and 8-Levels from this shaft was started early in 1953, but had not outlined the orebody when the mining ceased in February. This development consisted of: 70 feet of crosscutting and drifting on 7-Level, the last 40 feet of which was in ore; approximately 130 feet of crosscutting and drifting on 8-Level; two raises extending 28 feet and 86 feet respectively, above 8-Level; and five short X-Ray diamond drill holes, three from 8-Level and two from 7-Level. None of the 8-Level development was in ore, although it encountered extensive silicification. All workings below 6-Level filled with water when the mine was abandoned.

Four small stopes, in addition to those mentioned above, were developed in the Northern Light area, and will be described more fully later. These are: 788 A, 791 A, 79 A and 79 B stopes.

4. OPERATIONS:

Work started underground as soon as the camp was established. There were four major phases proceeding, in general, simultaneously. The first stage was the de-watering of the shaft to 8-Level, which started June 24th and required 34 days. This was achieved by the use of compressed-air pumps, progressively lowered by means of an air-operated hoist. Two "air-lifts" were also found necessary. Two diesel-operated compressors at Camp 4 supplied the air, which was brought to the shaft through at least one mile of underground piping. The water was lowered in the shaft at an average rate of 9 feet per

day, but this was by no means uniform. A cone of de-watering was soon formed around the shaft, with the result that just above 7-Level the water inflow nearly balanced the pumping rate for several days. This is a point worth bearing in mind for future operations, although the effect would probably be minimized if electric pumps were used. The water inflow below 8-Level was small, so that only intermittent pumping was required to maintain the level for an additional 13 days during the drilling program.

As soon as 7-Level was clear of water, the diamond drilling started, using an "EX" machine. All drilling was on a 24-hour basis and an average rate of almost 100 feet per day was realized, including "set-up" time - 2752 feet were drilled in 28 consecutive days. Nine holes were drilled from 7-Level, three from the shaft just above 8-Level (to allow time for de-watering 8-Level), and five from 8-Level itself. Holes were spotted by transit wherever possible and were drilled to a prepared plan (modified by results obtained) designed to trace the northwest ore zone to progressively lower horizons, while at the same time intersecting the ore at reasonably uniform intervals (to simplify the grade calculations). Core was hoisted to 6-Level by the air hoist and hand trammed one mile to 6-Level portal, where it was trucked to Camp 4 for logging and sampling. Samples were assayed by J.R. Williams & Son, Vancouver, B.C.

Concurrently with the de-watering and drilling, a 22-day program of geological mapping and sampling was undertaken, partly in an effort to determine the ore-controls and partly to assist in grade calculations. This work was handicapped by a thick coating of grime on the walls, which could only be partially removed by washing. Faults, contacts, silicified and mineralized areas were mapped wherever possible. The mineralized areas of the Northeast and Northwest zones on 6-Level were roughly outlined and marked. Regular channel samples were then cut across the back of these drifts, using an air-operated hitch-cutter. These were assayed for lead and zinc and, to-

gether with gold and silver assays from Silbak Premier records, were later used for grade calculations. Two large samples, as representative as possible of the Northern Light ore, were blasted from selected areas on 6-Level and sent to the Giant Mascot mill for metallurgical testing.

As time permitted, tours were made by Mr. Willox and the author through the various Northern Light stopes in an effort to determine visually both mining conditions and the extent of remaining mineralization. Stope maps were examined and assays correlated with visual observations whenever possible.

The underground program finished on August 9th, with the completion of the last diamond-drill hole and the removal of all drilling and other equipment from the shaft area. The compressors were operated 47 days. During this period, 3 compressor-men, 3 pump-men and 2 laborers were employed underground. In addition, one geologist and his assistant were continuously employed, either underground or at Camp 4, on mapping, sampling, core-logging and office work. Diamond-drilling was contracted to the C. Hutch Drilling Company. All administration and technical supervision were handled by Mr. Willox. Necessary surveying, the conduct of the geological mapping and sampling, direction of the drilling, plotting of results and calculation of reserves were under the jurisdiction of the author. One cook was also employed.

5. NORTHERN LIGHT ORE RESERVES.

(a). General:

As of September 21, 1955, the unbroken ore reserves in the Northern Light area are estimated at 71,146 tons, assaying 0.07 oz. Au, 1.98 oz. Ag, 4.25% Pb and 6.36% Zn. These consist of 66,800 tons in two large blocks below 6-Level and 4,346 tons in five small pillar areas above that level. Adding an estimated 3000 tons of broken ore, total reserves are 74,146 tons. These figures are listed in the appendix to this report, and are analyzed below. They are derived

in part, from Silbak Premier records and, in part, from this examination. Wherever feasible, Silbak records were checked by personal examination before being used. Four maps showing these reserves accompany this report.

It is, of course, realized that the mineralization in the Premier area is extremely variable in composition and distribution and that continuity between drill holes, for instance, cannot readily be assumed. It is quite evident from Silbak Premier records that drilling was used principally as a guide to mineralized areas and that "ore" was "blocked out" only in a generally conservative manner, which is quite satisfactory for an operating mine but rather inadequate as a base upon which to predicate a "new" operation. Accordingly, drill holes were spaced to give ore intersections as close together as seemed warranted and continuity has been assumed in calculating the ore blocks below 6-Level.

On the accompanying maps it will be noted that the ore shoots are not "veins" but instead are merely heavily mineralized areas more or less concentrated within wide silicified zones. This results in irregularly-shaped orebodies and, for calculating ore reserves, necessitates projecting all drill holes to a plane perpendicular to the average strike of the ore. Ore blocks were calculated by using "horizontal widths perpendicular to strike" together with vertical depths. Check calculations were then made, using "normal" widths and slope distances, and the two results were found to be in close agreement. A table is appendixed showing all ore intersections, together with "normal" and "horizontal" widths. No allowance has been made for dilution. This would be somewhat misleading as overbreak would usually be in mineralized, lower grade material rather than in barren wallrock. In practice, mining must be guided by "assay walls" and the dilution should not be excessive. All reserves were calculated at a tonnage factor of 10 cubic feet per ton, as used by Silbak Premier.

(b) Northeast Ore Block Below 6-Level:

This block is the downward continuation of the ore in 781 A and 782 A stopes. It averages 200 feet in length, 12 feet in horizontal width, 94 feet in vertical depth, and is estimated to contain 22,560 tons, assaying 0.08 oz. Au, 2.09 oz. Ag, 3.79% Pb and 7.25% Zn. As shown on the accompanying map, this orebody strikes N 62° 30' E, dips 40° NW and dies out in silicification about 110 feet below 6-Level. Grade calculations are based on ore intersections in five drill holes below the level and upon the average grade of ore undercut in 782 W drift on 6-Level. Lead and Zinc assays for the level were obtained from 21 channelled samples, while gold and silver values were taken from Silbak Premier's "Assay Plan 790 Level, section 4-0" dated August 4, 1941. Silicification in drill holes 1952 and 1953, below the plunge of the ore, was used as a guide to the bottom of the orebody. This zone tends to plunge to the west and may join the marginal ore intersected at the extreme end of hole NL 703 (see 7-Level geological map).

(c) Northwest Ore Block Below 6-Level:

This is the downward continuation of the ore mined in 782 W stope. It averages 158 feet in length, 14 feet in horizontal width, 200 feet in vertical depth below 6-Level, and is estimated to contain 44,240 tons, assaying 0.05 oz. Au, 1.90 oz. Ag, 4.55% Pb and 5.92% Zn. Although undulating considerably, the ore has an average strike of N 62° 30' W and an overall northeasterly dip of 84°. It maintains a remarkably uniform plunge of about 45° to the northwest and a quite regular strike length between 6-Level and 7-Level, but terminates rather abruptly 60 feet below 7-Level in a fringe of marginal-grade mineralization. This, in turn, passes into widespread silicification, extending down through 8-Level, containing considerable pyrite but only occasional disseminated lead and zinc. This silicified zone was intersected by the shaft between 7-Level and 8-Level.

When it became evident that no ore had been encountered on 8-Level, considerable lateral drilling was done to ensure that this was due to "bottoming" rather than to faulting or to a change in the direction of plunge. With no ore intersections in holes 804, 805 and 808, and only marginal ore in holes 708 and 709, it was realized that the ore had bottomed. Only high-grade intersections, determined by assays, were used in the calculations, except for hole 1948, which was averaged over 52 feet to maintain continuity. The ore encountered in hole 807 was not used, due to its isolated location, but may represent a slight additional reserve.

The total vertical extent of this block is 260 feet from the top of 782 N stope. This is about the average depth of many of the stopes in the Silbak Premier mine.

(d) PILLARS Above 6-Level:

General:

All stopes above 6-level are shown on the accompanying map entitled "Plan and Projection -- Northern Light Workings", which is up to date. Pillar reserves are indicated on this map in red pencil and are also listed in the appendix. They are unchanged from the Silbak Premier estimates of April 30, 1953, and amount to 4,346 tons assaying 0.14 oz. Au, 2.24 oz. Ag, 3.50% Pb and 6.00% Zn. Wherever accessible, these reserves were examined by Mr. Hill, Mr. Willox and the author. Stopes 79A and 79 B were not accessible. It was considered that some of these pillars should be re-sampled, but this was not practicable with the resources available to us, so the original estimates were accepted. The following observations were made:

782 N Stope:

These are sill pillars above 6-Level. The grades shown agree closely with channel samples taken on the back of the drift, but a

slightly greater tonnage would probably be obtained in mining. They could be extracted in the course of stoping the orebody below the level, but a 200-foot by-pass drive would be necessary around the pillar area to service the shaft.

781A and 782 A STOPES:

These stopes have an average dip of about 35° and all ore broken must be scraped to 6-Level below. A number of support pillars have been left in the course of mining. These are listed on the reserves as containing 1700 tons of ore grade. Observations in the stopes showed erratic, narrow, high-grade areas as well as extremely barren rock. The pillars are, of course, coated with grime. They should, therefore, be thoroughly washed and sampled and the reserves re-calculated. The results could be higher or lower than those shown. Consideration should also be given to alternate back-support if these pillars are extracted.

The 1220 tons listed as sill-pillars above 782 drift seems to be essentially correct, although probably a little high in lead. These could also be extracted in the course of stoping below 6-Level, but would necessarily be among the last pillars to be mined.

791 A Stope:

No reserves are listed for this stope. A few small pockets of high-grade ore were seen, but no appreciable tonnage.

782 A Stope:

This is a mineralized area, about 100 feet long by 30 feet wide, undercut on 6-Level, 200 feet northwest of 742 B stope. It is relatively low in lead and high in zinc. It has been developed for 85 feet above the level by a system of raises and 12 short "cored test holes". The raises are silicified and slightly mineralized. A block of ore containing 4,662 tons was shown on the reserves as of December 21, 1951. This has been cut on the

1953 reserves, to 800 tons, with higher grades. This stope should also be re-sampled. No drilling has been done below 6-Level in this area.

(e) Broken Ore.

There is a layer of broken ore, estimated to average one foot in thickness, covering the floors of 781 A and 782 A stopes. This is estimated at 3000 tons over the stope width of 150 feet and a stope-length of 300 feet, using a tonnage factor of 15 cubic feet to the ton. This could be recovered at any time by scraping it to 6-Level below. It appeared to contain high and low-grade ore as well as waste.

6. GEOLOGY:

(a) General:

The maps accompanying this report were compiled by the author from all available sources in an attempt to determine the geologic factors controlling the deposition and localization of the ore in the Northern Light area. Such a study, in the short time available, was necessarily incomplete and the conclusions drawn are, so far as known, applicable only to the immediate vicinity of the area mapped.

(b) Rock Structure:

No exact classification of the rocks in the Premier area has ever been achieved, despite intensive study by several competent geologists. In this examination the rocks were mapped and logged as light-green, dark-green-to-black, or porphyritic volcanics, as these types could be recognized and it was hoped that some indication of the primary rock structure would result. The porphyritic phases, however, were found to be gradational (and very probably due to re-crystallization), while the color of the light-green rocks was largely the result

of alteration to calcite, chlorite and epidote. The only evidence of primary structure found (and this is not considered very reliable) was that contacts between light-green and the dark-green-to-black rocks tended to strike northwesterly and dip moderately southwest.

The most prominent feature of the area is a broad belt of basic dykes. These are very fine-grained, greenish-grey, slightly porphyritic and are variously logged as lamprophyres or fine-grained diorites. They strike northwest and dip 50 to 60 degrees southwest, with widths varying from a few inches to ten feet. While they are not mineralised, they cut sharply through the envelope of silicification and pyritization that surrounds the Northwest orebody. They trend parallel to the tension-faults that control the mineralization and are occasionally cut by these faults, hence may be pre-ore. The Northwest Orebody tends to remain on the footwall side of these dykes, while the mineralization in 788 Drift is about 100 feet away on their hanging wall side. It is believed that some genetic relationship between these dykes and the orebodies in the Northwest Zone must exist.

(c) Mineralization:

The visible ore sulphides are pyrite, sphalerite, galena and chalcopyrite. Pyrrhotite, tetrahedrite, polybasite and electrum are reported by earlier investigators to occur microscopically. The silver minerals are associated with the galena but are not interstitial to it and so there is no fixed silver-to-lead ratio. Sulphides comprise about 12% of the ore, which has an average tenor of about 0.07 oz. gold, 2 oz. silver, 3.5% lead, 6% zinc and 0.1% copper.

The wall rocks are intensively altered to aggregates of calcite, sericite, chlorite and epidote. With pyrite and pyrrhotite, these comprise the gangue minerals. Within the ore zones, the wallrock is usually brecciated and the fragments are pyritized and surrounded by

quartz and calcite.

An envelope of silicification, with varying amounts of pyrite, borders the footwall (or southern) side of the ore zones for distances up to 150 feet and may plunge for hundreds of feet below the ore. On the hanging wall side of the ore, the silicification tends to occur as narrow, irregular, discontinuous bodies, usually with disseminated sulphides. In general, the ore gradually attenuates into sparsely-mineralized zones of intense but gradually-diminishing silicification, as illustrated on the accompanying maps.

(d) Fault Patterns and Ore Controls:

The twenty-five faults mapped on 6-Level can be resolved into three major "sets" according to strike and dip, as follows: The first set, consisting of large "shear" faults or zones with considerable gouge, strikes about NNE and dips 35 to 45 degrees west; a second set, some of which are shears, strikes NE to NNE and dips 40 to 65 degrees NW; The third set, most of which are "vuggy" tension-fractures, strikes NW and dips 50 to 85 degrees SW. These three sets form a tectonic pattern which, upon analysis, appears to control the localization of most of the known ore in the Northern Light area.

Faults
① ~200/35-45
② ~225/40-65
③ ~045/50-85

of Northern Light

As shown on the 40-scale "Plan and Projection" map, the large shear at the junction of the Northeast and Northwest ore zones, when projected down dip, roughly parallels the bottom of the plunge of the Northwest orebody. Most of the drill logs mention brecciation or shearing at the approximate projection of this fault. On the 20-scale geologic map it will be noticed that most of the faults in the Northwest orebody are members of the "third set", tension-type faults and that they persist for about 200 feet northwest of the large shear zone, terminating with the ore. A similar set of tension faults occurs in the same orebody on 7-Level. This strongly suggests that the ore-bearing solutions emanated from these fractures

and that the length of the Northwest orebody was limited by the fact that these fractures only extended 200 feet northwesterly from the junction with the main shear.

In 788 Drift, two parallel NNE faults, close together, appear to form a similar shear zone, which has again been intersected in drill hole 1918, 150 feet to the south. Three vuggy, northwest-striking tension faults occur in the mineralized zone in 788 Drift and probably control this mineralization. This is, therefore, a modified version of the same type of control noted in the Northwest Orebody.

The Northeast Orebody in 782 Drift is bounded on the hanging wall side by a persistent, slickensided, shear-type fault of the "second set". On the hanging wall side of this fault the rocks are dark green and unmineralized; on the footwall side they are silicified and contain the orebody which, however, is not frozen to the fault contact. The evidence suggests that this fault acted as a barrier to the rising solutions and is pre-mineral. A series of smaller faults of the same NE set occur at the west end of the Northwest Orebody and appear to act as barriers to this mineralization also. Finally, there is a fault of this type in 787 Crosscut that is slickensided and very slightly mineralized. This may have acted as a "feeder" to the mineralisation.in 788 Drift.

7. POSSIBILITIES:

Depending upon economic factors, such as the ability to market a zinc concentrate and the successful rehabilitation of the existing surface plant of Silbak Premier, the Northeast and the Northwest orebodies below 6-Level can be considered ore. Together with the pillars above 6-Level and the ore remaining in Silbak Premier ground, there is sufficient potential to support a limited mining operation.

Coincident with mining, further exploration of the

mineralized area below 788 Stope might considerably increase the reserves. This could take the form of drilling, and possibly drifting, to the west from 7-Level. There is also a definite possibility of developing more ore near the top of 782 D Raise. Hole No. 2016, drilled in April, 1951, penetrated 75 feet of mineralization assaying 0.09 oz. Au, 1.12 oz. Ag, 1.9% Pb, and 6.4% Zn. This would be new ore, roughly en-echelon with, but above, the Northwest Zone, at the extreme western end of 940 Sub-level. It is partly in Silbak Premier ground. More exploration is necessary before this can be considered reserves.

The suggestion has often been made, following the discovery of the West Ore Zone, that there is a possibility of discovering another set of "intersecting shears" (i.e. a new orebody) by drilling a few very long holes to the north or northwest. This is still true. These holes should be at least 1000 feet in length and preferably drilled from 8-Level, as any such repetition of structure would be influenced by the regional plunge. Such drilling should cost about $3000 per hole, providing the mine were operating, and there would be no guarantee of success, but as long as this possibility remains un-tested it cannot be concluded that the ore-potential is exhausted.

Recent exploration has been confined to only one of the eleven claims owned by the Premier Border Gold Mining Company, Limited. This has all been underground work on the Northern Light No. 1 mineral claim, which contains the downward extension of the Silbak Premier ore-bodies. In the past a number of mineralized outcrops, exposed in the vicinity of Cascade Creek, were explored but no comprehensive survey has ever been made of the entire group of claims. These should be thoroughly examined by geological and, possibly, geophysical methods, followed if necessary, by stripping or diamond drilling to thoroughly develop their

potentialities. These claims are favorably situated in an area that, regionally, contains widespread mineralisation.

Respectfully submitted,

W.N. PLUMB, P. Eng.

WNP/sa

Att.

PART II

SILBAK UNDERGROUND RESERVES

by

W. N. PLUMB, P. Eng.

CONTENTS

SILBAK UNDERGROUND RESERVES

1. SUMMARY:

As Phase II of the 1955 exploration program, all but three of the reported underground reserve areas in the Silbak mine were examined for location, accessibility and mining conditions. Stope records were consulted but, in the short time available, no attempt was made to re-calculate the reserves. They are conservatively estimated at 37,243 tons assaying 0.35 oz. gold, 3.42 oz. silver, 1.9% lead and 2.6% zinc, comprising 6,822 tons available for stoping, 27,421 tons in sills and pillars and 3,000 tons of broken ore. They are plotted on the accompanying maps and projections, listed in the appendix and described in detail in the body of the report.

During this brief examination it became apparent that large tonnages of probable ore existed that were not included in the reserves. Only the richer and more completely-explored areas were included and it is believed that a thorough study of the records, combined with additional underground exploration, would appreciably increase these reserves. The records are very comprehensive: All workings have been sampled at 10-foot intervals and assayed for gold and silver; some drifts have also been channel-sampled for base-metals, and logs covering more than 400,000 feet of diamond drilling are available. A study of these records should be made by an experienced mining engineer.

While the Silbak reserves are not yet exhausted, the approximate limits, both laterally and in depth, of the Main and West ore zones appear to have been reached and the search for possible "expansions" is, therefore, limited. Silbak and Premier Border reserves combined would probably support a two-year operation but, in order not to render the mine workings inaccessible by sill removal, new ore in considerable quantities, should be

discovered within the first year. This necessitates a critical examination of the geologic controls in order to intelligently guide an intensive underground exploration program directed toward the discovery of totally new orebodies at depth, or their definite elimination. Such a study should be made by a competent geologist, beginning at once with a correlation of the existing records and followed as soon as possible by deep underground drilling.

2. SCOPE OF EXAMINATION:

The purpose of this part of the examination was to verify the existence of the reserves and to determine their location, accessibility and ease of mining. It was not possible, with the available facilities, to re-calculate tonnages or grade, as this would require a great deal of time examining in detail dozens of assay and stope maps and a large number of diamond-drill records. In addition, it would almost certainly entail re-sampling of many pillar and drift areas for lead and zinc as this was neglected in the early days of the mine.

Accordingly, following an orientation-study of the mine maps, all accessible reserve areas were visited, conditions noted, and the original estimates accepted, with limitations. Only three areas were inaccessible and this was due to the condition of the manways, which could be remedied if the mine were operating. Some areas required circuitous approaches due to previous sill removal or uncontrolled water-flow. All workings on 4-level and below are accessible, but some parts of 2-level and 3-level are blocked due to pillar extraction, and most workings above 2-level are caved to the surface.

3. ORE CONTROLS:

Mineralization in the Silbak mine consists of replacements and fissure-filling along two sets of intersecting "shear" or fracture zones.

3. Ore Controls (Cont'd):

The strongest and longest zone forms an en-echelon pattern extending for 5500 feet in a north-northeasterly direction and dipping moderately northwest. It consists chiefly of intermittent gougy and brecciated shear faults varying up to ten feet in width along which movements of undetermined displacement have taken place. This is known as the Main Northeast Zone and is intersected on its hanging wall side by numerous sets of northwesterly-striking fractures that dip steeply southwest. These localize the strike-length of the ore shoots and cause them to rake strongly to the west. The dip of the ore is controlled by the northeast shearing.

In two localities the northwest fracturing becomes persistent along strike and nearly-vertical ore shoots occur, elongated in a northwesterly direction. Where these "Northwest Zones" intersect the "Northeast Zones" an arcuate junction results and large "boomerang-shaped" ore shoots are formed, which also maintain a westerly rake. In addition, at these junctions, vertical pipes and sheets of ore tend to form below the footwall of the main mineralization.

During the 35-year history of the mine, two major Northeast-Northwest junctions have been found: The first was in the original Premier mine and became known as the "Main" ore zone, with a short northwesterly branch and a long northeasterly branch extending into the former B.C. Silver and Sebakwe ground; the second, roughly 600 feet west of the Main zone, is known as the "West Ore Zone" and extends downward into the Premier Border ground. These junctions are the most important loci of ore deposition and, considering the mine as a whole, suggest a regional trend. First, the northwest faults are predominantly shears and have by far the greater strike-persistence, hence may be termed the compressional direction. They strike at right angles to the batholith

and probably tapped the source of the mineralizing solutions at depth. They are the "sine qua non" of ore deposition. Second, the northwest fractures are largely tensional and the mineralization appears to have emanated from and been localized by them. Where the northwest zone is strike-persistent (as in the West Ore Zone), northeast shears are still present and tend to "dam" or limit the mineralization. Third, the ore shoots persist to the greatest vertical depths at these major intersections. Finally, there are indications that the upper limit of the ore at these intersections is becoming progressively deeper to the northwest, occurring at elevation 2100 in the Main zone and at elevation 1400 in the West zone. This infers that, should a third major intersection be found beyond the West ore zone, it would apex about 100 feet below the elevation of 6-level.

The influence of rock-type on ore deposition in the Premier area is extremely controversial and, for lack of information, will only be briefly discussed here. The more competent a rock, the more readily it fractures, thus rock-type could indirectly control the distribution of the ore. In the Main zone, the northeast shearing follows closely the contact between the Bear River volcanics (green tuffs) and the more competent Premier porphyry, which is believed to be intrusive. In the West ore zone, however, the rocks are massive, northerly-trending volcanics, cut by northwest-striking basic dykes, all of which appear to be competent, and so the relationship of rock-type to faulting remains to be determined.

The "purple-tuff" theory proposed by E.G. Langille, former Silbak geologist, as a limiting ore control, deserves mention. His observations suggested that lenticular bands of incompetent gently-dipping purple tuffs, outcropping above the mine, provided a barrier

to rising ore solutions, largely by inhibiting fracturing, and thus "capped" the orebodies. As these tuffs strike northeasterly and dip gently westward, this theory could account for the greater depth of the West ore zone, and could also set an upper limit to future northerly exploration.

4. ORE SHOOTS:

Regardless of origin, ore shoots are found at or near intersections of northeast and northwest faults. They range in strike-length from 100 to 300 feet, in width from 5 to 40 feet and in vertical depth from 100 to 1100 feet. They occur in three variations: The "Northeast" type strikes northeast, changes down dip from 70 to 35 degrees in a northwesterly direction, and rakes strongly to the west; the "northwest" type strikes northwest, dips almost vertically and rakes westerly; while the "footwall" type, found near the major shear junctions, extends either pipe-like of sheet-like vertically down from the footwall of the northeasterly shoots, which it may or may not join. All shoots die out in silicification at depth. The ore shoots occur mainly in six major areas (see 400-scale Map of Property) and have been mined in more than 150 stopes.

The largest concentration of the richest ore, at the junction of the Main northeast and northwest "shears" in the old Premier mine, extended from the surface "Glory Hole" to a point just below 5-level, a vertical distance of 1100 feet. Mineralization was continuous around the arc of the junction and, except for some level pillars, has been completely extracted. To the northwest of the junction, stoping was continued to the erosion surface, while to the northeast the ore shoots became intermittent and apexed below the surface. Both gold and silver values were extremely high near the top but decreased gradually with depth. Pillars remaining in this sector have an average tenor of about 0.40 oz. gold, 4.5 oz. silver, 1.5% lead and 2% zinc.

As stoping was extended to the northeast into the B.C. Silver sector, the ore shoots at first showed a tendency to extend to higher elevations, but later, when exploration reached the Sebakwe sector, they apexed at lower elevations and their depth extent also diminished. Mineralization changed gradually over this distance; gold values becoming erratic, silver decreasing and base metals increasing in amount. Finally, at about 5500 feet to the north-northeast, an apparent economic limit was reached. A number of pillars, stoping areas and potential expansion areas still exist in these two sectors, all below 1350-Level. A weighted average of three of these gives approximate grades of 0.28 oz. gold, 1.71 oz. silver, 2.7% lead and 2.8% zinc.

The West Ore Zone, the second largest mineralized area in the mine, is similar to the Premier Main Zone in many respects. It is controlled by two major sets of intersecting fractures and the ore shoots conform to the three types described above. It is anomalous, however, in that the mineralization is low in gold, erratic in silver, but high in lead and zinc. Also, to the limits of present exploration, it is smaller in both lateral extent and vertical range. The greatest depth to which ore has been traced in the mine is elevation 590, near the Northern Light shaft. The average tenor of this ore is 0.07 oz. gold, 1.98 oz. silver, 4.25% lead and 6.36% zinc.

5. MINING METHODS:

The ore is mined by conventional shrinkage-stoping methods, with development drifts and raises driven in ore. Back-support pillars are left only when the dip of the ore flattens or uneconomic grades are encountered. To ensure close control, all

development faces and all stope walls, breasts and backs are sampled, and stopes are thus limited by assay walls. Ore is indicated prior to mining by EX diamond drilling and this is supplemented during the mining by short X-Ray diamond drill test holes. When stoping is completed, the stopes are drawn empty and are not usually back-filled. Some of the older stopes are partly filled with waste that has sloughed from the hanging walls, and some have been used as a convenient depository for development waste, which has made the recovery of some pillars economic.

The mine, unfortunately, has a dual numbering system. In the old Premier sector, levels are numbered downward from 1 to 6, the main haulage level, at mill elevation, being No. 4. In the remainder of the mine, however, levels are numbered by their average elevation. Thus, No. 6 becomes 790 Level and No. 4 is designated 1350 Level. As stopes are numbered from their starting level, both 4B and 13B stopes, for example, start from the same elevation. Letters are suffixed to the stopes in the order of mining and have no regional connotation.

As mentioned previously, the mill is at elevation 1330, while most of the remaining reserves are below this level. Due to topography and other factors, it is considered uneconomic to move the mill, so most of the future production will have to be hoisted from 5-level or 6-level for transport to the mill. This is a relevant factor in determining ore reserves.

6. ORE RESERVES:

(a) General

As a matter of record, Silbak reserves have always been conservatively estimated and have usually been exceeded in mining, generally with slightly lower grades. The tendency has been to use sampling and drilling results as a guide to possible "expansions" and to show

only thoroughly developed blocks in reserves. Silbak reserve estimates at the time of closure, as of April 30, 1953, totalled 34,425 tons assaying 0.35 oz. gold, 3.41 oz. silver, 1.9% lead and 2.6% zinc. These included 1,204 tons blocked out, 5,800 tons of possible expansions and 27,421 tons in pillars. These reserves remain unchanged except for the deletion of 182 tons of marginal grade and difficult access in 9J stope and the addition of 3000 tons of broken ore. Tables showing these and the Premier Border reserves are appendixed to this report.

It must be fully realized that, at the time of closure, mining was actively in progress and that operations ceased for economic reasons rather than from lack of reserves. The latest development maps show that, between Sept. 1952 and Feb. 1953, stoping was in progress in eight areas not mentioned in the reserves and the accompanying assay results in these stopes were of average mine grade (expressed in dollars). Many of the reserve areas were also being actively exploited and a preliminary study of the record suggests that these could possibly be expanded by about 11,000 tons.

Referring to the maps and sections accompanying this report, it will be noted that the pillar reserves are concentrated chiefly in two areas; namely, above 4-level in the Premier sector, and below 4-level in the West Ore Zone; while the stoping reserves are all below 1350-level in the B.C. Silver and Sebakwe sectors. The possible expansions occur in these sectors as well as in the West Ore Zone. The Premier Border reserves are, of course, all in the West Ore Zone. Brief summaries of all these reserves are given below.

(b) Stoping Reserves

10-B Stope (Downward)

This stoping area is estimated at 3800 tons assaying 0.21

oz. gold, 3.05 oz. silver, 3.0% lead and 3.0% zinc. It lies below 1070-Level in the B.C. Silver sector and has been developed on three sides. 10-B stope above it has been drawn empty and the stope pillars removed. The bottom has been undercut on 560 Sub-level, chutes established, and a raise driven to the floor of 10-B stope. The ore would have to be trammed on 560 sub-level, dropped to 6-level, trammed on 6-level and hoisted to 4-level. A temporary sill would have to be left below 1070-Level.

10-R Stope (1007 A Raise):

This reserve is shown at 1022 tons assaying 0.03 oz. gold, 3.80 oz. silver, 6.6% lead and 4.9% zinc. It is located above 1070-level in the B.C. Silver sector and consists of a raise, driven to 1350-level between May and September 1952. Ore was intersected in six diamond-drill holes in the vicinity of the raise, indicating a much larger tonnage than shown on the reserves. A sub-level was collared half-way up the raise in 1952. This ore would be handled by tramming 3000 feet on 5-level and hoisting to 4-level.

12-S Stope (Easterly):

This block is shown as a "possible expansion" estimated at 2000 tons assaying 0.40 oz. gold, 0.80 oz. silver, 1.3% lead and 2.1% zinc. It consists of a raise driven from 1250 sub-level to 1350-level in the Sebakwe sector, and a small stope started from the raise in November, 1952. This was still being slashed out in February, 1953. A large tonnage has been blocked-out, but has not been undercut and is not all shown on the reserve estimates. It lies immediately below 13-R stope, which contains several large sill-pillars of probable ore-grade. Ore would have to be trammed on 1250 sub-level, trammed 5900 feet on 5-level and hoisted to 4-level.

(c) PILLAR RESERVES, PREMIER SECTOR:

2-1 -- 3-G Sills:

Shown at 1661 tons assaying 0.44 oz. gold, 2.28 oz. silver, 1.5% lead and 2.0% zinc, these reserves include a small expansion area out-

lined by diamond drilling at the east end of 3-G stope, on 2-level in the Main Northwest Zone. This was being developed in January, 1953, and is reached from 2-level portal or by 44-Raise underground. Ore is dropped through stopes to 4-level.

3-R (Top) Sills:

These sills contain 460 tons assaying 0.46 oz. gold, 2.75 oz. silver, 1.5% lead and 2.0% zinc. The area adjoins 3-G stope and was temporarily inaccessible. It was recently being prepared for long-hole drilling.

41 Raise at 2-level:

2260 tons, assaying 0.24 oz. gold, 1.00 oz. silver, 1.5% lead and 2.0% zinc, are listed for this block surrounding the top of 41 Raise. The raise was unsafe, so this block was not examined below 2-level. Ore-formation was noted on the level. This is relatively low-grade ore, but as the raise is vertical and bottoms on 4-level, it could presumably be extracted inexpensively.

3-H -- 4-1 Sills:

These sills are estimated at 1200 tons assaying 0.40 oz. gold, 2.00 oz. silver, 1.5% lead and 2.0% zinc and include a pillar at the east end of 4-1 stope adjacent to 41 Raise. The area was inaccessible due to missing ladders on 3-level and cascading water in 41 Raise. Access via 44 Raise on 3-level was blocked by sill-removal. This block was being actively developed for extraction in February 1953. The ore would be dropped to 4-level either in 41 Raise or through 4-1 stope.

3A - 3D - 43 - 4F PILLARS:

This is a composite block of sills and pillars, on 3-level near 42 Raise, aggregating 8790 tons with good gold and silver values and moderate percentages of base metals (please see appendix for assays). The 3-level sills have been removed on either side of it and access is

via 44 Raise from 4-level or 2-level. The sills immediately to the east were extracted in February, 1953, and this broken ore is now in 4-FE stope available for milling. Calculations from cross-sections indicate that this block should contain about 12,000 tons, so additional ore would probably be obtained in mining it. Once the decision had been made to abandon this part of the mine, this ore could be dropped directly to chutes opening on the Main Haulage level, whence it could be trammed 1500 feet directly to the mill. A number of small stopes on 290 sub-levels, on the footwall side of this block still contain some broken ore (not shown in reserves) and one compartment of 42 Raise is full of broken ore, so this block should not be mined without prior investigation of the surrounding areas.

4A - 5B Sills:

These sills are shown at 1000 tons assaying 0.34 oz. gold, 3.57 oz. silver, 2.0% lead and 3.0% zinc. They are located on 4-level at the junction of the Main Northeast and Northwest ore zones and are among the largest stopes in the mine. These stopes, however, have been deliberately filled with waste and only a small proportion of the pillars, originally estimated at 11,400 tons, can now be economically recovered. Methods for the full recovery of these pillars were suggested in a thesis by A. Kirby, Jr., in 1943, but, as far as known, no attempt was made to mine them. The 1000 tons shown in the reserves, and possibly a little more, could probably be obtained by dropping the ore through 502 Raise to 5-level and then hoisting it to 4-level.

(d) PILLAR RESERVES, SEBAKWE SECTOR:

12-L -- 10-L Sills:

These relatively low-grade sills, at the west end of 1240 sub-level, are estimated at 542 tons assaying 0.32 oz. gold, 1.18

oz. silver, 0.9% lead and 1.4% zinc. Upon recovery, this ore must be trammed 5500 feet on 1070-level and then hoisted to 4-level. While the remaining sills contain at least an additional 1000 tons, they must be even lower in grade and, in view of the long haul, would probably be sub-commercial. Extraction would be relatively simple, however, and in consideration of the length of the stoping above and below the level (which must have been ore), these sills are mapped as possible expansions, pending accurate determination of grade.

(e) PILLAR RESERVES, WEST ORE ZONE:

12-J -- 10-D Sills:

1610 tons, assaying 0.27 oz. gold, 1.90 oz. silver, 2.0% lead and 3.5% zinc, are shown as reserves in these sills, which are near the western end of 1220 sub-level. Access is via 1008 A Raise from either 1070-level or 1350-level. Some of the pillars below the sub-level will require selective mining as they contain low-grade and waste areas. These reserves lie at the junction of northeast and northwest faulting and cover a triangular area in plan. When broken, the ore can be drawn from the 10-D chutes, trammed 2700 feet on 1070-level and hoisted to 4-level. The sills to the east of these reserves were extracted in December 1952, and February, 1953. This broken ore is now in 10-D stope, available for milling, and some of it is very rich in galena.

10D - 9A - 9B Sills:

These sills form an arcuate zone on 1070-level at the junction of northeast and northwest faults and contain 5,202 tons assaying 0.45 oz. gold, 2.31 oz. silver, 2.0% lead and 3.5% zinc. The ore dips at about 45 degrees and a number of support pillars have been left in the stopes above and below the level. It is not known whether or not these contain ore. Some of this ore may require scraping but, in common with all the remaining ore in the West Ore Zone, it must be transferred

to 790-level, trammed 2200 feet and hoisted to 4-level.

9D SOUTH (Top) SILL:

9D Stope is a pipe-like, footwall-type ore shoot with a steep plunge to the northwest. The top of the stope is 20 feet below 1070-level and the sill between the stop and the level, as blocked-out, contains 1772 tons assaying 0.30 oz. gold, 1.09 oz. silver, 0.7% lead and 1.8% zinc. This block closely conforms to the shape of 10-K stope, immediately above the level. A block approximately twice this size is indicated, however, by a series of eight holes drilled from the top of 9-D stope. The stope was visited but it was impossible to corroborate the drilling visually, so this "expansion" was not taken into reserves.

9D - 7A Sills:

This is the downward continuation of the 9D ore shoot. The sills on 940 sub-level are triangular in plan and contain an estimated 2265 tons assaying 0.42 oz. gold, 1.73 oz. silver, 2.0% lead and 3.0% zinc. This is in addition to the pillars removed in January and February 1953.

7-B PILLARS:

7-B is the easternmost large stope on 790-level, in the B.C. Silver sector. It dips about 45 degrees and several support pillars have been left. The reserves are partly in these pillars and partly in the sills above the level. When examined, these pillars were coated with grime but the mineralization seemed to be erratic. Reserves are listed at 659 tons assaying 0.13 oz. gold, 2.80 oz. silver, 4.0% lead and 5.0% zinc.

(F) BROKEN ORE RESERVES:

An estimated 3000 tons of broken ore was discovered during the examination, although none was listed in the Silbak reserves. One chute in 42 Raise was filled for 200 feet with ore, apparently

transferred from stopes above 3-level, and amounting to about 500 tons. The bottom of 4-FE stope contained about 1500 tons derived from the 3-level sills blasted in February, 1953. All this ore can be drawn from chutes on 4-level and trammed 1500 feet directly to the mill. The chutes at the bottom of 10-D stope, in the West Ore Zone, were full of high-grade lead ore, derived from sills blasted on 1220-level in February, 1953, and estimated at 500 tons. Chutes throughout the mine contained small tonnages of broken rock, of which 500 tons is estimated to be ore. No facilities were available for bulk sampling, so the grades could not be determined and the mine average is assumed for this reserve.

7. POSSIBLE EXPANSIONS:

As previously mentioned, Silbak's policy has been to show as reserves only the smaller, narrower, higher-grade sections and then to increase these by expanding into the lower-grade surrounding areas. Due to the erratic nature of the ore, it is difficult to estimate these expansion areas quantitatively. There are isolated high assays and diamond drill intersections adjacent to many stopes and much of the recent mining has been conducted in these areas. Subject to further study of assay values, the following possible additional ore is suggested by this examination of the reported reserves:

10-R Stope	2500 tons
12-S Stope	2000 tons
13-R Pillars (above 12-S Stope)	400 tons
3-A--3-D -- 4-B -- 4-F Pillars	3600 Tons
10-L -- 12-L Sills	1000 tons
9-DS (top) Sill	1500 tons
	11,000 tons

As a further indication of possible future production, the following areas (not shown in reserves) were being mined during late 1952 and early 1953, just prior to closure:

12-R STOPE:

This stope extends above 1240 sub-level, to the east of 12-L stope, in the Sebakwe sector. Development maps show that it was being mined during January and February, 1953, with assay values up to $32.50 per ton.

13-X STOPE:

Extending above 1350-Level, in the B.C. Silver sector, this stope was mined in December, 1952, with values up to $33.50 per ton.

15-H STOPE:

This stope, above 1525-level, in the B.C. Silver sector, was being mined in February, 1953, with values up to $28.00 per ton.

9-F, 9-J, 9-K and 9-H STOPES:

These stopes all lie above 940 sub-level and below 1018 Drift, in the West Ore Zone. They are in more or less continuous alignment along the northwest shearing for over 300 feet and contain high lead-zinc values. They were being intermittently stoped up to February, 1953, and a small lower-grade reserve was shown in 9-J stope. On 1018 Drift, however, above the stopes, channel sampling over a length of 194 feet and a width of 8.5 feet averaged (in 1947) 0.14 oz. gold, 2.79 oz. silver, 6.6% lead and 5.1% zinc. It is believed that some ore still remains in this area, as recent development maps show some values up to $49.00 per ton.

Diamond drilling to the north and south of this northwest zone indicates more expansion possibilities. About 150 feet to the north of 9-H stope, drill hole No. 2016, at the top of 782-D Raise, intersected 75 feet of mineralization assaying 0.09 oz. gold, 1.12 oz. Silver, 1.9% lead and 6.4% zinc. About 250 feet to the south of 9-F Stope,

below 12-K Stope on 1220 sub-level, drill holes 1501 and 1723 intersected mineralization with fair gold and variable lead-zinc values. These are plotted on the same map as the 10-D — 12-J Pillars. About 100 feet of drifting and 65 feet of raising would be necessary to explore this area.

290-C Stope, above 290 sub-level in the Premier Sector, represents a doubtful additional reserve. This was a vertical cylinder of ore under the footwall of 2B and 3D Stopes. It originally extended upward to 110 sub-level and contained an estimated 52,000 tons of ore assaying 0.18 oz. gold and 5.36 oz. silver, with no mention of lead or zinc. It was developed, drilled and blasted as a single block (about 1938) and reportedly failed to break below 2-level. If so, about 15,000 tons of low-grade ore probably remain below 2-level. This area, on 2-level, is choked with broken rock that appears to be mainly waste, while the draw-points on 250 sub-level below are empty. The walls are silicified and contain pyrite and a little sphalerite but sampling would be necessary to determine their grade. As this block probably contains unexploded powder and is close to the 42-Raise pillars, it should be investigated prior to extracting these pillars.

Base-metal mineralization was noted on the walls and backs of many of the drifts and no doubt if the walls were washed many more such areas would be found. In some places, such as 711 drift on 790-level, these had been partially explored by back-slashing or short raises. 20-scale assay plans of the entire mine are available, although these do not generally show lead-zinc values. In general, the walls have been explored for 200 feet on either side of the drifts by diamond drill holes spaced at 200-foot intervals. A thorough study of these records, considering current base-metal prices, could result in the discovery

of more ore.

8. CONCLUSIONS:

(1) Remaining Silbak reserves are conservatively estimated at slightly greater than 37,000 tons, of which 27,000 tons represent level pillars. On the reasonable assumption that 25,000 tons of additional stoping ore could be obtained from the many potential expansion areas, total reserves would amount to one year's production at a milling rate of 200 tons per day. In conjunction with the Premier Border reserves of approximately 71,000 tons, two year's production would be available. Within this time limit it would be necessary to find more ore. Indeed, after one year it would probably be necessary to start extracting pillars as this is a tedious process requiring considerable preparation. This means that, unless more ore is discovered in some quantity within the first year of operation, the decision must be made either to strip the mine or to again stop production until more ore has been developed.

(2(In order to expedite the development of all potential expansion areas and thus increase the stoping reserves, a thorough study of all the mine development maps, assay plans and diamond drill records should be made by an experienced mining engineer prior to reopening of the mine. This should be followed as soon as possible by underground examination, re-sampling, drilling if ncessary and the development of indicated areas.

(3) All exploration to date has consisted of the strict application of engineering and mining techniques to a geologic theory of ore deposition evolved in 1925 by A.H. Means and modified very little since. This was, briefly, that the mineralization was related to junctions of northwest and northeast shears which were controlled, in turn, by the relative competency of the rock-types. The controlling

rock was designated the Premier Porphyry. This theory was successfully applied and, in time, the Main Ore Zone was traced to its greatest lateral extent of 5500 feet and to its greatest depth of 1100 feet. Exploration was subsequently intensified within these limits and the West Ore Zone was discovered. This proved to be a smaller replica of the original zone except that the Premier Porphyry was absent, which indicated that faulting, rather than rock-type, was the predominant control. The West Ore Zone has now been traced to its apparent limits and it has become imperative to critically review the geologic"controls" to determine (if this is still possible) where to look for more ore.

(4) An examination should, therefore, be made by a competent geologist and should consist primarily of a thorough correlation-study of the geologic mapping to date, especially of the techtonic pattern and its relation to ore shoots, dykes and rock-types (where feasible). This should later be supplemented by detailed underground mapping and possibly re-logging of drill cores, as required. Consideration should be given to the possibility of a repetition of the West Ore Zone at depth to the northwest, to the "limiting" implications of the Purple-Tuff theory and to the relative possibility of the Main and West ore-bodies recurring at depth by a dip-reversal of the northeast shearing (due, for example, to "horsetailing" or a change in rock competency). The study of the record should begin at once and diamond drilling to test one or more of these possibilities should start as soon as underground conditions are suitable. An experienced geological assistant with some engineering training, would be required as soon as the underground work commenced.

Respectfully submitted,

W. N. PLUMB, P. Eng.

PART III

SILBAK SURFACE EXPLORATION

by

W. N. PLUMB, P. Eng.

CONTENTS

S I L B A K
SURFACE EXPLORATION

Summary:

Silbak claims occupy an area of about five square miles north of the Alaska boundary, between Bear River Ridge on the east and Cascade Creek on the west. The topography is rugged and the climate mild, with heavy precipitation. Due to the heavy snowfall and the influence of near-by glaciers, field exploration is usually possible only from July to September, inclusive.

The area is underlain by green and purple tuffs and breccias of the Bear River formation, which are on the east limb of a northerly-striking regional syncline. These are intruded by the Premier Porphyry, the host-rock for the Silbak orebodies. The exact shape of this stock-like body is unknown as its borders are indeterminate. It is partly capped by the purple phases of the tuffs. None of the orebodies in the mine extended above the base of the purple tuffs, which strike northerly and dip 17 degrees west. The green tuffs beyond the southern limit of the porphyry have been drilled, with negative results. Drilling to the north-east of the mine indicated that the porphyry was fingering out but did not limit it.

A self-potential geophysical survey was made, between August 3rd and 7th, 1955, by Dr. A.R. Clark, at the south end of a favorable tongue of Premier Porphyry on the Mist Fraction, two and one-half miles east of the mine on the upper slopes of Bear River Ridge. An anomaly 1100 feet long was found and drilling was recommended. A camp was established beside the anomaly and, in September, five holes, totalling 518 feet, were drilled. The first three holes reached depths of more than 100 feet beneath the anomaly and intersected oxidized fracture zones (but no iron-sulphides) vertically below its centre. One hole penetrated a zone containing black tuffs and fragments that may be an altered inter-

bed of argillite. It was concluded that the drilling effectively disproved the existence of ore beneath the anomaly, which was probably due to fracturing along which some graphite must have been introduced.

It is recommended that a geological survey be made of the claims in the northern part of the area, preceded by a study of the surface drilling and underground structure at the extreme northeastern end of the mine and followed, if warranted, by geophysical work as a guide to future drilling. Finally, surrounding properties should be examined for their base-metal potentialities.

2. CLAIMS:

The 85 claims shown on the accompanying MAP OF PROPERTY occupy about five square miles on the western slopes of Bear River Ridge and extend from the edge of the glaciers at 4500 feet elevation to the forks of Cascade Creek, 4000 feet below (an average slope of 20 degrees). Parallel to the ridge, they extend northward from the Alaska boundary towards Long Lake. Ten of these are reverted Crown Grants acquired by lease to protect the possible southward extension of an anomaly discovered this summer on the Mist Fraction, in the southeast corner of the area.

3. PHYSIOGRAPHY:

Bear River Ridge extends due north from the Portland Canal at an average elevation of about 5500 feet. Permanent ice covers its crest and fills small cirques on its western side, the source of many small streams that flow turbulently down the mountainside and converge on Cascade Creek. Precipitous, near-vertical cliffs form the upper western side of the mountain. Below these, a series of parallel northerly-trending ridges step-down at successively lower elevations toward the valley floor. Between the ridges are narrow depressions containing glacial drift and swampy vegetation. Forty degree talus slopes, covered by heather and moss, flank the base of the cliffs and overlap the ridges.

Below elevation 3000, the mantle of drift gradually becomes thicker until the ridges are obscured and only isolated cliffs outcrop. Vegetation progressively changes from stunted alpine fir and light brush on the upper slopes to heavily-wooded typical rain-forests, choked with undergrowth, near the valley bottom. In general, drift and thick vegetation obscure the southwestern half of the claim area (the part occupied by the mine and plant) while the northeasterly claims are in the alpine region.

The climate is mild, with abundant precipitation and very little direct sunshine. The temperature seldom falls below zero or rises above 90° F. Seventy five to 100 inches of rain falls between June and October and 40 to 60 feet of snow is recorded at the mine during the winter months.

The field season is short, due to the heavy snowfall and the influence of the glaciers. In general, most of the claims should be clear of snow during July, August and September although, this year, snow did not leave the mine area until mid-July, while fresh snow and freezing temperatures stopped work on the Mist Fraction (elevation 3850) by the end of September.

4. GEOLOGY:

The rugged terrain and extensive overburden make detailed mapping of the geology difficult and this has only been attempted locally. The Salmon River area was mapped regionally by J.J. O'Neill, S.J. Schofield and G. Hanson in 1919 and 1920. They show almost the entire claim area to be underlain by volcanic tuffs and breccias of the Bear River formation, intruded by sills and an apophysis of the Coast Range granodiorite. The breccias are composed of angular, purple and green masses of andesite in an andesitic matrix and are conformably overlain by sheared, massive, fine-grained green tuffs containing purple bands at

irregular intervals. The presence of argillites and occasional stratification is mentioned as evidence of partial sedimentary origin. In 1925, A. H. Means named (and outlined by reconnaisance methods) the Premier Porphyry intrusive shown on the accompanying map. This has been variously described as "stocklike" and "sill-like" and its exact shape is indeterminate as its border phases are usually indistinguishable from the enclosing green tuffs, especially when both are sheared. It is a highly altered, grey to light green, massive rock containing phenocrysts of orthoclase and quartz. It is the host rock for all the orebodies in the Premier mine except those in the West Ore Zone. It was described by G. Hanson, in 1935, as a stock 2 miles in diameter containing numerous large inclusions of sheared tuffs. In 1942, E.G. Langille determined that the lenticular Purple Tuff phases of the green tuffs were confined to the upper horizons of this formation and that no orebodies had been found above them. He mapped the outcrops of two of these bands to the north of the mine and found that they had a strike of N 17° E and a dip of 17° NW. Outcrops in the vicinity of Camp 4 were mapped in more detail by R.H. Seraphim in 1954, and the porphyry-purple tuff contact on the Mist Fraction was mapped by the author this summer. This is the full extent of the surface geological mapping recorded to date.

Structurally, these rocks form part of the east limb of a regional syncline and are believed to strike approximately north and dip gently west towards the Coast Range batholith. As the tuffs and breccias are so poorly stratified, practically no evidence of attitude can be determined locally. Aerial photographs show a distinct lineation to the north-northeast caused by the parallel rock ridges mentioned above, but these may be due to original rock-structure, faulting or

(most probably) glacial grooving. The Purple-Tuff theory suggests that the Premier Porphyry was a series of dyke-like intrusions and that most of these were originally capped by the westerly-dipping purple tuff bands, the present large outcrops of Premier Porphyry being due to subsequent erosion. As orebodies were found within the porphyry but below the purple bands, the logical place to prospect would be in the vicinity of the contact between these formations by (a) surface examination of the porphyry or (b) drilling through the purple tuffs into the underlying porphyry (if the dip of the contact could be determined).

As the claim map shows, the southern porphyry-tuff contact has been approximately defined and considerable surface drilling done along it. No mineralization of any consequence was found. Another series of holes was drilled "within" the porphyry to the north, without results. The contact, here, is poorly defined, however, and some of the holes intersected purple tuffs. To the north of this point the geology has not been mapped, so the distribution of the tuff and porphyry is unknown. This appears to be the logical area in which to concentrate future exploration. The long tongue of porphyry extending into the Mist Fraction was explored this summer and is the subject of this report.

5. THE MIST ANOMALY:

(a) Geophysical Survey:

The decision to make a trial geophysical survey on the Silbak claims was influenced partly by the fact that most of the orebodies apexed before reaching the rock surface and partly by the negative results obtained from previous extensive surface diamond drilling and prospecting. Discussions at the mine with Dr. A.R. Clark, Physics Professor specializing in geophysics at the University of British Columbia, revealed that electrical methods would be the most suitable for prospecting for blind orebodies in the Premier area, as the effects of topography would seriously interfere

with magnetic or gravimetric methods. Both "resistivity" and "self-potential" methods were considered and it was felt that, if an area could be selected in which there was a chance of finding an orebody near the surface, the self-potential method would be the most suitable. Self-potentials are due to small earth currents, spontaneously generated by massive bodies of iron-sulphides, at or near the surface, when oxidizing due to the action of surface waters. They can be detected by the use of sensitive galvanometers, any reading of more than 175 millivolts being considered anomalous and worthy of further investigation. Bodies of graphite and, in some cases, black argillites also cause these self-potentials, however, and the method is not applicable to sedimentary regions for this reason. The other limiting factor is depth: Dr. Clark's extensive experience with this method in the Canadian Shield had shown that readings could be obtained through a maximum of 75 feet of overburden or 25 feet of solid rock. An area that seemed to satisfy all these conditions (and was also geologically favorable) was shown on the Silbak geological maps, a tongue of Premier Porphyry striking southeasterly for 3500 feet across the Leslie, Mahood, Texada and Mist Fractional mineral claims. It was not capped by the purple tuffs; it should not contain graphite; and it was the rock-type in which all the massive-sulphide orebodies in the Premier mine had been found. Accordingly, Dr. Clark was retained to make the survey.

The survey was made between August 3rd and 7th, 1955, by Dr. Clark, with the assistance of the author and four additional men. A preliminary test was made across a prominent gossanized outcrop above the stoped area near No. 2 Portal and the method proved very satisfactory. As a check, a second test was made over an area known to be barren and

only low readings were obtained. Three days had been previously spent in locating a suitable route to the area, resulting in the discovery of an old pack-horse trail leading directly to the Mist Fraction. The area on which the anomaly was subsequently found is a narrow alpine plateau, 3400 to 4000 feet in elevation, at the base of steep bluffs, and two and one-half miles east of Camp 4 and some 2000 feet above it. Below the cliffs, talus and heather-covered drift almost completely obscure a series of low ridges that trend north-northeast and contain isolated outcrops of purple tuffs and Premier porphyry. The survey was run on compass bearings and later tied in by compass and chain. Almost at once anomalous readings were obtained and found to extend to the southeast rather than to the northwest, as might have been expected. An anomaly was found, as shown on the accompanying map, extending over 1100 feet in south-southeasterly direction, with self-potentials of 175 millivolts or more. This was very encouraging: geologically, it seemed to indicate an orebody in porphyry beneath a shallow capping of purple tuffs; geophysically, it indicated to Dr. Clark greater-than- average probabilities, considering the magnitude of the self-potentials and their longitudinal and lateral persistence. Drilling was, therefore, recommended by both Dr. Clark and the author.

As the anomaly was not "closed" to the southeast, additional claims were leased to protect a possible extension in this direction. Subsequently, the author, assisted by Mr. G.J. Garrison, carried the geophysical survey farther in this direction and established limits to the higher readings.

(b) Surface Drilling:

As soon as authorization was received, preparations were made to establish a tent camp and drill the anomaly. In consideration of the physical factors and the lateness of the season, it was decided to use an X-Ray drill, which was readily available. In 19 days under the very

able direction of Mr. Willox, 1000 feet of new trail was built (in thick underbrush around the Glory Hole), tents and supplies secured, pack-horses obtained and a camp established adjacent to the anomaly. Between September 3rd and 28th, five holes, totalling 518 feet, were drilled. These are plotted on the map, and logs and sections accompany the report. The results are discussed below. Four drillers were employed, on two 12-hour shifts, until freezing water supplies forced the discontinuance of the night shift. The first three holes reached depths of more than 100 feet below the anomaly, the fourth had to be discontinued due to overburden and the fifth had only reached a depth of 56 feet when the program was stopped by the advent of winter conditions. The drill and equipment were packed-out and the camp was abandoned on October 1st.

(c) Results:

While the last two holes would have been desirable as confirmation, the first three disproved the existence of any commercial orebodies beneath the anomaly. This was disappointing, but not entirely unexpected, as the ratio of success to failure in drilling anomalies is never very high. Holes M-1 and M-2 penetrated the porphyry and then passed into purple tuffs. (This extends the porphyry 500 feet farther than indicated by surface mapping). Both intersected fractured zones within the porphyry, containing limonite but nc iron-sulphides. In addition, Hole M-2 went through a 50-foot zone characterized by black tuffs, or green tuffs with black fragments, generally fractured and iron-stained, and containing a 12-inch band of quartz in which hair-like stringers of graphite were seen. This may represent an altered band of argillite interstratified with the tuffs. Hole M-3 was entirely within green and purple tuffs and ended in an intensely fractured and iron-stained zone. In all three holes the fracturing was almost directly beneath the centre of the anomaly. In discussing these results with Dr. Clark, it was concluded that (1) the

anomaly was probably due to near-vertical fracturing along which some graphite must have been introduced and (2) the drilling had effectively disproved the existence of ore beneath it.

6. CONCLUSIONS:

(1) Surface exploration on the Silbak claims has consisted largely of reconnaissance and diamond drilling, especially to the south and east of the mine. While these areas are capped by the Barr River tuffs, in which little mineralization is likely to be found, the claims to the north should be, to some extent at least, underlain by Premier Porphyry and have not been eliminated as prospecting ground. From the Mist Fraction, the area to the north could be observed and, while there is thick bush in the vicinity of the Leslie claims, the East Fork of Cascade Creek traverses a broad alpine valley that is fairly clear of vegetation. Outcrop mapping should be possible there. In conjunction with a study of the underground structure and the previous drilling at the extreme northeast end of the mine, surface geological mapping might serve to define the northern limits of the porphyry-tuff contact. According to W. H. White, drilling on the Leslie M claim indicated that the porphyry was "fingering out" to the north, but its limits have not been defined.

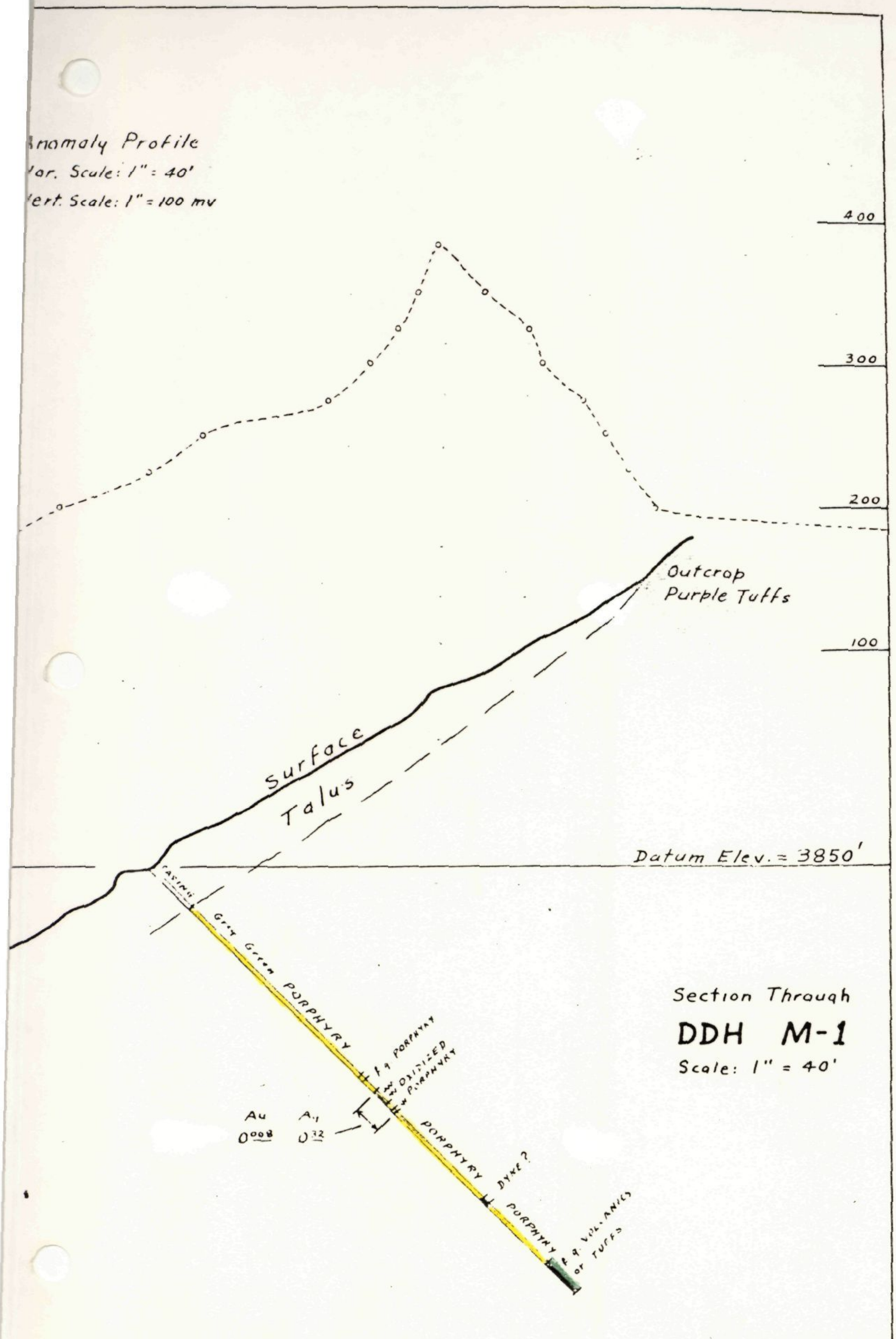
(2) In view of the fact that good results were obtained in testing the gossan above the mine, the self-potential method has not been eliminated as a useful prospecting tool in the Premier area. Both this and the resistivity method are readily adaptable to the topographic conditions encountered. Both are influenced by graphite, however, so their use is now somewhat limited. Anomalies could be checked prior to drilling by the use of electro-magnetic methods, although this requires very accurate surveying and is difficult to apply in rugged territory. The claims to the north of the mine should, therefore, be mapped geologically and

this should be followed, if warranted, by geophysical surveys as a guide to future drilling. It is important that this area be thoroughly explored before abandoning the mine.

(3) The Salmon River Valley contains widespread mineralization, much of which is probably related to common geological controls. If the study of the Premier geology should result in some hitherto unsuspected control, such as a "new" techtonic pattern, many of the surrounding properties could probably be re-examined with profit. In any event, many of these, including Premier Border ground, should be studied for their base-metal potentialities as the history of the region indicates that lead, zinc and copper have always been subordinated to the gold-silver values. In any such study, stereoscopic examination of the excellent aerial photographs available should prove useful in applying known controls. Silbak ground should, of course, be thoroughly examined before outside properties are considered.

Respectfully Submitted,

W. N. PLUMB, P. Eng.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Vert. Scale: 1" = 100 mv
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200
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Datum Elev. = 3850'
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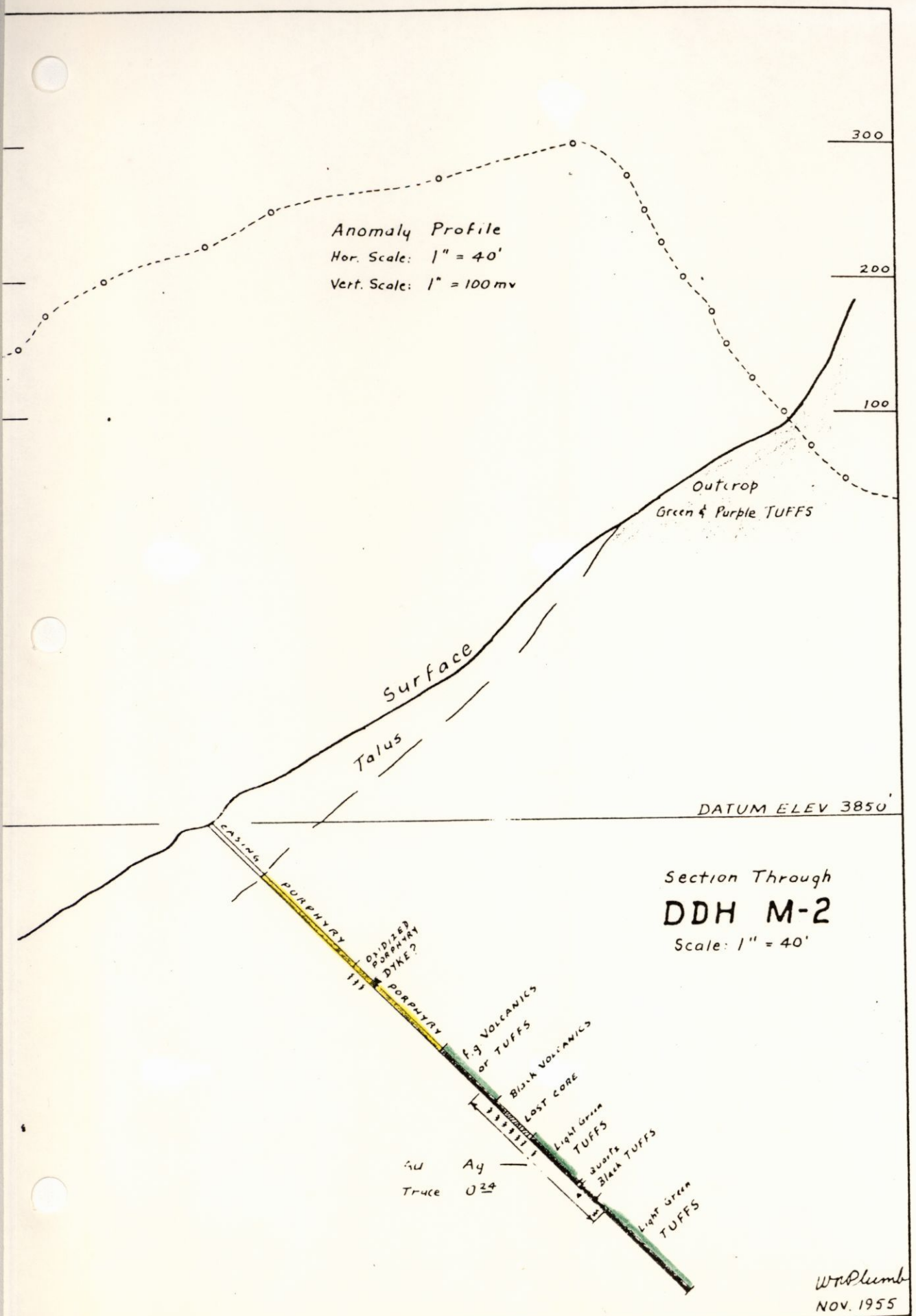
PORPHYRY
OXIDIZED PORPHYRY
Au
0.008
PORPHYRY
DYKE ?
PORPHYRY
VOLCANICS or TUFFS
Section Through
DDH M-1
Scale: 1" = 40'
NOV 1955

Appendix V


Anomaly Profile
Hor. Scale: 1" = 40'
Vert. Scale: 1" = 100 mv
300
200
100
Outcrop
Green & Purple TUFFS
Surface
Talus
DATUM ELEV 3850'
CASING
PORPHYRY
DIVIDED PORPHYRY DYKE?
PORPHYRY
f.g VOLCANICS or TUFFS
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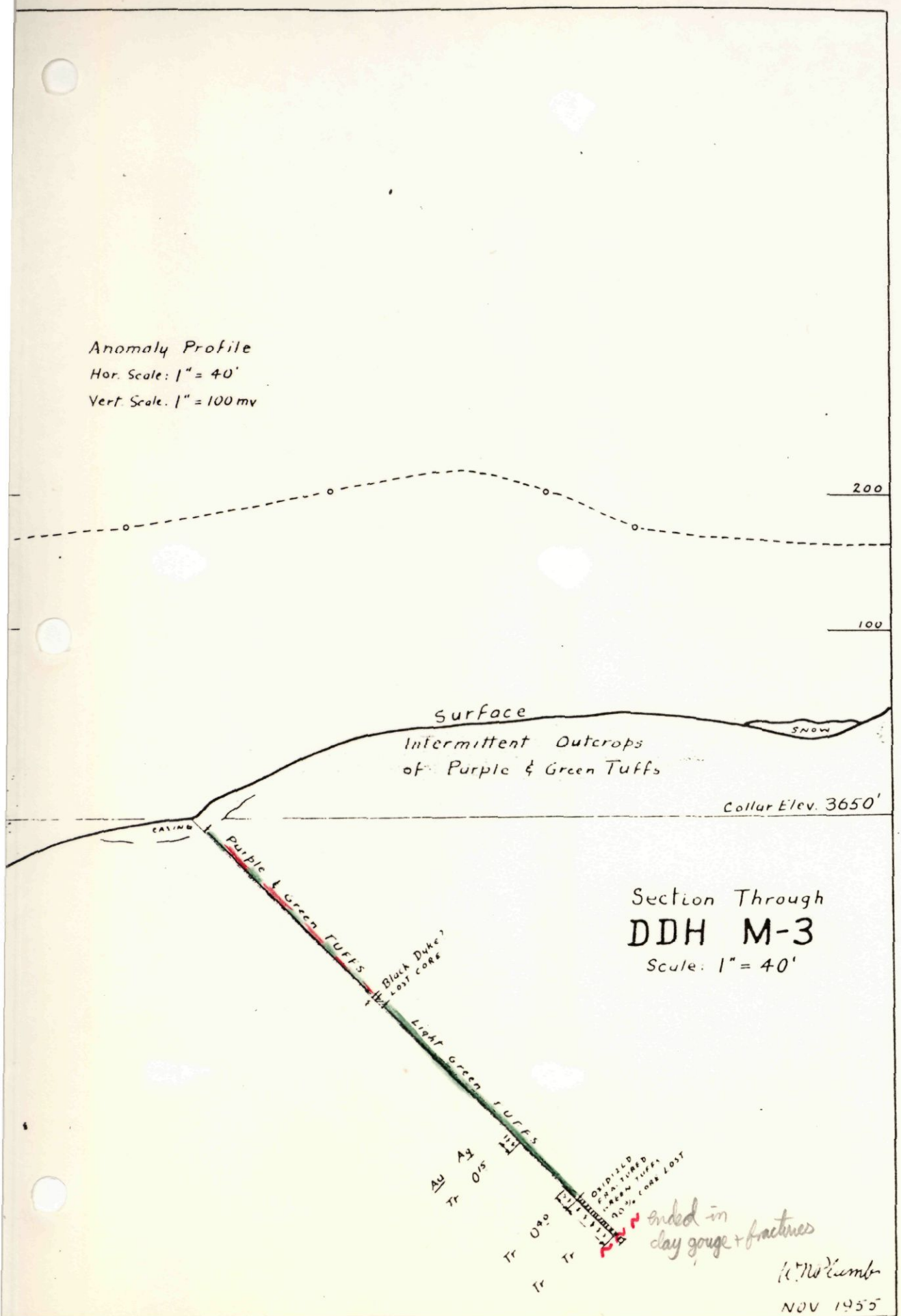
Section Through
DDH M-2
Scale: 1" = 40'
W.H. Plumb
NOV. 1955

Appendix VI



Appendix VII