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REPORT

NAME AND LOCATION OF MINE

Kathleen-Margaret (K-M) Copper prospect at Latitude 63-17 N., Longitude 146-35 W., west of the lower end of Maclaren Glacier in the Denali Mining District, Talkeetna Recording District, Alaska. The claims are in Section 2, 3, 10 and 11, T 19S; R 6E, Fairbanks Meridian.

OWNERSHIP

16 unpatented lode mining claims are owned by the Maclaren River Copper Corporation of Fairbanks, Alaska and are under lease and option to Thomas E. Slick. Title and existing agreements were not checked.

METALS

Copper and gold.

SUMMARY

5% copper ore with about $2.00 in gold and silver has been developed in a portion of a quartz vein in limestone. Development by drifting, crosscutting, diamond drilling, percussion drilling and surface trenching has disclosed an oreshoot about 7 1/2 feet wide and 35 feet long with an indicated development potential of about 25 tons per vertical foot over a known vertical distance of about 260 feet, a total of 6,500 tons.

It is doubtful if there are any other oreshoots with surface exposures within 3,000 feet from the original discovery.

The northwesterly striking band of limestone, with some dolomite, may be a "window" in a thrust fault and a dioritic intrusion near the westerly property boundary may be emplaced within the thrust plane. Northeasterly shearing, especially at its intersection with easterly trending shear zones, may carry copper mineralization.

The geology would appear to be favorable for the existence of larger orebodies than have been discovered but it appears than any that may exist will be found below a capping of greenstone or glacial drift.

CONCLUSION AND RECOMMENDATION

The known oreshoot is too small and too low grade to sustain a mining operation. While it is possible that this shoot represents leakage from a more important orebody, it is also possible that it is the root of an

orebody now eroded or that it is simply a small chimney-like body at a favorable shear intersection. The risk is high and no development at depth is recommended at this time.

However, the geological setting is intriguing, the magnetometer survey indicates that the presumably favorable limestone is fairly extensive and is cut by northeasterly shearing, and some copper mineralization is rather widespread. These facts suggest that an electro-magnetic survey by competent geophysicists might disclose a massive sulfide orebody.

Although the high risk involved in any development within an area that has yet to produce an operating mine must be accentuated, it is felt that a moderate expenditure of about $5,000 for an E-M survey is justified.

The known rock types within the area studied are such that anomolies caused by sulfides should be recognized without great difficulty and that drilling of these anomolies might be undertaken with some reasonable assurance of success. However, carbonaceous limestone has been found about five miles west of the K-M and this could give misleading results if it also occurs within the limestone beds at the K-M.

EXAMINATION

I arrived on the property, with a geological assistant, on August 18 and departed on August 30. The weather was bad most of the time - it was eight days before there was a break long enough to make a solar observation for azimuth.

Underground and surface workings were tied to a co-ordinate system by transit-stadia, observable geology was mapped to the extent shown on the attached maps and a magnetometer survey was run over part of the property.

Certain pertinent references, such as the assay results in the trenches and the geochemical survey by Leo Mark Anthony, were not available for study. References used were:

USGS Bulletin 498 by Fred H. Moffit, 1912
GS Circular 332 by Chapman and Saunders, 1954
Alaska Copper Mines, Inc. 1" to 20' map with assay data, no date, copied by E. Fairbanks in 1958
Maclaren River Copper Corporation 1" to 20' map, not dated
Letter of February 14, 1958 from E. Fairbanks to F. S. Pettyjohn, with assay data tied to above map.

DESCRIPTION OF PROPERTY

Location and Climate: The property is located between the elevations of 3,100 feet and 4,500 feet along the west side of the Maclaren Glacier and Maclaren River. This is above the tree line but the surface is mantled with soil and glacial debris. There are rock outcrops along cliff faces and in stream courses.

Rainfall and snowfall are heavy, storms are not infrequent and winters are said to be severe. Normally, snow covers the ground from mid-September to the first part of June. However, underground or open-pit mining can be carried on during most, if not all, of the year.

Rock Types: The principal rock, classed and mapped as greenstone, consists of somewhat altered volcanics. Frequently, these are amygdaloidal but dense varieties are not uncommon. Some members may be classed as olivine basalt, others are less basic. Epidote is common and, near shears that have acted as solution channels, the rock may be altered to chloritic greenstone. Very rarely, fine, native copper was found in the chloritic greenstone.

There is a band of impure limestone that appears to lie under the greenstone, a position that may be due to thrust faulting. The limestone varies in color from gray to dark green or nearly black. The green variety is usually dolomitic. Like the greenstone, the limestone contains much epidote in bands that may be either parallel to or crosscut the bedding.

A highly altered dacite prophyry dike was noted both underground and on the surface. This is interesting since all of the copper shows seen by me on the West Fork of the Maclaren River are closely associated with a similar dike rock (which is fresh at those localities).

There is a diotitic intrusion near the western margin of the property. This rock (megascopically) appears to be composed of plagioclase, pyroxene and hornblende.

At the southerly margin of the diorite there is an exposure of a quartzose sediment that is tentatively classed as hornfels. It is thought that this rock belongs in the upper part of the limestone series and, if so, may indicate a rather large body of limestone underneath glacial debris to the south.

Mine Workings: At an elevation of 4,020 feet an adit has been driven northerly for some five hundred feet; crosscuts have been turned off and there is some drifting on the ore structure. A blind raise extends 100 feet up on a quartz vein.

At the point of discovery the vein has been partially stripped and trenches have followed its course, or its presumed course, for about 1200 feet.

Orebody: Drifting and drilling have disclosed an ore shoot about 35 feet long and 7 1/2 feet wide. The lowest intersection by diamond drill is some 260 feet below the outcrop.

The orebody consists of a quartz vein formed by replacement of limestone and as a fissure filling in greenstone. Where the wall rock is limestone the vein attains widths of as much as 20 feet but it is rarely over a few feet wide when the walls are greenstone. Selective replacement of limestone by quartz is often obvious.

The primary ore mineral is bornite which occurs as fracture filling in the quartz and very slightly as replacement of either limestone or greenstone. Much of the quartz is barren.

Pyrite is rare but one small mass of solid pyrite in quartz is exposed at the original discovery.

Improvements and Equipment: A good camp had been built in 1954 at an elevation of 3100 feet. It is now in disrepair and there has been some theft. Usable buildings are:

13x24 insulated frame house with oil heater; needs roof repair

13x30 Butler building with oil cook stove, tables, sink, storage, refrigerator, h/w tank and heater, cook's quarters, shower, washing machine, toilet. Needs roof replacement.

28x58 Butler building with 10x10 door. Needs repair to structural members bent by snow load.

12x16 tent floor - no frame

13x24 floor of collapsed frame building. Floor usable but no other part of building is salvageable.

At the camp there are:

26 bundles 2'x50' fibre-glass insulation in rolls
Hobart 200 amp welder w/Chrysler Industrial engine. No leads.
Kohler Model SM 21H 4 KW gas-engine driven light plant.
7 steel cots w/mattresses
7 steel folding chairs.

At the adit portal there is a frame building that needs repair of roof and siding. The whole structure, including the outdoor mine trackage is in imminent danger of collapse because the support is being washed away by a small creek. Within this building are:

Chicago-Pneumatic diamond drill w/20 - 10' rods; 13 - 5' rods; 4 - 3' rods; 1 - 10' AX swivel type core barrel; several AX and EX rigid type core barrels, incomplete.
Sullivan E-111 air tugger
Eimco 12B rockershovel
GD 600 cfm compressor w/Caterpillar engine and 5x12 receiver
Stoper
Air driven electric generator
6" blower, electric
14" " "
1 1/2 electric transfer pump
Electric bit grinder (for carbide insert bits)
20 cf mine car
Drill steel and unused carbide insert drill bits of various sizes.

Underground there are:

Pump for diamond drill
Joy drill jumbo with two, shell mounted heavy drifters
20 cf mine car
Air line, track, hose, etc.

No attempt has been made to protect any of the equipment against rust but most of it appears to be usable.

The adit is partially blocked by a small rock fall but otherwise the workings stand well.

RESERVES

Within a vertical distance of 260 feet there are about 6500 tons of ore with an average of a little under 5% in copper and a little under $2.00 per ton in gold and silver. Dilution in mining and milling lo ses would alter the reserve figures to about 7,200 tons with a recoverable copper content of 4% and $1.60 in gold and silver.

POTENTIAL RESERVES

Persons familiar with the property have previously stated their belief that oreshoots similar to the one now developed would be found in an echelon occurrence along the quartz vein. I do not find sufficient evidence to support that belief and consider that similar oreshoots are more likely to be confined to the intersections of the more important easterly and northeasterly fractures. At least two additional intersections may be inferred and are indicated on the 1" to 40' map. Drilling of these might be productive but there is scant assurance that they would make substantial additions to reserves.

The K-M is on the eastern end of a long "copper belt" in which, as pointed out in Appendix A, the geology is somewhat similar to that in which the well known and valuable Kennecott orebodies were found. Inasmuch as the great Jumbo orebody at Kennecott had an insignificant surface showing (but the Bonanza was spectacular) there is some reason to hope that the K-M, or some other part of the "copper belt", contains a large, rich orebody.

In my opinion the known geology does not warrant a drilling program but a search for a large conductor by electro-magnetic methods is justified. A careful study of properly conducted E-M work should indicate if there are potential reserves on the property.

PROPOSED DEVELOPMENT

The magnetic work (see Appendix B) appears to have some value in determining structure and should be continued as it is relatively inexpensive and might make interpretation of electro-magnetic work more reliable.

It is proposed that in 1963 a well qualified geophysical company be instructed to conduct an electro-magnetic survey along the presumed strike of the limestone series from the mouth of Discovery Creek towards the

diorite intrusive. The area of investigation should be about 1500 feet wide and 8000 feet long. Magnetometer work with a rapid reading and not necessarily very accurate instrument should also be conducted.

A study of the geophysical results during the winter of 1963-64 should determine if there are any targets that are worth drilling and give some idea of possible size. It will not pay to search out small conductors such as the developed oreshoot and only those that give some promise of large tonnage should be drilled.

If no strong conductors of apparent large size are found, the project should be abandoned.

If suitable targets are discovered they should be drilled in 1964. Renovation of the camp and road repair would be required.

If the drilling indicates the existence of sufficient ore of sufficient grade the mine should be opened by an adit, possibly drive in limestone, from the 3200 foot elevation.

Although the initial geophysical work will be moderate in cost, possibly as little as $5,000, the total expenditures for development prior to mill construction would almost certainly exceed $500,000.

MINING CONDITIONS

Except in the shear zones the ground stands well and requires little support.

An orebody that is not more than 800 feet below the present adit level can be mined from an adit without pumping problems.

MILLING CONDITIONS

The copper in the quartz vein and all of that seen as minor replacements of limestone or greenstone occurs in bornite with very few other sulfides. There is a little gouge on some of the faults but talcy minerals are not common.

It would seem that the ore is ideally suited to simple, relatively inexpensive milling methods and that recovery should be high. Of course, the oxidized surface ores will give some recovery problems. It is not expected that the oxidized zone will persist to any considerable depth but there is no certain knowledge on that point.

Bornite is an ideal mineral for concentration and there should be no difficulty in maintaining a concentrate grade of 40% copper.

TRANSPORTATION

The property is about 14 miles from the Denali Highway which provides alternate routes to a seaport, as shown below:

To Valdez:

14 miles, incomplete, sub-standard dirt road to Denali Highway.
Requires new bridge, all new culverts, completion and some relocation - probable cost about $100,000 to make all-weather road.

44 miles, fair gravel road, not normally open in winter.
185 miles, all-weather pavement, two lane.
No bulk loading facilities at Valdez, which is rather infrequent port of call for steamers.

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243 miles, all truck, probable back-haul rate, $15 to $20/ton.

To Anchorage:

14 miles, as above
90 miles, fair gravel road, not open in winter.
104 miles to Cantwell on railroad; no loading facilities.

215 miles, railroad to Anchorage docks. Clams and heavy lift equipment available. Port is sometimes closed by ice.

To Seward:

Same as to Anchorage, plus about 105 railroad miles. Good port and fair facilities. Frequent port of call.

Since copper concentrates are a highly desirable back haul for steamers, fairly reasonable rates can be negotiated. There is competing barge and steamer service to the smelter at Tacoma, Washington but the lowest freight rate is to Japan where concentrates can be carried as ballast in vessels loaded with pulp or timber.

Japanese smelting charges are considerably less than those in effect at Tacoma.

POWER

If there is sufficient demand, water power can be developed on the East Fork of the Maclaren River and on Boulder Creek. Power lines would have to cross the badly braided Maclaren River.

For moderate power demands diesel power could be provided at a cost of about $0.035 per KWH.

Coal is available from the railroad belt by trucking from Cantwell or, possibly, by opening the coal beds near Delta Junction (Jarvis Creek). This would require a truck haul of about 135 miles.

TIMBER

There is no local timber and very little suitable timber along the Denali Highway. The best source would be in Prince William Sound by way of Valdez.

WATER SUPPLY

Spray Creek and Discovery Creek probably can supply enough water for a 500 ton per day operation even during the winter months.

OPERATING COSTS

There is no point in preparing a cost estimate for the developed oreshoot. Since it has taken over 800 feet of openings and well over 2000 feet of drilling to develop some 7000 tons of mill feed it is obvious that even if the discovery rate should be substantially improved the development cost per ton of ore would come close to equally the net smelting returns after freight, smelting and marketing charges.

However, it might be helpful to study the possible costs if there should be found sufficient ore to maintain a 500 tpd operation for a period of 10 years, i.e., 1,500,000 tons. If we assume that an orebody of that size or orebodies aggregating that tonnage are found in firm limestone and that development and stope preparation costs will not exceed $2.00 per ton of ore, the mine should be profitable if the average grade is 3% recoverable copper with $1.15 per ton recoverable gold and silver and if the average selling price, adjusted to 1963 costs, is $0.30 per pound of copper.

It is further assumed that present ocean freight rates and smelting charges in Japan will be maintained.

The bornite ore should produce a concentrate that will assay 40% copper, which, after smelting loss, will yield 780 lbs of copper per ton of concentrate.

The value per ton of concentrate is estimated as follows:

Nominal value of 780 lbs. of copper @ $0.30/lb			$234.00
Less:	Sales expense @ $0.035/lb.	27.30	
	Freight, handling, insurance, smelting	35.00	62.30
			171.70
Add:	gold and silver payment, net		15.00
			186.70
Deduct 5% royalty (?)			9.35
Net value of concentrate at mine			$177.35

The estimated cost per ton of ore would be:

Direct labor, supplies and power, per ton of ore	6.00	
Amortization of preproduction and construction costs of $2,500,000	1.70	
Minimum allowance for pre-tax profit and administrative costs, 35% or $2,500,000 per year	5.80	
Cost per ton of ore mined and milled		13.50

The ratio of the net value of the concentrates (which contain 39% paid-for copper) to the above cost per ton is 13 to 1. That is, 13 tons of ore must be mined and milled to provide $177.35 to cover costs and profit in one ton of concentrate. Since the concentrate contains 39% salable copper the mill heads must contain 39/13 or 3% recoverable copper plus $1.15 recoverable gold and silver.

CONCLUSION

There is a geological bet that a sizeable orebody or group of orebodies may be found. If such postulated orebodies contain 3% recoverable copper plus a little more than $1.00 per ton in gold and silver, they should be profitable.

Geophysical exploration has been recommended and it should be noted that 3% copper would be close to the lower limit of detectability for a clean bornite ore in limestone.

Charles F. Herbert
Registered Mining Engineer

A P P E N D I X A

GEOLOGY

Map A gives a general picture of the distribution of the principal rock types: largely greenstone which comprises amydaloidal and dense lava flows; limestone and dolomite in a northwesterly trending band; diorite and hornfels (?).

The limestone beds appear to underlie the greenstone but the presence of amydaloidal lavas which can be formed only subaerially make it doubtful if the limestone is intercalated with the greenstone. However, the base of the limestone has not been seen and it is possible that the limestone predates the greenstone and is separated from it by an erosional unconformity.

It is also possible that the limestone is infolded into the greenstone and that, locally, both have been involved in overturn folding. Considerable effort was made to determine strikes and dips of the beds but only a few measurements are considered to be reliable. These indicate an anticlinal structure that is difficult, but not impossible, to reconcile with overturning.

A somewhat similar problem involving the greenstone and limestone was noted on the West Fork of the Maclaren River but, in that case, bedding was easily discerned.

Tentatively I should guess that the greenstone has been carried over the limestone by thrust faulting along an east-west strike with considerable re-adjustment of the thrust plates by high angle faulting sympathetic to the "profound fault" postulated by Moffit as occupying the valley of the Maclaren River.

The diorite, which is an outlier of intrusions mapped by Moffit southwest of the property, may have been intruded along a thrust plane.

The greenstone is believed to be Carboniferous in age and to be contemporaneous with the Nikolai greenstone of the Copper River valley. Similarly, the limestone (if it is not pre-greenstone in age) is Triassic and probably contemporaneous with the Chitistone limestone of the Copper River valley.

The similarity in rock types and ages and the presence of low temperature copper mineralization in the area under discussion and the area near the famous Kennecott Mines has led to conjecture that Maclaren River deposits may equal those of Kennecott. Geological interpolation over the long distance separating the two areas is doubtful at best, and there are dissimilarities.

At Kennecott the Chitistone limestone lies confomably on the Nikolai greenstone in spite of the difference in their respective ages. At the K-M property the apparent position of the limestone is below greenstone, although it probably lies over another part of the greenstone series. There is a well defined zone in the Chitistone limestone which may be ore-bearing along cross-fold. At the K-M no limestone zone favorable for replacement has been found; cross-folding may and probably does exist but it is complicated by much faulting.

Slight copper mineralization (invariably bornite is present; chalcopyrite is less common) is found on almost all of the northerly or northeasterly striking shear or fracture zones where they intersect easterly shears. This would indicate a very widespread source of copper and the simple form of mineralization over a considerable vertical range would suggest stability of mineralizing conditions for a long time. It would seem that replacement should take place if the solutions should have had access to any beds favorable for replacement by the type of solutions available and at the temperatures then prevailing.

Most frequently copper replacement bodies are formed in the more dolomitic beds of a limestone series. At Kennecott the ores were strictly confined to dolomite and at Kennecott's new property near Kobuk, Alaska the ore is again exclusively confined to dolomite (a primary dolomite breccia).

Dolomite is quite common at the K-M. The lower portion of the exposure west of the portal is a green dolomite and dolomite, with some copper, is exposed just north of the mouth of Discovery Creek.

A P P E N D I X B

MAGNETOMETER SURVEY

A preliminary magnetometer survey was undertaken to see if such a survey would have value in determining structure where surface exposures are poor or non-existent. There was no thought that a magnetometer would give any direct indication of ore since there is no magnetite or pyrrhotite associated with copper mineralization at the K-M.

It was expected that the greenstone beds would have discernibly different magnetic susceptibilities and that the limestone would give a different response than the greenstone. It also seemed possible that hydrothermal alteration of the greenstone might have formed some magnetite from the malfic minerals and so form a guide to solution channelways. It appears that both expectations were correct.

The instrument used was an Arvella "pocket magnetometer" which is fast and simple but is rather insensitive. Readings are taken to 100 gammas and at least two readings were taken at each station. If the readings checked within 100 gammas they were recorded, otherwise additional readings were made. The instrument is affected by moisture and gives erratic highs during rain. Since the weather was bad during the examination over half of the survey was repeated.

Calibration had been made against a Sharpe A-3, which is not a particularly sensitive instrument, so the absolute values recorded may be off by more than 1000 gammas. However, the relative values shown on the map are believed to be accurate within 300 gammas. No monitoring was done but stations were checked on separate days.

Stations were set 50 feet apart on E-W lines and 100 feet apart on N-S lines.

The northwesterly strike of the greenstone became evident from the magnetic readings before it was determined by field measurement. In fact, a persistent joint system had been misinterpreted as bedding and it was some time before a contact between an amydaloidal bed and a fine grained bed were traced out to corroborate the magnetic findings.

The known limestone areas gave a low response, which suggests that the low from 400 ft. to 500 ft. east of the portal may indicate limestone beneath a thin cover of greenstone. Since there is also a steep magnetic gradient about 350 ft. east from the portal and fractured greenstone and some bornite are exposed, the postulated limestone in this area may be ore-bearing.

Other deductions may be made from the magnetic map but it is not felt that any of the results should be interpreted as indicators of ore. They are useful only in assisting in the study of proposed electromagnetic work.

In addition to the magnetic survey shown on the map a traverse was carried from the camp site up Discovery Creek. The results are interpreted as indicating thick greenstone for the first 1,500 feet from the camp (i.e. roughly parallel to the Maclaren River); then 500 feet in which limestone may underlie the exposed greenstone; then westerly up the creek for 1,000 feet in which somewhat erratic readings may show either varying depths of greenstone or faulting; then 200 feet of hydrothermally altered greenstone followed by 600 feet of greenstone and, finally, 500 feet of greenstone overlying limestone. The end point of the traverse was about 700 feet ESE from the portal.