

COPY

THE SALTCHUCK MINE.

*(Alaska Iron & Metals Co.)*

MR 119-2A  
Submitted by  
H.S. Melcon - 1937  
B.H.

LOCATION.

The property is located at the upper end of a land locked, saltwater lagoon, at the head of Kasaan Bay, Prince of Wales Island, Alaska. Ketchikan, the trading center for the area is distant about 45 miles. Barges and small craft can be brought directly to the property at high tide. Transportation therefore, offers no difficulties.

HOLDINGS.

Nineteen claims and two mill-sites, all unpatented, comprise the property. The claims are well timbered.

TOPOGRAPHY.

A low ridge, attaining a maximum elevation at about 400 feet above sea level and lying roughly parallel to and at a distance of approximately one half mile from the beach is the locus of the principal mineralized zone containing the orebodies.

The surface is almost entirely covered with moss, brush and timber. Rock outcrops are confined largely to knolls.

GEOLOGY.

The orebodies occur along the contact of two intrusive rocks, gabbro and pyroxenite. These rocks are evidently differentiated from the same magmatic mass and together with other basic igneous rocks form a belt extending for about two miles along the upper reaches of Kasaan Bay thence extending inland in a northwesterly direction for several miles.

Augite, plagioclase feldspar, chlorite, a small percentage of magnetite, and other accessory minerals are present. In the vicinity of the orebodies alteration has produced a number of secondary minerals, chiefly epidote. Feldspars are sparingly present in the pyroxenite; in the gabbro more abundant.

A dark green rock with a fine grained ground mass and large augite crystals, which has been designated, augite porphyrite, occurs north of the mine workings a short distance.

OREBODIES AND CHARACTER.

The metals of economic importance are gold, silver, palladium, platinum and copper. For the most part the copper is in the form of cornite with lesser amounts of chalcocite and minor quantities of chalcopyrite occurring locally. Native copper is found in the fault planes and fractures, possibly secondary and is of little economic importance. The ore is undoubtedly primary.

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Ore bodies seem to be localized along the gabbro-pyroxenite contact at least where encountered on the 300 ft. or main working level. Ore shoots occur as chimneys or pipes in both gabbro and pyroxenite. The ratio of precious metals to copper is higher in the pyroxenite than in the gabbro.

The copper minerals are rather evenly disseminated in the gabbro although each shoot seemingly has a definite area in which values are higher than the average of the orebody as a whole. In the pyroxenite, distribution of the values is more erratic although continuous along highly inclined to vertical axes, in definite chimneys. The ratio of precious metals to copper in ore of milling grade is quite uniform.

It is not definitely known how the precious metals occur. The gold is, in part at least, free, as it has been observed in the ore. It is my belief that the palladium is in the elemental form, mechanically held by the bornite. The fact that platinum is not recovered indicates that it may have segregated from the original magma. The orebodies were probably formed during the closing period of or immediately following the magmatic invasion. Certain features would tend to place them as a type with the Sudbury nickel deposits although this metal is lacking here. Possibly a better classification would be to say that they are on the border line between intermediate and basic-magma deposits, with productive zones restricted to the contact between any two of the various rocks which have segregated from the original magma.

Numerous small fractures are found in the orebodies and two narrow filled fissures, a few inches in width, one carrying chalcocite largely and the other mostly calcite persist to depths so far attained. They strike about north while the mineralized zone in general strikes about N 70 degrees W. Calcite is scantily present as a gangue mineral.

#### OUTCROPS.

The principal known outcrops and the area from which all ore has been extracted, occur about one half mile from saltwater at an elevation 400 ft. above sea-level. Other outcrops have been found of which the largest lie 400-600 ft. to the east and west respectively. They have only been slightly prospected but promise a grade of ore commensurate with that so far mined.

At the site of operations there are two main outcrops one in gabbro and the other in pyroxenite separated by a few ft. of barren rock. The contact occurs in this belt.

Area exposed in gabbro	8,400 sq. ft.
Area exposed in pyroxenite	<u>21,500 sq. ft.</u>
Total	29,900 sq. ft.

ORE MINED.

Shipped to smelters 534 tons averaging about as follows:

Gold 0.15 oz. per ton, Silver 0.16 oz. Palladium 0.30 oz.  
Platinum 0.03 oz. Copper 4.0%

Also 240,000 tons of milling ore derived from

1. Shrinkage Stoping 60,000 tons

Assays.	Gross value per ton.	Net recoverable
Gold 0.018 oz @ \$35	\$1.68	
90% 0.013 oz @ \$33		\$1.42
Silver 0.20oz @ 64.5%	.13	
90% .18oz. @ 50%		.09
Palladium 0.11 oz @ \$24	2.64	
90% .09 oz. @ \$18		1.80
Platinum 0.01 oz. @ \$35	.35	
Practically none recovered/		
Copper 1.3% 28¢ @ 9%	2.34	
90% 23.4% @ 6.5%		<u>1.52</u>
Totals	\$7.14	\$4.83

2. Glory Hole Mining. 100,000 tons.

Assays	Gross value per ton	Net recoverable.
Gold 0.03 oz. @ \$35	\$1.05	
90% .027 @ \$33		\$0.89
Silver .12 oz. @ 64.5%	.08	
90% .11 oz. @ 50%		.05
Palladium 0.06 @ \$24	1.44	
90% .054 @ \$18		.97
Platinum 0.01 oz. @ \$35	.35	
Not recovered.		
Copper 0.60% 12¢ @ 9%	1.08	
90% 10.8% @ 6.5%		<u>.70</u>
Totals	\$4.00	\$2.61

It will be noted that present prices have been used in calculating values. Also recoveries which can now be made as will be shown later, are used. In former operations mill recoveries were about 60-65% on the precious metals.

It is apparent now that glory hole mining methods should not have been applied to this deposit. With allowance for areas of "subore" mineralization between chimneys it is probable that 125,000 tons of ore could have been derived from operations with net recoverable values of \$4.53 per ton. About 6,000 tons were derived from gabbro ore directly above the 300 level, the balance being mined in pyroxenite. About 20,000 tons of waste were sorted from the glory hole ore. Large additional amounts were broken inevitably in reaching ore otherwise unobtainable by this method of mining. In one instance 30 ft. of waste just east of No. 1 stope on the 100 level was broken and mixed with ore from other sections.

DEVELOPED ORE.

Number 312 drift driven eastward from the main workings on the 300 level passed through 30 ft. of ore and mineralized ground in gabbro on the contact between this rock and pyroxenite. This orebody has been opened between the 300 and 200 levels. From the 200 level to the surface the raise passed through well mineralized ground probably leaving the ore on its dip. 25 ft. of continuous ore in this shoot on the 300 level averaged as follows:

Assays	Gross Values per ton	Net recoverable per ton
Gold 0.042 oz. @ \$35	\$1.47	
90% 0.037 oz @ \$33		\$1.22
Silver .20 oz. @ \$4.5	.17	
90% .23 oz. @ \$50		.11
Palladium .09 oz. @ \$24	2.16	
90% .08 @ \$18		1.44
Copper 1.53% 30.6# @ 9¢	2.75	
90% 27.5# @ 6.5¢		1.78
Totals	<u>\$6.55</u>	<u>\$4.55</u>

The remaining 30 ft. carries gross values of about \$2.25 per ton in total metals.

The estimate by the former mine supt. of the tonnage available in this shoot between the 300 and 200 levels was 20,000. On this basis the amount to be derived by selective mining between these levels is about 10,000 tons. In the past estimates on tonnage have proved to be low, partly because of unforeseen extensions laterally and also because ore shoots have not been absolutely delimited before stoping operations were commenced.

All known pyroxenite ore shoots in the immediate vicinity with one exception have been mined to the 300 level. About 6000 tons can be broken in the glory hole with a net value of \$3.00 per ton.

PROBABLE ORE.

1. In pyroxenite below No. 1 stope comprising an indicated area of about 1,000 sq. ft. This shoot has been mined between the 100 ft. level and the surface. Since every other shoot has persisted to the 300 level it is probable that this shoot also will persist to a like depth at least. The estimated probable ore in this body is 20,000 tons of an average value the same as the other shoots in the pyroxenite with a net value of \$4.83 per ton. The ore already extracted from this stope averaged about 20% higher than the figure given above based on present prices.

2. In pyroxenite below the 300 level. The area of pyroxenite ore so far known on the 300 level and in the stopes immediately above projected to this level is approximately 2500 sq. ft. It may be reasonably assumed that ore will persist to the 400 ft. level at least. The estimated tonnage to be derived is 25,000 with a net value of \$4.83 per ton.

3. In gabbro below the 300 level. The known area in gabbro on the 300 level is about 3600 sq. ft. with a reduction to 1500 sq. ft. if selective mining be practiced, and the grade maintained as under developed ore in gabbro. Between the 300 and 400 levels we may reasonably expect to obtain 15,000 tons of gabbro ore containing a recoverable value of \$4.55 per ton.

POSSIBLE ORE.

North of the glory hole surface stripping has disclosed a mineralized area of 8,400 sq. ft. with boundaries not yet reached on the north and northwest sides. The average value as determined by careful sampling is as follows:

Assays.	Gross value per ton	Net value per ton
Gold .02 oz. @ \$35	\$0.70	
90% .018 @ \$33		\$0.60
Silver .10 oz. @ \$64.50	.06	
90% .09 oz. @ 50¢		.04
Palladium .05 @ \$24	1.20	
90% .045 oz. @ 18		.81
Copper .90 @ 187¢97	1.62	
90% 16.2# @ 6.5		<u>1.05</u>
Totals	<u>\$3.58</u>	<u>\$2.50</u>

A large possible tonnage of ore is indicated here. Surface assays do not indicate enough segregation of values to make selective mining feasible though this condition may change with depth. The gabbro orebody originally cut by the main adit on the 300 level was thought to be the probable downward extension of this orebody. It is my present belief however that this oreshoot should be sought to the west of

the present working and near the gabbro pyroxenite contact on the 300 ft. level. If this shoot maintains it's size to the 300 level it will yield 240,000 tons of ore above this horizon. The average grade as indicated on the surface is too low to show a profit on present metal prices. More exploration should be done in this area as ore opened in gabbro on the 300 level shows a definite tendency toward a concentration of values. The ore cropping under discussion shows this tendency only to the extent that the grade might be raised 20% by selective mining with a reduction in tonnage.

Lack of stripping on other outcrops makes it impossible to state with accuracy as to what may be expected in the way of ultimate tonnage and grade of ore. Other prospects are found on adjoining ground in this same formation, but with a lower content per ton in platinum metals. In view of the fact that several exposures are known on the property and further when one considers that probably 95% of the surface is covered by vegetation, this area will in my opinion produce a large tonnage of ore. Known surface exposures in this belt are found at intervals over a distance of five miles. These deposits are not to be confused with the so-called contact metamorphic chalcopryite magnetite deposits of Kasaan Peninsula.

ORE TONNAGE.

Location	Tonnage	Net value per ton
In gabbro developed #308 ore shoot between 200 and 300 levels	10,000	\$4.55
In glory hole	5,000	3.00
Probable Ore.		
In gabbro 300 ft. to 400 ft. level.	15,000	4.55
In pyroxenite below #1 stope.	20,000	4.83
In pyroxenite 300 to 400 ft. level	25,000	4.83
Totals	75,000	\$4.61 per ton

POSSIBLE ORE.

1. Between 200 level and surface. #308 ore shoot
2. In present working below 400 ft. level.
3. In gabbro cropping north of glory hole.

4. In pyroxenite about 600 ft. east of workings
5. In gabbro 400-600 west of workings
6. In several other known outcrops.

A total area of 200,000 sq. ft. would not be an unreasonable guess as to expected surface exposures. Experience in the present workings indicates that similar ore shoots found elsewhere in this formation will be persistent in depth.

#### MINE WORKINGS.

The mine was originally opened at a surface cut from which ore was broken, sorted and shipped. Approximately 6,000 tons were disposed of in this manner. Later a 90 ft. cross cut at a depth 90 ft. below the outcrop was driven. From this level a winze was sunk to the 200 ft. level. Subsequently a long adit was driven at an elevation about 90 ft. above sea-level. This adit which has served as the main haulage way encountered ore 1150 ft. from the portal and 300 ft. below the outcrop. The adit was continued for a distance of 110 ft. to a point directly below the winze mentioned above.

A raise was driven connecting the adit with the bottom of the winze. This raise was used to transfer ore from the glory hole in that section of the mine to the adit, whence it was trammed over a 24" gauge railroad to the mill. The adit was ultimately continued as a prospect opening for about 120 ft. with a change in direction from northerly to northwest.

For the first 550 ft. the adit is in pyroxenite followed by a belt of gabbro for 250 ft. Then pyroxenite for 350 ft. and at a point about 1150 ft. from the portal gabbro was again encountered and simultaneously ore which persisted for 35 ft. The adit was continued in barren gabbro and at a point 20 ft. beyond the raise, ore was again encountered for a distance of about five ft. Then a decided change takes place in the rock.

For about 60 ft. the rock has the appearance of a highly metamorphosed mass of the gabbro or it may possibly be a dyke. It is heavily mineralized with finely divided pyrite disseminated throughout. A considerable amount of epidote and a brownish mica are also present. So far it has shown only small amounts of gold, about .01 oz and .15 oz. silver. One assay gave 0.50 oz. in gold but this was apparently accidental. The platinum group is absent. No attention has been paid to nor any work done in this section of the mine. This mineralized zone probably crosses north of the glory hole in a muskég area.

The gabbro ore at a point 1150 ft. from the portal was opened to the eastward for 60 ft. thence the drift passes through slightly mineralized ground for 70 ft. in gabbro. Subsequent development showed that this drift headed away from the contact. It is designated 314 drift.

A drift run in the southeast wall of the gabbro ore picked up the ore in two or three rounds across the contact in pyroxenite. Three general samples taken were averaged

Gold 0.10 oz. Silver 0.25 oz. Palladium 0.15 oz. Copper 1.8%

Approximately 6,000 tons were mined in the gabbro but no attempt has been made to follow it through to the surface. The ore mined in this area averaged about as follows

Gold 0.03 oz. Silver 0.12 oz. Palladium 0.06 oz. Copper 1.3%

It was the policy at the time not to mine the gabbro but to concentrate on the pyroxenite on account of the proportionally higher precious metal content, particularly Palladium. Platinum is present in the gabbro ore to the extent of about 0.003 oz. per ton.

The gabbro ore mentioned here was at one time thought to be the downward extension of the gabbro ore cropping north of the glory hole. It is my belief, however, that if this were true we should find evidence of this ore shoot in the raise from the 300 level connecting with the winze in the original workings. If it is the same shoot there must be a rather sharp swing to the westward and back to the north between the 300 level and the surface.

An inclined raise from the 200 level shown only in part on the sketch accompanying this report trends west, then north west and swings finally to the northeast, breaking through on the surface just east of the gabbro outcrop and a short distance north of the diabase dyke shown cutting the orebody. The dyke is apparently later than the ore. The raise is in low grade ore most of its length. I suspect on the eastern margin of the ore shoot.

Only a limited amount of exploration has been carried out along the pyroxenite-gabbro contact. #312 drift projected several hundred feet to the southeast, to reach an objective vertically below an outcrop of pyroxenite ore, passed through 55 ft. of ore in gabbro just at its beginning and at the contact. From this point onward the drift appears to be in gabbro and to the north of the contact. Occasional scattered particles of bornite are present. The drift will have to be extended another 100 ft. or so to reach its objective. Since all orebodies encountered so far on the 300 level are contiguous to the contact it is probable that the downward extension of this ore shoot should be sought to the south. The contact dips 60 to 70 degrees to the southwest.

#### FAULTS.

A considerable number of minor slips and fractures are found cutting the orebody and one dipping about 30 degrees to the east with a northerly strike a short distance above the 300 level is notable because of the large flakes of native copper and gold copper alloys which were found in it when mining the pyroxenite ore shoots through which it passes. Flakes of native copper and alloys of varying proportions up to about



80% gold and as much as one fourth inch diameter were found in this zone. Rarely also were found similar flakes of a soft grey metal, probably bismuth.

There seems to be no displacement of the orebodies due to these faults of which the largest is the one just described.

#### MINING METHODS AND COSTS.

During past operations the ore was mined partly by glory hole methods and partly by underground stoping. Costs were about the same under the two methods as lower breaking costs in the glory holes were offset by higher bulldozing costs on the grizzlies which were spaced 12 inches. Ore was drawn through undercut arc gates and trammed by means of a storage battery locomotive to the mill 1200 ft. from the portal of the adit. No timbering is required except for chutes.

Mining costs on a 200 ton daily basis will be about as follows:

	Cost per ton.
Direct mining	\$0.75
Hoistings & Trimming	.20
Development & Exploration	.50
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Total	\$1.45

The mine has been operated on a basis of 300 tons per day but adequate recoveries demand finer grinding with a reduction in tonnage to about 200.

#### MILLING AND PLANT EQUIPMENT.

The power plant consists of 5 semi and full diesel engines totalling 635 H. P. of which 220 H. P. is electrically connected, the balance being belted directly to ball mills and flotation equipment. A small water power installation is also available which will furnish about 75 H. P. one shift per day throughout most of the year.

Compressor equipment consists of a 14" by 12" single stage Class E. R. 1 compressor and one converted steam compressor of slightly larger capacity.

The haulage equipment is adequate and apparently in good condition consisting of a 4 $\frac{1}{2}$  ton Mancha storage battery locomotive with Edison cells and 11 20 cubic ft. ore cars as well as some smaller cars all 24 in. gauge.

The mill equipment includes

- 1 7' by 36" Hardinge ball mill
- 1 8' by 48" Hardinge ball mill
- 3 Wilfley sand pumps
- 2 3" Krogh sand pumps
- 1 4" Krogh sand pump
- 6 K. and K. flotation machines.
- 1 15' by 7' Dorr thickener
- 1 3' by 4' Oliver filter and accessories
- 1 9" by 15" Blake type jaw crusher.

1 24" symons disc crusher  
1 14" by 55" Traylor Gyratory crusher  
3 Allen sand cones.  
Conveying, feeding and screening equipment.  
Also various motors, generators and storage battery locomotive charging equipment.  
4 oil storage tanks with a total capacity of 16,000 gallons.

Mining equipment consisting mostly of air drills probably should be largely replaced as the property has not been operated since 1926. The blacksmith shop is adequate and well constructed.

#### BUILDINGS.

The buildings consist of cookhouse, several dwellings, sust. cottage, two story office building, warehouse, docks storage sheds and about 15 individual well built cabins for housing labor.

The old bunkhouse and cookhouse have been abandoned.

It would cost about \$250,000 to duplicate existing plant and surface equipment.

#### TAILINGS.

During the summer of 1934, the plant, except for the crushing department, was reconditioned and placed in operation with the object of re-milling tailings from previous operations. It was thought that if the problem of making adequate recoveries, particularly of the precious metals were solved, the additional recovery would warrant re-opening the mine. In the past recoveries on the precious metals has averaged about 02.5%

50 to dry tons of concentrates were produced from about 11,000 tons of tailings of the following average composition.

Gold	.017 oz.	per ton
Silver	.06	oz.
Palladium	.025 oz	Assay by Le Doux & Co.
Platinum	.025 oz	" " " " " "
Copper	.22%	

The concentrates had the following average analysis

Gold	3.10 oz.	per ton
Silver	7.5	oz.
Palladium	4.10	oz.
Platinum	.05	oz.
Copper	34.5%	

The ratio of concentration was 220 into 1 with recoveries of metals except platinum about 75%. Recoveries could probably be improved somewhat if the grade were lowered. The theoretical limit on grade is determined by the copper which could be raised to about 50%.

Recovery on the tailings added to the original recovery gives an overall recovery of approximately 90%. There is still considerable room for improvement in milling practice as classification equipment is not entirely adequate. I believe also that platinum may likewise be recovered with a little research.

Glory hole mining and poor recoveries were responsible for closing down the properties in 1926. In addition development was permitted to lag.

About 45,000 tons of tailings remain for treatment, which if handled at the rate of 9,000 tons per month will yield a profit of approximately 35¢ per ton. The net smelter receipts are about 88¢ per ton of tailings.

#### COSTS.

Costs are estimated as follows based on past experience

	Per ton.
Direct mining	\$0.75
Tramming & Hoisting	.20
Development & Exploration	.50
Milling	.85
Marketing Conc.	.30
Superintendance	.10
Local Transportation	<u>.10</u>
Total	\$2.80

The average specific gravity of the ore is about 3.3 which contributes to a lower cost per ton, inasmuch as it is the volume rather than the weight which determines the ease with which ore may be handled.

#### PRODUCTION.

The total metal content of all ore shipped and milled is estimated to have been as follows

		Per ton
Gold	8,074 oz	.033 oz
Silver	39,500 oz.	.16 oz
Palladium	19,000 oz.	.077 oz
Platinum	2,500	.01 oz
Copper	4,225,000 lbs.	.85%

The gross value of the above total production per ton based on the present prices is \$ 5.05. The net recoverable value based on present prices is \$3.33 per ton.

#### METAL PRICES

- Gold. It is improbable that the price of this metal will be reduced.
- Silver. There are forces operating to raise the price of this metal.
- Palladium. \$18 per oz. is realized for this metal on the present market. The trend of the platinum group metals should be upward especially if the important part played by platinum in the direct conversion of light into electricity is applied commercially. We believe an assumed price of \$10 per oz. for palladium to be conservative.
- Platinum. This metal is evidently present to the extent of .01 to .015 oz. per ton in the pyroxenite and in traces only in the gabbro ore. I am of the opinion that it can be recovered.
- Copper. The price of this metal will probably not increase for some time to come.

#### SUMMARY AND CONCLUSIONS.

1. The Saltchuck mine is fully equipped except for minor accessory equipment for a production of 200 tons per 24 hours.
2. Possibilities for continued downward extension of the orebodies are excellent.
3. Large areas of potential ore bearing ground are almost entirely unprospected.
4. The pyroxenite ore is capable of yielding a profit of about \$2.20 per ton on present prices. If an estimate of \$10 per oz. is assumed for palladium the indicated profit will then be \$1.70 per ton or approximately \$9,000 per month based on 90% running time and 200 tons per running 24 hours.

5. If selective mining be practiced the gabbro should yield a profit of \$1.11 per ton with an assumed price of \$10 per oz. for palladium.
6. The mine cannot, in it's present condition, produce 200 tons daily. It can, however, with about two weeks preparation and the expenditure of \$1,000 operate on a daily schedule of 50 tons. This supplemented by production from the tailings will maintain the property on a profitable basis with a limited amount of working capital; say \$15,000.
7. The preferable method if capital is available could be to allocate \$60,000 to be apportioned tentatively as follows:

a.	Development and stope preparation in ore shoot below No. 1 stope	\$5,000
b.	Sink inclined shaft 200 ft. in ore shoot below 300 level.	5,000
	Equipment	2,000
c.	Raise from 500 to 300 level to be used as working winze outside productive zone	5,000
	Equipment	8,000
d.	Exploration and development on contact.	12,000
e.	Additional drilling equipment	2,000
f.	Reserve	<u>21,000</u>
	Total	\$60,000
8. Two years will probably be required to bring the property to a production of 200 tons daily. It can be operated efficiently on a shift basis.
9. The concentrates produced are well suited for treatment at the plant with the production of electrolytic copper and refined precious metals.
10. The property has excellent prospects for future life and is recommended as a legitimate mining enterprise in which the risk has been minimized to an extent not often found in initiating mining ventures.

Seattle, Wash.  
Jan. 7, 1935

Respectfully submitted

(SGN) A. L. Howard