

MR-195-36

Summary Report of the Mining Survey Team
for Alaska

OVERSEAS MINERAL RESOURCES DEVELOPMENT

CO-OPERATION ASSOCIATION

Forward

This is an English summary of the report of the Mining Survey Team for Alaska which was despatched about one month in this summer with the support and sponsorship of the Overseas Mineral Resources Development Cooperation Association (hereinafter referred to as OMCA). The team conducted an investigation principally on the physical and economic circumstances in Alaska for mining and mineral transaction business while visiting several mines and properties to look into the possibility of its development on economic basis.

In view of its geographical position very close to Japan, OMCA has long continued to study on the mining of Alaska to collect information for realizing the filed investigation. When Mr. Phil R. Holdsworth, commissioner of Department of Natural Resources, State of Alaska, came to Japan last fall, he had a series of talk with the government officials in charge, and the people of OMCA and leading mining companies, and agreed with them to have a Japanese mining survey team in Alaska.

The survey schedule was originally made through exchange of documents between Alaska State Government and OMCA. But some changes were made to the original plan after giving careful consideration to weather, transportation and other physical conditions. Mines and properties for an object of the survey were selected according to the recommendation of the State government, but some of them had to be given up due to the weather condition in the area. The team were divided into two parties, one for south-central Alaska and the other for south-eastern, and investigated 9 mines in total.

At the meeting held before the team left Tokyo, Mr. P. R. Holdsworth addressed to the members that he understood this survey team would lay the foundation for the development and promotion of the friendly relationship in the field of mining and mineral business between the two countries, and the business should be brought to a success by the hands of private companies, for which he and his people would be willing to render any assistance and cooperation at any time. In reply to his kind words, all the team members promised to him that they would exert their utmost effort to fulfil their mission.

We wish to take this opportunity to express our sincere gratitude to the State government of Alaska, U. S. Geological Survey and to the people of the good country who so unselfishly contributed their time and effort to enable the team attain a successful and fruitful survey trip. We would also like to express our best regards to Mr. Holdsworth, and to Mr. M. W. Jasper and Mr. W. H. Race who joined our field survey.

General Features

Alaska occupies about 1,520,000 km² in area locating both sides of north arctic circle (Lat. 67.5° N. L.), and about one third of it belongs to the Arctic region. She has fairly concentric highlands and mountain ranges convexed to the Alaskan Sea, and is devided into several physiographic blocks by J. C. Reed and H. W. Williams. As Alaska is situated at high latitude, topographic featurea are affected by and derived from glacier and glaciofluvial efforts, and are characterized by glaciers, morained, glaciofluvial plains, U-shaped valleys, permafrost plain, fijord and so on. At several places, silty tide-lands are seen along the coast. It is siad that there are big deltas along the Mukon river and a lagoonal plain covered tundra at the polar slope, which none of the members could have a chance to see.

Weather condition in Alaska varies so widely by blocks under the influence of mountain ranges, tidal current and other factors. Many meteorological cneters for the aircraft and vessel provide us with many data on climatic conditions in the area where a mine is located. However, actual observation is required since the weather is very changeable by sidtrict as mentioned above. It is a noticeable characteristics of Alaska's weather consitions that it has very remarkable seasonal ch_anges as compared with south pole region with the temperature going up to 32°C in summer and down to -60°C in winter. Humidity is not so high in the northern part where it is foggy in winter time, while it is somewhat high in the south-eastern district all through the seasons.

Population of Alaska is only about 250,000 in total. It has increased as twice as much in the last decade. About sixty per cent of it is members of armed forces, their family and employees. 56 per cent lives in two cities, Anchorage and Fairbanks, and their environs, and the remaining 44 per cent is scattered in other vast land. It is said, though not ascertained, that many skilled labourers are available for mines through the congress of labour unions.

It is obvious that transportation facilities have influence on exploration and development, and Alaska is no exception to this. Transportation is indeed limited, but it is not impossible to obtain access to almost every district in the countries. Railroads are also limited in that they generally serve a specific purpose such as a connecting link between a seaport and a big city where some military bases exist. The highway, partly paved, is now complete between main cities, but a certain part of it is closed during winter season. Air transportation in Alaska is good, with main

lines connecting the principal cities and feeder lines spread out most of the districts. Landing strips and lakes are available at most towns which are quite familiar with the sight of a small plane. Sea transportation is fairly good at south-eastern and south Alaska with good harbours and nice facilities and is free from ice throughout the year. Harbours at west and north-western Alaska, however, are frozen in winter. There is an Alaskan liner travelling from Japan to Anchorage, Sitka and Wrangell.

Labour costs and commodity prices are extremely higher than those in west coast of the state. Price indices of Nome, Fairbanks, Anchorage, Juneau and Sitka show respectively 161, 160, 141, 132, and 137 compared with 100 of Seattle, Wash. Mining laws and regulations have a lot in common and generally are favourable for exploration, development and operations of mine. Taxation for mining is not so excessive, but state taxes should be fairly higher than those of other states.

Geology and ore deposits

Geology of Alaska has been described and reported for many years by U. S. Geological Survey and others. Thus compiled geologic map of Alaska was published by Gault H. R. et al of U. S. G. S. in 1954. But because of the severe topography and the shortening of the survey period resulted from weather conditions and other reasons, several regions were left without any geologic working. Metal ore deposits were mainly discussed as they were formed with a close relationship to igneous activities, especially to granite and its allied rocks which intruded during the development of geosynclines of various geologic ages. And thus they were recognized their situations as belts or areas. These general discussions must be quite important to ore-search, but as just above mentioned, all the areas in Alaska is not geologically surveyed and geologic history is not completed and so these are not enough to be the indicators for new ore deposits or deposit groups. It is hoped that further geologic survey will be carried out and all histories will be clear to us. Mines and properties surveyed by us were briefly described below.

(a) Spirit Mountain

The Spirit mountain property is situated at about 24 kilometer south-east from Chitina and can be reached only by small plane in non-frozed seasons. Ore deposits are found at the slope along Canyon Creek and are lenticular in ultra basic intrusives which are composed of peridotite, pyroxenite and amphibolite and intruded into gneissose rocks probably as sills. Reported ore minerals are pyrrhotite, chalcopyrite, pyrite,

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pentlandite, bravoite, sphalerite, magnetite and limonite and are impregnated in the country rocks and are sometimes concentrated like veins. Ultrabasic rock lenses range 7 meters to several centimeter in width and distribute along a supposed tectonic line which is striking NBO^oE and is stretching over both side of the creek. Tenor of metal is not so high and assay of check samples taken by us. shows 0.31 to 4.79% nickel and 0.54 to 1.09% of copper. As dimensions of ultrabasic rocks are not big and lie lenticular of small size ore reserves will not come big figures. Lack of transportation to mine is also unfavourable factor for mine to be developed and operated.

(b) Rainbow Mountain

The Rainbow Mountain property is located at about 68 km from Paxson and occupies the northern parts of Rainbow Ridge. It is composed of various rocks, and its geologic structure is complicate as many faults can be observed. Ore deposits are originally impregnation of sulfide minerals in serpentized complex. According to Dr. Forbes of the University of Alaska, serpentized complex exists as roof-pendant like form in the gnciss which is changed lateraly its rock facies, and may be psendoequivalent to grano-diorite and the complex also distribute along tectonic line striking north-southerly. Trenchings for investigation was worked along the slope and at the top of the the hill composed of the serpentized complex. Pyrrhotite, secondary nickel minerals and secondary copper minerals can be observed. Results of assay done by U. S. Geological Survey shows 0.3 to 0.6 per cent of nickel at the trenching cut about 400 meter long and two parts of 4 feet width of it are recognized as enriched zone of 7% nickel. The magnetmeter survey has done by U. S. C. S. and several anormal centers are Known. 68-14

The newly discovered outcrop is situated at about 4.5 km north of the trenchings and is observed as a float zone of impregnated ores with about 33 meters width. No estimate of ore reserves are available because of its earliest stage of development. Also we have no advanced information on geologic structure, width and extension of serpentized complex and so on, and nickel contents obtained now is not high. But we must be watching the further exploration because the magnetic anomalies are known at several parts over wide area and these will be good indications for nickel minerals.

(c) Mc laren River

The Mc laren River mine is situated about 19 km north of Mc laren River Lodge located at Denali Highway. It was reported that it was found someday in 1930's and established its mining lease in 1953. Underground prospecting, diamond drilling and K+68-4

trenching were done. A private road from McLaren River Lodge to the mine exists now, but several part of it have washed out where only jeeps can go through.

The rocks occurred around the mine are mainly consisted of greenstone and its allied rocks which was derived from basaltic lava flow and Triassic in age. Ore deposits are two to three copper-quartz veins in the greenstone. Main component minerals of veins are bornite, covelite, chalcopyrite, pyrite, quartz and so on. Veins are arranged in parallel and strike N10°W (magnetic) and dip steeply and range from 5 meters to 30 centimeter in width. They are also cut by faults which strike almost perpendicular to veins and has a sheared zone of 20 meters in width.

About 16 km (air) west of the mine the West Fork ore deposits were reported, but unfortunately we didn't visit them. Copper contents of veins are reported as 4 to 5 per cent and workable reserves are estimated over 20,000 tons at the McLaren ore bodies. The mine will be watched for more advanced prospecting until extension of the mineralization zone is recognized in distinct distances.

(d) Snettisham

The Snettisham mine is situated at the coast of the main land in about 45 km southeast of Juneau, state capital, and can be reached by boat. It is established its mining lease in 1950. The mine and its environs are composed of black phyllite, amphibolite and quartz diorite. Amphibolite intruded to phyllite as sills with concordant boundaries to the bedding planes shows north-southerly lineations by parallel arrangements of mafic minerals in some parts of the bodies. Quartz diorite is the latest in age and intruded to both black phyllite and amphibolite with sharp boundaries. Ore minerals to be prospected is titaniferous magnetite scattered in amphibolite. Elongation of ore shoots may be of NNE to SSW direction judging from the charts of magnetic surveys. Magnetite may be concentrated during the latest stage of differentiation of amphibolite intrusives, so it may show higher titanium contents and is found at some particular thin layers in the bodies. A grade of iron is reported about 17 per cent and ore reserve is figured about 100,000,000,000 ton. Feasibility of the mine may mainly depend on development of its concentrating processes. It is also important to study the new process which can utilize amphibole, pyroxene and other gangue minerals that are now considered only waste materials.

(e) Mt. Andrew

The Mt. Andrew mine is situated at Kasaan Peninsula of Prince of Wales Island, north-westerly 43.5 km far from Ketchikan. Copper ores of Kasaan Peninsula were worked

splendidly between 1895 to 1900. The Mt. Andrew mine began its production in 1908 and produced about 270,000 ton of copper ores till the end of the World War I.

The mine is mainly consisted of Kasaan greenstone which was probably derived from lavas and volcanic pyroclastic and interbedded by small amounts of siliceous and calcareous sediments. Rocks were attached by skarnization of granitic rocks and had many secondary minerals such as pyroxene, diopside, epidote, chlorite and other minerals. Magnetite which is of the minerals prospected for is accompanied with skarn in the form of vein and impregnation. Chalcopyrite is seen as it has been mined out and is said to be richer in northern part than in other parts. About 5,000,000 ton of iron ore and a little amount of copper ore are left now at the mine. Due to many reasons, that is, some contents of copper in the iron ore and somewhat lower iron grade in bulk, little reserves as copper ore, and so on, negotiation for development and operation don't seem to take favourable way. But we must keep our eyes open on the further working of the mine because the prospecting work has been proceeded smoothly and mineralization area is recognized in wide extensions.

(f) Riverside

The Riverside mine is one of the gold, silver, lead and zinc mine of Hyder district which is a producing center of metal ores. It is situated about 11 km north of Hyder town and occupies the east side of Salmon River. Ores of this district are complex one, so the items of production differ by year.

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The mine and its environs are consisted of green schist, tuff, volcanic conglomerate, greywacke, slate and quartzite which belong to Hazelton group, jurassic in age and are intruded by granodiorite called Texas Creek granodiorite. A sheared zone called Lindeborg runs from north-west to south-east in the crystalline schists which are metamorphosed facies of the Jurassic sediments and dip steeply due to north. Width of the sheared zone can be measured 24 to 31 meters at the mill level with recognized extension of 610 meters in length and 210 meters in depth.

Ore deposits are composit veins which are embedded in the sheared zone and are composed of galena, sphalerite, sheelite, quartz and so on. Width of veins is 30 cm inaverage. Five bonanza are recorded in the veins and some of them swell to about 2 meters in width. Ore reserves are not available and are throught to be insufficient to operate the mine economically.

(g) Admiralty mine of Funter Bay

The admiralty mine occupies the southern slope of Funter Bay of Admiralty Island and can be reached by a boat from Juneau, about 88 km by sea. Mertie vein was found in 1919, warmly explored through the mertie drift in 1943 and the DMEA drift in 1954. K112-24
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Underground diamon drillings were successfully done from 1954 to 1960.

The mine is consisted of black phyllite, siliceous schist, green schist, marble and basic ifneous rocks. Basic igneous rocks intruded to sedimentary rocks as dykes and sills and affected to them a metamorphizm. An anticlinal structure can be recognized and the axial plane of it extnedes from north-west to south-east and the crest line pitches south-eastly.

Ore bodies are nickel-copper bearing basic sills and expose at the north-eastern flank of the anticline. Ore minerals are magnetite, pyrrhotite, chalcopyrite and pentlandite. Average constitutional proportion of ore minerada are reported as below:
pyrrhotite : magnetite : chalcopyrite : pentlandite = 66.5 : 17.7 : 11.4 : 5.9.
Extension of the outcrop of the sills that means ore deposits can be measured 25 meters in length and 40 meters in width which are believed to pinch at the lower levels. Ore reserves are reported 560,000 tons averaging 0.34% of copper and 0.35% of nickel. A later examination shows somewhat higher both in nickel and copper. Owing to its low grade of metal contents, the mine can't start its operation marginally.

(h) Sundum

The Sundum mine is situated at east slope between Tracy Arm and Endicott Arm of Petersburg district, 65 km far from Juneau, and can be reached by only air due to its steep slope. It is also located at higher parts of 915 meters above sea level and is covered by Sundum glacier which is over 150 meters in thickness. It was found by a helicopter pilot in August, 1958 and investigated and prospected during the season of 1959. Kv 115-50
The mine is composed of many kinds of crystalline schists and quartz-diorite and gneiss which are members of the Coast Range Batholith.

Ore bodies of the Sundum mine are reported to exist in the biotite-quartz-schist and to be consisted of pyrrhotite, pyrite, chalcopyrite, bornite, covellite, sphalerite and galena as ore minerals. Outcrops of ore deposits are mainly found in five places and named as No. 1 to No. 5. No. 3 outcrop and No. 5 are shown good both in quantities and qualities. No. 3 outcrop is situated at the north of the glacier and its extension can be measured 1.2 to 11.3 meters in width and 338 meters in length. An average zinc grade is reported 0.27% and copper 2.6%. No. 5 ore deposits is located at the south of the glacier and is continued its extension to with No. 4. Ore shoot in No. 5 is characterized

by impregnation of metal minerals and extends 135 meters in length and 30.5 meters in width. Mean width of ore deposits in total can be measured 11 meters and extension of them lengthen 2,400 meters. Thus ore reserves calculated above sea level is said to come to 90,000,000 tons averaging 1 per cent copper. As we made a survey in a very short time, we can't say anything definitely on details of the mine, but we can at least point out that the ore deposits are quite similar to the Kieslager type in Japan, its calculated reserves are trimendous, and so the mine will be worked marginally on large scale operation if further studies are made on method of operation and detail prospectings to prove its reserves.

(1) Klukwan

The Klukwan mine is located at 37 km north-west from Hains and can be reached by 30 minute's drive by car. It was recently discovered by a pilot and an investigation survey and some diamond drillings were done during the seasons of 1960 and 1961. Ore deposits are considered as an iron placer of older age which will be derived from the basic intrusives. Extension of deposits are recognized in the area of 2,500 meters by 1,000 meters, but bonanza may be 1,500 meters by 500 meters in the above mentioned area and is measured 30 meters in depth by drillings with content of about 17 per cent iron. Accordingly, the ore reserves come to bigger figures, but they are not considered homogeneous in its qualities that require further concentration processes than usual ore treatment.

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Conclusion

The writers described briefly on the mining industry of Alaska, especially on the present state of the metal mining, some conditions to be considered at the actual mine operation and general features of several mines surveyed. In spite of its glorious history and its high potentialities, the metal mining of Alaska is rather in a state of depression. Many factors, such as isolation from the other states, high commodity price and labour costs, scarce population, less development of transportation, capital shortage for mine development and so on, seem to prevent the mining business from attaining high growth. Handicapped by those many unfavourable factors, ore deposits to be mined are required to have big amount of reserves, high contents of metals and some special prospecting technique to be applied. State government has employed the able engineers to promote the mining industry and has carried out the fundamental surveys. It is just the same for federal government which governes Bureau of Mines and U. S. Geological Survey.

Private companies has dispatched survey crews to many favourable areas to discover new ore deposits and to develop the mine. Japan and Alaska are geographically neighbouring countries separated by a narrow streak of the Pacific ocean and have been keeping very friendly relationship. Alaska has big potentialities for many kinds of metals and expect earnestly to have mining businesses in a concrete form with Japan as the market for the products. Therefore, there exists a bright prospect for realizing on the ore business to the mutual benefits of both countries.