

MINING ON PRINCE WILLIAM SOUND.

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GENERAL FEATURES.

The mineralization of the Prince William Sound region followed the intrusion of granitic rocks (Jurassic?) into the closely folded sediments (Mesozoic?) bordering Prince William Sound. These sedimentary rocks may be gathered into two great groups—one consisting dominantly of graywacke and argillite, and the other including black slates, dark-colored limestones, cherts, greenstones, argillites, jasper, and graywacke. The minerals introduced during this period of mineralization included gold, silver, chalcopyrite, pyrite, pyrrhotite, arsenopyrite, galena, sphalerite, stibnite, quartz, epidote, albite, chlorite, calcite, and siderite. The valuable metals of the ores are copper, gold, and silver. The gold is native. The copper occurs chiefly as chalcopyrite, but another copper-iron sulphide containing about 16 per cent of copper has been recognized at Landlock. Silver has been noted only as an alloy with the native gold.

The ore deposits of this region may be broadly grouped into two classes—copper deposits and gold-bearing quartz lodes. The mineral associations in both gold and copper deposits are in general the same, the dominant characteristics of the deposits depending on the relative abundance of the different minerals. The copper mines produce large amounts of gold or silver, or both, and chalcopyrite is present in small amounts in many of the gold quartz veins.

This separation of the valuable mineral deposits into two classes is carried further by the natural grouping of each of the classes in certain districts that correspond closely with the bipartite grouping of the rock formations of the region. The gold quartz lodes occur in the areas of folded and broken graywacke and argillite, whereas the sulphide ores are restricted to the areas of sheared slate, limestone, and greenstone. The gold quartz lode districts occur in a belt concave southward, bordering the inner shores of the Sound and surrounding the southern belt, which contains the copper camps.

The gold quartz ores are free milling. They are treated locally in small stamp or roller mills, with amalgamation. The concentrates

are shipped to the smelter at Tacoma, Wash. The copper ores are base and require smelting, with or without previous concentration. No local smelters being available, the copper ores and copper-bearing concentrates are shipped to Tacoma by water. Their gold and silver content is recovered in the smelting process.

The productive mines on Prince William Sound in 1915 so far as known included four copper mines and five gold mines. A much larger tonnage of copper ore than of gold quartz was mined and treated, and the total value of the metals produced from the copper ores was about five times that obtained from the gold quartz ores. The value of the total mineral production of the Prince William Sound region in 1915 was \$1,340,996, compared with \$1,198,742 in 1914.

COPPER MINING.

GENERAL CONDITIONS.

An increased activity in copper mining over the preceding year was evident in 1915, and although no appreciable boom occurred there was also considerable interest manifested in copper prospecting, and it is reported that a few new discoveries were made in Passage Canal and in the district between Valdez and Port Wells. Some of the old copper properties on Knight Island were restaked. Both of the regular producers, the Beatson Copper Co., at Latouche, and the Ellamar Mining Co., at Ellamar, made large shipments as usual. The Threeman Mining Co., on Landlocked Bay, resumed shipments after two years, and the Fidalgo Mining Co., on Port Fidalgo, also shipped ore to the smelter. Development work was done on some of the nonproducing copper properties on Solomon Gulch, Landlocked Bay, Port Fidalgo, and Knights Island, and assessment work is reported on many others. All the copper ore shipped consisted of crude sulphide ore, in which the copper-bearing mineral was dominantly chalcopyrite. Much of the copper ore mined also carries either gold or silver, or both.

An increased quantity of copper ore was mined on Prince William Sound in 1915, but the average grade of the ore fell from \$12.60 a ton in 1914 to about \$8.07 in 1915. The total production of copper, gold, and silver from the copper ores was for each metal less than in 1914, but because of the high price of copper the total value of the metals recovered from the copper ores in 1915 was slightly greater than in the preceding year.

The future position of Prince William Sound as an important copper producer appears to depend on the successful treatment of the lower-grade copper ores by concentration or by a marked lowering of the mining or metallurgic costs through some radical change from the methods in use in the past. The completion and operation

of a mechanical concentration process, chiefly by flotation, at the Beatson-Bonanza mine, on Latouche Island, for the recovery of the valuable metals in the ore marks a step in this direction.

LATOUCHE ISLAND.

The Beatson Copper Co. operated the Beatson-Bonanza mine, on Latouche Island, throughout the year. About 150 men were employed at the camp, half of whom were at work at the mine. Development work was continued as usual by open cuts, tunnels, and drifts, and more ore was mined than in previous years. A large plant for the concentration of the lower-grade ores, chiefly by an oil flotation process, is reported to have started operations early in the spring of 1915 and to have been in full operation during the later part of the year. Considerable crude sulphide ore was shipped to the Tacoma smelter, as in previous years, but a much larger quantity was put through the concentrating plant at Latouche, and the concentrates from this plant were shipped to Tacoma. One large cargo of concentrates was lost at sea on the way to the smelter.

On the property of the Latouche Island Copper Mining Co. (Ltd.), on Latouche Island, only assessment work was done in 1915, and this work was restricted to surface development.

KNIGHT ISLAND.

Development work is reported to have been started in August, 1915, on the Pandora property, on the Bay of Isles, and to have continued steadily during the fall with a crew of several men. The work done in 1915 included the deepening of the shaft 66 feet and the driving of 10 feet of crosscuts and 14 feet of drifts on the 90-foot level. The total underground developments now are reported to include a 90-foot shaft, 132 feet of drifts, and a 75-foot adit. A wide chalcocyanite-bearing ore zone is said to be developed by these workings.

On a copper property on Drier Bay considerable open-cut work is said to have been done and 60 feet of tunnel driven during 1915.

Only open-cut assessment work was done in 1915 on the property of the Knight Island Copper Mining Co.

PORTAGE BAY.

The discovery of a copper lode on the north side of the Portage Glacier Pass is reported, but no development work is known to have been done on it.

UNAKWIK INLET, WELLS BAY, LONG BAY, AND GLACIER ISLAND.

Only assessment work is reported on the copper prospects on Unakwik Inlet, Wells Bay, Long Bay, and Glacier Island.

VALDEZ DISTRICT.

No development work was in progress at the Midas mine of the Granby Consolidated Mining, Smelting & Power Co. (Ltd.), on Solomon Gulch, during the winter of 1914-15. Such work as was necessary to complete the aerial tramway, the mine terminal of the tramway, and the buildings at the mine and to fill in about the pile foundations of the shipping bins at the wharf was started in April, 1915, and was about completed at the end of the season. The aerial tramway was completed late in August and run intermittently during the fall. Considerable ore from the mine and dump was sent down on the tramway and stored in the ore bunkers on the wharf, but no shipments to smelters were made. About 50 men were employed on the property. Underground development work at the mine started late in June, and an average force of 10 men were at work in the mine during the rest of the season. Two shifts were at work all summer, the night shift consisting of two men. The lowest tunnel on the lode was extended to a length of about 410 feet (Oct. 21, 1915), and a 50-foot crosscut was driven on the next higher level. The buildings at the mine, besides the mine terminal of the tramway and the ore bunkers and blacksmith shop, include a large cook and bunk house, three cottages, three sheds, and an air-compressor building.

A large low-grade copper prospect, known locally as the Addison Powell property, situated on Sulphide Gulch about 4 miles from its junction with Lowe River, was relocated in the spring of 1915. About 150 feet of open cuts and stripping and 100 feet of tunnel are reported to constitute the development work done during the year. The principal copper mineral in the ore from this property is chalcopyrite, but some malachite is found. A little gold is also reported.

A copper lode is said to have been found on the south side of Lowe River about 15 miles east of Valdez.

ELLAMAR DISTRICT.

Only assessment work was done in 1915 on the property of the Galena Bay Mining Co., near the head of Galena Bay.

At Ellamar the plant of the Ellamar Mining Co. was operated throughout the year, and a large quantity of ore was mined and shipped. The underground work included the driving of additional crosscuts. Raises in the slate country rock at this mine in recent years are reported to have encountered explosive gases, the exact composition of which has not been determined.

The Threeman Mining Co. carried on operations from June to December and made several shipments of ore. Crosscuts were also driven on the Keystone and A. C. claims. A force of 10 men are reported to have been working for this company.

Two men are said to have been engaged in development work at the mine of the Landlock Bay Copper Mining Co. (Dolan & Rystrom property), on Landlocked Bay, but no shipments are known to have been made during 1915.

No work was done on the Standard Copper Mines ground on Landlocked Bay.

PORT FIDALGO.

Some development work was in progress in 1915 at all three of the copper mines on Port Fidalgo. The Fidalgo Mining Co. worked a small crew of men from June 1 to December 15, and shipped several hundred tons of ore to the Tacoma smelter. Mining was restricted to the footwall pay shoot.

Underground development work was started in the fall on the Schlosser property. The wharves and ore bunkers are reported to have been rebuilt, and a shipment of ore is said to have been sent to Tacoma near the end of the year.

The Mason & Gleason mine, now the property of the Dickey Copper Co., was operated only during November and December, 1915. Ore bunkers and a wharf were erected on Irish Cove.

GOLD MINING.

GENERAL CONDITIONS.

The gold produced in the Prince William Sound region, other than that from the gold-bearing copper ores, comes from both gold quartz lodes and gold placers. The placer deposits, because of the recent intense glaciation of the region and the consequent lack of concentration of the widely distributed gold, are few, small, and irregularly distributed. They are worked only intermittently, on a very small scale, and contribute little to the gold production. The producing gold quartz lodes are in the Port Wells and Port Valdez districts. In 1915 the Port Wells district was the larger producer, although most of the producing properties are in the Port Valdez district. The Granite mine, on Port Wells, made the largest contribution to the gold output of the region, and second place was held by the Ramsay-Rutherford mine, in the Port Valdez district.

PORT WELLS DISTRICT.

The geology and economic features of the gold deposits of the Port Wells district, together with the developments up to and including 1914, have been described in recent reports.¹ The Granite mine is the most productive property in the district and the largest

¹ Johnson, B. L., The Port Wells gold lode district: U. S. Geol. Survey Bull. 592, pp. 195-236, 1914; Mining on Prince William Sound: U. S. Geol. Survey Bull. 622, pp. 131-139, 1915.

producer among the gold quartz mines of the Prince William Sound region. Underground development and assessment work was done on several other properties in this district in 1915, and a few new lode discoveries are reported. Ocean-going steamers continued their visits to Port Wells, and a regular mail and passenger service was maintained between Valdez and several points on Port Wells. The district was not visited by Survey parties in 1915, and few notes have been obtained regarding the developments of the year.

The Granite mine was under development throughout the year. Besides the work necessary to take out ore for the mill, a crosscut tunnel, reported to be 800 feet in length, was run at a lower level, and a long raise was made from this tunnel to the vein. In addition to the underground work at the mine, a substantial wharf was built for large boats, a new oil-burning power plant was installed on Hobo Bay, and a power line 4,800 feet long was erected between this plant and the auxiliary power plant near the mill. A 10-stamp mill, added to the milling plant in the spring of 1915, was in operation about seven months. The Lane mill was also reported in operation for several months. From 50 to 70 men were employed on the property during the year.

Considerable development work is reported on properties adjacent to the Granite mine.

Development work is reported on the North Star claim, on Avery River.

The Cordova Mining & Development Co. started the installation of a 5-stamp mill and an aerial tram on the Nugget and Golden Wonder No. 9 claims, near Golden, with a force of about 25 men. Some underground development work is also reported to have been done by this company on these claims. Later in the year, after the erection of the mill house, operations were discontinued, and the plant is reported to have been moved off the ground.

The Golden Eagle mill, at Golden, was idle in 1915, but some underground development work is said to have been done on this claim during the preceding winter. A tunnel was driven on the Wagner prospect near Golden, and in the spring a crew of 15 men started to sink a shaft on the Keynote claim.

On Hummer Bay surface stripping and opencut work is reported on the prospect of Bennett, Bailey & Heinz. On Pigot Bay 100 feet of tunnel is said to have been driven on the Hamilton property. Other properties on this bay were under development.

The Thomas Culross Mining Co. did some underground development work on its claims on Culross Island and is reported to have made a small shipment of ore to Tacoma.

PORT VALDEZ DISTRICT.¹

The number of producing gold quartz properties in the Port Valdez district in 1915 was less than in the preceding year, but the total value of the bullion produced appears to have been about the same. The mills operated included only the Ramsay-Rutherford, Cliff, and Gold King. A small additional output is reported to have been obtained by mortar from the National claim, on the Columbia Glacier. Only assessment work was done over most of the Port Valdez district, but a small amount of additional development work is reported on a few of the properties. In all only about 45 men were employed at the producing properties throughout the year, but numerous others were employed for short times in the annual assessment work on the many claims scattered throughout the district.

The mill and plant at the Ramsay-Rutherford mine were operated from June 2 to December 31, 1915. After the completion of a 742-foot mill-level crosscut tunnel, which cut the vein about 310 feet below the outcrop, and the connection of the shaft from the upper workings to this level a change was made in the method of handling the ore, which is now lowered to the mill-level tunnel and trammed to the mill. The aerial tram connecting the shaft house with the surface tram to the mill was taken down, and this surface tram is no longer used. Underground work was in progress throughout the winter of 1914-15 and in 1915. The principal work was the completion of the long crosscut tunnel at the mill level. Early in July, 1915, the underground developments consisted of the 742-foot crosscut tunnel with 80 feet of drifts and a 25-foot raise on the 300-foot level, 50 feet of drifts on the 150-foot level, 210 feet of drifts and a crosscut on the 100-foot level, about 220 feet of drifts on the 50-foot level, a 70-foot crosscut tunnel, a raise from the 300-foot level to the surface, and stopes between the 50-foot and 100-foot levels and between the 50-foot level and the surface. At the end of the year it was reported that additional drifting was done on the 300-foot level. A total of 480 feet of drifts were opened in 1915. An average force of 16 men were employed on the property during the year.

The Valdez Mining Co. extended its lower tunnel 83 feet, drove a 40-foot crosscut, and after cutting the vein drifted along the footwall for 34 feet and then crosscut the vein again. Where first crosscut the vein is reported to have had a width of $10\frac{1}{2}$ feet. The work was done under two contracts, four men being employed on the first and three men on the second.

On the Pinochle claim the lower tunnel is said to have been extended 60 or 70 feet and to have cut the vein. No work was done in the upper tunnel. Three men were at work on the property in July.

¹A detailed report on the Port Valdez district is now in preparation.

Only assessment work was done on the Mineral Creek lodes in 1915, and the mills on the Mountain King and Big Four properties, which had been in operation the previous year, lay idle.

On Gold Creek some underground development work was done on the McCallum claims, near the head of the creek, where the owner was at work during part of the summer.

The upper workings of the Cliff mine were under lease to John E. Hughes, and the property was operated from May to December. A new vein, occupying a well-defined fissure and showing from 1 to 6 inches of quartz, was discovered on the crest of the hill. An adit 175 feet in length was driven, and the vein was stoped for about 75 feet. Several tons of the ore were milled in the Cliff mill, three stamps and two tables being used. Some underground work was also done under the original discoverer of the property, H. E. Ellis, in the old workings on the 100-foot and 200-foot levels, and some ore from these workings is said to have been milled. An average force of 20 men were employed during the season.

No work was done on the Three in One group during the first half of the year, but late in the summer two men were at work developing the property.

On the Sealey-Davis Mining Co.'s claims, on Shoup Bay, one man was at work during the summer and is reported to have done 200 feet of drifting in the middle tunnel, extending this tunnel to a total length of about 815 feet.

Four men were engaged in driving a 25-foot raise near the end of the long tunnel on the property of the Seacoast Mining Co. in the summer of 1915. A 4½-foot vein was cut in this raise about 18 feet above the tunnel.

On the Bald Mountain group one man was engaged in development work.

On the claims of the Cameron-Johnson Gold Mining Co. from two to six men were employed for a short time during the later part of the summer. The mill on the property was not operated during the year and no production was made. In the fall the company was placed in a receiver's hands and later was reorganized as the Valdez Gold Co.

Assessment work is reported on the Alice, Nymond, and Bence-McDonald claims.

The Gold King claims reverted to the original owners, and the property was worked by them during the summer. The mill was run for about a month during the spring, and seven or eight men were employed on the property at that time. During most of the summer, however, but one man remained on the property, and the development work was restricted to the driving of a crosscut in the long

lower tunnel. In October three men were reported at work on the property.

Assessment work is reported on the Mayfield and National claims.

A 160-foot tunnel is said to have been driven during the winter of 1914-15 on a gold quartz property on the south side of Port Valdez, about a mile back from the Eight Mile Beach.

The entire valley of Lowe River from Keystone Canyon to the head of the river was located in the spring of 1915 as possible placer ground, and some of the claims were tested with a churn drill, apparently with unsatisfactory results, as no further work is reported to have been done. The Bud Mining Co. on Gold Creek did not operate in 1915, and only assessment work is known to have been done on the Mineral Creek placers.

ANTIMONY MINING.

Some prospecting for antimony was in progress on Prince William Sound in 1915, and some new stibnite-bearing prospects are said to have been located in the Port Valdez and Port Wells districts. No antimony shipments are known to have been made, and no extensive developments of antimony lodes were in progress.

