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Preliminary report on a lead-zinc occurrence at Berg Basin, Wrangell district, southeastern Alaska

by
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INTRODUCTION

A brief examination of a lead-zinc occurrence at Berg Basin, Wrangell district, southeastern Alaska, was undertaken in 1947 as part of the U. S. Geological Survey's program of minerals investigations in Alaska. No lead-zinc ore body has yet been proved at Berg Basin, but because of recent interest in that area this preliminary report has been prepared for the purpose of making available immediately all data collected to date. A more complete report is in preparation.

Berg Basin is at the head of Berg Creek on the mainland about 14 airline miles east of Wrangell (see fig. 1). The relief in the area is very rugged. The floor of the basin, which has an altitude of about 1,500 feet, is bounded on all sides by mountain peaks ranging from 3,920 feet to 4,430 feet high. Berg Creek valley is a U-shaped glacial trough now covered with glacial debris and slide material from steep talus slopes. A thick growth of alders and salmonberry bushes covers most of the main valley and side slopes. A few small timbers can be obtained within half a mile of the lead-zinc prospect, but no large trees are found closer than one mile downstream.

The prospect is accessible by an old trail in poor condition which extends northward from 7 miles along Berg Creek from a point where the Aaron Creek Forest Service trail crosses Berg Creek. The prospect is at an altitude of about 1,780 feet.

The deposit was discovered and staked in 1907 by Messrs. Ludwig Berg, J. E. Berg, and Chris Wedow. Development work has continued intermittently since that time. The property is covered by 10 unpatented claims known asthe Silver King group and is now owned by Mr. Lester C. Berg of Sitka, Alaska.

The property has been prospected by several surface pits and by a tunnel nearly 800 feet in length. The driving of the tunnel originally was begun for the purpose of exploring the downward extension of a quartz vein which crops out on the surface and which was reported to carry gold. Late in the summer of 1947 a diamond drilling program was initiated partly to explore further the possibility of locating the gold-quartz vein at depth and partly to test the prospect for lead and zinc minerals. Because the diamond drill cores have not been completely examined, no logs have been recorded in this preliminary report.

The writer spent approximately four weeks in 1947 mapping geology at and around the Berg Basin prospect. Detailed mapping at the prospect was carried out by Brunton compass and steel-tape traverses. The only previous work in Berg Basin was a brief examination by Buddington in 1921.[1/]

GENERAL GEOLOGY

The Berg Basin area is underlain predominantly by highly metamorphosed rocks which are part of the metamorphic series extending along the west flank of the Coast Range batholith in southeastern Alaska (see fig. 2). In the vicinity of Berg Basin this belt of metamorphic rocks is approximately 2½ miles broad. It is bordered on the east by the Coast Range batholith and on the west by two separate sill-like masses of granitic rocks. The foliation in the metamorphic rocks generally strikes about N. 25° W. and dips steeply northeast, but in the area between the sill-like masses of granitic rocks west of Berg Basin the metamorphic rocks are deformed considerably. The main northwestward structural trend here is destroyed. Tight folding is characteristic. Drag folds are very common, and at least one tight fold of large magnitude was observed. The drag folds plunge consistently from 30° to 90° to the southeast. At least part of the stratigraphic

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1/ Buddington, A. F., Mineral deposits of the Wrangell district: U. S. Geol. Survey Bull. 739-b, p. 67, 1923.

sequence probably has been repeated. In general, the trend of the foliation in the metamorphic rocks is paralled to the contacts between the metamorphic and igneous rocks.

The metamorphic rocks have been derived mainly from sedimentary rocks and now comprise high-grade quartzose and micaceous schists and gneisses, along with a few thin bands of marble. The metamorphism probably accompanied the emplacement of the Coast Range batholith and related intrusions. The original sedimentary rocks were presumably soaked with igneous solutions prior to or during the period of folding. Pegmatite sills as much as 6 feet thick have been infolded with the sedimentary rocks three quarters of a mile southwest of the Berg prospect. In some areas ribbon gneisses have been developed where the rocks were steeply tilted with little or no close folding. These rocks are characterized by remarkably straight bands of light-colored, injected igneous material ranging from a fraction of an inch to two inches in width.

Sills and dikes of rhyolite and rhyolite porphyry as much as 25 feet thick, and basaltic sills and dikes as much as 5 feet thick, have intruded both the metamorphic and igneous rocks. The basaltic dikes most commonly crosscut the rhyolite. At least one locality was examined, however, where the rhyolite appeared to be younger than the basaltic dike.

Most of the intrusions of basaltic and rhyolitic material are in the form of sills, which characteristically occur in sill groups. The rhyolitic sills generally are greater in thickness and can be traced for greater distances than the basaltic types. Pegmatite sills and dikes also are fairly common, but quartz veins are found only occassionally.

No faults of large displacement have been observed in the Berg Basin area. Faults parallel to the foliation in the metamorphic rocks are common, however, and contain as much as several inches of gouge. Faults of this type are especially well exposed in the underground workings (see fig. 4).

LEAD-ZINC OCCURRENCE

Galena and sphalerite are the principal lead and zinc minerals at the Berg prospect. They are found in association with rhyolite dikes or sills which have been intruded by basaltic dikes. In the surface exposures examined, the galena and sphalerite occur in small irregular pockets within a composite basaltic dike, along the contacts of basaltic dikes with rhyolite, along the contacts of basaltic dikes with schistose country rock where rhyolite crops out close by, and disseminated within the rhyolite. No galena or sphalerite have been found in Berg Basin where basaltic dikes are not associated with rhyolite sills and dikes.

The original discovery of galena was in a basaltic dike 4 feet thick located 40 to 45 feet N. 55° W. from the portal of the prospect tunnel (see fig. 3). Blocks of galena nearly 1 foot in diameter are said to have been found along the dike at the bottom of the main prospect pit which is now partly filled in. A composite dike here is in contact with schistose country rock, but a few feet to the north it has intruded a hard, fine-grained, greenish-colored rhyolite. Pods of galena occur within the dike as well as along its contacts with schistose country rock and rhyolite. The lenses of galena now exposed are only a few inches thick and one to two feet long. Some pyrite and black sphalerite also are present. Milky quartz is the predominant gangue mineral.

Analyses of two samples of galena from the discovery pit yielded 27.90 oz. and 28.70 oz. of silver per ton.[2/] These figures should be interpreted with caution, however, as it is known that in certain silver-lead mining districts there is no consistency in the ratio of silver to galena in the ore.

Basaltic dikes in the immediate vicinity of the Berg prospect commonly split into branches. Pyrite, sphalerite, and galena in a gangue of quartz have been

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2/ Silver and gold analyses by Ledoux & Company, New York, N. Y.

localized in one of these forks 170 feet N. 17° W. of the prospect tunnel.

Approximately 90 feet nearly due north of the discovery pit is an outcrop containing sphalerite with some galena in a zone about 8 inches wide and 6 to 8 feet long at the contact of a basaltic dike with rhyolite (see fig. 3). The South-east limit of this zone was not determined.

Diamond drill hole no. 2 was drilled a distance of 100 feet from the face of the side drift in order to test the possible northward extension of the galena-bearing zone along the basaltic dike exposed in the discovery pit (see fig. 3). This is a horizontal hole bearing N. 66° W. At 76 feet a 5-foot zone of solid and disseminated galena is said to have been penetrated. The mineralized zone is bounded by basaltic dike material on one side and by rhyolite on the other. No analyses have been made as yet to determine the silver content of the galena penetrated in this drill hole.

GOLD-QUARTZ VEIN

A quartz vein estimated to be about 1 foot thick and reported to contain $14.00 to the ton in gold occurs within a rhyolite sill on the surface 150 feet N. 62° E. of the tunnel portal and at an altitude about 165 to 170 feet higher than the tunnel portal. This area is accessible with difficulty and was examined only briefly. The rhyolite sill strikes northwest and dips fairly steeply to the north-east. A dip of 57° was measured on the footwall of this sill. From surface exposures it is not evident whether the quartz vein dips with the sill or cuts across it. It may be pointed out, however, that a rhyolite sill in the tunnel 216 feet from the portal (see fig. 4), and which is logically the downward extension of the rhyolite sill on the surface, contains no late vein quartz. But a quartz vien 1.5 feet thick, which may be the downward extension of the vein cropping out on the surface, is exposed in the tunnel at a point 346 feet from the portal (see inset, fig. 4). This vein, however, contains only 0.01 oz. gold per ton.

During the latter part of the 1947 field season an attempt was made by diamond drilling to locate the downward extension of the gold-quartz vein at a point beyond the face of the main drift. Diamond drill hold no. 1 was drilled a distance of 180 feet, but no significant quartz-bearing zones were penetrated.

The rhyolite sill which has been intruded by the gold-quartz vein locally contains pyrite and galena. Stringers of sphalerite are present in some of the schistose wall rock. Two basaltic sills each about 1 foot thick cut the metamorphic rocks on the footwall side of the rhyolite sill. Six to twelve inches of quartz is found on each side of one of these sills, but it has not been analyzed for gold content. High-grade galena is reported to have been taken from an old prospect pit nearby.

OTHER MINERALIZED AREAS

Pyrite and pyrrhotite are common in the metamorphic rocks. Some of the schist exposed in the prospect tunnel is estimated to contain one or more percent of sulfide minerals. On the west side and near the top of Berg Mountain small areas of schist are also mineralized with disseminated pyrite and pyrrhotite. No attempy has been made as yet to delimit any of the more conspicuously mineralized zones, however.

In the underground working about 175 feet from the portal of the tunnel a light gray felsite sill is exposed. The sill has a maximum thickness on the north wall of 14 to 16 inches and locally contains from 1 to several percent of pyrite. A channel sample cut from this sill contained 0.01 oz. of gold per ton.

Zones heavily mineralized with pyrite and pyrrhotite were encountered in diamond drill hold no. 1, and it is reported that 6 to 8 inches of solid sulfide material was penetrated at one place. No analyses of this sulfide material are available at present.

GENESIS

The lead-zinc deposits in the Wrangell district generally are believed to be genetically associated with the Coast Range batholith or related intrusive bodies.

Certainly the galena and sphalerite minerals are younger than the basaltic dikes, which in turn are generally younger than the rhyolite dikes and sills. The presence of galena within the basaltic dikes at Berg Basin would suggest that these dikes, as well as the rhyolite dikes and sills, were a late phase of Coast Range batholith igneous activity.

Available data from surface exposures suggest that the sphalerite and galena were formed under moderately high-temperature conditions. Sphalerite and galena were deposited in part as cavity fillings although some replacement and filling of minute fractures took place. These cavities and fractures probably were formed by movement which accompanied the intrusion of the basaltic dikes.

Quartz is the principal gangue mineral along with minor amounts of carbonate. Galena, sphalerite, and pyrite are the predominant sulfides. Chalcopyrite rarely is present. The galena generally is coarse-grained, and individual crystals commonly are coated with a thin, platy mineral, possibly barite.

Near the contacts between basaltic dikes and rhyolite or schist the quartz gangue commonly exhibits a comb structure. In some places the original cavities were filled with sulfide minerals although some open vugs still exist. Banding within the sulfide bodies, which is more characteristic of low-temperature deposits, was not seen in any of the surface exposures at Berg Basin.

The pyrite usually is massive, but small cubes also have been formed. The sphalerite is dark brown to black in color and is the iron-rich variety marmatite.

In general, both the basaltic dikes and rhyolite dikes and sills have been altered considerably. The feldspars have been replaced extensively by sericite and chlorite. A specimen from one of the basaltic dikes contained a large amount of secondary interstitial calcite.

CONCLUSIONS AND SUGGESTIONS FOR FURTHER EXPLORATION

Diamond drilling undertaken in 1947 proved the existence of a 5-foot galena-rich zone at Berg Basin, but further exploratory work is needed before the presence of an ore body can be validly appraised. The current high price of lead should be an inducement to continue the exploration at this locality.

Because Berg Basin is accessible only with difficulty, a large tonnage of ore in this area would have to be proved to make lead mining economically feasible. The value of possible lead ore would be enhanced appreciably by its silver content. Two samples of galena analyzed for silver contained 27.90 oz. and 28.70 oz. of silver per ton.

One quartz sample and two silicic sill samples were collected at the Berg prospect for gold analysis, but no sample contained more than 0.01 oz. of gold per ton. It may be discouraging to the gold prospector to note that the several adjacent mineralized areas north of Berg Basin which have been examined in detail by the Geological Survey 3/ also are characterized by deposits containing only a trace of gold or no gold at all.

It is inferred from structural and lithologic data available that the gold-quartz vein at the surfact 150 feet N. 62° E. of the tunnel portal at the Berg prospect either pinches out with depth or rakes somewhat and is represented in the tunnel by the quartz vein at 346 feet which contains only 0.01 oz. of gold per ton. Continuation of the present program of exploration to locate the quartz vein at depth at a point beyond the end of diamond drill hold no. 1 is therefore unwarranted. The relation of the location of the vein on the surface to structure and lithology in the tunnel is shown on figure 4.

On the basis of information obtained in diamond drill hold no. 2, further exploration is recommended to determine the extent of the galena body penetrated in that hole. Horizontal holes fanned from the face of the side drift to either side of the existing diamond-drill hold no. 2 would explore the lateral extent of the body and would serve as a basis for planning additional exploratory work.

3/ Groundhog Basin, Glacier Basin, and the Lake Claims

It might be advantageous, however, to prospect further the galena body by diamond drilling from the surface at a point some 200 or more feet northwest of the tunnel portal and at about the same altitude as the tunnel. Before any such plan is considered it would be necessary to determine more accurately the relation of topography to the zone of galena penetrated in diamond drill hold no. 2.