UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

PITCHBLENDE OCCURRENCE AT THE SUNSHINE MINE, SHOSHONE COUNTY, IDAHO

by

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and

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Abstract

The Sunshine mine in the Coeur d'Alene district of Idaho has in recent years been an outstanding silver producer from siderite veins in sedimentary rocks of the pre-Cambrian Belt series. The siderite veins, which have been most productive below the 1700-foot level, contain silver-bearing tetrahedrite, pyrite, galena, and other sulfides. Cobalt minerals have been found in the oxidized zone.

Ore concentrations in this and adjacent mines are believed to be associated most closely with zones of alteration in which wall rock has been sericitized and bleached.

Pitchblende was discovered at the Sunshine mine by E. E. Thurlow of the U. S. Atomic Energy Commission in 1949, and the occurrence was brought to the attention of the U. S. Geological Survey at that time.

Examination of specimens from the 3100-foot level shows that finely divided pitchblende occurs in and along the margins of siderite veins in quartzite and appears to be one of the earliest-formed vein minerals.

Introduction

The Sunshine mine in Shoshone County, Idaho, was examined briefly by R. U. King of the Geological Survey on October 8, 1949, and specimens containing pitchblende were collected from the 3100-foot level.

The present report includes the results of laboratory examination of the specimens by J. W. Adams of the Geological Survey. As no general summary of the geology and ore deposits of the Sunshine mine has been published recently, the writers have prepared a summary of the available published material. This summary is presented before the descriptions of specimens in order to serve as background material.

Summary of geology and ore deposits

Location and history.--The Sunshine mine of the Sunshine Mining Company is in the Silver Belt area of the Coeur d'Alene district, Shoshone County, Idaho (fig. 1). It is in T. 48 N., R. 3 E., three and a half miles west of Osburn and on the east side of the valley of Big Creek.

The mine, operated for years as a small producer, is in an area not considered favorable for the large ore bodies known in other parts of the Coeur d'Alene district. In 1930, however, rich ore was found on the 1700-foot level of the mine and further exploration in this and adjoining properties was successful. In 1931 _/ the Sunshine mine produced more silver than any other mine in Idaho, and in 1937 it produced more than any other mine

_/ Shenon, P. J. and McConnel, R. H., The Silver Belt of the Coeur d'Alene District, Idaho: Idaho Bureau of Mines and Geology, Pamphlet No. 50, p. 2, 1939.

in the world. Production for 1949 _/ was 156,027 tons of ore

_/ Regional News, Idaho. Eng. and Min. Jour., vol. 151, pp. 135-136, 1950.

averaging 30.89 ounces of silver, 2.47 percent lead, and unstated amounts of copper and antimony.

Workings at the Sunshine mine consist of the 3900-foot vertical Jewell shaft, and drifts on the 500, 1700, 2300, 3100, and 3700-foot levels _/. Mine workings in 1949 totaled over 186,000 feet. Ores

_/ Fifty-first annual report, Mining industry of Idaho, p. 206, 1949.

are treated in a 1100-ton concentrating plant located at the mine.

The pitchblende deposits in the Sunshine mine were discovered in the fall of 1949 by Mr. E. E. Thurlow of the Atomic Energy Commission, and were brought to the attention of the Geological Survey at that time.

General geology.--The Coeur d'Alene veins are in strongly folded and faulted pre-Cambrian sedimentary rocks of the Belt series, principally quartzites, argillites, and impure limestones. These rocks have been divided into six formations as shown in Table 1.

The only igneous rocks in the Sunshine mine area are dikes of diabase and lamprophyre. Some diabase dikes contain ore minerals, but the lamprophyre dikes appear to be barren and in some mines occur along faults that offset veins _/.

_/ Shenon, P. J. and McConnel, R. H., op. cit., p. 6.

The major structural feature in the area is the Big Creek anticline. The axis of this fold trends roughly east and many of the important veins, including the Sunshine vein, occur in faults and fractures along its steeply dipping north limb.

Alteration zones.--The rocks in the Coeur d'Alene district locally have been altered hydrothermally along well-defined zones as much as half a mile in width _/. This alteration has affected

_/ Shennon, P. J. and McConnel, R. H., op. cit., p. 6.

rocks of all types but is most pronounced in argillites, and consists of sericitization and general loss of color. Altered and bleached rocks appear to mark the zones where important ore deposits occur _/, but individual veins are not confined to these

_/ Sorenson, R. E., Deep discoveries intensify Coeur d'Alene activities: Eng. and Min. Jour., vol. 148, no. 10, pp. 70-78, 1947.

zones. The Sunshine vein lies partly within one such alteration zone that extends in an easterly direction for several miles.

Ore deposits.--The ores of the Silver Belt, including those of the Sunshine mine, are generally siderite-quartz veins containing pyrite, tetrahedrite, and galena, and minor arsenopyrite, sphalerite, specular hematite, chalcopyrite, boulangerite, and bournonite. Gersdorffite (NiAsS) has been reported _/ from the Polaris ore body,

_/ Willard, Max E., Mineralization at the Polaris mine, Idaho: Econ. Geology, vol. 36, p. 541, 1941.

adjoining the Sunshine deposits. An unidentified cobalt mineral occurs sparingly at the Polaris and Sunshine mines, and erythrite, $Co_3(AsO_4)_2 \cdot 8H_2O$, is found in the oxidized zone at the Sunshine mine _/. Pitchblende is locally associated with the sulfides in

_/ Shenon, P. J. and McConnel, R. H., op. cit. p. 8.

the Sunshine mine _/.

_/ Regional notes, Idaho: Eng. and Min. Jour., vol. 150, no. 11, p. 131, November 1949.

Anderson _/ stated that siderite was the earliest vein mineral

_/ Anderson, R. J., Microscopic features of ore from the Sunshine mine: Econ. Geology, vol. 35, pp. 659-667, 1940.

in the deposit, but that both siderite and quartz continued to form during most of the period of mineralization. He described the following sulfide sequence: pyrite and arsenopyrite, tetrahedrite, and galena. Anderson did not find silver minerals as inclusions in the tetrahedrite and concluded that the silver in the tetrahedrite is an isomorphous constituent.

In a study of the mineralization of the Polaris mine, Willard _/

_/ Willard, Max E., op. cit.

concluded that deposition of vein minerals was not continuous and that early pyrite-carbonate veins were reopened at least twice, the first fracturing admitting quartz which replaced part of the carbonates. The important ore minerals were deposited later, but only where access was provided by post-quartz fracturing.

Results of examination of specimens

General description.--Two thin sections, one polished section, and several hand specimens of ore, all from the 3100-foot level of the Sunshine mine, were studied. In these, the common sulfide and gangue minerals were recognized, and in addition most of the specimens contained a highly radioactive mineral, probably pitchblende. From a study of the specimens a few general inferences may be drawn regarding the occurrence of the pitchblende and its relationship to the other minerals.

All the specimens have a groundmass of fine-grained reddish-brown quartzite which in thin section shows abundant sericite. The quartzite is crossed by veins containing various amounts of the gangue and ore minerals. Siderite is the most abundant constituent of the veins. Pyrite and tetrahedrite are common, and are accompanied by galena, chalcopyrite, sphalerite, and quartz. Pyrite is probably the earliest sulfide and tetrahedrite the latest. Sphalerite, chalcopyrite, and galena appear to have formed during an intermediate period. Galena commonly occurs as inclusions in tetrahedrite. Pitchblende occurs on the edges of siderite-pyrite veinlets and is probably the earliest vein mineral.

Pitchblende occurrence.--On smooth surfaces on hand specimens the pitchblende appears to be a black band about a millimeter wide separating a siderite-pyrite vein from quartzite. A thin section (fig. 3) shows that the contact between the siderite-pyrite vein and quartzite is sharp and that the black band is produced by a concentration of small irregular opaque particles that are disseminated in the quartzite adjacent to the contact and to a lesser extent in the vein itself. Radioactivity, as shown by autoradiographs, is confined to the opaque particles, probably pitchblende, and siderite is appreciably darker near contacts with them.

Some pitchblende was found concentrated in veins, in association with siderite and sulfide minerals. In the specimen illustrated in figure 2, and in the accompanying autoradiograph, the narrow vein is fringed with pitchblende, and the wide vein has pitchblende distributed irregularly through its exposed width. In the polished section studied, the pitchblende appears to be brecciated, and the fragments are embedded in a matrix of siderite. In one thin section, the pitchblende has a box-work structure filled by siderite. Both modes of occurrence suggest that the pitchblende is the earliest vein mineral.

In the specimen shown in figure 2, a vein of siderite and tetrahedrite cuts the quartzite between the two siderite-pyrite veins. The siderite-tetrahedrite vein shows no appreciable radioactivity, as can be noted from the autoradiograph. This vein does not contain pyrite and is probably younger than the siderite-pyrite veins. All three veins in the specimen have been displaced along small faults, as shown for one vein in figure 3.

Table I

Generalized tabular section of pre-Cambrian rocks in the Coeur d'Alene area. Modified from table by F. L. Ransome, U. S. Geological Survey Prof. Paper 62, p. 25, 1908.

Formation	Description	Approximate thickness
Striped Peak formation.	Siliceous sandstones, generally flaggy to shaly. Top removed by erosion.	1,000 ft. minimum
Wallace formation.	Thin-bedded calcareous shales, argillite, calcareous sandstones, impure limestones all underlain by siliceous argillites.	4,000 feet
St. Regis formation.	Indurated shales and flaggy sandstones.	1,000 feet
Revett quartzite.	White, thick-bedded quartzite.	1,200 feet
Burke formation.	Sandstones,.shales, and quartzites.	2,000 feet
Prichard slate.	Mostly argillite with interbedded sandstone. Base not exposed.	8,000 feet minimum
		17,200 feet

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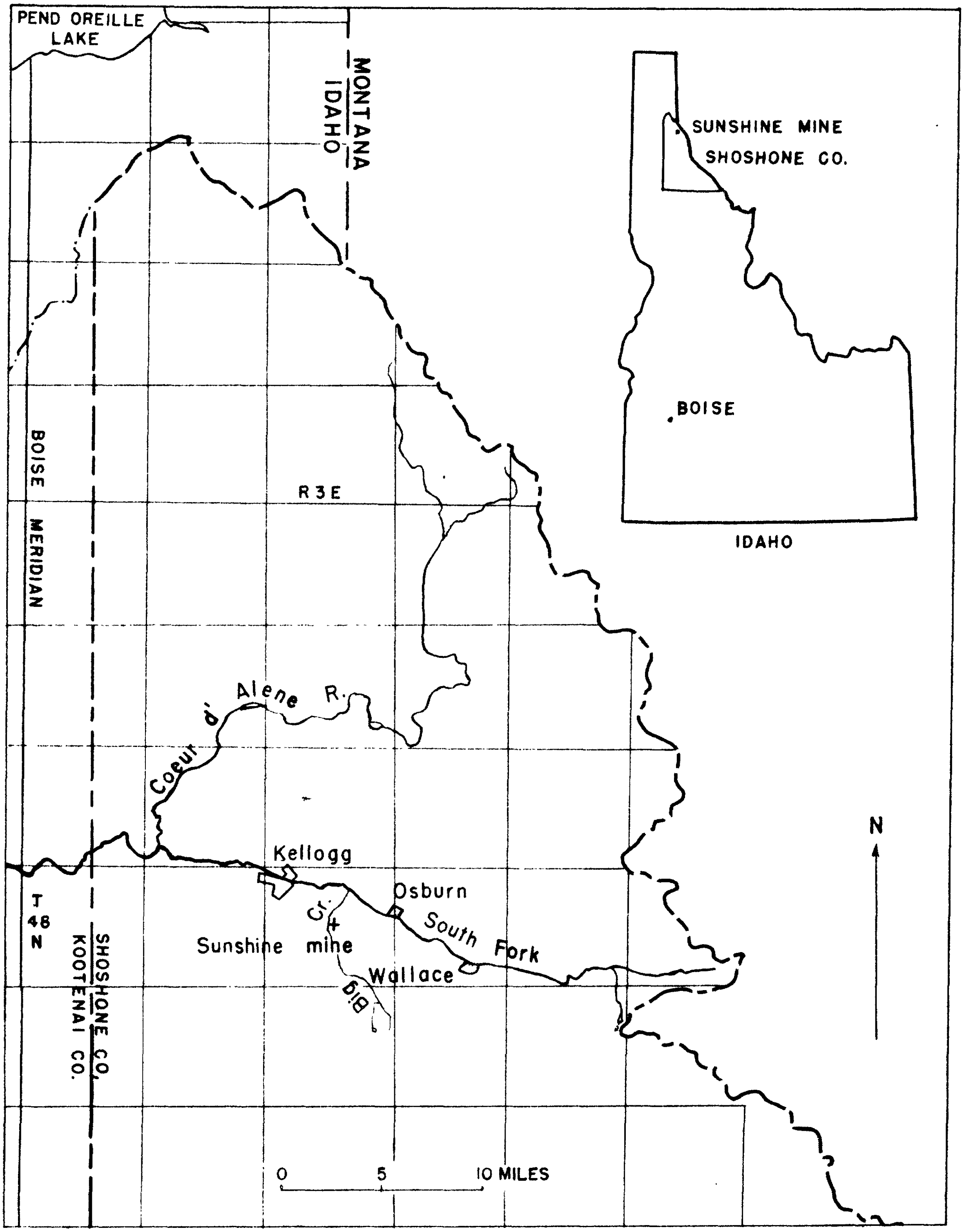

FIGURE I.—INDEX MAP SHOWING THE LOCATION OF THE SUNSHINE MINE, SHOSHONE COUNTY, IDAHO.

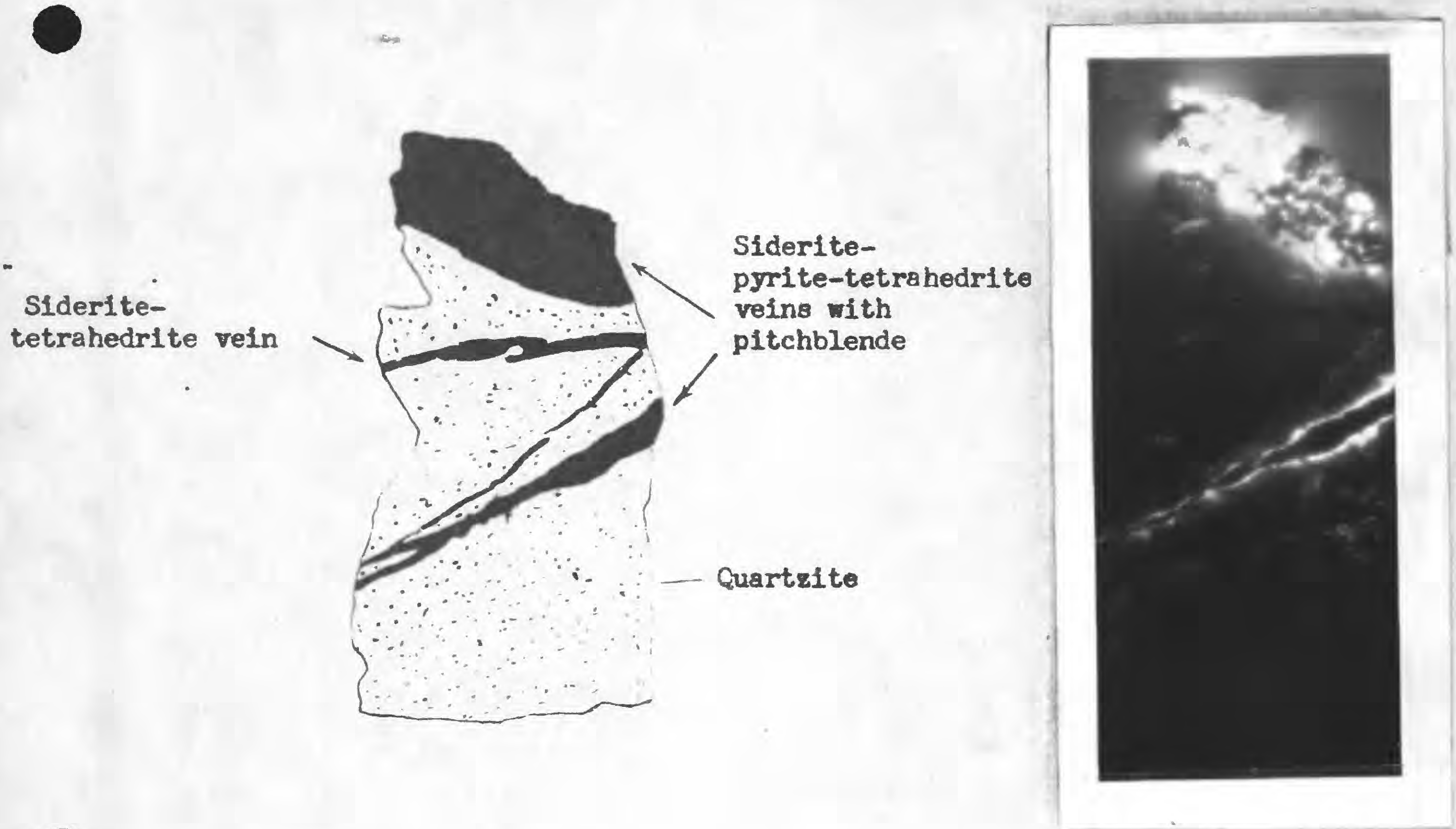

Figure 2 Sawed specimen of ore and accompanying autoradiograph, 3100-foot level, Sunshine mine. Actual size.

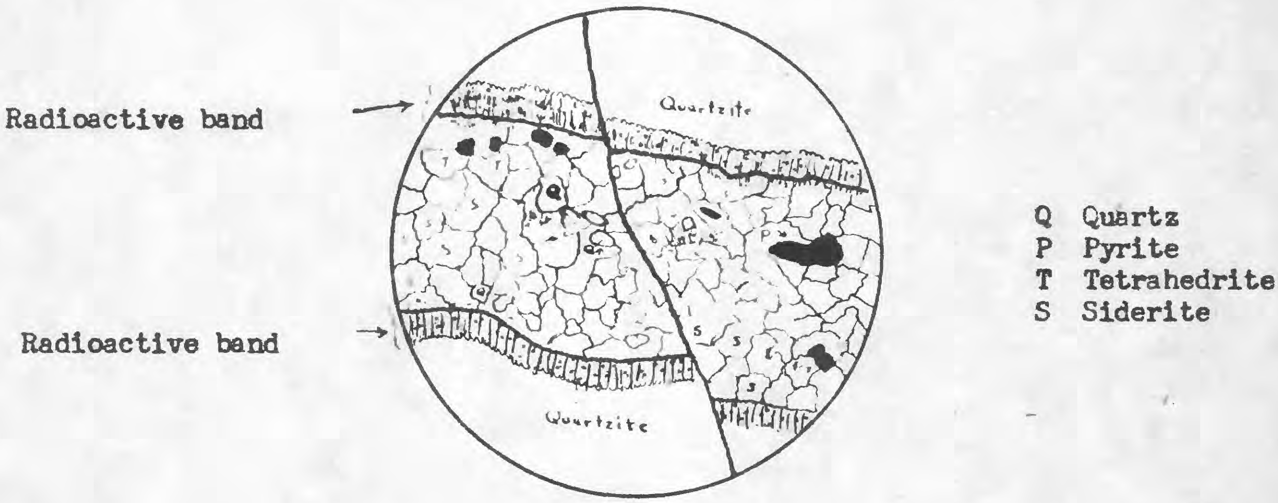

Figure 3 Portion of thin section made from specimen shown in figure 2. Siderite-sulfide veinlet cutting quartzite. Radioactive zone along edges of veinlet. 7X.