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MARCH 1948

UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, SECRETARY

BUREAU OF MINES
JAMES BOYD, DIRECTOR

REPORT OF INVESTIGATIONS

ANTLER COPPER-ZINC DEPOSIT, MOHAVE COUNTY, ARIZ.

BY

T. M. ROMSLO

R.I. 4214,
March 1948.

REPORT OF INVESTIGATIONS

UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

ANTLER COPPER-ZINC DEPOSIT, MOHAVE COUNTY, ARIZ.[1]

By T. M. Romslo[2]

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1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Report of Investigations 4214."

2/ Mining engineer, Bureau of Mines, Tucson, Ariz.

INTRODUCTION

This report presents factual data obtained by the Bureau of Mines in the course of an investigation of the Antler mine in the Cedar Valley mining district, Mohave County, Ariz.

The Antler property was first examined by Thomas L. Chapman, mining engineer, Bureau of Mines, on December 18, 1943, and January 28, 1944. In June 1945, A. H. Wadsworth, Jr., and R. L. Griggs, geologists, Federal Geological Survey, examined the Antler mine and several other mines in the district. Both Chapman and Wadsworth recommended diamond drilling of the Antler property to determine the character and extent of ore deposition.

In October 1946, the surface and underground workings were surveyed by George Huseman, mining engineer, and T. M. Romslo, project engineer. The following month Eldred D. Wilson, geologist of the Arizona Bureau of Mines, assisted by the project engineer, mapped the geology. Subsequently trails were built to drilling sites and diamond drilling started January 16, 1947. The project was completed April 25, 1947.

ACKNOWLEDGMENTS

In its program of investigation of mineral deposits, the Bureau of Mines has as its primary objective the more effective utilization of our mineral resources to the end that they make the greatest possible contribution to national security and economy. It is the policy of the Bureau to publish the facts developed by each project as soon as practicable after its conclusion. The Mining Division, Lowell B. Moon, chief, conducts preliminary examinations, does the actual investigative work, and prepares the final report. The Metallurgical Division, O. C. Ralston, chief, analyzes samples and makes beneficiation tests.

With respect to this report, field work was conducted under the supervision of J. H. Hedges, chief, Tucson Branch, Mining Division, and analytical work was done by Ray Stiles under J. Bruce Clemmer, chief, Tucson Branch, Metallurgical Division. Special acknowledgment is due Eldred Wilson of the Arizona Bureau of Mines and A. H. Wadsworth, Jr., and R. L. Griggs of the Federal Geological Survey for their assistance in mapping and interpreting the geology of the area.

LOCATION AND ACCESSIBILITY

The Antler mine is in the Cedar Valley mining district, secs. 3, 4, and 9, T. 17 N., R. 16 W., Mohave County, Ariz. (fig. 1). It is 12 miles east of Yucca, the nearest shipping point, and about 21 airline miles southwest of Kingman, county seat of Mohave County. Both these towns are stations on the Atchison, Topeka & Santa Fe Ry. The mine is accessible by highway from Kingman by traveling west 4-1/2 miles on U. S. 66, thence south 19 miles to Yucca and then east 12 miles to the property. The road from U. S. 66 is graded and has no excessive grades.

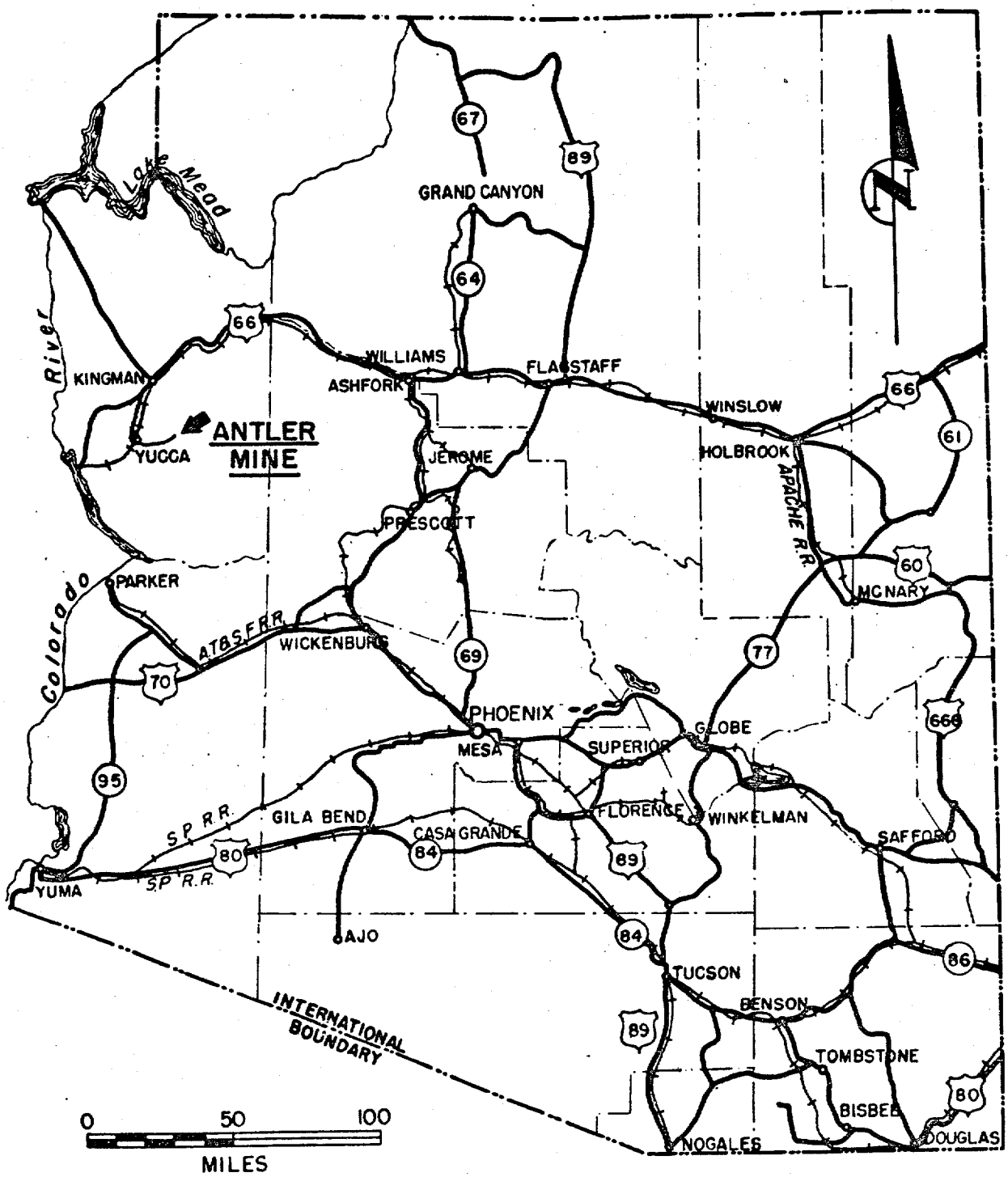

Figure 1. - Location map, Antler copper-zinc deposit, Mohave County, Ariz.

PHYSICAL FEATURES AND CLIMATE

The Antler mine is on the southwest flank of the north-trending Hualpai Mountains at an altitude of approximately 3,200 feet. The mountain range, about 35 miles long, has an average crestline altitude of about 7,000 feet, with a maximum of 8,200 feet on Hualpai Peak. One of the several canyons that cut deeply into the range emerges near the mine onto an alluvial plain.

Vegetation at the lower altitudes is of the typical desert variety. Scrub oak and groves of yellow pine grow near the top of the mountain range.

The climate is characteristic of the intermediate altitudes of northern Arizona. At Kingman, the average annual temperature is 61°, with an annual range from 8° to 117°. The winters are mild and the summers are hot. Annual precipitation averages about 11 inches. Snow seldom falls at the mine.

PROPERTY AND OWNERSHIP

The Antler property consists of two patented lode-mining claims, the Antler and the Spuyten Duyvil. The side lines of the claims bear N. 19° E. and S. 35° W., respectively, from the common corner monument shown on figure 2. The end lines have a common bearing of N. 71° W.

The property is owned jointly by R. B. Strassburger of Philadelphia, Pa., and the operating company, the Arizona Antlers Mining Co., 603 Beason Bldg., Salt Lake City, Utah. The company owns one third of the property. It has a lease with option to purchase Strassburger's interest.

HISTORY AND PRODUCTION[3/]

The Antler and Spuyten Duyvil claims were located in 1879 and 1888, respectively. Later the claims were patented, and the Phelps-Dodge Corp. obtained possession of them. Although some work had been done on the property, little or no ore was produced before World War I. During the period 1916 - 18, when high copper prices prevailed, lessees shipped 27 cars of 5- to 12-percent copper ore, mostly oxidized. Most of this ore came from trenches and shafts south of the Antler shaft.

In 1929 the property was leased by Pete Vukoye of Kingman, Ariz., who shipped 7 cars of 5- to 14-percent copper ore. In 1943 Pete and Mike Vukoye obtained a lease with an option to purchase and later bought the property. The Vukoyes sold the mine to R. B. Strassburger of Philadelphia, who leased it in October 1943 to the Silver Shield Mining & Milling Co. of Salt Lake City, Utah. That company started production in December 1943 but suspended operations in February 1944. Production by the Silver Shield company amounted to about 400 tons of ore averaging 12 percent copper and 2.5 percent zinc.

The Arizona Antlers Mining Co., the present operators, acquired the lease and reopened the mine in July 1944. Labor shortage forced them to

3/ Wadsworth, A. H., Jr., and Griggs, R. L., The Antler Mine: Unpublished report, Geol. Survey, 1945.

close in June 1945, but shortly thereafter the mine was again opened and has operated continuously to the present time (July 1947). To February 1947 this company produced 6,026 tons of ore averaging 8.38 percent zinc, 2.43 percent copper, 0.69 percent lead, 0.95 ounce silver a ton, and 0.009 ounce gold a ton.

At present all ore is shipped to Bisbee, Ariz., where it is beneficiated in the Shattuck-Denn custom mill.

GEOLOGY[4]

General

The Antler mine occurs in one of the large roof pendants of schist that, with pre-Cambrian granites and gneissic granite, comprise the principal rocks of the Hualpai Mountains (fig. 2). The schist has been tentatively correlated with the Yavapai schist of pre-Cambrian age.

Rocks

The schist belt, about one fourth mile wide in the Antler mine area, trends northeastward and is bounded on both sides by intrusive granite. The schist is readily divisible into two mapping units designated as black and gray.[5] The black schist contains abundant hornblende and dark mica. Locally it contains some magnetite or garnet. It has a somewhat speckled appearance, except where its composition is mainly mica. The gray schist is composed mainly of siliceous arkosic beds. Adjacent to faults and near the ore zone pyrrhotite occurs in fractures in both types of schist.

Pegmatite, composed largely of quartz and orthoclase or microcline, intrudes the schist as dikes and lenses. It contains local concentrations of large biotite or muscovite crystals. The pegmatite bodies vary in width from less than one fourth inch to a foot or more and in outcrop length they range from a few inches to several feet.

Aplite, replaced and veined by epidote, occurs as dikes that parallel the laminations of the schist. The dikes are generally only a few inches wide and seldom over 5 feet in length.

Two types of granite occur in the vicinity of the mine. Hornblende granite occurs as a fine-grained massive rock that shows definite foliation and mineral elongation parallel to the schistosity. Biotite granite that verges on quartz monzonite has the same physical characteristics as the hornblende type, except that it is coarse-grained.

Structure

The schist shows pronounced schistosity that strikes northeastward and dips steeply northwestward. The pegmatite and aplite bodies, as well as the major jointing of the granite, characteristically parallel the laminations of the schist. In places the pegmatite and aplite branch out across the strike, and in a few instances aplite dikes cut across the pegmatite bodies.

4/ Previously cited, see footnote 3.
5/ Unpublished notes, Wilson, E. D., December 1946.

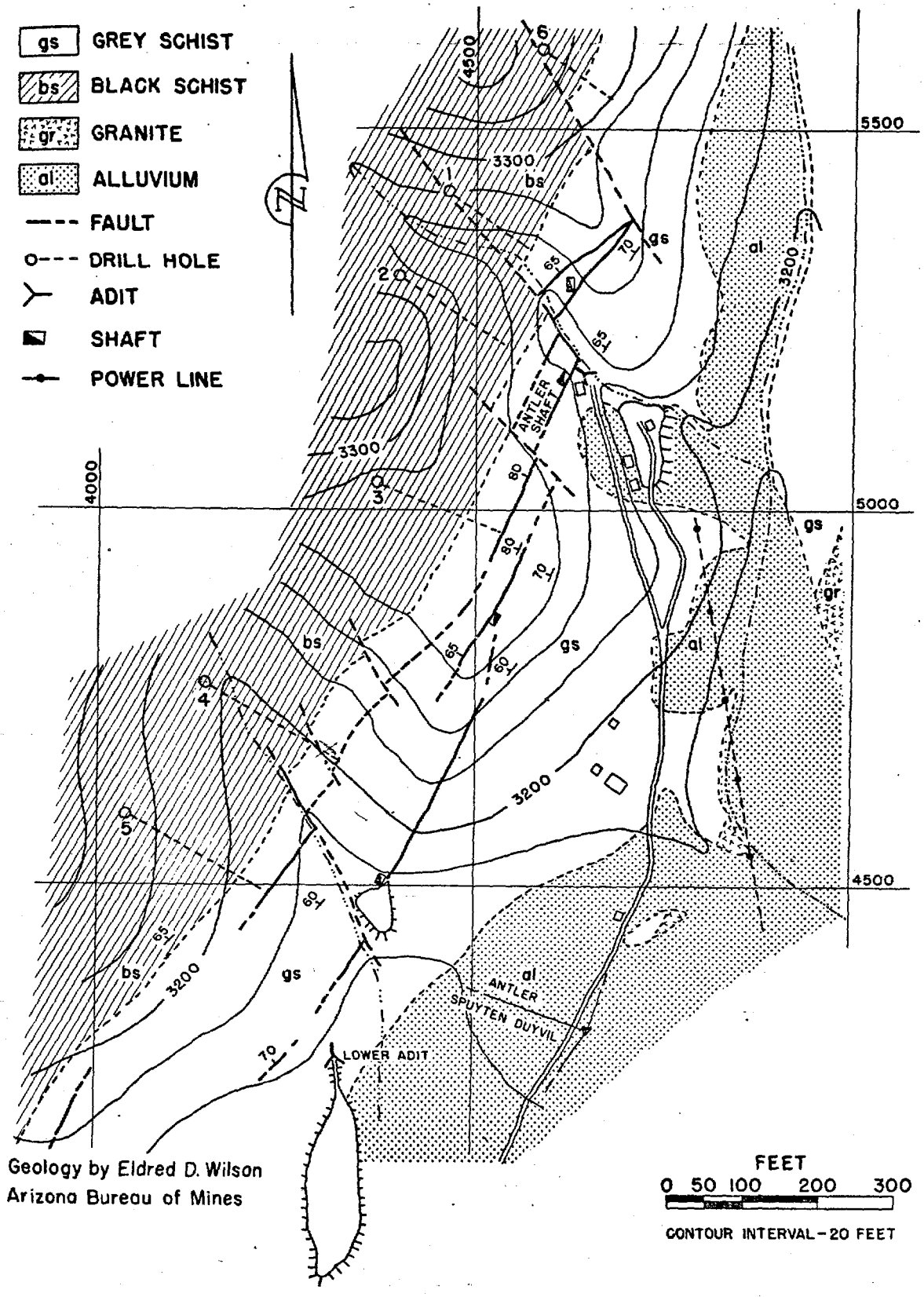

Figure 2. - Geologic map, Antler copper-zinc deposit, Mohave County, Ariz.

The schist has been displaced by two fault systems. The faults of the older system roughly parallel the schistosity and have been offset by a later system of northwestward-striking faults. The faults of the first system become progressively weaker southward from the Antler shaft.

Geology of Ore Deposits

The ore and associated minerals mainly replace altered schist. They also fill open fissures, seam and impregnate altered schist, pegmatite, and gneiss, and fill fractures in unaltered schist.

In the workings from the Antler shaft the Cholla and Yucca faults form the footwall and hanging wall respectively of the "vein" zone (figs. 3 and 4). The vein zone is composed mainly of altered schist. The contacts between the altered and unaltered schist are irregular, and altered schist sometimes encloses bodies of unaltered schist. Masses of quartz, coarsely crystalline mica, and feldspar are common in both types of schist. Pegmatite is found erratically throughout the zone. The ore occurs as pods and lenses that swell and pinch rapidly along both strike and dip. The maximum width stoped is about 20 feet. Above the first level, the ore is almost completely oxidized, while below this level very little oxidation has occurred. The vein zone shows a maximum width of about 40 feet. It is offset about 45 feet to the west by the Saguaro fault. Drilling data show that the Ocotillo fault offsets the zone to the west by about 85 feet. Both these faults dip steeply southwest. The average dip of the Cholla fault is approximately 70° to the northwest. The Yucca fault dips 50° northwest in the stope nearest to the Antler shaft. It steepens in depth, as indicated by its position in drill holes 1 and 2.

To the south of the Antler shaft veins ranging in width from 6 inches to 2 feet have been prospected. They are thoroughly oxidized at the surface, but sulfides were encountered at depths of less than 30 feet in some of the prospects. These veins occur along schistosity-plane faults belonging to the northeast system. Ore mineralization encountered by drill holes in this area appears to lie within a zone bounded by the Cholla and Yucca faults. Gneiss, verging on quartz diorite, was penetrated only in holes 3 and 4.6/

Mineralogy

The principal ore minerals, in order of their abundance, are marmatite, chalcopyrite, and galena. Covellite occurs as a coating on pyrrhotite, and a small amount of bornite was noted. Minerals common to the oxidized zone are antlerite (a basic copper sulfate first described from this mine), chalcanthite, and malachite.

The principal gangue minerals are mica, quartz, pyrrhotite, magnetite, anthophyllite, tremolite, and pyrite. A thin section of altered schist from the present workings consisted largely of anthophyllite, tremolite, sericite, antigorite, allophane, and delessite. Specimens of altered schist from

6/ Rock identified by H. Wenden, mineralogist, Arizona Bureau of Mines.