NOTES ON ORE DEPOSITS AT CAVE VALLEY, PATTERSON DISTRICT, LINCOLN COUNTY, NEVADA

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ORE DEPOSITS AT CAVE VALLEY, PATTERTON
DISTRICT, LINCOLN COUNTY, NEVADA

By F. C. SCHRADER

INTRODUCTION

The visit to Cave Valley that formed the basis of this report was prompted in the summer of 1930 by a request from the
Congressional Committee on Appropriations of the House of Rep-
resentatives to the Geological Survey for an investigation of
radium reserves. The deposits at Cave Valley had recently been
reported to contain uranium, which is the source of radium, and
the writer was therefore delegated to examine them; but the
results of the examination were negative. Small shoots of silver-
lead ore have been mined in this locality, and the outlook for
the district depends principally upon conditions that would favor
the working of similar ore bodies.

For courtesy and valuable information received, thanks are due
to officials of the Great Western Mining & Development Co.,
especially Mr. Claude Morris, without whose aid in the field
the illustrations and much of the material contained in the
report would not have been available.

LOCATION

Cave or Steptoe Valley is in the Patterson (Geyser) district,
about 50 miles south of Ely and 45 miles north of Pioche, which
are the nearest railroad stations. It covers the south end of
the Shell Creek Range, which here is high and narrow and sepa-
rates Lake Valley on the east from Cave Valley on the west.
Patterson Pass stands at an elevation of about 7,250 feet, and
Patterson Peak, six miles north of the pass, at 10,000 feet, or
3,500 feet above the adjacent valleys. The principal supply point
is Ely, which is reached by a good road along the long, narrow
Cave Valley.

EARLY DEVELOPMENTS

The Patterson district has been described more fully by Hill,1
and more briefly by Lincoln,2 according to whom the country
rocks consist of Cambrian quartzite, limestone, and shale, which

1Published by permission of the Director, U. S. Geological Survey.
2Hill, J. M., Notes on some mining districts in eastern Nevada; U. S. Geol.
3Lincoln, Mining districts and mineral resources of Nevada, pp. 123-124.
Reno, 1923.
Ore Deposits at Cave Valley

Ore Deposits at Cave Valley are folded and faulted and have a total thickness of several thousand feet. They dip steeply east for the most part. The only igneous rock noted is a dike of granite porphyry, which is 50 feet thick and strikes northwest across the crest of the range at the head of Swartz Canyon, three miles north of the pass.

Rich silver ores were found in the north side of Patterson Pass about 1869. Soon thereafter more than 200 claims were staked, including a few in Swartz Canyon, and a mill was built. About this time or later showings of mineral were also found at and near Cave Spring, on the west side of Cave Valley, six miles northwest of the pass.

The deposits of the district consisted chiefly of small replacement veins of well-crystallized quartz and calcite, mostly in the limestone, accompanied by minerals containing lead, antimony, copper, and iron in moderate quantity. A few thin films of argentiferous lead carbonate and more numerous small pockets of argentiferous copper carbonates were of most interest, but they were shallow and soon exhausted, and the district was abandoned with no record of the early-day production.

In 1913 some work was done on the Robertson property, near the summit of the range on its west side three miles north of the pass. There the showing consisted mainly of crushed and iron-stained shale coated with copper carbonate. At the Swartz property, on the summit of the range at Swartz Canyon, which was also worked at that time, films of sphalerite and pyrite, mostly on joint planes, and a little molybdenite occur in shale that is highly metamorphosed and resembles greenstone.

In 1920 and 1921 the Lake Valley Mining Co. shipped some siliceous silver ore and began building a 50-ton cyanide plant, in which in 1922–1925 it produced some silver bullion.

In 1920–1930 some work was done on the Cave group, at Cave Spring, and on the Streator group, three miles northwest of the spring. These two properties are described in some detail in the following pages.

DETAILED DESCRIPTIONS

CAVE GROUP

The Cave group of claims, owned by the Great Western Mining & Development Co., is in Cave Valley just north of Cave Spring. It is in the lower west foothill slope of the Shell Creek Range at an average elevation of about 6,700 feet. It lies for the most part on a broad ridge with rolling surface, which declines gently westward into the valley. A portion of it is shown in Figure 1.
History and Production

The Cave group comprises 21 claims, the nucleus and most important part of which is the original group of five claims, inclosed by the heavy border line in Figure 2. These five claims were located in 1921 by John C. Clark and J. C. Riordon, although previously different persons had tried unsuccessfully to work them from time to time.

In 1925 the Ely-Pioche Amalgamated Lead-Silver Mines Co. did some work on them, and in 1926 they were acquired by the Great Western Mining & Development Co., which has since been developing them intermittently on a small scale and has added 16 claims to the original group. According to Mr. Clark, some good ore was mined and shipped during the period of Clark-Riordon and Ely-Pioche ownership. A lot of oxidized lead ore derived from development work was shipped by the Ely-Pioche Co. in 1925.1

No further production has been reported except a few test shipments of ore, about five tons each, and a fair quantity of low-grade ore that remains on the dump at the mine.

The workings extend to a maximum depth of 120 feet, as shown in Figure 3. The mine is equipped with a 50-horsepower 8-ton Alamo engine, air compressor, and buildings to accommodate a crew of 16 men. The camp is supplied with excellent water from Cave Spring, which issues in a strong stream from a fissure at the foot of a limestone cliff 30 feet high at the upper edge of the camp.

Geology

The country rocks in Cave Valley are chiefly Cambrian quartzite, limestone, and shale, similar to those at Patterson, and are believed to be a part of the same series. Their relations and attitude are indicated in the section, Figure 4. In general they dip southeastward, or diagonally into the Shell Creek Range, at angles of $20^\circ$ to $40^\circ$. This attitude is similar to that of the rocks at Swartz Canyon and suggests that the Shell Creek Range in this latitude is essentially monoclinal, with easterly dip. The apparent great thickness of the rocks may involve considerable duplication, as they have been much crushed and faulted. Several fault fissures occur near the middle part of the section, as indicated in Figure 4.

Nearly all the fissures trend north and dip steeply to the west, away from the range. On the Big Fissure group the two cross

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fissures stand about vertical. The south one makes the better mineral showing.

The limestones are mostly bluish-gray and blue, more or less crystalline, and medium to thick bedded. The shales occur chiefly as dark intercalated thin beds.

Near the middle part of the section there is a bed of micaceous shale about 100 feet thick. (See Figure 4.) It is lead-gray or iron-gray, dense, closely but dimly banded, more or less finely pyritic, and on weathered joint planes is banded by yellowish-brown limonite streaks one-tenth of an inch or more wide. Locally, especially in the southern part of the Cave Valley mine, it has a pronounced laminated structure. The microscope shows it to be composed of very fine grained quartz, sericite, and secondary calcite, with considerable disseminated pyrite and detrital garnet. It seems to be peculiarly susceptible to mineralization, as the veins of the Cave Valley mine and other prospects occur in it.

The chief ground for referring the rocks to the Cambrian system consists of fossil remains which were found in the present work near the Cave Valley mine and the middle part of the section, in the limestone above the quartzite, and which Mr. Edwin Kirk, paleontologist, of the United States Geological Survey, has determined to be alge of Cambrian age. The stratigraphic relation of the fossil-bearing limestone seems to be the same as that existing near Patterson, where F. B. Weeks collected Cambrian fossils in limestone that overlies the quartzite.1

The deposits consist of replacement bodies along fissures in the limestone and quartzite. The replacement veins along fissures are shown in Figures 2 and 4. The bodies that have replaced certain beds of limestone are as much as two feet in thickness and are regarded as favorable features. They also are mostly associated with fissures, but some of them occur independently, as shown in open pits north of the mine.

Cave Valley Mine

The principal replacement vein is that of the Cave Valley mine, which is opened to a depth of 120 feet and has been followed by 500 feet of drifts, as shown in Figure 3. It strikes north-northwest and dips 80° WSW. in the gray micaceous shale, which dips 45° SE.

Ore is said to have been followed from the outcrop nearly all the way down the shaft, and good ore was mined from short

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1Spurr, J. E., Descriptive geology of Nevada south of the fortieth parallel and adjacent portions of California: U. S. Geol. Survey Bull. 208, p. 40, 1903.

drifts on the 40-foot level. Most of the ore produced, however, came from the south drift and stopes on the 120-foot level.

The vein seems to be continuous throughout on the 120-foot level, and ore several inches thick is exposed at each end of the drift, particularly the south end; but its thickness on the whole is irregular, ranging from an inch to about five feet. The vein consists of extensive lenses, which in places contain only barren fault gouge or finely crushed rock. In some places the ore and gangue are irregularly banded and streaked.

The ore is siliceous lead-silver-copper with a trace of gold. The gangue is mainly silicified limestone. One test shipment of 4½ tons made by the present owners is reported to have been valued at $85 a ton and another of 5½ tons at $94 a ton, but the small shipments over a period of several years imply that the quantity of high-grade ore in any continuous body is not great. There is a small amount of ore of milling grade.

In places the ore is stained green with malachite or brownish with limonite and lead carbonate, and some of it contains spots an inch or less in diameter of a dull black substance, which may be analogous to "copper pitch ore" in occurrence but seems to carry most of the silver and lead of the ore. Examinations made by M. N. Short, of the United States Geological Survey, indicate that this material is mainly an undetermined oxidized mineral or aggregate of minerals containing arsenic, lead, and a little copper. It is nonmetallic and translucent and gives a light-brown powder when scratched. In polarized reflected light it is isotropic, which probably indicates that it is amorphous. It contains also microscopic remnants of a silvery white metallic mineral which proves to be pearcite, a sulphide of silver and arsenic (9Ag₂S₃As₂S₇), and has been almost completely replaced by the black mineral. The
pearcite, however, is regarded as primary and the chief source of the silver content of the ore. The trace of gold contained in the ore is probably associated with the pearcite and its oxidation products. Silver is probably present also as horn silver or cerargyrite, or in some other oxidized mineral derived from pearcite and perhaps contained in the lead carbonate.

A thin section from the face of the north drift on the 120-foot level shows that the ore there has essentially a gangue of dimly banded vein quartz. The quartz occurs mostly in elongated forms with very irregular or ragged terminations and borders and exhibits in places a gratelike structure. Other constituents of the vein include bunches of sericite, seemingly derived from argillaceous material of the replaced rock, and considerable secondary calcite, which occurs (a) interstitially in the quartz, (b) as veinlets and seams, and (c) as minute, slightly greenish rhombs scattered throughout the section. Pyrite is present in small amount, as is also the dull black mineral with pearcite inclusions, which occurs in irregular spots and in seams or veinlets and is associated in places with calcite. Here and there, especially on joint planes and fractures, the ore is coated or stained with a yellowish-green powdery finely crystalline mineral. This was formerly thought to be uranium oxide or carnotite, but it has been positively indentified in the present work as psittacinite, a hydrous lead-copper vanadate (2PbO.2CuO.V₂O₅.2H₂O) containing much vanadium, lead, and copper and a trace of zinc. As the presence of uranium and radium had been reported, however, seven representative ore specimens were collected from well-distributed parts of the Cave Valley deposits and were tested for these elements by the radiograph method. Six of the specimens came from the Cave Valley group property and included one from the clay deposit in the cave. The seventh was from the Streator group of claims. Photographic plates were exposed to the specimens for periods of one to ten days, without giving any trace of radioactivity. Chemical tests of the ore also failed to show any trace of uranium oxide or any radium-bearing mineral.

Clay in Cave Valley Cave

The cave from which the valley takes its name is covered by the Subterranean claim group, shown at the left in Figure 2. Although it lacks the stalactites and stalagmites that are features of many limestone caverns, this cave has long been visited as a point of interest by people of the surrounding region. It is very accessible, the entrance being nearly on a level with the road at the foot of the limestone ridge. The cave is said to extend
northeastward beneath the ridge for 2,300 feet and to have a maximum width of about 600 feet. Its floor is nearly horizontal, and its ceiling in general stands six feet or more above the floor.

A possible economic feature of the cave is a clay deposit that forms the floor for a distance of at least 1,500 feet from the portal and perhaps for the full length. This deposit has a maximum thickness of 40 feet or more. The clay has recently been explored by the present owners to a depth of ten feet without reaching bottom, and a prospect shaft is said to have been sunk by Mr. Robinson to a depth of 40 feet without reaching bottom.

Mr. Robinson reported that he found silver in the clay in this shaft but not enough to encourage further prospecting. The clay so far as seen by the present writer is stained a decided red by iron oxide, but it is said to become yellowish in the deeper part of the cave.

The clay is slightly streaked or laminated. It is very homogeneous, free from grit of any kind, and smooth or talcose to the feel. A partial analysis made for the owners by Crismon & Nichols indicated 27.8 per cent aluminum oxide, 0.4 ounces silver to the ton, small quantities of iron, phosphorus, lime, magnesium, and silica, and traces of gold, copper, arsenic, antimony, and vanadium. It also showed 0.251 per cent of uranium oxide, but a specimen of the clay collected by the writer from a pit 8 feet deep and 600 feet in from the portal of the cave showed no trace of radioactivity in the radiograph test.

The deposit is estimated to contain about 200,000 cubic yards of clay, but the red color of its upper part and the yellow color of the remainder imply that the iron content is too high to adapt the clay for high-grade uses, and costs of transportation to centers of consumption afford no hope for its development at present.

**STREATOR GROUP**

The Streator group, which is also owned by the Great Western Mining & Development Co., is situated in the foothills about three miles northwest of Cave Valley, at an elevation of about 7,000 feet, and is easy of access. The hills here support a moderate growth of cedar, juniper, and pinon.

The property comprises a group of five claims known as the Consolidated group. (See Figure 5.) It is reported to have produced some high-grade shipping ore at a relatively early day. About 90 tons of mill ore lay on the mine dump at the time of visit. Considerable work is said to have been done in 1929, and some in shallow openings was done as late as June, 1930.

The property is developed at several points by shallow openings, the largest of which, known as the Streator mine or shaft, is on the Consolidated No. 1 claim and has a depth of 60 feet.

The country rocks are blue limestone, quartzite, and schist and are evidently continuations of those at Cave Valley, though the quartzite here seems to be lighter in color. They dip about 40° SE., and here, as at Cave Valley and Patterson, the mineral deposits occur in the limestone and schist above the quartzite.

The ores contain lead, silver, and copper and are very similar to those at Cave Valley in general occurrence, appearance, and mineral composition, but the psittacinite stains are here more conspicuous, and some of them have a pronounced canary-yellow color. The ores occur mostly as replacement deposits in silicified limestone in a gangue of quartz, barite, and altered rock. The chief ore mineral is argentiferous galena, but spots of the dull-black mineral with pearcite inclusions as much as three-tenths of an inch in diameter are also present. Some of the ore consists chiefly of silicified limestone, stained by yellowish-brown iron oxide and by lead and copper carbonates. It is crudely ribbed or banded with stringers of replacement quartz as much as two-tenths of an inch wide, which are associated in places with smaller
stringers and irregular spots of fine-grained galena and the dull-black mineral.

The principal deposit is the replaced limestone bed intersected by a cross fissure at the 60-foot shaft. Here good ore is shown in the cross fissure, opened to depths of ten feet or more on the northwest or footwall side of the ore bed. In the upper part of the workings the ore body is exposed for a width of 2½ feet. It parallels the limestone in strike but dips more steeply and may pass into the underlying shale in depth. Probable continuations of the same ore zone are opened by shallow shafts at points about 100 feet northeast and 350 feet southwest of the mine, and both openings are encouraging. The ore in this zone is mostly stained brown and shows less galena and less copper stain than the ore along fissures, but this difference may be due to a greater degree of oxidation along the replaced bed. The deposits collectively are believed to contain a fair quantity of mill-grade ore.

EAGLE ROCK GROUP

Up in the range east of Cave Valley, just below a pair of peaks called the "horns," John C. Clark and Francis Riordon are developing two quartz veins on the Eagle Rock group. The veins are in silicified limestone and are said to contain tungsten ore that assays $8 to the ton in gold and "appreciable" amounts of silver. Two specimens were collected from the veins for the writer by Mr. Clark. One of them, said to be from the Eagle Rock claim, contains no tungsten. It consists chiefly of vein quartz, which is somewhat brecciated and contains irregular spots of dark-gray or blackish cerusite with disseminated specks of residual galena. Some of the cerusite occurs also in the wall rock associated more or less with quartz stringers. Associated with the cerusite is a yellowish lead-antimony mineral, probably bindheimite, which stains the surrounding quartz or occurs in veinlets and stringers. It seems to be a secondary oxidation product derived from the cerusite. The quartz is also traversed by stringers and veinlets of secondary calcite.

The other specimen, from the vein on Eagle Rock No. 2 claim, also consists chiefly of vein quartz, in part stained reddish-brown by iron oxide and slightly porous or honeycombed by cavities from which pyrite has evidently been dissolved. It contains considerable tungsten in the form of wolframite, a black submetallic mineral that occurs plentifully as tabular crystals and lamellar masses as much as three-tenths of an inch in diameter.