The Scheelore tungsten mine, Mono County, California

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Introduction

The Scheelore tungsten mine is on the east slope of the Sierra Nevada in southern Mono County, California. (See fig. 1.) It is accessible by means of a 10-mile dirt road following McGee Creek, which joins U. S. Highway 395 at the McGee Creek resort 35 miles north of Bishop. As shown on the U. S. Geological Survey Mt. Morrison quadrangle map the deposit is in a glacial cirque at the head of one of the tributaries to McGee Creek, about one mile southeast of Mt. Baldwin. The elevations along the outcrop of the deposit range from 11,000 to 11,550 feet in an area above timberline and covered by deep snow a large part of the year. A bunkhouse suitable for housing about 25 people is 3 miles from the mine on the access road. The writer and M. P. Erickson, then of the U. S. Geological Survey, spent 5 days in September 1943 at the deposit preparing the accompanying map by plane table methods. (See plate 1.)

History and production

The Scheelore property was owned by J. E. Morhardt and H. A. Van Loon of Bishop, California, until 1946 when J. E. Riley of Reno, Nevada, purchased a one-third interest. The deposit was discovered in 1940 by Mr. Morhardt after two summer seasons prospecting, and the 10-mile access road was constructed by the Public Roads Administration in 1942 to 1944.

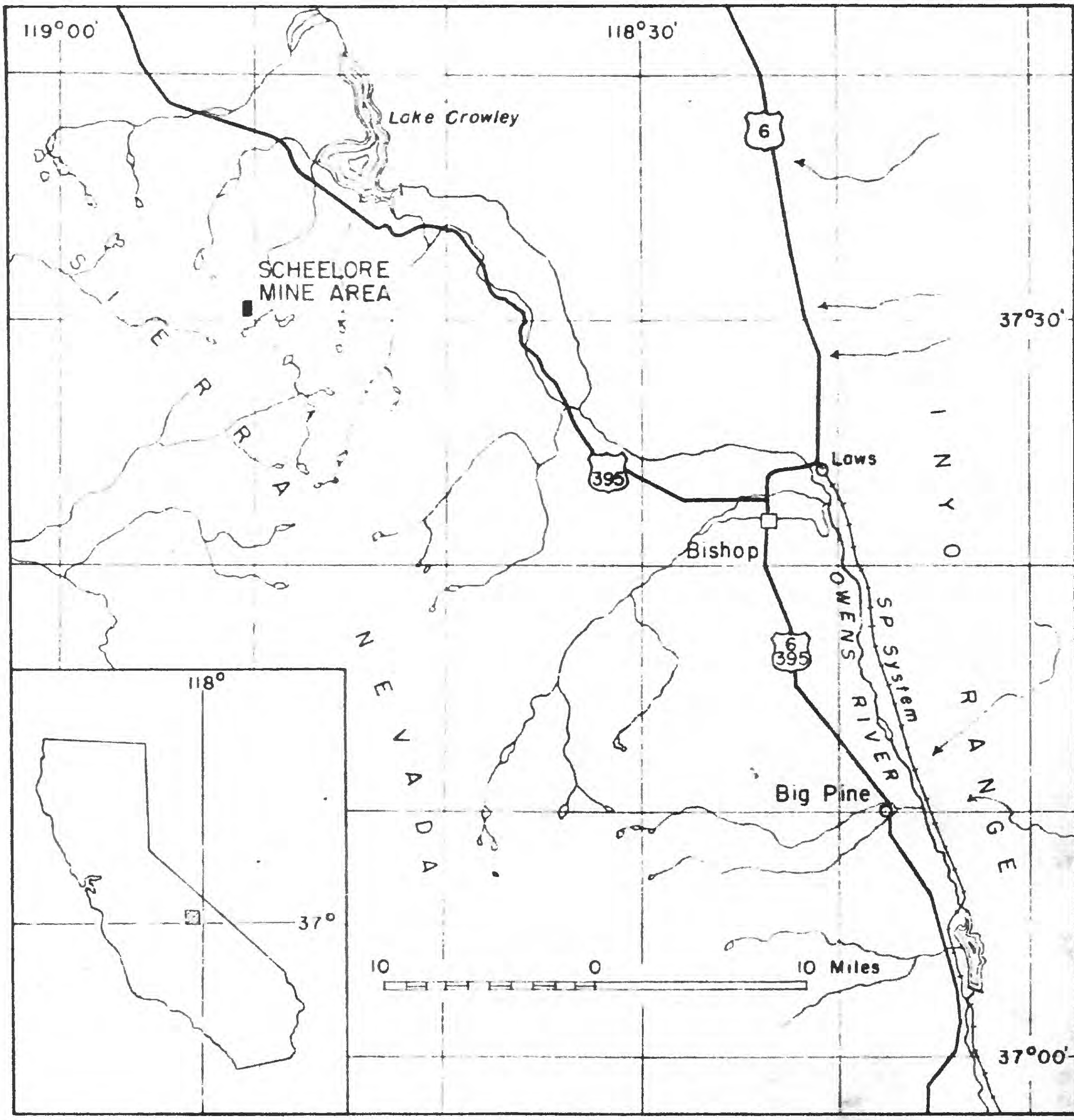

Figure I. Index map showing location of the Scheelore Tungsten Mine, Mono County, California

The only significant production was made in 1942 to 1944 when approximately 800 units of WO_3 were recovered by direct concentration of scheelite from the fines of tungsten-bearing talus. During the first two years a small mill at the lower end of a pit dug in the talus was used in concentrating the ore, but after completion of the access road in 1944 it was replaced by a larger one built near the lake shown in the southern part of plate 1.

Neither of the two mills was constructed to treat ore from the lode deposits, and a total of only about 100 tons of ore has been mined from the lodes. Of this amount 11 tons of ore was packed out from the Number 1 and Number 3 tactite masses and milled at the Jones mill near Benton. In 1944, ninety tons of ore mined from the Number 1 tactite mass was treated at the Red Hill mill near Bishop. No other work has been done on the lode deposits and the only development consists of the surface pits from which ore was mined.

In October 1950 the mine was optioned to the Wah Chang Trading Co., which promptly sampled the outcrops of the lode deposits.

Geology

The main geological feature of the mapped area (plate 1) is a north-trending contact between intrusive quartz monzonite on the east and metasedimentary rocks on the west. This contact crops out in the floor of the glacial cirque and at the cirque head in the northern part of the mapped area. In the central part of the mapped area the quartz monzonite is in contact with coarsely crystalline white marble, but both to the north beyond the mapped area, and to the south reddish- to brownish-gray quartz-mica schist lies between the quartz monzonite and the marble. The relation of the metasedimentary rocks to the contact is important because the lode deposits are of the contact-metamorphic type and are closely related to the contact between marble and quartz monzonite. This part of the contact is about 2,000 feet long, but for more than half this distance it is concealed by talus.

The metasedimentary rocks, with the exception of those shown in the extreme northwest part of the map, strike, on the average, a few degrees west of north and dip about 40 degrees east, although locally they dip as steep as 75 degrees east. In the northwest part of the mapped area, west of the talus pit at the south end of the Number 3 tactite mass, the beds are vertical; farther north, at the north edge of the mapped area, the beds dip steeply southeast and strike about N. 55° W.

Lode deposits

Although almost all the past production has come from talus, the amount of tungsten-bearing material in talus is so small compared with that in the lode deposits that any future large production must come from the lodes. The lode deposits are composed of tactite, a dark-colored silicate rock derived from marble by additive metamorphism. Scheelite ($CaWO_4$) is the only tungsten-bearing mineral that has been recognized. The tactite consists largely of andradite garnet, hedenbergite, quartz, and epidote, but locally the Number 3 tactite mass also contains abundant pyrite and pyrrhotite. At the surface the sulfide minerals are partly oxidized to limonite. During the talus operation free gold and bismuthenite collected on the concentrating table, and these minerals presumably are present in small amounts in the tactite.

Most of the exposed parts of the favorable contact between marble and quartz monzonite are occupied by thick tactite masses. Three such masses crop out and are designated from south to north as the Number 1, Number 2, and Number 3 tactite masses. The tungsten-bearing talus from which the past production was made extends southward from the Number 3 tactite mass, and similar talus also extends north from the same tactite mass.

Examination under ultra-violet light indicates that the scheelite content in the tactite masses varies from place to place and that some parts contain little or no scheelite. These variations in the scheelite content can be determined accurately only by careful sampling, and are not shown on plate 1.

Number 1 tactite mass.—The Number 1 tactite mass in outcrop is 200 feet long and about 30 feet in average width. Under ultraviolet light the highest content of scheelite appears to lie along its edges, and the central part, in most places, contains little or no scheelite. At both the north and south ends the tactite disappears beneath talus. Southward, schist lies between the marble and quartz monzonite, but tactite may extend south or east as much as 100 feet before schist intervenes along the contact. Northward, the tactite mass may continue beneath talus and connect with the Number 2 tactite mass.

The fundamental control over the localization of the tactite mass is probably the contact between marble and quartz monzonite, but the western contact of the tactite mass appears to be concordant with the bedding in the marble. The marble here strikes northerly and dips about 70 degrees east. The dip of the quartz monzonite contact is not known but is probably concordant with the marble; however, it may be vertical or dip steeply west. If such discordant relationships exist the tactite mass is likely to be irregular, especially on the side in contact with marble.

Number 2 tactite mass.—The Number 2 tactite mass is separated into two parts near its north end by a quartz monzonite dike that cuts southwest into the marble from the main mass of quartz monzonite. The larger part, south of the dike, has an outcrop plan like a crude east-facing crescent. The total length of the crescent is about 500 feet, and the average outcrop width is about 40 feet. The smaller part of the tactite mass, north of the dike, has a roughly triangular shape, and its greatest width in outcrop is about 60 feet. Light-colored silicate bodies and quartz bodies are found at several places along the margins of the tactite. The scheelite appears under ultra-violet light to be more uniformly distributed in the tactite than it is in the Number 1 or Number 3 tactite masses.

The crescent-shaped tactite mass, south of the quartz monzonite dike appears to be the outcrop of an eastward dipping tabular body localized along beds in marble, and the triangular outcrop of tactite north of the dike is probably a similar tabular mass replacing the same marble bed. If this concept is correct the ore body underlies most of the area between the Number 1 tactite mass and the outcrop of the Number 2 tactite mass. The Number 2 tactite mass may be confined to the more gently dipping parts of the marble and be absent eastward where the beds dip more steeply; if the tactite does continue eastward it would not be expected to join the Number 1 tactite mass at a depth of less than 200 feet beneath its outcrop.

Number 3 tactite mass.--The Number 3 tactite mass is at the head of the cirque and extends northward along the wall of another cirque to the northeast. It has an exposed length of over 500 feet and an average outcrop width of about 25 feet. Under ultraviolet light scheelite appears to be most abundant in the south one-third of the tactite mass, but the north part is difficult to examine because of the steepness of the outcrop. At the north end the tactite mass terminates against schist, which, north of the mapped area, separates the marble from the granite. At the south end of the tactite mass enlargement of the talus pit in 1944 exposed the tactite about 50 feet farther to the south than is shown on plate 1. The path of the tactite mass in the pit and across the head of the cirque suggests a dip near vertical and therefore transgressive to the bedding. Some irregularities in the shape of the tactite mass can be expected because of the discordance of the bedding with the contact.

At the south end the tactite mass is covered by talus which conceals the contact for 900 feet, so that the southward extent of the tactite mass cannot be predicted. The trends of the quartz monzonite contact at the south end of the Number 3 tactite mass and north of the Number 2 tactite mass suggest that in the intervening talus-covered area the contact will follow close to the west wall of the cirque, at least for the north half of the talus covered span.

Economic potentialities

The Scheelore deposit might conceivably be developed into an important tungsten mine, but three factors must be determined before the true value of the deposit will be known:

(1) The distribution of the scheelite in the outcrops of the tactite masses must be established. A thorough sampling of the exposed tactite masses was made in late 1950 by the Wah Chang Trading Co., but the results of this sampling are not available for publication.

(2) The amount and the scheelite content of tactite covered by talus along the parts of the contact between the exposed tactite masses must be determined. Thick tactite is present at most places along the exposed part of the contact between quartz monzonite and marble, the notable exception being the thin tactite strip along the 300-foot span extending northwest from the Number 2 tactite mass. Along the exposed parts of the main contact (omitting most of the Number 2 tactite mass, which is not on the main contact) are 700 feet of thick tactite and 300 feet of thin tactite. If this is taken as

a rough guide for the unexposed parts of the contact another 700 feet of thick tactite may be concealed beneath talus. However, this figure is probably too high because tactite is notably resistant to erosion, and the known tactite masses may be exposed because of their resistance.

(3) The continuity and scheelite content of the tactite masses at depth must be established. Local discordance of the bedding in the marble with the tactite is the only geological condition observed that seems likely to produce irregularities or discontinuities of the tactite at depth, but continuity can be proved only by underground exploration. The Number 2 and Number 3 tactite masses can be explored economically at shallow depths by means of drifts. Shallow exploration of the Number 1 tactite mass can best be accomplished by means of a shaft. Diamond drilling of the tactite masses and of the talus-covered parts of the contact between tactite masses can be accomplished best from stations in the quartz monzonite. The deposits can be explored at greater depth by means of a crosscut adit from the cirque northeast of the deposit. A 2,500-foot adit could intersect the deposit at about 10,000-foot elevation, or 1,000 to 1,500 feet below the outcrops.