3460 0021

Shoshone, Nevada
June 25, 1941

DIRTY SHIRT MINE

The Dirty Shirt mine is located on the north slope of Mary Ann Canyon between Osceola and Willard Canyons in the Snake Range, White Pine County, Nevada (see photo 148, job GSO 3 1). A fair road leads from Goody's mill (on the Ely-Baker highway) to a loading ramp about ¼ mile from the mine and 600 feet lower. Ore is sledded with a caterpillar tractor from the mine to the ramp.

The mine is developed by a 90 foot shaft inclined 45° east. A drift has been run about 30 feet north and 25 feet south from the bottom of the shaft, and a small stope has been taken out on the south side of the shaft for 35 feet above the level. An adit, perhaps 350 feet long, lies 250 feet below on the same vein.

In the area immediately surrounding the mine, the country rock is the Lower Cambrian Prospect Mountain quartzite. The overlying limestone crops out ¼ mile northerly, and stratigraphically probably lies only a few hundred feet above the Dirty Shirt shaft. The bedding strikes northerly and dips westerly, the average angle of dip being about 30°.

The only tungsten orebody known occurs near the footwall side of a wide quartz zone that strikes northerly and dips 45° easterly. There are no surface outcrops, everything being masked by quartzite debris one to five feet thick. The vein has been uncovered for a distance of several hundred feet near the shaft in several widely spaced crosscut trenches. It is reported to be cut off by a fault 100 feet north of the shaft, but appears to extend several thousand feet south across Mary Ann canyon where there are numerous prospect pits that seem to be on the same vein.

The known scheelite orebody has a maximum exposed length of 40 feet, and a width of 2 to 5 feet. It appears to rake northward, the shoot crossing the shaft from right to left when one looks down the dip of the vein. The ore is of high grade, but its occurrence is spotty. The scheelite,

orange brown in color, occurs in masses several inches in size distributed through white quartz. There is a small amount of calcite gangue. The ore now being mined may average 3% of WO_3. The operators are crushing to about ½ inch, screening, and then hauling the fines in sacks to Goody's mill for tabling. One hundred sacks of these fines reportedly yielded 375 pounds of concentrate (yield of 2¼ % of WO_3 if the sacks weighed 100 pounds and the concentrate contained 60% of WO_3). The mill probably makes a 50% recovery or less.

The adit contains no scheelite. The operators think that the vein is 40 or 50 feet wide, that the adit is on the hanging wall side, and that a crosscut through the vein beneath the shaft might locate extensions of the known ore shoot. They have been trying to get the Bureau of Mines to do some drilling from the adit, but there seems to be no justification for such a program. None of the workings have been surveyed.

Outlook. If the oreshoot extends 30 feet above the stope, and 30 feet beneath the bottom of the shaft, with an average width of 3 feet and length of 30 feet, it will yield 414 tons of ore. If the grade is 3% of WO_3 this ore will contain 1242 units of WO_3. It is not known how deep this lense may continue, or what the possibilities are for finding other similar bodies. Extensions of the same ore shoot laterally have not been definitely disproved.

The property, owned by Jim Henry, a prospector, is optioned to a Los Angeles lawyer. Major Griffin, reputedly a Los Angeles civil engineer, is in charge of the operation, and Frank Richey now runs the mine. Four other men constituted the crew at the time of my visit. Richey and his partner own the Keyes mine near Kernville, and expect to return there as soon as they can straighten out the Dirty Shirt mine.

The Molybdenum Corporation of America has a contract for the output of the mine.

Dwight M. Lemmon

June 25, 1941
Shoshone, Nevada

WILLARD CANYON TUNGSTEN PROSPECTS

Scheelite has been found in a quartz vein near the Red Devil silver-lead prospect on the north side of Willard Canyon, Snake Range, White Pine County, Nevada (photo 149). Jim Henry owns the Red Devil, and has staked the tungsten vein for Ralph Kauffman of Baker. In the only prospect pit, orange-brown scheelite occurs in narrow seams in a 2-foot quartz vein. It is also present in one-inch quartz stringers that parallel the vein in the same cut in sheared granite, which is the wall rock. Float from the quartzite (Prospect Mountain) which crops out a hundred feet higher on the hill masks the tungsten veins and possibly other parallel ones. Jim Henry thinks that there is considerable placer below the veins.

Scheelite bearing veins in granite have been found in numerous other prospe cts in the Willard Creek basin. None have been productive, and none are now being actively prospected.

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Dwight M. Lemmon

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Item 23

TUNGSTEN (HUB, LINCOLN)

Weeks, F. B., Tungsten Deposits in the Snake Range, White Pine County, eastern Nevada, U.S.G.S. Bulletin 340, pp. 263-270, 1908

Introduction

A brief description of the tungsten deposits in the Snake Range, eastern Nevada, was published by the writer (2)[a] in 1901, and in 1902 F. D. Smith (6) published an account of the occurrence and development of the prospects. In October, 1907, the writer made a more detailed study of the development at this locality and the character and occurrence of the ore deposition.

Situation

In 1900 a mining district was formed under the name Tungsten mining district, embracing several square miles along the western slope of the Snake Range south of Wheeler Peak (locally known as Jeff Davis Peak). This range as an orographic feature begins about 25 miles south of this locality and extends northward from its southern limit about 135 miles between latitude 38° and 40°. It includes the Deep Creek or Ibanpah Range and the group of connecting hills known as "Kern Mountains." This is one of the most extensive and prominent ranges between the Wasatch and the Sierra Nevada. Its highest point, Wheeler Peak, reaches an elevation of 12,000 feet. (See fig. 5, p. 118) In the area of the tungsten prospects the surface of the mountain slope is dissected by several wide, shallow gulches which are dry except when occupied by melting snow or storm waters. There are several small springs, but at present the water sinks in the gulch gravels.

The region is about 45 miles southeast of the nearest railroad at Ely, Nevada. This road--the Nevada Northern--is 140 miles long and connects with the Southern Pacific Railroad at Cobre, Nevada. The wagon road to Ely is an excellent mountain road which crosses the Schell Creek Range (see map, fig. 5) over a comparatively low pass with no very steep grades. Prior to September,

1906, the outlet to the railroad was via Osceola over the Snake Range to Newhouse, Utah, a distance of 100 miles.

Geology

The rocks of the region are granites, which may be in part the oldest rocks; Cambrian argillites, quartzites, shales, and limestones, and an intrusive granite porphyry which is younger than any of the sedimentaries. Within the Tungsten mining district the only rocks exposed are the granite porphyry and the quartzites and argillites.

The granite porphyry ranges from fine to coarse in texture and from light to dark gray and red in color. It occupies the lowerpart of the mountain slope and forms a portion of a considerable mass which extends to the northeast for several miles and is exposed on the eastern side of the range. There seem to be slight indications of deformation within the eruptive mass, and contact metamorphism is developed only to a limited extent. Apparently the intrusion took place since the formation of the mountain range. In general character and mode of occurrence this intrusion of granite porphyry resembles many intrusive masses in other parts of Utah and Nevada. Some of these are known to be post-Carboniferous and they may be of much more recent occurrence.

The base of the sedimentary rocks is not exposed in the Tungsten mining district. Only a small area of purplish argillite is exposed in the northwest corner of the district, overlain by 100 to 200 feet of quartzite. The quartzites are gray, blue, and purple, the gray quartzite forming the larger part of the series. The strata are cut by many quartz veinlets which are probably of secondary origin, formed during the silicification of the original sandstone. The rocks are fine grained and the alteration by silicification is very complete. In thickness the beds range from a few inches to 2 feet.

The argillite is a compact purple rock in rather thick layers. In this area it is little altered, but in other parts of this region the process of metamorphism has progressed much farther and the rock has been called "silvery slate."

Geologic Structure

The Snake Range in this region is a quaquaversal dome, having its center near Wheeler Peak. Subsequent to the uplift there was an intrusion of a considerable mass of igneous rocks that tilted the beds to a high angle in some parts of the region and displaced them in others. The steep southerly dips in Wheeler Peak and the high ridges to the south flatten to 25° in the Tungsten district. North of Wheeler Peak the fold has been broken by several northeast-southwest faults of considerable displacement, the beds having a northeast-southwest strike and dipping 45° NW.

In the area shown on the map the metamorphism and deformation which accompanied the intrusion are not so extensive as in other parts of the region.

Veins

General Description

The veins carrying the tungsten ore are not vertical, but pitch to the northwest or southeast at varying angles, ranging from 55° to 75°, the general direction being northeast and southwest. The actual outcrop is usually limited to a few feet. From the close proximity of some of the veins it might be considered that they are branches from a main vein, but neither outcrops nor underground workings have shown this to be the case. In some places the vein splits into several narrow veins separated by the country rock. Their occurrence is irregular and from the debris it appears probable that there are veins now covered by "slide rock". In width they range from

a few inches to 3 feet. The composition of the vein material is essentially quartz and hubnerite, with here and there a little fluorite, pyrite, and scheelite. The quartz is compact and contains no pores, vugs, or honeycombed areas. A few assays have been made which show the presence of gold and silver, but the amount is small and no attempt has been made to recover it. Well-defined walls are of common occurrence, but they are not persistent.

Occurrence of the Tungsten Ores

The hubnerite occurs irregularly through the vein material. In some places there has been a concentration of the ore near the walls. Hubnerite crystals, varying in size and completely surrounding the quartz crystals, and also quartz crystals inclosing the hubnerite, are abundant. The greater part of the ore is disseminated in fine grains through the quartz or in irregular massive bodies. Where the veins pinch to a few inches in width the hubnerite occurs in thin stringers or is interlaminated with the quartz. No wolframite has yet been determined from this region. In 1901 Dr. W. F. Hillebrand made a qualitative test of two or three specimens from the principal vein which showed the ore to be hubnerite. Scheelite has been found very sparsely disseminated in zones which appear to indicate shearing. It occurs in small flakes instead of the usual granular or massive forms.

Extent of Mineralization

There appears to be a general consensus of opinion among prospectors and others interested in tungsten deposits that these ore-bearing veins do not extend in depth. No workings have thus far been put down which determine this point. It may be true that some, possibly most, of the individual veins do not extend to great depths. In considering the question of depth, however, it should be remembered that in this region the intrusive mass is a part of a magma of unknown depth, which has been forced through a considerable

thickness of sedimentary strata. In the area under discussion erosion has removed at least 300 feet from the upper part of the principal vein. In the light of present knowledge of veins of this kind it seems probable that there may be ore-bearing veins within the igneous mass which have not yet been exposed by erosion.

Origin of the Veins

The magma which intruded the sedimentary strata probably cooled entirely beneath the surface and is now exposed by erosion as a body of granite porphyry. Before complete consolidation the magma was subjected to strains which produced cracks and fissures. These fissures, varying in width and vertical extent, were distributed irregularly through a portion of the rock, but in the main strike in a nearly uniform direction. The latest phase of consolidation consisted in the deposition of the fissure filling by magmatic waters carrying in solution silica and a small amount of certain rare metals;

Mining Developments

About 30 claims have been located within the Tungsten mining district, and at present all of them are controlled by the Tungsten Mining and Milling Company.

The principal underground workings are on the Hub claim (No. 1 on map, fig. 13). Tunnel No. 1 (fig. 13) is 225 feet in length, and the face is 125 feet below the surface, which forms the deepest workings on any of the veins. At 150 feet from the mouth of the tunnel an upraise has been made to join an incline from the surface. In this tunnel nearly all the various features described under the headings "Veins" and "Occurrence of the tungsten ore" are exhibited. The vein ranges from a few inches to 3 feet in width, strikes N. 68° E., and dips 65° NW. Present developments show that this is the largest and most prominently mineralized vein in the region. Tunnel No.

2 is about 125 feet vertically above No. 1 and is 59 feet in length. This portion of the vein is split into four parts, separated by the granite porphyry. There is about 18 inches of steaky ore in the face of this tunnel. Shaft No. 1 is 37 feet in depth. Near the surface the vein is pinched, but about midway of the shaft it is about 3 feet wide. Shaft No. 2 shows the vein about 30 inches in width, with a small amount of ore. In the face of the tunnel near shaft No. 2 the vein is 24 inches wide, with ore in steaks.

On the slope below the outcrop of this vein several tones of ore, which was reported to average about 68 per cent of tungstic acid, were picked up among the "slide rock" and shipped before underground work was begun. Grains of hubnerite are disseminated through the finner material of the slope and the bottoms of the gulches. Considerable ore has also been gathered from time to time and added to the dumps.

The development work on the Tungsten claim (No. 3 on map) consists of two tunnels and a shaft. On the Wolframite and Great Eastern claims (Nos. 4 and 5 on map) are several small trenches exposing narrow veins with ore. On the Eagle claim (No. 7 on map), just below the contact of the granite porphyry and quartzite, the vein is exposed in a trench, standing nearly vertical and striking N. 40° E. Hubnerite with a small amount of scheelite is found here. In the quartzite debris it was found that small veinlets of quartz penetrate the quartzite, a few of them carrying a little hubnerite. It is probable that this ore occurs near the contact zone. The region is said to have been thoroughly prospected and very little material of this kind has been found in the quartzite, which therefore seems unlikely to yield a deposit of commercial importance.

In the Side Issue claim (No. 2 on map), on the south side of Hubnerite Gulch, a mineralized vein is exposed in a 10-foot cut pitching 80° S. and

striking N. 45° E. On the lower side of the cut the vein is 2 feet wide and it is said that from this place a piece of solid hubnerite was taken weighing 114 pounds. On the upper side of the cut the vein is split into two 6-inch veins separated by 4 feet of granite porphyry. In the bottom of the gulch these veins have pinched to a thickness of 3 inches each. The country rock is a coarse-grained, light-colored porphyry which, it is said, can be worked more easily than the rock in other parts of the district.

On the Tungstic claim (No. 9 on map) is a 4-foot vein striking N. 65° E. which shows very little ore. About 50 feet above is a 3-foot quartz vein in which no ore was seen.

In the ridge west and a little north of the Hub claim a hubnerite-bearing vein is exposed in several places. Several small veins appear to extend in a direction about N. 60° E.

The Star claim (No. 8 on map) is developed by a tunnel 32 feet long in which the vein ranges from 6 inches to 2 feet in thickness, pitching 55° SE. and stiking N. 30° E. In this tunnel scheelite associated with hubnerite occurs in larger quantity than in any other known locality in the district. About 55 feet and 70 feet south of this vein are two hubnerite-bearing veins striking N. 42° E. The country rock is granite porphyry of a more pronounced reddish color than in other parts of the area. A short distance north of the tunnel a 1-foot vein striking N. 42° E. and showing considerable hubnerite is exposed in a shallow trench.

Methods of Mining

The vein material is exceedingly hard and difficult to mine. Drills quickly become dulled and the rock does not shoot well. The work is all done by hand labor and tunneling is said to cost nearly $30 per running foot. At present it would appear advisable to develop the vein by open cuts at

different levels with a steel-lined shoot on the surface on each side-one to care for the waste and the other for the ore. A much larger amount of material would be dislodged by each shot than when confined in a tunnel or shaft. There would be no expense for hoisting and there would always be good light for sorting. In handling the material care should be taken to save the fines, as a considerable part of the hubnerite occurs in grains disseminated through the quartz. The scheelite also is likely to be thrown away in the waste on account of its general resemblance to quartz.

On account of the large percentage of waste a considerable amount of hand sorting is necessary. After crushing, the hubnerite is easily separated from the quartz. A hand-made jig, operated by horsepower, was used and afterwards replaced by a 5-horsepower gasoline engine.

Summary

The occurrence and character of the vein material vary so much within a few feet that the depth and width of the veins and the amount of hubnerite can not be estimated. Nature has, however, done much to assist in determining the other factors which affect the commercial value of these deposits. Several springs of small flow occur at a considerable elevation above the natural location for a concentrating plant and their combined flow would be sufficient for milling purposes. Williams Creek has an estimated flow of 700 cubic feet per minute and would furnish power to generate electricity for a mill and drilling purposes. There is still sufficient timber on the higher mountain slopes to furnish mine timbers. The lower slopes are covered in spots with mountain mahogany, which makes a good domestic fuel. There are ranches in the valley which could furnish general supplies. Railroad facilities are now at a considerable distance, but surveys have been made for a railroad to connect Ely with southwestern Nevada and Salt Lake to

TUNGSTEN (HUB, LINCOLN) Cont.

the northeast. One of these surveyed lines crosses the Schell Creek Range into Spring Valley opposite Osceola, about 20 miles north of the Tungsten mining district.

Notes:

a Numbers in parenthesis refer to corresponding numbers in "List of recent publications" at end of this paper.

RECENT PUBLICATIONS RELATING TO THE OCCURRENCE OF TUNGSTEN ORES IN THE UNITED STATES

1. Trans. Am. Inst. Min. Eng., vol. 28, 1899, pp. 543-546.

2. Twenty-first Ann. Rept. U. S. Geol. Survey, pt. 6, 1901, pp. 319-320.

3. Mineral Resources U. S. for 1900, U. S. Geol. Survey, 1901, pp. 257-259.

4. Bull. South Dakota Geol. Survey No. 3, 1902.

5. Bull. South Dakota Geol. Survey No. 6, 1902.

6. Eng. and Min. Jour., vol. 73, 1902, pp. 304-305.

7. Mineral Resources U. S. for 1903, U. S. Geol. Survey, 1904, pp. 304-307.

8. Eng. and Min. Jour., vol. 78, 1904, p. 263.

9. Min. Reporter, vol. 50, 1904, p. 217.

10. Econ. Geology, vol. 2, 1907, pp. 453-463.

11. Eng. and Min. Jour., vol. 83, 1907, pp. 951-952.

Lincoln, F. C., Mining Districts and Mineral Resources of Nevada, Reno, 1923 p. 256.

The Tungsten deistrict is located at Tungsten, formerly Hub, on the west flank of the Snake Range south of Wheeler Peak. Ely on the Nevada Northern Railroad is 45 miles northwest.

Silver ore was discovered in the district in 1869 and the Lincoln district was organized, but the mines were unsuccessful and the district

was soon abandoned. The Tungsten district was organized in the same region in 1900. Tungsten claims were developed and in 1904 were sold to the Tungsten Mining and Milling Company, which shipped a little ore and continued the development. The Hubnerite-Tungsten Company purchased the property in 1909. The following year this company changed it name to the U. S. Tungsten Corporation and erected a 50-ton concentrating mill which operated for a short time in 1911 and again in 1915 and 1916.

Hubnerite-bearing quartz veins occur in granite porphyry which is intrusive into Cambrian quartzites and argillites, according to Weeks. The veins are narrow and irregular and dip at angles of from 55° to 75°. A little fluorite, pyrite and scheelite are present in the veins and they carry a small amount of silver and gold.

MR 1899 "In the early part of 1900 a vein was discovered about 12 miles south of Osceola, White Pine County, Nevada, which carried wolframite as described by Mr. F. B. Weeks in another paper.

"The mine is 100 miles from Frisco, Utah, on the O. S. L. Railroad, which is the nearest Railway point."

MR 1900 "During 1900, the wolframite deposit located about 12 miles south of Osceola, White Pine County, Nevada, described by Mr. F. B. Weeks (21st Annual Report, part 6, pp. 319-20) in the foothills of the west slope of the Snake Mountains and near the base of Wheeler Peak, has been developed by a tunnel driven in at the lowest outcrop of the vein. The vein widened as the work was continued, till at the head of the tunnel it has a width of 4 feet, the wolframite occuring in bunches across the entire vein. There has not been sufficient work done to determine how extensive this deposit is, but the indications are that it can produce Tungsten minerals in quantity."

MR 1901 "Development work was continued on the Tungsten deposits that

are located in the foothills of the west slope of the Snake Mountains, near the base of Wheeler Peak, about 12 miles south of Osceola, White Pine County, Nevada, and rich tungsten ores have been shown to exist there. Practically the only drawback to these deposits is their distance from railroad transportation..... At the Nevada mines, near Osceola, 1200 tons of ore were taken out and are now lying on the dumps."

MR 1903 "The tungsten property, located near Osceola, White Pine County, Nevada, was bonded during 1903, and development work was carried on to determine what production per month could be made from these deposits."

MR 1904 "The tungsten deposits in this State are in the foothills on the west slope of the Snake Mountains, near the base of Wheeler Peak, and about 12 miles south of Osceola. On account, however, of the distance of the deposits from the railroad, the nearest point being Frisco, Utah, on the O. S. L. Railroad, about 100 miles distant, there has been no shipment of ores from these deposits and most of the work has been the annual assessment work. Recently these deposits have passed into the control of the Tungsten Mining and Milling Company, which has worked them during the past year. The Company has taken out about 80 tons of ore, but has not concentrated any of it. The tungsten mineral is hubnerite and occurs in veins of quartz, which vary from a few inches to a number of feet in width, being normally about 3 feet wide, but pinching in places to a few inches. The main vein or deposit can be traced for a distance of 2,100 feet by means of outcroppings and of float and is composed principally of milky white quartz and hubnerite. The vein, which cuts across the porphyritic granite, is composed of quartz, mica and hornblende, has a strike of N. 68° E. and dips 65° NW. The hubnerite occurs in solid masses up to 16 and 12 feet in thickness, and also in disseminated particles or blade-like forms through the quartz and occasionally

in groups of rocks intermingled with quartz and limestone. Occasionally small apophyses of ore are found penetrating out into the country rocks. It should be an easy matter to concentrate this ore, as it crushes readily and hubnerite could undoubtedly be easily concentrated by jigging."

MR 1905 "The Nevada deposits have been described in detail in previous reports, and although there was considerable tungsten ore mined during 1905, there was none shipped or concentrated, principally on account of the distance of the deposit from the railroad."

MR 1906 Nonknown production... "Though considerable development work was reported from Osceola, Nevada."

MR 1907. May have been some production.

MR 1908. "At Osceola, deposits have been under development which consist of hubnerite-bearing quartz veins which reach 3 feet in width and cut granite porphyry of Post-Carboniferous age. The ore is in shoots and is accompanied by small quantities of scheelite, fluorite and pyrite. Gold and silver are shown by assay, but the amount is not sufficient for commercial recovery. Some hubnerite, part of which is said to have been rich pieces of float ore, has been shipped, but there have bean no shipments for several years. Ely, the nearest railroad point, is 45 miles away."

MR 1909 "The hubnerite deposits 12 miles south of Osceola, Nevada, which have been held for years by J. H. Marriott and the Tungsten Mining and Milling Company, were sold in the fall of 1909 to Oscar A. Turner, who organized the Hubnerite Tungsten Company. About 30 men were employed in prospecting and development work during the remainder of the year and a large amount of work was done. A mill was planned so that the ore could be concentrated at the mine. This is expecially necessary, as there is a 45 mile haul to Ely, the nearest railroad point."

TUNGSTEN (HUB, LINCOLN) Cont.

MR 1910 "On the hubnerite deposits in the Snake Range, 12 miles south of Osceola and 45 miles southeast of Ely, considerable development work was done during the year by the U. S. Tungsten Corporation, formerly the Hubnerite Tungsten Company, and a mill was erected. The mill is equipped with a crusher, rolls, screen, classifiers, Wilfley tables and Isbell vanners, and has a nominal capacity of 50 tons each 24 hours. Water power by which the mill can be operated part of the year is furnished by a ditch about 6,000 feet long, which brings water from Williams Creek and gives a head of 600 feet. The ditch also furnishes water for concentrating. A steam plant to furnish power when water power is not available has been erected."

MR 1910 (additional) "12 miles south of Osceola, hubnertie with a little scheelite, pyrite, chalcopyrite, fluorite and white mica occurs in quartz veins cutting granite. Much work has been done on the deposits and some ore has been shipped. Ely, 45 miles northwest, is the nearest railroad point."

MR 1911 "A mill erected in 1910 was operated for a short time on the hubnerite deposits in the Snake Range at Hub, 12 miles south of Osceola and 45 miles southeast of the railroad at Ely. The Company became involved in financial troubles and its concentrates reached the market when prices were low, so that it did little work during the year."

MR 1912 "At the mines of the U. S. Tungsten Company, at Hub, near Osceola, the local papers reported the prosecution of development work, but no concentrates were made. Some concentrates made in 1911 were sold."

MR 1913 "Nothing is known to have been done during the year on the property of the U. S. Tungsten Corporation at Hub, near Osceola, White Pine County....."

MR 1915 "The hubnerite mines and mill 12 miles south of Osceola, at

the locality formerly known as Hub but rechristened Tungsten, were actively operated toward the end of the season by the U. S. Tungsten Corporation, the present owner."

MR 1916 "Hubnerite was mined at Tungsten, 12 miles south of Osceola, from the veins known for many years, and in a small way from newly discovered veins a mile south of Tungsten."

An Occurrence of Tungsten Ore in Eastern Nevada
F. B. WEEKS, U. S. G. S. 21st Annual Report 1899-1900, part 6 pp. 319-320. 1901

The existence of a hubnerite-bearing vein about 12 miles south of Osceola, Nevada, was discovered in the early part of 1900. It occurs in the foot-hills on the west slope of the Snake Mountains, and near the base of Wheeler Peak, which is the culminating point of the range. The region is about 100 miles from Frisco, Utah, on the Oregon Short Line Railway, which is the nearest railroad point. A hasty examination of this locality was made in the course of a reconnaissance trip through this region in August, 1900. Prior to that time a small amount of ore had been gathered from the debris of the surface below the outcrop of the vein, and had been shipped in ton lots. The mineral was also seen to be disseminated through the loose soil of the mountain slopes.

The Tungsten mining district was organized in April, 1900. At the time of this examination a small gasoline plant with crusher and jigging apparatus was being installed so that shipment by the carload is now possible.

The vein in which the hubnerite occurs cuts across the country rock, which is a rather coarse porphyritic granite of the usual quartz-mica-hornblende variety. This granite has a rudely bedded structure, parallel to that of the overlying Cambrian quartzite which dip 20° to 25° SSW. The strike of the vein is N. 68° E., and the dip is 65° NW. The main vein

is normally about 3 feet in width. In places it pinches to a few inches in thickness, but resumes its usual width within 30 to 40 feet. Several smaller veins from a few inches to a foot in thickness were seen to outcrop on the slopes and could be traced to the main vein, with which they form a sharply acute angle. The main vein was traced for a distance of 2,100 feet by croppings and floats from its outcrop near the base of the lowest foothill up the slope of the mountain.

A sufficient development of the vein had not been made at the time of the examination to determine the extent of the ore deposition. A tunnel about 40 feet in length had been driven in at the lowest outcrop of the vein, and was the only opening that had been made. The walls of the vein are well defined. Where the vein has its average thickness it is formed of a milky-white quartz and carries a large amount of the hubnerite. Where the vein is pinched the quartz is schistose and the ore is in thin stringers and of small amount. The ore occurs in solid masses, frequently attaining a thickness of 6 to 12 inches. It is disseminated through the vein material in thick, plate-like forms, and also occurs crystallized with the quartz crystals. Small shoots of ore were seen penetrating the country rock for a few inches. The vein material is readily crushed, and the mineral, on account of its weight, is easily separated by jigging.

Later information stated that the tunnel was extended to a length of 65 feet, the vein widened out to 4 feet, and that the mineral occurs in bunches across the full width of the vein. Scheelite has also been found in small bunches and streaks with the hubnerite.

On one locality on the vein there was a somewhat remarkable occurrence of the ore. It was found in large bunches or blocks averaging 75 per cent

of tungstic acid, and from a small space 4½ tons of the tungsten ore had been obtained. From report it was learned that other smaller quartz veins carrying wolframite had been found and located in the immediate vicinity. The veins are said to carry gold in very small amount.

SMITH, F. D., The Osceola, Nevada, Tungsten Deposits, E. & M. J., vol. 73, pp. 304-305, 1902

This occurrence has been noted by Mr. F. B. Weeks, of the United States Geological Survey, who visited the locality in the autumn of 1900. His notes on the "Occurrence of Tungsten Ore in Eastern Nevada," which were published in the twenty-first Annual Report of the Survey, were reproduced in the ENGINEERING AND MINING JOURNAL in the issue of July 6, 1901.

During December, 1901, the writer made a careful examination of this deposit and was greatly impressed by the quantity of this ore on the claims comprising the present group. It is his belief that the occurrence is worthy of a more detailed description. Compared with other visible supplies of tungsten ore in the world, these mines are of a most extraordinary economic importance, as they are capable, apparently, of producing more tungsten mineral than any other mine known, and perhaps than all other mines combined.

History

The very prominent outcrops of the veins of white quartz in the brownish gray granite were noticed by the earliest prospectors, and the black mineral therein examined. The writer is informed that as early as 1885 samples of this mineral were sent to the chemist of a prominent reduction works in California, who reported same to be "specular hematite," thus confirming the prevalent misconception of the mineral.

In 1889 more observing prospectors, refusing to accept the mineral as one of iron, sent samples to Denver for analysis, with the result of learning the true character of the same and of its value as a source of

tungstic acid. It is probable that from this analysis the prevalent idea was obtained that the mineral is hubnerite and not wolframite. The writer has never made a complete analysis of it and is not aware of any such from an authoritative source.

Messrs. C. W. Gaby and W. Buntin located on the more prominent veins in 1899 and have since made several small shipments of hand cobbed ore which was taken from the outcroppings of the richest parts of the veins. In the summer of 1900 a small handmade jig and canvas table were erected and operated by horse power. Later a gasoline engine was used for motive power, but the equipment was not adapted to the concentration of the mineral either from the economic or the metallurgical standpoint.

A shipment of about 10 tones of concentrates, which carried from 65 to 70 per cent WO_3, was made in 1900. The owners then sold their claims to Mr. J. H. Marriott, of Osceola, Nevada, who had previously located the surrounding claims which showed any veins of the mineral. The present owner drove a tunnel for a distance of 208 feet on one of the stronger veins, the workings of which can be seen in Fig. 2. The ore taken from this drift was left on the dump and shows plainly the character of the vein filling.

Geology

The veins are in the foothills and lowest slope of the Snake Mountains. (See fig. 1.) For a distance of several thousand feet up the side of the mountain and for an elevation of about 1,500 feet the formation is granite, which is overlain by Cambrian quartzite. The latter rock forms the main ridge of the mountains to the top of Mount Wheeler or of Davis Peak, which is directly above the deposits in question. The veins, of which there are five prominent ones, all occur in the granite and plainly cut across the bedding of the granite, which is very indistinctly marked. They have been

traced to the contact of the two rocks, though noe has yet been found in the quartzite. The general strike of the veins is northeast-southwest and the dip to the northwest. Only one is developed, and as the directions are determined from the croppings only, there is necessarily much uncertainty regarding the parallel character, or whether some of the veins will ultimately run together.

In many cases the croppings are very prominent, for instance on the hubnerite, where the vein can be traced in one continuous line for a distance of 600 feet. Figure 2 shows the vein running from the dump of the tunnel up the mountain side. Talus has covered the veins in many places, but they are discernible for a total distance of 1,800 feet, either as one vein or as parts of several, up the mountain side which has a general slope of about 18°

The hubnerite vein, as shown in the tunnel, has a strike of N. 70° E. and a dip of 65° NW. The walls are well defined and part easily from the vein being separated on the foot by a layer of clay. The width varies from 18 to 36 inches and averages 26 inches throughout the whole length of the tunnel.

On the surface the vein shows greater width in places, and in some it has narrowed to 6 inches. Large boulders of quartz not properly in place, which from their proximity to the vein show their connection with it, are scattered along the slopes below the vein.

Character of the Ore

The hubnerite occurs in the white quartz in various sized crystals, many of which are 3 inches long and plainly show the crystalling character. Massive specimens when broken show cleavage planes from 2 to 4 inches long and 1 to 3 inches wide. However, much of the mineral is in fine grains and in irregular bodies. The quartz is found entirely enclosing the hubnerite

in some cases while the reverse is also true in that some specimens of apparently solid mineral will be found to enclose the quartz. This plainly shows that the two minerals were deposited simultaneously. In some cases a laminated appearance of the quartz is found with the hubnerite concentrated between the laminaee of quartz, giving a banded appearance to the mineral. This is more prominent where the bein pinches to a width of 6 to 12 inches.

The quartz is very solid with practically no evidences of weathering such as shown by pores or a honeycomb character. No oxidation products as iron oxides, etc., are found. In some few instances a yellowish efflorescence suggesting tungstite, WO_3, was observed though unidentified.

In one locality a considerable amount of scheelite was found mixed with the hubnerite. Its color varies from a waxy grayish white to a pale yellow and is often overlooked or mistaken for the quartz.

As far as studied, it appears that the mineralization of the vein has taken place across its whole width, though it often occurs in larger quantities on one wall than on the other. This concentration on the walls was found to change from one side of the vein to the other in short distances. It was also found that a concentration of the mineralization into so-called shoots had taken place. These shoots were from 15 to 25 feet in length and were separated by less mineralized portions of the vein of about the same length. At a depth of 80 feet at the face of the tuhnel, it is reported that the mineral was found in as good a proportion as the surface indications would suggest.

Accessory Minerals

As far as examined the ore is remarkably free from other minerals. Pyrite was found in a few places in small bunches, but the absence of iron

stains would indicate a small content of pyrite. None was seen on the croppings. Fluorite in very small quantities was found on the dump from the tunnel workings, though to what extent it occurred in the vein could not be learned. These two minerals, besides the hubnerite, scheelite and quartz, were the only ones found, unless more careful examination discloses the presence of wolframite mixed with the hubnerite.

Practically all of the ore shipped has been either hand sorted and cobbed or concentrated by the crude methods outlined above. These ores carried an average of 68 per cent tungstic acid. One shipment of 2,000 pounds gave 600 pounds of 65 per cent concentrates. The ore was closely cobbed before shipment. Hand concentrated samples have assayed as high as 67½ per cent WO_3.

From the ore as exposed in the croppings and in the tunnel workings it is the opinion of the writer that the whole vein matter, if carefully concentrated so as to save both the hubnerite and the scheelite, would produce 10 percent of mineral carrying 70 per cent, WO_3.

A small sample of the pyrite found on the dump was assayed for gold and silver and found to carry 2½ ounces of silver and a trace of gold. Samples of pure hubnerite were found to carry 2 ounces of silver and likewise a trace of gold.

The mine appears to be singularly favored, for Nevada mines, in that it is very accessible, being practically in the valley, at the foot of the mountain, and in close proximity to water both for milling purposes and for power. The mountain sides above are still covered with wood for fuel and some of this is large enough for mill and mine timbers. The nearest railroad point is Frisco, Utah, on the Oregon Short Line, a distance of 85 miles, over fairly good desert roads.

3460021

Shoshone, Nevada
June 25, 1941

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Item 23

DIRTY SHIRT MINE

The Dirty Shirt mine is located on the north slope of Mary Ann Canyon between Osceola and Willard Canyons in the Snake Range, White Pine County, Nevada (see photo 148, job GSO 3 1). A fair road leads from Goody's mill (on the Ely-Baker highway) to a loading ramp about ¼ mile from the mine and 600 feet lower. Ore is sledded with a caterpillar tractor from the mine to the ramp.

The mine is developed by a 90 foot shaft inclined 45° east. A drift has been run about 30 feet north and 25 feet south from the bottom of the shaft, and a small stope has been taken out on the south side of the shaft for 35 feet above the level. An old adit, perhaps 350 feet long, lies 250 feet below on the same vein. (This old working was done about 30 years ago in search of Au-Ag ore)

In the area immediately surrounding the mine, the country rock is the Lower Cambrian Prospect Mountain quartzite. The overlying limestone crops out ¼ mile northerly, and stratigraphically probably lies only a few hundred feet above the Dirty Shirt shaft. The bedding strikes northerly and dips westerly, the average angle of dip being about 30°.

The only tungsten orebody known occurs near the footwall side of a wide quartz zone that strikes northerly and dips 45° easterly. There are no surface outcrops, everything being masked by quartzite debris one to five feet thick. The vein has been uncovered for a distance of several hundred feet near the shaft in several widely spaced crosscut trenches. It is reported to be cut off by a fault 100 feet north of the shaft, but appears to extend several thousand feet south across Mary Ann canyon where there are numerous prospect pits that seem to be on the same vein.

The known scheelite orebody has a maximum exposed length of 40 feet, and a width of 2 to 5 feet. It appears to rake northward, the shoot crossing the shaft from right to left when one looks down the dip of the vein. The ore is of high grade, but its occurrence is spotty. The scheelite,

orange brown in color, occurs in masses several inches in size distributed through white quartz. There is a small amount of calcite gangue. The ore now being mined may average 3% of WO_3. The operators are crushing to about ½ inch, screening, and then hauling the fines in sacks to Goody's mill for tabling. One hundred sacks of these fines reportedly yielded 375 pounds of concentrate (yield of 2¼ % of WO_3 if the sacks weighed 100 pounds and the concentrate contained 60% of WO_3). The mill probably makes a 50% recovery or less.

The old adit contains no scheelite. The operators think that the vein is 40 or 50 feet wide, that the adit is on the hanging wall side, and that a crosscut through the vein beneath the shaft might locate extensions of the known ore shoot. They have been trying to get the Bureau of Mines to do some drilling from the adit, but there seems to be no justification for such a program. None of the workings have been surveyed.

Outlook. If the oreshoot extends 30 feet above the stope, and 30 feet beneath the bottom of the shaft, with an average width of 3 feet and length of 30 feet, it will yield 414 tons of ore. If the grade is 3% of WO_3 this ore will contain 1242 units of WO_3. It is not known how deep this lense may continue, or what the possibilities are for finding other similar bodies. Extensions of the same ore shoot laterally have not been definitely disproved.

The property, owned by Jim Henry, a prospector, is optioned to a Los Angeles lawyer. Major Griffin, reputedly a Los Angeles civil engineer, is in charge of the operation, and Frank Richey now runs the mine. Four other men constituted the crew at the time of my visit. Richey and his partner own the Keyes mine near Kernville, and expect to return there as soon as they can straighten out the Dirty Shirt mine.

The Molybdenum Corporation of America has a contract for the output of the mine.

Dwight M. Lemmon

cc to T B Nolan
7/24/41
Tom:
If I had had time, I would have surveyed the workings. I shall do so if at any time I am in the area and have a free day. I send you this memo for filing — in case of correspondence.
Dm L 7/24/41

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Item23

Skipper

U. S. Geological Survey
Box 1110, Ely, Nevada
Dec. 1, 1943

Lane Tilford Group of Tungsten Claims

Ohio Gulch, White Pine County, Nevada

by
Dwight M. Lemmon

The Lane Tilford group of 5 claims, known as the Skipper, Skyline, Paycheck, Apex, and Hungry Three, is on the South side of Ohio Gulch, tributary to Willard Creek, in Section 29(?), T. 14 N., R. 68 E., 15 miles north of the Tungsten Metals Corporation mill at Minerva, White Pine County, Nevada. The claims, owned by Lane Tilford, and leased to N. W. Keller, are prospected by an adit 130 feet long on the Skipper claim; by a shaft 20 feet deep, perhaps on the same vein; and by a 50-foot shaft with a 50-foot drift from the bottom on a second vein. The adit is readily accessible by a steep, dirt road from Willard Canyon; this road could be extended to the other prospects without difficulty. There has been no production from the property.

Accompanied by Mr. Keller, I examined the property briefly on the evening of June 28, and looked at the veins in ultraviolet light. The property is idle, and has not been worked since September 1942. The claims were visited by F. W. Horton of the Bureau of Mines in June 1942, and subsequently by an engineer from RFC. An application for an RFC loan was denied.

Scheelite occurs in several narrow, steep-dipping quartz veins in granite. These veins are poorly exposed and have not been adequately explored by surface trenching, but may extend as much as 600 feet in length. The property has no appreciable showing of commercial ore. The Skipper adit follows the main vein for 130 feet; a sample of the face, taken by D. M. McAffee for Nevada Scheelite Co., is reported by Keller to have assayed 0.66% of WO_3 across 4 feet. A sample cut by Mr. Horton of the Bureau of Mines 100 feet from the portal yielded 0.30% of WO_3 across 4 feet. The vein is not exposed on the surface ahead of the face.

The mineralization in the prospects appears too meager to encourage additional exploration under present economic conditions. Numerous other quartz veins in the Willard Creek basin are reported to be even less promising.

* It is reported that about 150 units of WO_3 were produced during World War I.

DML.

OSCEOLA

Weeks, F. B., Geology and Mineral Resources of the Osceola Mining District, White Pine County, Nevada, U.S.G.S. Bulletin 340 pp. 117-133, 1908.

Introduction

As a part of the general reconnaissance of the Great Basin region the geology of the region was studied by J. E. Spurr[a] in the summer of 1899 and by the writer in 1900. The geologists of the Wheeler Survey[b] also published some general observations on the region. A portion of October, 1907, was spent by the writer in making a more detailed study of the geology and mineral resources of the Osceola mining district.

General Description of the Snake Range

The Snake Range, in which is located the Osceola mining district, is one of the most prominent and extensive mountain ranges between the Wasatch and the Sierra Nevada. It extends between latitude 38° 30' and 40° 30', a distance of 135 miles parallel to and a little west of the Utah-Nevada boundary. (See fig. 5) As an orographic feature it comprises the Deep Creek or Ibanpah Range and the connecting hills designated as Kern Mountains on the map of the Wheeler Survey. The Snake Range is about 10 miles in width. The interior portion has been eroded into sharp ridges trending in general with the range, and the east and west flanks descend in steep slopes or bold escarpments to the valleys below. Snake Valley occupies a broad depression on the east and opens into the southwest end of Great Salt Lake desert. Spring Valley, west of the Snake Range, extends from the Cedar Range on the south to the so-called Kern Mountains on the north. The difference in elevation between the valleys and the highest part of the range is about 6,000 feet. The rugged character of the range makes it a formidable barrier to east and west travel. There are only four natural passes which afford a practicable route for wagon roads. The highest summit

of the range is Wheeler Peak (locally known as Jeff Davis Peak), which has an elevation of 12,000 feet. In the region of the Osceola mining district the range presents an abrupt face to the west and a long, gentle slope to the east.

Upon a basement complex of granite and schist, only a small area of which is exposed, there has been deposited a series of Paleozoic sediments from 8,000 to 10,000 feet in thickness. As shown by their fossils the strata were laid down in Cambrian, Ordovician, and Carboniferous time, a long interval of nondeposition occurring throughout the Silurian and Devonian periods. Some beds of unknown age may represent the Mesozoic era, but the evidence is inconclusive. On the lower slope of the range in certain areas there are sands and gravels which lie above the Lake Bonneville beds and which were probably laid down in late Tertiary time. At the north end of the range terraces of the Pleistocene Lake Bonneville have been noted. It seems probable that from Carboniferous time to the present the greater part of this area has been subject to erosion.

Considerable bodies of igneous materials are exposed in the northern and central portions of the range. These igneous masses intruded Carboniferous strata and so, in part, at least, are Mesozoic or younger.

The prominent structural feature of the range is a dome in the region of Wheeler Peak, which both to the north and to the south passes into anticlinal folds whose axes in general trend with that of the range. This structure has been subsequently modified by compression and faulting and by the intrusion of igneous masses, so that the sedimentary beds generally have steep dips and are in many localities separated by considerable displacements. This is especially true in the region of the Osceola mining district.

OSCEOLA MINING DISTRICT

Situation and Physical Features

This mining district is about 35 miles east of Ely, Nevada, the southern terminus of the Nevada Northern Railroad. It includes the crest and western slope of the Snake Range in the vicinity of Osceola. The east-west wagon road through the district is the principal route of travel between Utah and central Nevada. Near the summit on the eastern side the road forks, a branch leading over the Sacramento Pass and descending to Spring Valley on the west.

The principal drainage lines in the mining district are Dry Gulch and Mary Ann Canyon and along them and in their alluvial fans occur the most important placer deposits. The stream beds are dry during most of the year. About one-fourth mile above Osceola, near the wagon road, are several small springs and a small stream flows from the mouth of the New Moon mine. The elevation of the district ranges from 6,000 to 9,600 feet above sea level. The region is arid, the principal precipitation being in the form of snow.

General Geology

The distribution of the rocks in this district is shown in the sketch map forming fig. 6, and a general section is given in the following table.

No. in fig. 7	Age	Character	Thickness feet
1	Recent	Gravel, coarse to fine, gold bearing	up to 80
2	Upper and middle Cambrian	Gray to white, rather pure limestones and dark-blue crystalline limestones	1,000
3.	Lower Cambrian	Green sandy shales, Olenellus zone . .	150
4.	do	White, blue, and purple quartzites, gold bearing	2,000
5.	do	Purple argillite	750
6.	do	Conglomerate	100 to 150
7.	Archean (?)	Granites and schists, with intruded granite porphyry.	-----

OSCEOLA Cont.

Fig. 7 is a cross section showing the structural relations along a line crossing Dry Gulch.

A short distance south of the mining district and near the crest of the range is an area of granite and schist overlain by a coarse conglomerate which grades into a compact argillaceous rock resembling argillite. The argillite is succeeded by a series of quartzites which pass into shales containing an Olenellus fauna. It appears from these observations that there is exposed here a small area of the basement complex rocks. Their structure has, however, been broken by an intrusive mass composed largely of gray and red granite porphyry which, north of the road crossing the range to Osceloa, has penetrated through strata of possible Carboniferous age.[c] On the divide north of Wheeler Peak certain observations made in an area of poor rock exposures indicate that the granite porphyry cuts through the granites and schists of supposed Archean age.[d] These Archean rocks are much finer in grain and generally more basic than the intrusive rocks. By the presence of sheared zones and general schistose structure they bear evidence of stresses and strains which were not observed in the intrusive granite porphyry.

The conglomerate which overlies the basement complex is about 100 feet thick and is formed of large subangular pebbles and bowlders derived from the older rocks. The conglomerate pebbles gradually become more rounded and smaller in size, argillaceous material forming a considerable portion of the rock, which passes into a massive bedded argillite. The argillaceous series is about 700 to 800 feet thick and is well exposed on the eastern slope of the high ridge that forms the crest of the range east of Osceola.

In this region the dip ranges from 25° to 40° NW.[e] and where the strata

are cut by the intrusive porphyry they have been altered for the most part into a bluish-gray, generally schistose rock that has been called "silvery slate." This series is overlain by gray and white fine-grained quartzites. The beds have been thoroughly silicified and contain many veinlets of probably secondary quartz. They have also been subjected to compression and numerous extensive belts of cross fracturing have been developed in which the quartzite has been broken into small angular fragments. The quartzite series has been estimated to be 2,500 feet in thickness. In the upper part of these beds occur the gold deposits and from the erosion of their outcropping edges the placer deposits in and along the sides of the gulches and in the alluvial fans have been formed.

The quartzite is succeeded by about 150 feet of green sandy and argillaceous shales. Where the outcrop of these beds crosses the south end of the ridge facing Spring Valley fossils of Olenellus type were found. These are the lowest beds in which fossils are known to occur, though careful search was made for them in the argillite.

Above the shale series occur dark-blue and gray limestones about 1,000 feet thick. The individual beds range from 1 to 3 feet in thickness, but in the crest of the ridge facing Spring Valley there are about 100 feet of thin-bedded and shaly blue limestones. The dark-blue limestones immediately overlie the shales and for the most part are crystalline or semicrystalline and contain numerous calcite veins. The gray limestone is comparatively pure and ranges from dark gray to white in color. Fossils have been collected at several horizons in the limestone series on the east and north slopes of the ridge facing Spring Valley and these have been determined as forms characteristic of the middle and upper Cambrian.[f]

Within the area of this mining district there are no other sedimentary

rocks except the recent deposits in which occur the placers. These deposits are from a few inches to 80 feet thick. The gravel ranges from fine to coarse and contains few large bowlders.

History of Mining Development

In 1877 work was begun on the placer deposits of Dry Gulch. A few quartz locations were made prior to that time. It is reported that 300 to 400 miners were working on the placers during 1877 to 1880 and during the latter year 400 placer andlode locations were on record. The important placer properties in Dry Gulch became the property of the Osceola Gravel Mining Company, subsequently known as the Osceola Placer Mining Company, in theearly eighties. Prior to 1890 this company had constructed two ditches approximately 34 miles in length, at a cost of about $200,000. The operations of this company and of individuals continued until about 1900, when on account of light snowfall and the loss in efficiency of the ditch from leaky flumes and other causes work was discontinued.

The alluvial fan which spreads out from the mouth of Mary Ann Canyon, in the southern part of the district, is locally known as Hogum. Here pay gravel was found several years after the discoveries in Dry Gulch and the deposits have been worked intermittently since that time.

Several attempts have been made to work the gold-quartz properties on a small scale. Three mills of 5, 10, and 20 stamps have been erected and operated, but none of them has been commercially successful. It is admitted that more than 50 per cent of the values went down the gulch with the tailings. Since field work was completed the 20-stamp mill has been partly repaired and a run of several hundred tons of ore from the Cumberland mine has been made. The results are not known.

From all accounts that have been obtained, it seems safe to estimate

that the production of gold from this district approximates $2,000,000, of which about one-tenth was probably derived from the quartz mines.

Mining

The slopes being steep, underground development is through tunnels, there being not more than half a dozen shafts in the district. In one or two mines an upper and lower tunnel have been connected by winzes. The quartzite is exceedingly hard and no timbering is required in the tunnels. In winzes and stopes a few stulls are all that is needed.

Some ore has been sacked and shipped to the smelters, but the greater part has been locally milled. Stamping and amalgamation constitute the principal method of treating the gold quartz. A small cyanide plant was constructed several years ago but was abandoned, apparently before receiving a satisfactory trial.

The Boston and Nevada Mining and Milling Company employs half a dozen men and about the same number are engaged from time to time in doing assessment work for nonresidents. The average wage for miners is $3.50 per day of eight hours.

All the mines and placers have been located by prospectors and working miners. No extensive consolidations have been made and the camp remains an aggregate of small mines and prospects on which, with the possible exception of the Osceola placers, but little outside money has been expended. The ores so far discovered have not been of high enough grade to attract lessees.

Extent of Productive Territory

There seems to be no ground for assuming that the productive territory extends beyond the limits of the area shown on the map (fig. 6). So far developments indicate that the deposits are confined to fairly well defined zones in the quartzite. It has been thought by some that the same mineral belt extends northeastward to the recently opened Black-Horse district. It

may be that the effects of the same dynamic forces which developed the lode systems in this district extended to the Black Horse district, but a slight examination of that region indicates that although the lithologic characters of the strata are in general similar, the beds at Black Horse were deposited during a later period and the ores are very different in character.

The fissures appear to be confined to the quartzite. They were not observed in the overlying shales and limestones and the underlying argillite has not been exposed in the underground workings. To the east and south of the area mapped the argillite series is well exposed and shearing with more or less movement along the bedding planes is a prominent feature, the beds being locally altered to a silvery slate.

Distribution of Mines

The areas of greatest mineralization are (1) the ridge on the west and south sides of Dry Gulch, (2) the slopes of Mary Ann Canyon, and (3) the north end of the main mountain ridge. (See fig. 6.) In the Dry Gulch area are situtated what is locally known as the Gold Exchange group, including the Woodman, Golden Eagle, Star, Time Check, Crescent, Exchange, and January. There also are the Butterfield and the Cumberland mines. In the region of Mary Ann Canyon are the Serpent, Mayday, Drummer, and other prospects. On the north end of the main ridge at an elevation of about 8,000 feet are the King, Queen, Gold Hill, June, and Gold Crown claims, locally known as the Summit group, and a little to the west are the Whitney and Mulligan groups.

Underground Development

The most extensive underground workings are in the Gold Exchange group. The tunnels in these mines have a total length of about 1,000 feet, and connect with one or two shafts and several stopes and winzes. In Mary Ann Canyon several prospects have tunnels from 50 to 125 feet long. In the Summit group the tunnels range from 50 to 350 feet in length. The Whitney

and Mulligan groups have about the same amount of development. The three tunnels in the Cumberland mine have a total length of approximately 1,700 feet.

Structure of the Gold Deposits

There appear to be only two types of auriferous deposits in the district—(1) regular zones of fracturing or sheeting and (2) irregularly shattered masses of quartzite adjacent to these zones of fracture. In most places there is no distinct line of demarcation between the two types. There no massive veins solidly filled with quartz such as are characteristic of many other regions.

The most characteristic structure is the sheeted zone. In this district these zones consist of narrow, nearly parallel fissures forming lodes ranging from several inches to 15 feet in width. In the wide belts, which may be considered as compound sheeted zones, there are generally one or more zones of closely spaced fissures. The sheeted zones contain some fracture planes which show slickensiding, but the displacement appears to be slight. This may be due to the brittle character of the fine-grained quartzite that forms the country rock. Beds which are broken into fine brecciated masses lie between massive beds of quartzite which apparently were not affected by the compressive stress.

Circulating waters carrying silica in solution have filled the fissures of the sheeted rock. The original openings were small, and they are as a rule completely filled. The most important exception is the Cumberland lode, in which the vein material contains many vugs lined with gold, fluorite, and other minerals.

The lodes are in places conspicuously exposed, forming bold outcrops of quartz. They are somewhat more resistant to erosion than the country

rocks, but can not be followed on the surface fora very great distance. There are also lodes intthe mines which do not appear at the surface. It is therefore impossible to describe in detail the lode systems, as there is a relatively small amount of underground work and the limits of the fracture zones have not been reached.

The Osceola lodes form two intersecting groups of approximately parallel fissures. In the northeastern part of the district the strike is northeast. In other parts of the area the strike varies but little from east and west, except that in the southwestern part there appears to be a northeast-southwest system of fracture zones which cut the east-west lodes. In general the lodes do not coverge but maintain their direction until they can no longer be distinguished from the irregular jointing which occurs in all the rocks. The two systems seem to have formed simultaneously and they do not appear to fault each other. In Mary Ann Canyon the fissures intersect without noticeable displacement. The intersection is usually marked by an irregular broken zone, as may be seen on the outcrop and in the upper and lower tunnels of the Mayday mine.

The lodes are steeply inclined, nearly all being above 70° and many vertical. So far as the underground workings show they are fairly regular in dip. Adjacent fissures in general dip in the same direction. This is well shown in the Gold Exchange group. In many places the lodes for considerable distances are so ill defined that the dip can not be determined. It may be said in general that the east-west lodes are vertical and that the northeast-southwest lodes dip at high angles. No systematic relation between dips, distribution of fissures, and general structure of the district has been found.

Persistence

Very little can be said definitely regarding the persistence of the lodes

in depth. The deepest underground workings are not more than 300 feet below the surface and the fissures extend to this depth. The ore shoots and sheeted zones are not necessarily coextensive, for the highly productive areas have generally proved to be moderate in extent. Detailed information concerning the length of the lodes is wanting. In the Gold Exchange group the principal lode has been fairly well traced for a distance of half a mile, the west end being cut off by erosion and the east end passing into undeveloped ground. In the Summit group not one but several fissures which appear to replace each other have been traced at irregular intervals for more than half a mile.

Origin of the Fissures

The character of the stresses that fissured the strata is not easily determined. It is clear, however, that they were such as could be relieved by fracturing with only slight displacement. The hypothesis which seems to accord best with field observations is that in the readjustments, which followed the intrusion of the magma, stresses were set up that resulted in the shearing of the argillite and the fracturing of the fine-grained, brittle quartzites along vertical or highly inclined zones. Fissuring and the intrusion of the igneous magma appear to be genetically connected and were followed by ore deposition from circulating waters.

Character of the Ore

The lodes of the Osceola district contain a relatively small amount of metallic or gangue minerals. Inasmuch as these minerals occur as the filling of narrow fissures or cracks in the fractured zone which usually constitutes a lode, or as the incomplete replacement of the country rock, the gangue of the ores is similar in character and composition to the rocks adjoining the fissures. Pyrite is very sparingly desseminated in grains so minute as scarcely to be distinguishable by the unaided eye. Ferruginous clays are common in the fissures. In certain lodes, particularly that in the Cumberland

mine, the quartz is here and there honeycombed and contains many bugs lined with fluorite and other minerals as well as free gold. More commonly the gold occurs in flakes and also finely disseminated in quartz seams and veinlets.

So far as known gold is the only metal of commercial value in the Osceola ores. From the information available it is impracticable to estimate definitely the average gold content. Commercial assay returns show a wide range in value. Three samples taken by the writer gave assay values of $5, $32, and $77 per ton, the last representing the face of a tunnel about 4 by 6 feet. Other samples taken by the writer ranged in value from 80 cents to $4.50 per ton and represented portions of lodes not less than 3 feet in width. The return from a shipment of several tones of selected ore from the fractured country rock adjoining a fissure zone gave a value of $28 per ton. It is evident that the gold content of the lodes varies greatly, as in other known gold-bearing veins. It is not unlikely that careful prospecting will develop ore bodies of sufficient size and value to render their exploitation profitable.

Oxidation

The greatest depth of underground workings does not exceed 300 feet, and the sulphide zone has not been reached, so far as known. No water is found in any of the mines except in the New Moon tunnel, which crosses a fault in the argillite series. Under present climatic conditions there is very little precipitation, so that the mines are practically never wet. The district stands high above the adjacent valleys, and other conditions suggest unusual depth of ground water.

The greater number of lodes contain a considerable amount of material oxidized to a yellow or brown clay, that does not appear to be easily carried away. Oxidation, however, does not seem to have changed the composition or

obliterated the structure of the lode materials to any marked degree. No evidence was obtained that there had been a secondary enrichment of the lodes from the surface downward by leaching of the ore. Such action, however, may have taken place under more humid climatic conditions, such as are believed to have existed in this region in recent geologic time.

Origin of the Ores

No extended discussion of the origin of the gold-bearing ores of the Osceola district can be presented here, as the examination of the mines was not made in sufficient detail to determine many questions that have an important bearing on their genesis, and it has not been possible to study the field collections prior to the preparation of this paper. From general analogy with other deposits it is considered that the ores were deposited from circulating waters within fissure zones formed by compressive stresses. If, as seems likely, the greater part of the mineralization occurred by deposition from ascending waters the silica and the fluorine in the fluor spar locally developed were derived from the originally molten magma that probably underlies the region at no great depth, in geologic terms. In an adjoining area tungsten-bearing veins in granite porphyry contain a considerable amount of fluorite. Evidence bearing on the source of the gold is inconclusive. That it was leached from the quartzite strata is not improbable, for there is some evidence that they are gold bearing. It may, on the other hand, have been separated from the intrusive magma and brought up through the fissures by magmatic waters.

Detailed Description of Mines

Gold Exchange Group

The Gold Exchange group comprises eleven lode claims, of which three are fractional. They extend from the west face of Pilot Knob Ridge around the

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north end, following the south and west slope of Dry Gulch. The slope is steep, but good mountain roads have been constructed to the several tunnel openings. A 20-stamp mill has been erected on the Star ground, which adjoins the Golden Eagle (No. 2 on map, fig. 6) on the west. Water from the west-side ditch has been used in operating this mill. The Star, Golden Eagle, Crescent (No. 3 on map), and Exchange (No. 5) are patented ground; the other claims are held by annual assessment work.

The underground workings on this group, except a portion of the lower tunnel on the Star ground, are in the upper part of the quartzite series. The average dip is 40° NW. and the strike is N. 10° E., but both dip and strike vary within short distances. There are many vertical or highly inclined fault planes, but the displacements observed do not exceed a few feet. The shale series overlies the quartzite and above the shales are the limestones capping the ridge. Near the mill a fault has trhown down the limestones and below these outcrops the slope is covered with debris.

The quartzite strata have been subjected to stresses resulting in two fracture zones, one having an east-west direction, the other northeast and southwest. The east-west zone is the principal one and within it occur many small displacements, the rocks showing well-marked slickensides. This zone can be traced on the surface as a succession of "blowouts." In some of the beds the fracturing extends beyond the usual limits of the lodes, but the other strata retain their massive character. The shattered beds were broken into small anuglar fragments.

There are two lode systems within this group, one within the Time Check and Crescent (Nos. 4 and 3 on map) and the other within the Golden Eagle (No. 2), Exchange (No. 5), and January ground. They are approximately parallel and are several hundred feet apart. The latter is apparently the more

extensive and has produced the larger amount of ore.

The gold is concentrated within fissure zones of varying width and is also disseminated to a greater or less extent in the beds of finely shattered quartzite. It is not known to what extent these beds have been mineralized, as no drifts have been made in them. They evidently contain some pay ore, for in places chambers several feet in extent have been stoped. The gold is rarely visible, being very finely disseminated.

In accordance with the locally held idea that these ores are free-milling they have been treated in the ordinary stamp mill with amalgamation tables. These properties have not been worked since 1899 and at this time it is impossible to obtain definite information as to the average value of the material milled or the percentage saved. Itis generally conceded, however, that there was considerable loss-possibly as much as 50 per cent of the assay values. On account of the high degree of fineness of the gold and the fact that it is not all in the free state it is believed by many that a much greater perdentage of saving would result from cyanide treatment.

Summit Group

The Summit group of claims is situated on the crest of the range about 1 mile south of the wagon road which crosses the mountains from Osceola. Some underground work has been done on each of the claims which comprise this group.

The Gold Hill tunnel (No. 7 on map) is 309 feet inlength and its direction is south. It is entirely in the quartzite strata, which strike N. 10° E. and dip 45° NW. They are generally massive bedded and contain several clay seams and fractured zones about 6 inches in width. On the eastern side of this claim there is another tunnel about 100 feet in length, having a direction S. 60° W., with a drift to the south from the face of the tunnel about 100 feet long. In these workings is exposed a broad zone of fractured and

brecciated rock whose limits are not know. Considerable ore from this tunnel is said to have been milled, but no satisfactory estimate of value could be obtained.

The June tunnel (No. 16 on map) varies in direction and has a total length of 240 feet. The tunnel cuts a fault trending N. 26° E. East of the fault, in the direction of the face of the tunnel, the beds show little disturbance but contain many soft seams from which gold can be obtained by panning. To the northwest, or toward the mouth of the tunnel, the quartzite is very finely brecciated. In this fracture zone assays ranging from $8 to $15 are said to have been obtained, but no definite statement as to the width of the zone furnishing such assay values could be given. This fracture zone appears to have a general direction of N. 30° E.

The Gold Crown, Queen and King (Nos. 8, 9, and 10 on map) are developed to a small extent. Average assays of $14 are said to have been obtained from these claims.

Within the Summit group there appear to be at least three fracture zones separated by intervals in which the quartzites are relatively undisturbed. The amount of mineralization varies greatly within these zones and extensive prospecting will be necessary to determine the distribution of the values.

Whitney Group

The Whitney group (No. 11 on map) has been prospected by several tunnels cutting the shale and quartzite nearly at right angles to the strike. The strata are in places much broken and shattered and in others are undisturbed. Certain fault planes, indicated by slickensided surfaces, have been followed as walls in the tunnels. These fault planes dip 60° S. Considerable ore has been mined and milled from these workings, but no satisfactory statement of its value could be obtained.

Mulligan Group

At the north end of the Mulligan group (No. 12 on map) there is an incline following what appeared to be a fault fissure nearly filled with vein quartz. The fault strikes N. 80° E. and dips 65° S. About 600 feet south of this incline is a tunnel which at the time of visit was closed, but the material on the dump showed that there must be considerable underground work in a formation of very finely crushed white quartzite. At the south end of this group is a 200-foot tunnel entirely in a crushed white quartzite.

Cumberland Mine

The Cumberland mine No. 1 on map) has three tunnels having a common direction of S. 80° W., at vertical intervals of 100 to 200 feet. The lower tunnel is 500 feet in length and follows a fault zone in which are many small fissures showing slickensided surfaces and dipping both to the north and south at high angles. In some places a fault plane dipping steeply to the south has been followed until it became nearly horizontal in the roof and then another steeply inclined fault plane farther on in the tunnel has been used as a wall. In some places, for distances of 10 to 20 feet, the quartzite strata are unbroken and have the normal strike and dip. Many beds not showing distinct fault planes have been crushed into confused masses of small fragments. Clay seams are abundant, and some of them follow bedding planes.

The second tunnel was not examined. The third and upper tunnel is 650 feet in length. At 450 feet from the entrance is a winze 50 feet in depth and an upraise to the surface. In this upraise there is an ore shoot 3 to 4 feet in width which pitches 75° S. The greater part of this ore shoot has been worked out. Its hanging wall is a well-defined fault plane. The

lower edge of the shoot is cut in the back of the third tunnel, but its pitch carries it to the south of the first and second tunnels, and no prospecting has been done to determine its extension in this direction. It is reported that most of the ore mined and milled from the Cumberland came from this upraise, but no definite information as to its average value could be obtained. The ore contains much free gold, partly in vugs with fluorite. Many beautiful specimens have been found in these ores.

Other Prospects

In the southwestern part of the Osceola district, in the region about Mary Ann Canyon, there has been considerable prospecting since 1900. This area is locally known as Hogum. The granite porphyry is exposed on the western edge of this area and small veins, generally of quartz, extend from it into the adjoining sedimentary strata. The derivation of the vein filling from the intrusive mass is more clearly shown here than in the other parts of the district. Although the structural features of this area have been affected by the intrusion of the igneous magma, they nevertheless are closely connected with those of other parts of the district previously described.

The Mayday claim (No. 14 on map) is developed by a tunnel 130 feet in length following the strike of the vein, which is S. 70° E. The gangue material is nearly all quartz and it pitches to the southwest, or in the direction of the granite porphyry, which is exposed about one-eighth of a mile farther south. The vein contains many gouge seams and small displacements. In the area between this vein and the granite porphyry the quartzite is fractured and broken into small angular fragments.

The Drummer claim (No. 13 on map) is developed by a shaft 18 feet in depth following an offshoot from the granite porphyry. This vein is about

4 feet wide and is formed of fine-grained granite porphyry and quartz. Its general direction is N. 30° E.

The Serpent claim (No. 15 on map) has two tunnels 50 to 80 feet in length. The entrance to the upper tunnel is in the limestone, which dips 45° NW. and strikes N. 30° E. The vein strikes N. 50° E. and dips 45° SW. The ore-bearing portion ranges in width from a 10-inch vein to a thin parting. The best ore, said to have been found where the pay streak averaged 4 inches wide, assayed $400. Coarse gold was observed on exposed faces of the vein. The lower tunnel is 25 feet below the upper tunnel and has a direction S. 80° E. The vein is from 6 to 8 inches in width and dips 25° SW. The returns from the milling of this ore were reported as $17 to $20 per ton. Considerable lead ore is found in a parallel vein.

Placers

The placer deposits of Dry Gulch range from a thin covering of the edges of the quartzite strata in the upper part of the gulch to deposits 25 to 30 feet in depth in the lower part, below which the debris spreads out into an alluvial fan. Hydraulicking and ground-sluicing methods were employed to recover the gold. The values were more or less disseminated through the gravel, the principal pay deposits being as usual near bed rock. Large nuggets were rarely found, the gold being in general very fine. There still remains a considerable area of ground to be worked, but lack of water has thus far rendered further operations impracticable.

In the southwestern part of the district, in the area locally known as Hogum, the placer deposits occur in channels buried under the material of the alluvial fan below the mouth of Mary Ann Canyon. They usually occur in stratum overlying a so-called cement or false bed rock, of which there appear to be several at different levels. The channels are worked by sinking and

drifting. The material is raised by a whim, shoveled into sluice boxes, and washed with a small quantity of water from the ditch. Here, as in every other part of the district, the gold is fine and nuggets of much size are seldom found. Frequently small potholes are encountered in the false bed rock. These have the gold concentrated around their edges, but not within them. During the summer of 1907 the Gold Bar Placer Company employed from two to four men and the operations are said to have given a satisfactory return on the investment. The pay stratum was reported to have yielded from $6 to $8 per cubic yard.

Placer mining has also been carried on east of the divide, above the town of Osceola, in Mill and Weaver creeks. This area lies to the northeast of that shown on the map and was not studied in detail. The gold is derived from the erosion of the quartzite strata, as in all other parts of the district.

General Summary

The lode systems of the Osceola district are known to be extensive. All of them carry gold, but the values are irregularly distributed along the fissure zones. Systematic and extensive prospecting must be done to determine the average value of these lodes. It seems certain that the average product of the lodes will be a low-grade ore which must be worked at a small cost and in large quantity to be profitable.

Water for milling purposes and placer mining can be obtained from the several creeks heading around Wheeler Peak, which are also available for the generation of electricity. As it will require the waters of all these creeks to fully develop the resources of the district there should be such a combination of interests as would permit the development of the water and power for the use of the various mining companies. Future development and prosperity depend on a concentration of local interests on a basis that will attract capital.

OSCEOLA Cont.

MR 1916 "Scheelite was mined and milled on the western side of the Snake Range...on Willard Creek, 3 miles south of Osceola" (See Shoshone card for 1930 and 1934)

Lincoln, F. C., Mining Districts and Mineral Resources of Nevada, Reno, 1923 p 253.

The Osceola district is situated at Osceola on the west flank of the Snake Range. Ely, which is on the Nevada Northern Railroad is 40 miles west-northwest. Osceola is 6,800 feet above sea level and the mountains to the east rise to an altitude of 9,600 feet. The Sacramento district adjoins the Osceola district on the north and the Black Horse district adjoins it on the northeast and is sometimes considered as a section of the Osceola district.

The gold lodes were discovered by Matteson and Heck in 1872; and the placer mines by John Versan in 1877. The gold ore was first worked by arrastras, but a 5-stamp mill was erected in 1878. The most important placers were operated by the Osceola Company from the early eighties to 1900. Both placers and lodes have been operated irregularly and intermittently down to the present time. Tungsten was discovered in the district in 1916, and the Pilot Knob group erected a 20-stamp mill. Phosphate rock was discovered in 1917 and lead ore shipped in 1918. In 1921, the Sunrise property operated a 2-stamp mill and the American group a 10-stamp mill, producing gold bullion with a little silver content.

According to weeks, the production of the Osceola district up to 1907 may be safely estimated at $2,000,000; of which about one-tenth came from the quartz mines, the remainder being from placers. Stuart states that estimates range from $3,000,000 to $5,000,000.

OSCEOLA Cont.

Cambrian conglomerat, argillite, quartzite and limestone have been intruded by granite porphyry, according to Weeks. The country rock of the auriferous lodes is quartzite and the ore occurs in regular zones of fracturing or sheeting and in irregularly shattered masses of quartzite adjacent to these zones of fracture. The gold commonly occurs in flakes and finely disseminated in quartz seams and veinlets, but in the Cumberland Mine it is present in vugs lined with fluorite and other minerals. At the Pilot Knob Group, scheelite occurs in quartz veins in limestone, while the Lucky Boy Mine has silver-lead ore, according to Mines Handbook.

K. Krauskopf and R. Stoppel
U.S. Geological Survey
June 8, 1943

THE DIRTY SHIRT TUNGSTEN MINE

Osceola District, White Pine County, Nevada

The Dirty Shirt mine is on the west slope of the Snake Range, ½ mile north of Mary Ann Canyon in T14N, R67E (Mt. Diablo B & M), at an elevation of approximately 6500 feet. It is reached by two miles of steep mountain road from U.S. Highway 6. The nearest railroad is at Ely, 35 miles northwest. Owners of the mine are Jim Henry of Osceola, Nevada and Walter Spencer of Salt Lake City.

Production has been about 90 units of WO_3 from 82 tons of ore mined in the winter of 1941-42 and about 30 units from 15 tons of ore mined in the winter of 1942-43.

Workings consist of an 85-foot inclined shaft, adjoining small stopes, and a 650-foot adit at a lower level. Part of the shaft and adit date from earlier exploration for silver. Most of the ore has been concentrated in a small mill built by Mr. Henry.

The ore consists of scheelite in a quartz vein cutting lower Cambrian (Prospect Mountain) quartzite. The quartzite beds strike about N15°E and dip 35°W; the general trend of the vein is about N45°E and its dip about 45°SW. The upper workings expose a single vein about ten feet thick, with a metadolerite dike of similar thickness along its hanging wall. In parts of the lower workings several veins appear, ranging in thickness from thin stringers to at least 20 feet. These follow the same metadolerite dike, the principal bodies of quartz lying sometimes on the hanging wall and sometimes on the footwall of the dike. Shearing is prominent both within the quartz and along its borders.

The scheelite is yellow-brown in ordinary light and fluoresces bluish white in ultraviolet light. Much of it occurs in good-sized crystals, from 1/8 inch to over an inch in diameter. Often associated with the scheelite and resembling it closely in ordinary light is yellow-brown calcite. Another conspicuous mineral in the vein is a dark gray carbonate, either siderite or rhodochrosite, occurring in long bladed crystals. A little powellite is visible in ultraviolet light. No sulfide minerals were observed in the vein, but Mr. Henry reports an occasional crystal of galena; pyrite is abundant in parts of the metadolerite dike.

Scheelite crystals are disseminated thru the quartz, concentrated erratically in streaks and patches. The limited exposures in the upper workings suggest that practically all the ore is restricted to a belt between two feet and seven feet from the footwall of the vein. The occurrence of the best ore near the top of the east stope and in the small stope just west of the end of the shaft (see map) suggests possible concentration of scheelite in an ore shoot raking to the northeast. No scheelite except rare tiny grains was observed in the lower adit.

Reserves. The map shows roughly the part of the ore with a concentration of WO_3 of 1% or over (as estimated in ultraviolet light). Ore in the richer pockets contains at least 5% of WO_3; an average for the ore shown on the map is between 1.5 and 2%, an estimate corroborated by the production record. On the assumptions that ore of this grade persists upward to the surface above the east stope and downward and sideward for at least ten feet from the small stope at the base of the shaft, indicated ore would amount to about 250 tons or about 400 units of WO_3. Probably 200 tons of 0.5% ore are available in addition.

The 650-foot adit, at a level 180 feet below the top of the shaft, evidently follows the same vein system exposed in the upper workings. Near the end of the adit is a thick mass of quartz with approximately the same attitude and the same conspicuous bladed crystals of gray carbonate found in the upper workings. The almost complete absence of scheelite in this quartz might suggest that the ore does not continue far below the base of the shaft; on the other hand, if the ore lies in a shoot raking northeastward, the adit has not quite reached a possible downward extension of the shoot (see map). The amount of inferred ore depends on an assumption about the persistence of the shoot: if the shoot extends downward as far as the adit, 1500 tons or 2500 units would be available; but there seems no way at present to judge the validity of such an assumption. Persistence of the shoot could be checked by extending the adit 50 or 60 feet northeastward.

The surface near the upper workings is a moderately steep slope covered with quartzite talus. No outcrops are visible except a few poor ones of quartzite, so it is impossible to determine the continuity of the vein on the surface. Mr. Henry reports finding ore in a small pit which he dug several years ago about 60 feet northeast of the shaft, but the pit is now caved.

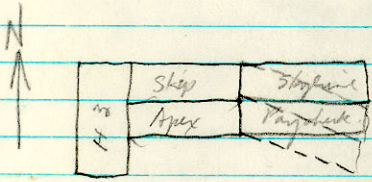
Copies to Allen, Lasky, Lemmon, Nolan

Skipper adit - 130' long -

Face 0.66 oz - 4'

Dm McAffee (?) Ner. schedule - Thin vein - ~~Entire~~ Skipper half face 4'6" Numerous quartz stringers in monzonite.

Skipper, Apex, Skyline, Ponydude, Chimney 3



Shaft 20' deep on vertical vein

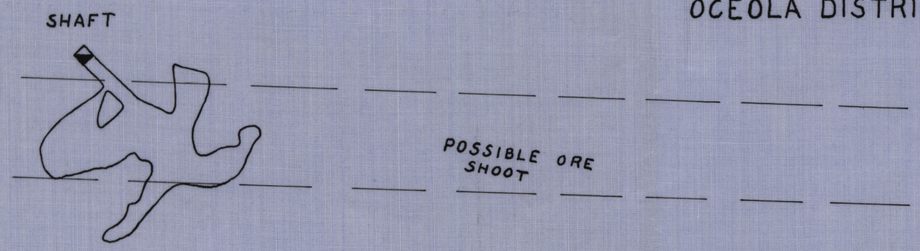
1 ft thick good streak W 0 3 on N wall

Dump grab sample 0.25

Some high grade pieces on surface.

DIRTY SHIRT MINE

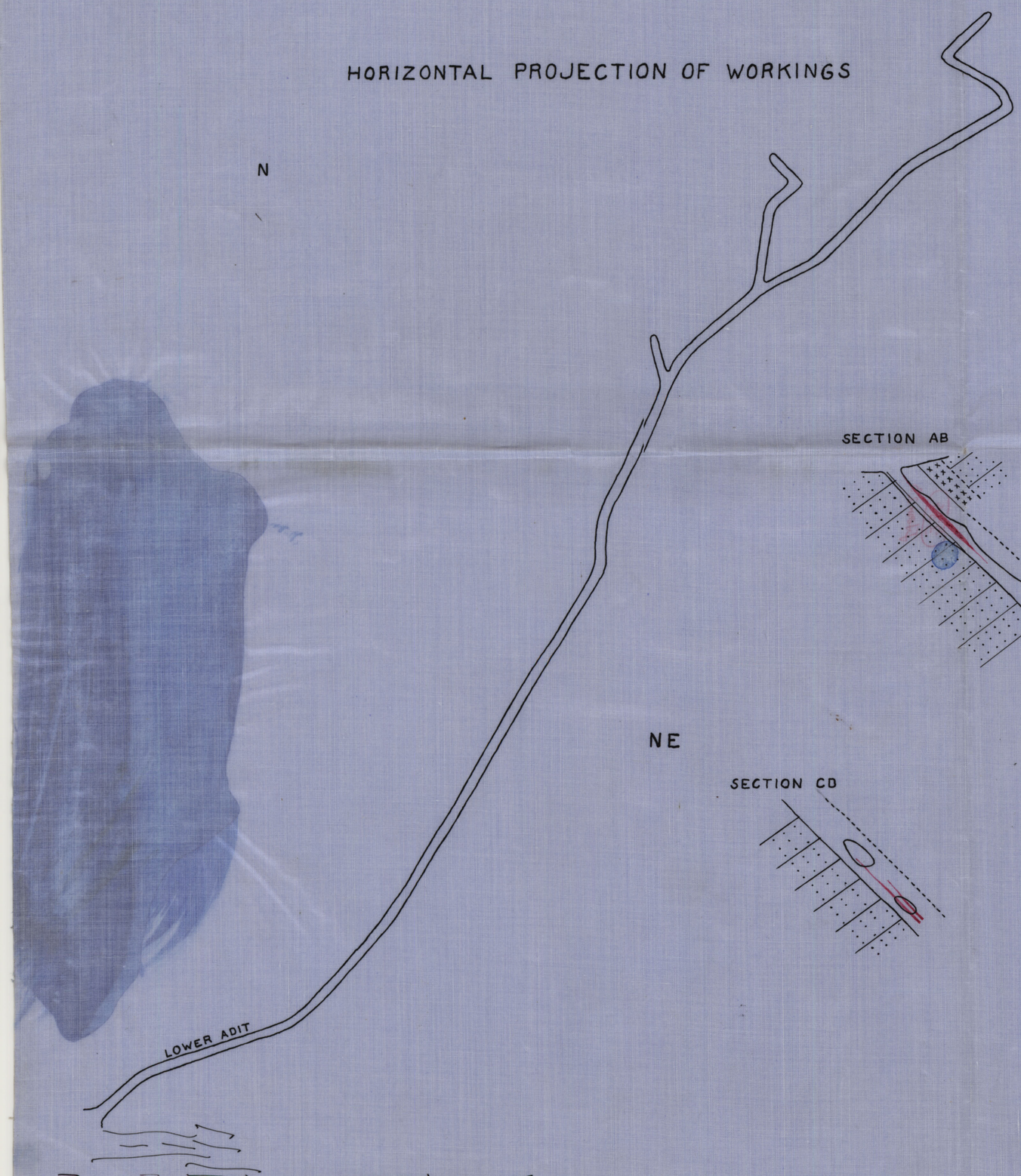
OCEOLA DISTRICT, WHITE PINE CO., NEV.



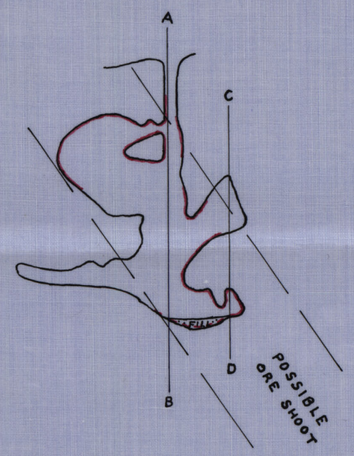
EXPLANATION

BLANK - QUARTZ
- ORE-GRADE 1% OR BETTER
- METADOLERITE
- QUARTZITE
- SHEAR

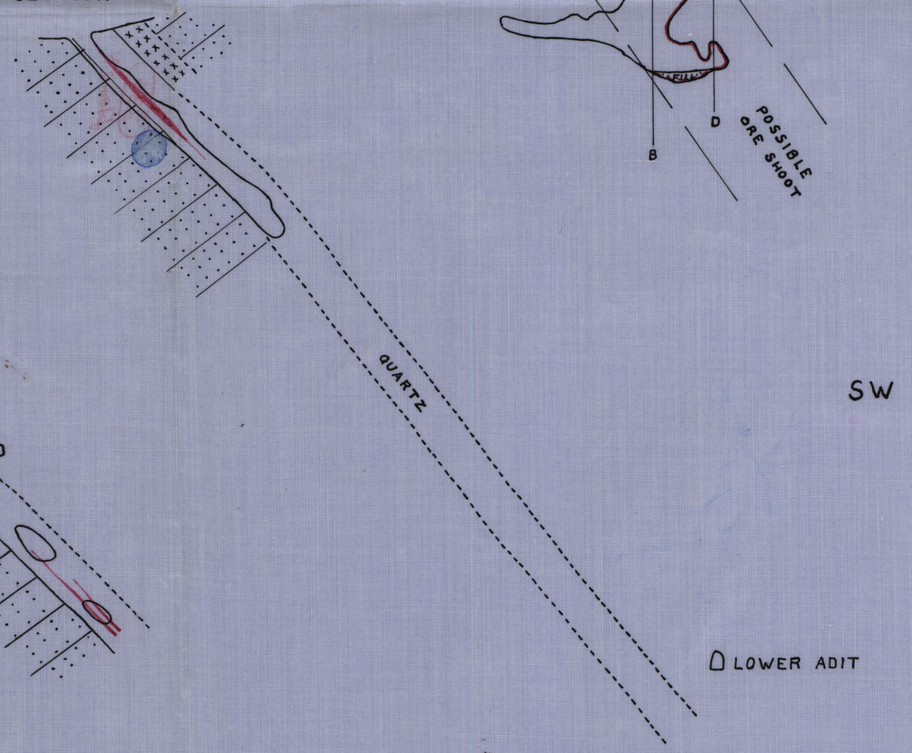
HORIZONTAL PROJECTION OF WORKINGS



PROJECTION ON PLANE OF VEIN
STRIKE N45°E, DIP 45° SW



SECTION AB



SECTION CD