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TUNGSTEN DEPOSITS IN THE WEST TINTIC MINING DISTRICT JUAB COUNTY, UTAH

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Introduction

The West Tintic mining district is at the southern end of the Sheeprock Range in west-central Utah (fig. 1). The greater part of the district is in Juab County and may be reached by 31 miles of good road from Eureka, Utah. The nearest rail-head is at Jericho, Utah, on the main line of the Union Pacific railroad about 18 miles from the district. The area is at an average elevation of 6,000 feet above sea level.

The mining district, known since 1870, for many years produced base metals, silver and gold ores. Tungsten was known to occur in the district, but not until 1940 was any attempt made to develop the deposits of scheelite, the tungsten-bearing ore mineral. Most of the exploration and mining activity centered at the Tintic Western mine, owned by the Tintic Western Mining Co., J. T. Sullivan, President. This property was leased and operated as a tungsten mine by the Desert Tungsten Mining Co., James Quigley, President and Manager. Under the lease it was known as the Desert Tungsten Mine. The mine is developed by two vertical shafts and five levels, the 30, 70, 154, 296, and 398 foot levels.

Two published accounts of the area are available. The first is the work of Loughlin[1] who visited the area for the Geological Survey in 1920 and mapped the geology and ore deposits. Stringham[2] worked in the area in 1940 mapping a portion of the district in somewhat greater detail.

Field work by the Geological Survey was done intermittently from June 1942 to the spring of 1943. A. E. Granger and A. F. Shride spent 8 days during June 1942

1/ Butler, B. S., Loughlin, G. F., Heikes, V. C., and others, The ore deposits of Utah: U. S. Geol. Survey Prof. Paper 111, 1920.

2/ Geo. Soc. America Bull., Stringham, B. F., Mineralization in the West Tintic district of Utah: vol. 53, pp. 267-290, Feb. 1942.

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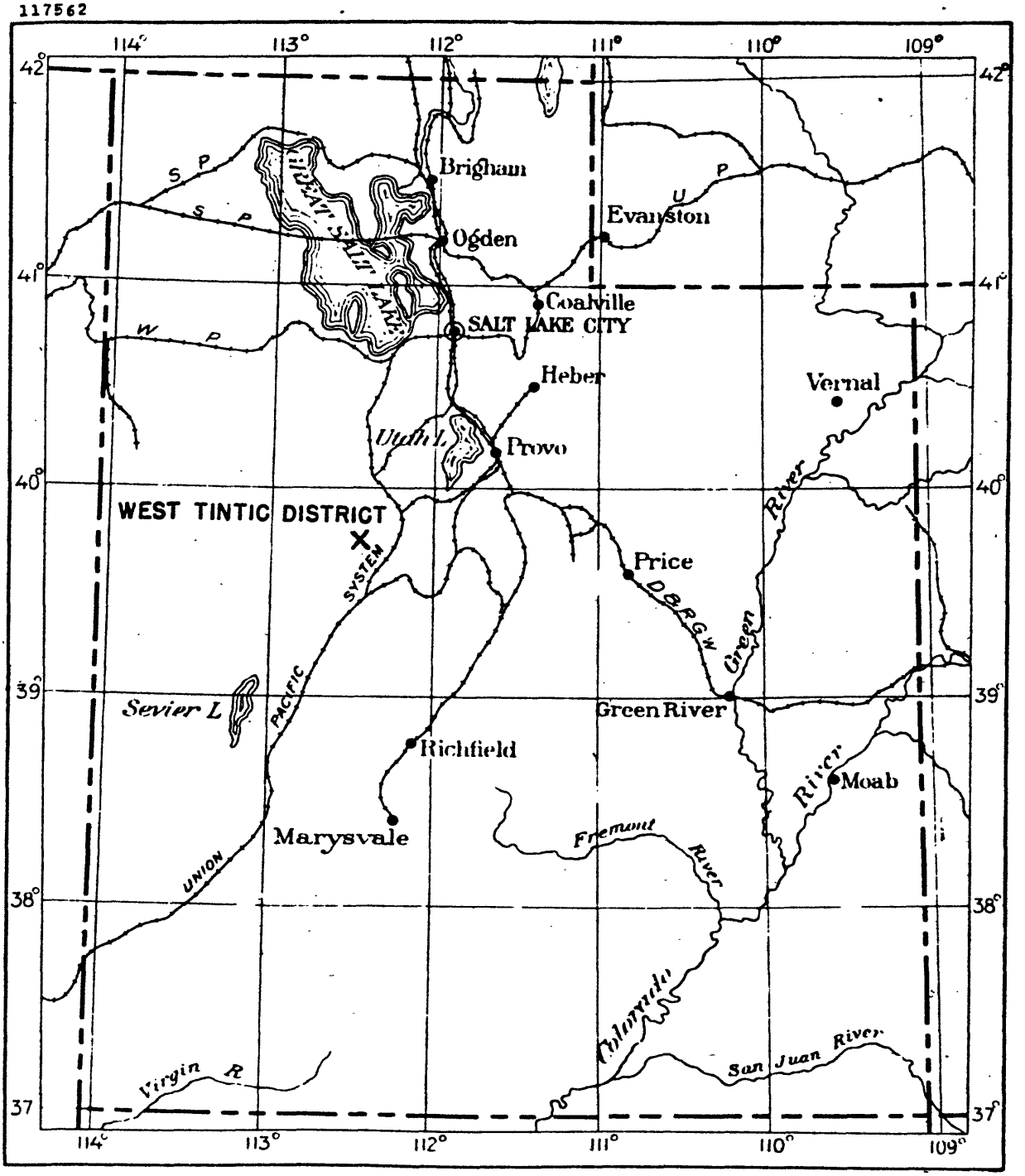

FIGURE 1. INDEX MAP OF UTAH SHOWING LOCATION OF THE WEST TINTIC DISTRICT

in the preliminary field work. An area of approximately 1,500 to 2,000 feet and the more important mine workings were mapped. John H. Wiese and Gordon Bell spent 2 months, from September 15 to November 15, 1942, in detailed mapping of the surface and underground workings of the Desert Tungsten Mining Co. property. S. W. Hobbs visited the area several times in the winter of 1942 and in the spring of 1943 to bring the mine mapping up to date and to follow the results of a Bureau of Mines exploration program.

The Bureau of Mines conducted exploration of the property by bull-dozing, surface trenching, and diamond drilling during the fall and winter of 1942-43. Most of this work was confined to the extensions of the deposit to the north and south of the underground workings.

Illustrations accompanying this report consist of a map of the surface in the vicinity of the Desert Tungsten mine (pl. 1) and maps of the mine levels (pl. 2). The mine operators were courteous and helpful in making available maps, assays, and other information.

Geology

The country rock in the vicinity of the Desert Tungsten mine consists of a series of Paleozoic limestones, folded and faulted into vertical or nearly vertical attitudes, and an intrusive stocklike mass of Tertiary (?) monzonite, which lies mainly to the west of the area mapped (pl. 1). From this stock irregular, fingerlike apophyses and dikes extended into the limestone. The dikes tend to follow the bedding and have steep contacts with the limestones in contrast to the contact of the main igneous mass, which cuts the strike of the sediments and at its eastern contact dips about 60°W. The principal tungsten deposits of the district are in a narrow elongate pendant of limestone between the main contact on the west and a large monzonite dike on the east.

The main igneous mass in the vicinity of the mine is predominantly monzonite but portions of the dikes and other small offshoots from the main mass are diorite and granite. Most of the igneous rocks are coarse-grained and locally porphyritic, but a few of the dikes exposed in the workings and in diamond-drill holes are fine-grained porphyries with a very dense groundmass. The relative ages of these different rocks was not determined.

The limestones of the district are prevailingly dark bluish gray in color, and are fine-grained, but in the area shown in plate 1 they have been recrystallized to coarse-grained, light gray marble. Metamorphism is most intense along the contacts with the monzonite and along the fault zones which cut the marble. Near the main contacts siliceous hornfels has developed locally, and at many contacts and along some fault zones, veins and irregular masses of tactite have formed.

The important structural features of the district are the vertical attitudes of the limestone beds, a series of steeply dipping faults in the limestone, and contacts of the igneous rocks with the limestone. The limestones around the mine strike N. 15° to 20° E. and dip 85° to 90°. They appear to have been nearly

vertical when intruded by the monzonite and were not further deformed by the intrusion. Prominent faults, most of which either parallel the bedding or cut across it at only slight angles, have a general strike of N. 40° to 60° E. and dip steeply both to the northwest and the southeast. A few faults are at right angles to this general trend and dip gently to the northeast or southwest. Most of the faults were probably present before intrusion, but renewed movement occurred on them during and following the emplacement of the igneous rock. The contacts of the igneous rocks vary in character from the continuous and fairly regular main contacts of some of the larger masses to the extremely irregular and discontinuous contacts of the small dikes and apophyses within the mine area.

The monzonite contact on the west side of the limestone pendant that contains the ore bodies dips about 60° W, and the thickness of the pendant increases from an outcrop width of about 60 feet at the collar of the Sullivan shaft to a width of several hundred feet at the level of the bottom of the shaft 400 feet below. The monzonite thus overlies the limestone; much of the bedding, many of the faults and the ore zones terminate upward against it, and consequently do not appear at the surface.

Ore deposits

Introduction.--Many of the workings of the Desert Tungsten mine (Tintic Western mine) were opened in a search for metals other than tungsten, but the presence of existing mine workings greatly enhanced the opportunities for mining the scheelite which was found in the ore.

The tungsten deposits, although all of contact-metamorphic origin, are of two principal types: veins along faults and fractures in limestone, and tactite bodies immediately adjacent to the monzonite. This differentiation is based not only on differences in the general characteristics and localization of the ore, but more importantly on the fact that most of the minable ore is confined to the veins within the limestone. The tactite bodies on the contacts contain only scattered and very localized concentrations of scheelite.

Veins in shear zones in limestone.--The veins in limestone are explored and exposed almost entirely in the mine workings. So far as is known, these veins are confined to the limestone area between the main monzonite body to the west and the large dike on the east and have not been found very far south of the present workings. Their extent to the north is also unproved, with the possible exception that the north vein, exposed 350 feet north of the Sullivan shaft, is a direct continuation of one of the main veins of the mine.

These veins, which appear to be of both fissure filling and replacement types, pinch and swell both laterally and vertically. The minable portions of the veins are localized in the thicker lenses--the intervening areas being too narrow to work. In no place is a vein fully explored, the greatest proved extent being about 120 feet along the strike by 200 feet down the dip. It is possible, however, that some of the veins may have a vertical extent of more than 200 to 250 feet and a lateral extent equally great. The average width of the veins is from 1 to 1½ feet, and the maximum width seldom exceeds 2 or 2½ feet.

According to Stringham the following mineral assemblage is typical of the veins of this deposit: grossularite, clinozoisite, andradite, quartz, chlorite, epidote, calcite, chalcopyrite, pyrite, magnetite, specularite, and scheelite. This assemblage of minerals is probably a composite from all the ore bodies, both in limestone and on the contacts. The veins in limestone, once composed of at least some of the above minerals, are now largely altered to a soft, friable mass of partly decomposed porous material containing abundant limonite and carrying disseminated scheelite. These veins contrast strongly with the tactite bodies on the contacts which are usually but little decomposed.

The location of the veins is controlled by premineral faults. Most of the ore is found along the steep strike or bedding-plane faults, and there appears to be a greater concentration at intersections of the strike faults and the more northeast crosscutting faults. In general at these intersections, the brecciated zones of the strike faults are wider than the brecciated zones of the northeast set; consequently the strike fault veins are generally the best developed. The northeast veins seldom cross the strike veins but usually merge with them. Concentration of ore is also influenced by the termination of the veins against the overlying monzonite contact. In at least one place, the ore expands considerably along the monzonite contact from the end of a narrow vein. In another, the altered material of the veins in limestone merges with the more extensive and less altered tactite at the contact, but the scheelite content of the tactite is so low that the material does not constitute ore.

There are at least five and possibly six distinct ore shoots partly developed in the mine (pl. 2). One, on the 70-foot level of the Bates shaft, dips westward and has several small stopes on it. The highest grade ore so far encountered in the mine was from this vein, but it has been largely mined out. Another vein has been mined out above the south end of the 154-foot level. This vein dips eastward and could conceivably extend downward and intersect the westward-dipping vein of the Bates shaft. A third and somewhat unique shoot of ore has been removed from a gently dipping vein which lies above the south end of the 154-foot level. This vein strikes at right angles to the other veins and dips 35° N. (see geologic map and sections of low angle stope and sub-levels above the 154-foot level, pl. 2). No extension of this vein to the north has been found. A fourth ore shoot has been stoped for a short distance near the Sullivan shaft on the 154-foot level, and a fifth shoot has been worked on the 296-foot level, extending upward to the monzonite contact and downward to the 398-foot level. A sixth shoot is suggested to the east of the shaft on the 398-foot level.

The possible vertical extensions of these veins are indicated on the cross-section Y-Y', plate 1. The lateral extensions appear to be quite limited and the only lateral connections along the veins are tight shears with little or no mineralization.

Tactite bodies along the contacts.--The true tactite zones in the area are all closely related to contacts of the quartz monzonite. The tactite bodies have been exposed and sampled on the surface and in drill holes by the Bureau of Mines. The surface map and cross sections of the area (pl. 1) show the general distribution of these tactite bodies. Structural interpretations in cross sections X-X' and Z-Z' are based on Bureau of Mines drill-hole data.

The tactite bodies are irregular in shape and size. The largest and most continuous bodies are located along the main contact, but many of the smaller dikes and irregular igneous bodies, the location of several of which is known only from drill holes, are bordered by narrow tactite zones. The factors controlling the location of the larger or better mineralized portions of the tactite zones are not readily determined.

Tactite is well developed along most of the contacts, but only a part of this tactite is scheelite-bearing. The tactite shown on plate 1 is differentiated into scheelite-bearing and scheelite-poor types. The sampling and drilling of the scheelite-bearing tactite south of the Bates shaft by the Bureau of Mines revealed the extremely erratic thickness and grade of these ore bodies. The thickness ranges from a fraction of an inch to 6 feet, and the grade from 0.01 to 2.23 WO_3. Only very small parts of all the tactite are potential ore, and these ore-bearing tactite bodies are so scattered that it is very difficult to locate and mine them.

Ore Reserves

Veins in limestone.--Most of the easily accessible ore was removed from the mine by the time the Desert Tungsten Mining Co. ceased operations in June 1944. Small amounts of ore remain in some of the stopes and an indeterminate amount of inferred ore may be present in unexplored extensions of the veins or in as yet undiscovered veins which may parallel the known veins.

The steeply dipping vein at the south end of the 154-foot level has been mined by a winze for a short distance below the level. This vein probably extends to greater depth and contains some ore. Two veins on the 154-foot level, one 25 and the other 70 feet west of the Sullivan shaft, apparently extend below the level and contain small amounts of ore. Some ore remains in the vein opened by the narrow stope south of the shaft on the 398-foot level. However, it is rather badly broken and crushed at this place. A diamond-drill hole to the west on the 296-foot level intersected two veins, one at 97 feet and the other at 155 feet from the Sullivan shaft. The vein at 97 feet was opened by a crosscut and drifts and was stoped both from the 296-foot level and from the 398-foot level. The vein at 155 feet has not been explored. It is quite possible that other veins, parallel to those known, occur in the limestone to the west of the veins thus far developed. Such undiscovered veins would occur at progressively greater depths because of the westward dip of the monzonite contact. It is also likely that other veins may occur in the relatively unexplored limestone to the east of the mine workings.

The North vein, about 350 feet north of the Sullivan shaft and outside of the area of the mine workings, was diamond-drilled by the Bureau of Mines and a small amount of ore was blocked out.

The grade of the ore varies considerably from place to place within any one ore shoot. An average grade of 1 percent of WO_3 was determined from the results of assays of the ore shipments sent to the Metals Reserve Co. and assays of trench and drill-hole samples furnished by the Bureau of Mines.

The accompanying table gives the indicated and inferred ore reserves of the veins in limestone, separated into the individual ore shoots in the mine. It is emphasized that other veins may occur and ore contained in them would increase the total reserves.

Tactite deposits.--The results of the Bureau of Mines drilling on the tactite bodies south of the Bates shaft were generally disappointing. Two small pockets of ore were outlined by surface sampling and shallow drilling, one in the vicinity of diamond-drill hole H-1, another at hole I-1. Both of these ore bodies are on the main monzonite contact. Deeper drilling in this vicinity revealed no ore.

The combined calculated reserve of tactite ore is as follows:

	Tons	Units of WO_3
Indicated ore	775	925
Inferred ore	400	400

Production and outlook

From May 1942 to June 1944, the Desert Tungsten Mining Co. produced 7,198 tons of ore containing 6,734 units of WO_3. Most of this ore came from the veins in the limestone. In addition, a small amount of ore was mined by lessees.

All of the readily accessible ore has been mined out. A small amount of ore is scattered in various parts of the mine, but the future of the mine cannot be predicted without extensive exploration. Scheelite mineralization in tactite along the monzonite contacts has proved to be too erratic to be counted on as a source of ore. Any undiscovered ore probably is confined to the veins in limestone. The geologic conditions are favorable for the existence of other veins in the limestone pendant, but these would probably be at greater depth and therefore more difficult to mine. All of the known veins in the mine are narrow and there is no reason to expect others to exceed the average width of the mined-out veins.

Ore reserves

Veins in limestone

Location of ore shoot	Measured and indicated ore		Inferred ore	
	Tons	Units of WO_3	Tons	Units of WO_3
At south end of 154-foot level. Extension below drift.	350	350	420	420
25 feet west of Sullivan shaft on 154-foot level. Extension below drift.	250	250	370	370
On 398-foot level just south of Sullivan shaft.	250	190	260	200
70 feet west of Sullivan shaft on 154-foot level.	210	210	230	230
Vein 97 feet west of Sullivan shaft on 296-foot level.			500	500
TOTALS	1,060	1,000	1,780	1,720