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TIN DEPOSITS OF THE GORMAN DISTRICT, KERN COUNTY, CALIFORNIA

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ABSTRACT

A number of small tin-bearing iron deposits were discovered in 1940, 1942 and 1943 on the south slope of the Tehachapi Range, in Kern County, California, about 6 miles northeast of the town of Gorman. The deposits are tactite bodies formed by the replacement of limestone along the boundaries of an intrusive body of granite. Cassiterite, the only tin-bearing mineral definitely recognized, is accompanied by magnetite, scheelite, pyrite, arsenopyrite, chalcopyrite, epidote, tourmaline, ludwigite and amphibole, although all these minerals do not occur in each deposit.

The largest deposit, the Meeke, is for the most part a limonite gossan derived by weathering from pyrite, containing stringers, pods, and disseminated grains of cassiterite, generally associated with tourmaline. The other deposits contain higher proportions of magnetite and silicate minerals, and less limonite.

The only production has come from the Meeke mine, from which 5 tons of hand-sorted ore containing the equivalent of 1.93 tons of tin were shipped in 1944. At the end of 1944 all the properties were idle.

Reserves of ore in place in the district are estimated at 3,740 short tons containing 1.0 to 2.0 percent of tin, 3,450 tons containing 0.5 to 1.0 percent of tin, and 25,600 tons containing 0.1 to 0.3 percent of tin. Placer reserves total 800 cubic yards containing 0.5 to 1.0 percent of tin, 2,460 cubic yards containing 0.1 to 0.5 percent of tin, and 10,000 cubic yards containing 0.05 percent of tin.

INTRODUCTION

The tin deposits of the Gorman district are about 6 miles northeast of Gorman, California, a town on the Los Angeles-Bakersfield highway (Fig. 1). They are on the south flank of the west end of the Tehachapi Mountains, in T. 9 N., Rs. 17 and 18 W., near the southern boundary of Kern County. The distance by road from Gorman is 20 miles and from Lancaster, the nearest railroad point, about 33 miles. At Barnes Ranch, 10 miles east of Gorman, on the paved highway that leads to Lancaster, a graded dirt road branches off to the north and leads to the deposits. The dirt road has some steep grades and, although easily passable in dry weather, cannot be traveled for days at a time during the winter rains.

Figure 1. Index map of Southern California showing location of the Gorman tin district.

Tin was discovered in the Gorman district in 1940, when Willard Mallery identified cassiterite in the gravels at the head of Alamos Creek. In 1942 he found cassiterite at the Butler, Meeke, and Dunton iron prospects, and in 1943, in the vicinity of Crowbar Gulch (fig. 2).

Prior to the discovery of tin, the iron-bearing outcrops at the Upper Butler had been prospected by three shallow pits, those at the Lower Butler by three pits, and those at the Meeke by one pit 10 feet deep. In addition, some stripping had been done at the Meeke and Dunton deposits.

In November 1942, Mallery interested Dana Hogan, of the Hogan Petroleum Company, in these properties. With Hogan's backing, the surface was stripped at the Meeke, Lower Butler, and Upper Butler deposits. Later 9 pits, each 10 feet deep, were sunk at intervals of about 50-feet along the Meeke outcrops and two 50-foot inclined shafts with a total of 122 feet of drifts and crosscuts were dug.

In the summer of 1944 the United States Bureau of Mines explored the Meeke deposit by means of 11 diamond core-drill holes and did additional bulldozer work at the Meeke and Upper Butler deposits. At this time, Hogan and Mallery drilled one exploratory hole.

All the tin deposits, except the initial discovery, the Gray Eagle claim, are on the La Liebre ranch, owned by the Tejon Ranch Company. Willard Mallery holds a permit to operate the Meeke and Butler properties, and he and Dana Hogan have a prospecting permit on the Crowbar Gulch and Dunton prospects. The Gray Eagle claim is on public land, and is held by Hogan and Mallery by right of location.

The tin production of the Gorman district (table 1) is limited to two shipments made from the Meeke deposit, consisting of high grade nodules gathered from the surface and from the soil overlying the gossan.

Table 1. Tin production[a/], Gorman district, Kern County, California

Date	Tons	Percent Sn	Impurities
May, 1943	3.5	35.65	
December, 1944	1.4	48.90	S-0.26, Pb-0.03, Sb-0.06, AS-0.20, Bi-0.01, Cu-0.05, Zn-0.05.

a/ Sold to Metals Reserve Company, Fresno, Calif.

Previous Investigations

The tin deposits of the Gorman district have been examined by numerous members of the Geological Survey during the recent period of prospecting. The initial examination was made by D. M. Lemmon and P. C. Bateman in September 1942.

Figure 2. Geologic map and section of the Gorman tin district, Kern County, California.

In February 1943 the Meeke and Upper Butler deposits were mapped by Page, assisted by L. C. Pray and R. Porter, though field work was carried on at intervals from December 1942 to May 1943.[1/] In October 1943 T. P. Thayer mapped the Crowbar Gulch deposits. Between June and September 1944 Wiese studied the district during the course of a joint Geological Survey-Bureau of Mines project at the Meeke and Upper Butler deposits. At this time the Meeke deposit was re-mapped (Fig. 3) and a reconnaissance map (Fig. 2) of the district was made using aerial photographs as a base.

Members of the Bureau of Mines visited and sampled the tin properties at various times from August 1942 to December 1944, and in the summer of 1944 a program of core drilling and bulldozer exploration was completed under the direction of Robert H. Bedford.

The writers are indebted to Mr. Willard Mallery for his willing cooperation and aid in the field work and for much information regarding the previous work done at these deposits. Mr. Dana Hogan kindly made available much valuable assay data. Miss Jewell Glass, of the Geological Survey, identified ludwigite, molybdenite, pargasite, vermiculite, and other minerals, and contributed to the report by her helpful discussion on the origin and nature of the deposits.

GENERAL GEOLOGY

The cassiterite-bearing deposits of the Gorman district are bodies of iron-rich tactite or gossan replacing recrystallized limestone at the margins of a granite intrusion (Fig. 2). Erosion has exposed the granite in several places, and a northeast-trending, north-dipping series of limestone, hornfels, quartzite, and schist appear to form a thin shell, in most places only a few hundred feet thick, resting on the flat-roofed intrusive body. The outcrops of brecciated white dolomite shown on the map are probably erosional remnants of a thrust sheet which formerly extended over most of the area mapped. In the valley, terrace gravels cover the bedrock.

The meta-sedimentary rocks are unfossiliferous and their age is not known. They may belong to the Bean Canyon series, of Triassic and Jurassic age, which Simpson[2/] has mapped in the adjacent Elizabeth Lake Quadrangle. Most of the granitic intrusive rocks of this geologic province are believed to be of Jurassic age.

Figure 3. Geologic map, section, and isometric diagram of Meeke tin mine, Kern County, California.

1/ Page, Lincoln R., Meeke-Hogan, tin prospect, Kern County, California. U. S. Geol. Survey Preliminary Map, 1943.

2/ Simpson, E. C. Geology and mineral deposits of the Elizabeth Lake quadrangle, Calif. Calif. Jour. Mines and Geology, vol. 30, no. 4, pp. 371-415, October 1934.

Rock formations

Four main lithologic units were mapped in the district: (1) granite; (2) brecciated dolomite; (3) limestone, hornfels, quartzite, and schist; and (4) terrace gravels. On the detailed maps (Figs. 3, 5, 6, and 7) the different types of limestone, hornfels, and quartzite were mapped separately.

Brecciated dolomite

Numerous patches of dolomite scattered over the district are believed to be erosional remnants of a thrust sheet. The dolomite is a white, fine-grained, brecciated rock with many intersecting calcite-filled fractures, which weathers to a characteristic rough surface. When freshly broken the rock has a fetid odor.

Limestone, hornfels, quartzite, and schist

Medium- to coarse-grained, recrystallized limestones, interbedded with some hornfels, quartzite, and schist, crop out over much of the area mapped (Fig. 2). These limestones are mainly blue to bluish-white in color, but in places they are bleached to light buff or white. At the margin of the granite the limestone has been altered to a white, fine-grained rock with a sugary texture, and only traces of bedding are indicated by a few streaks of hornfels. Near the iron deposits much of the limestone has a brownish cast, caused by fine-grained iron oxide along the cleavage planes and crystal boundaries of the calcite.

Thin layers of hornfels occur throughout the limestone, and some members at least 100 feet thick are predominantly hornfels. The hornfels is a finely laminated, greenish rock made up mostly of garnet, zoisite, and epidote. It is easily weathered and crops out only in a few places, although small fragments persist as float over long distances.

Thin layers of fine-grained white to green quartzite occur in many places in the limestone and are even more common in the hornfels members. At the Meeke tin mine one 20-foot layer of quartzite and interbedded hornfels served as a horizon marker in mapping.

In Juniper Canyon, northeast of the Meeke mine, there are small outcrops of a fine-grained, greenish schistose rock whose relation to the limestones is not known.

Figure 5. Geologic map and sections of Upper Butler tin prospect, Kern County, California.

Figure 6. Geologic map and section of Crowbar gulch, tin prospect, Kern County, California.

Figure 7. Geologic map of Lower Butler tin prospect, Kern County, California.

Granite

Granite probably underlies the entire area shown in figure 2 but it is exposed only along Black Canyon and Alamos Creek, and as isolated patches north and south of Juniper Canyon. The contact between granite and limestone is generally poorly exposed, for leaching and slumping of the limestone at the contact is common. In most places the contact dips gently between 5° and 40°. No fault contacts between granite and limestone were observed, although at the Upper Butler and Meeke prospects the granite appears to have been intruded along pre-existing faults.

Most of the granite is a light colored, medium- to coarse-grained rock consisting of approximately equal amounts of quartz and potash feldspar in a graphic intergrowth associated with perthite and anti-perthite. Muscovite, the most common accessory mineral, is associated with lesser quantities of biotite, hornblende, and magnetite. Near the contacts the granite is much finer grained, and has an almost aplitic texture. In places there are coarser pegmatitic streaks of quartz and feldspar in an aplitic matrix.

The coarser-grained parts of the granite are deeply weathered and furnish fewer good exposures than the finer-grained facies.

Structure

The Gorman tin district is a few miles east of the San Andreas fault and between two branches of the Garlock fault. These are two of the major structural features of southern California, and as a result the structure of the tin district is complicated by many minor faults and associated folds. No attempt has been made to work out the detailed structure of the district as a whole (Fig. 2), though a major thrust fault which underlies the brecciated dolomite has been mapped. The faults and folds shown on detailed maps, such as figure 3, indicate the structural complexity of the entire district.

The major thrust fault strikes northeast and dips 5° to 40° SE. Outcrops of brecciated dolomite (Fig. 2) are the only remnants of the overthrust block. Small granite boulders found in the soil at the Meeke tin deposit, uphill from any known granite outcrops, indicate that the thrust was post-granite in age and that the overriding block moved northwestward.

In the area immediately adjacent to the Meeke deposit (Fig. 3) there appear to be three sets of faults. One set, which includes the East fault, strikes northwest and dips steeply. The second set, also steeply dipping, strikes west-northwest. The third set, which includes the North fault, strikes east-northeast and dips from 45° to 90° SE. Minor folding, probably the result of drag, is commonly present adjacent to these faults, although the rocks may have been folded prior to faulting.

MINERAL DEPOSITS

Although, the tin deposits of the Gorman district are similar in origin, the individual deposits differ widely in size, shape, mineral composition, and degree of alteration. The two largest, the Meeke and Upper Butler, probably contained a large proportion of sulfides and have been weathered to limonitic gossans; the smaller deposits are relatively unweathered. In the primary ore, cassiterite occurs with scheelite, powellite, pyrite, chalcopyrite, arsenopyrite, molybdenite, magnetite, epidote, tourmaline, ludwigite, amphibole, garnet, phlogopite, calcite, and quartz, though not all of these minerals occur in each deposit. As a result of secondary alteration the sulfides have been altered to hydrated iron oxides associated with malachite, chrysocolla, jarosite, gypsum, chalcedony, opal, cuprite, native copper, and clay minerals. The magnetite is in part altered to hematite and the amphibole to chlorite.

At the Meeke and Upper Butler prospects the cassiterite is in limonitic gossan, indicating that the original ore contained a large proportion of sulfides though only a few relict nodules of massive pyrite remain. The Lower Butler and Dunton prospects are primarily magnetite-rich tactite deposits with minor quantities of sulfides. The Crowbar Gulch and Gray Eagle deposits are tactite characterized by fibrous to radial amphibole with minor magnetite and ludwigite. Apparently the cassiterite is not as closely associated with the magnetite as with the sulfide and silicate minerals.

The largest deposits are less than 250 feet in length and 40 feet in width, and to date none have been proved to extend down dip more than 150 feet. Most are measured in tens of feet and few are large enough to be worth consideration as an economic operation. All the deposits are very irregular in shape and unpredictable in depth.

The proportion of cassiterite is quite variable both from deposit to deposit and from place to place within individual deposits, resulting in a wide variation in the assay results. At the Meeke, although specimens weighing several pounds assayed more than 50 percent tin, the main ore shoot contains only 1.5 to 2.0 percent tin and the average grade of most of the tin-bearing rock is 0.1 to 0.5 percent tin.

The occurrence of tin in limestone replacement deposits has also been noted in the Cima district in San Bernardino County, Calif. Both there and at Gorman cassiterite is associated with scheelite and sulfide minerals in deposits with contact-metamorphic relationships. At the Meeke deposit the relict sulfide masses clearly indicate that cassiterite was more closely related in the original ore to the sulfides than to the magnetite, and it is evident that the gossan was developed by the weathering of sulfide minerals. The association of cassiterite with amphibole, ludwigite and tourmaline was observed only in the Gorman area, not at Cima.

MINES AND PROSPECTS

Six groups of tin-bearing deposits have been recognized in the Gorman district. Only one, the Meeke deposit, has produced tin ore of commercial grade. Five others, the Dunton, Crowbar Gulch, Lower Butler, Upper Butler, and Gray Eagle deposits have been prospected only to shallow depths. At other places along the margin of the granite small, scattered pods and lenses of magnetite-rich tactite have been found, and additional prospecting might discover other tin-bearing bodies.

Meeke tin mine

The Meeke tin deposit is at an altitude of about 3,900 feet, on a flat spur halfway between Alamos Creek and Black Canyon, about half a mile from the edge of the valley floor (Fig. 2). It may be reached from Barnes ranch by dirt road along the edge of the valley to Juniper Creek and thence over a steep grade to the spur. A permanent spring, 1,000 feet south of the mine and about 250 feet lower, has a flow sufficient to supply a small mill or mining operations.

Mr. Willard Mallery discovered tin in the limonitic gossan at the Meeke deposit in the spring of 1942.3/ Some years before, the deposit has been prospected for gold and iron by means of a 10-foot pit and a small bulldozer trench. In 1942 and 1943 Mallery and Hogan explored the property by bulldozing and by sinking 9 pits, each 10 feet deep, and two inclined shafts, known as the East and West shaft, each about 50 feet deep. At the West shaft, 105 feet of drifts and crosscuts were made to the north from the 23-foot level (Fig. 4) and an 18-foot crosscut was driven south from the bottom of the shaft. A crosscut 23 feet long curves southeast from the bottom of the East shaft.

In June 1944 the Bureau of Mines carried out an extensive stripping program and removed most of the remaining overburden from the two gossan areas. In July and August the Bureau of Mines, in coöperation with the Geological Survey explored the ore bodies at depth with 1,000 feet of core drilling, and at the conclusion of that project, Hogan and Mallery drilled another hole to a depth of 84 feet.

In May 1944, 3½ tons of sorted ore containing 35.65 percent of metallic tin was trucked to the Metals Reserve Company stockpile in Fresno, Calif. The shipment consisted entirely of high-grade residual boulders from the soil near the West shaft. In December, Mallery made another shipment of 2,770 pounds of sorted ore to the Metals Reserve Company. A small part of this was from near the West shaft, but most of it came from a layer of high-grade nodules in the soil near pit 8 (Fig. 3). This shipment contained 48.90 percent of tin (table 1). At the end of 1944, about 3 tons of sorted ore, estimated to contain 10 to 20 percent of tin, was stockpiled.

3/ Mallery, Willard, Tin in California: The Dana Magazine, (Los Angeles, Calif.), Part I, vol. 5, no. 1, pp. 8-11 and 18-20; Part II, vol. 5, no. 4, pp. 6-8, 1944.

Geology and structure.--The Meeke tin deposit is in bleached, recrystallized limestone about 200 feet from the nearest outcrop of granite (Fig. 3), but as bleached limestone appears to occur only near granite contacts in this district, it seems likely that granite underlies the deposit at a shallow depth.

The sedimentary rocks are cut by at least four main faults and many smaller ones. The East fault, the major structure, dips 70° to the east and can be traced between limestone and hornfels for several hundred feet north of the mapped area. South of the mapped area it passes under the brecciated dolomite and the thrust fault. The block west of this normal fault has moved relatively northward, perhaps as much as 1,000 feet.

A second important fault, the North fault, strikes N. 60° E. and dips nearly vertically. The north block has moved about 120 feet southwestward relative to the south block. South of the North fault there are two smaller faults and many small slips which also strike N. 60° E. and dip 45° or more to the southeast. Where these faults offset the ore body (Fig. 3), slickensided surfaces show that the latest movement was essentially horizontal.

Throughout the limestone there is a strong set of joints that strike east, and dip 70°-80° S. Another series of joints and small faults strikes N. 50° W. and dips steeply. These fractures are best exposed northwest of the deposit, where they offset the contact between the limestone and the overlying hornfels.

The flat-lying dolomite thrust sheet (Fig. 2) probably extended above the deposit only a few feet above the present land surface. Rounded pebbles of granite were found at several localities between pit 5 and the East fault (Fig. 3) in crevices in the bedrock beneath several feet of soil. As no granite is known to crop out on the slopes above, these pebbles are regarded as remnants of the breccia at the sole of the thrust sheet. If this interpretation is valid, the thrust sheet must have moved relatively northward.

Mineralogy.--Cassiterite, the ore mineral, occurs in dark brown grains and crystals as much as one-half inch in diameter, but most of the grains are very small and cannot be seen readily in the gossan because they are obscured by iron oxides. The cassiterite grains form thin stringers and clusters in parts of the gossan and limestone, and fine grains or crystals can be found disseminated through most of the gossan. At the surface of the gossan boulders of cherty iron oxide, as much as 5 feet in diameter, contained irregular streaks and pods of granular cassiterite. This residual material was hand-cobbed and shipped. Underground, small veinlets and pods of granular cassiterite with fine-grained greenish tourmaline occur in essentially barren clay, gossan, and limestone (Fig. 4). Specimens collected from these veinlets have assayed as much as 50 percent tin.

In thin sections of unoxidized material the cassiterite shows remarkably perfect color zoning and commonly appears as euhedral twinned crystals replacing calcite, associated with magnetite, pyrite, epidote, and garnet. The iron oxides of the gossan ore are later than these minerals and are accompanied by secondary cherty silica and calcite. Concentrates of samples contain occasional grains of chalcopyrite, arsenopyrite and galena. Scheelite and powellite are associated with the cassiterite ores at pits 8 and 2.

Cassiterite may occur in any of the varieties of iron oxide making up the gossan, which range from soft, clayey, friable varieties to hard clinkery material, that may be light to dark yellow, brown, red, or purplish red in color. Irregular masses of magnetite and epidote, containing little cassiterite, if any, occur in the limestone and hornfels near pit 7 and northwest of pit 2. The magnetite shows little evidence of alteration, though hematite forms thin films along fractures.

Some of the tin ore in the north wall of the bulldozer cut about 20 feet northeast of pit 2 consists of dark brown grains of cassiterite in a soft, greenish micaceous mass made up principally of a potassium-bearing vermiculite. Miss Jewell Glass of the Geological Survey who studied samples of this material, says, "The vermiculite is derived from a pale green chlorite; the chlorite in part at least is derived from a blue-green, potassium-bearing amphibole, probably pargasite. Other minerals present are calcite (secondary), strontianite, zoisite, magnetite, hematite, limonite, and apatite. The rock is extremely altered, apparently as a result of the action of hydrothermal solutions in a contact metamorphic zone." Material similar to this but containing a larger proportion of limonite was found in drill holes 7 and 10 and in the underground workings on the 23-foot level.

A qualitative spectrographic examination of a composite sample of gossan ore from the Meeke deposit, made by the Smith-Emery Co. for the Geological Survey, gave the following results:

Major constituents: - Calcium, iron

Intermediate constituents: - Silicon, zinc

Minor constituents: - (amounts approximate)

1%	Al
0.5%	Sn, Mg
0.1%	Cu, K, As, Ba
0.05%	Sr, Ti, Mn, Na
0.01%	W, B, Sb, Pb, Mo
0.005%	In, Cr, V, Be
Trace	Cd, Ag

No zinc minerals were recognized at the deposit; they were probably masked by the iron oxides and clay. Only a small amount of zinc was reported in the ore shipments (table 1).

Size and grade of the tin deposits.--The two bodies of tin-bearing gossan on the Meeke property are referred to as the West and East gossan. In general, cassiterite-bearing rock is limited to these gossan areas, though cassiterite was observed in limestone at pit 8 and also on the 23-foot level of the mine (Fig. 4). However, not all parts of the gossan carry appreciable quantities of cassiterite. The tin ore appears to occur in small streaks, pods, or masses scattered through gossan that contains little cassiterite.

Figure 4. Geologic plan and section, 23-foot level, Meeke tin mine.

Table 2. Results of diamond drilling by the Bureau of Mines at the Meeke tin deposit.

Hole Number	Inclination	Formations, Intervals in Feet				Percent tin in gossan			Remarks
		Limestone	Hornfels	Quartzite	Gossan	Core	Sludge	Weighted	
1	55°	0-84			None				0-10 feet ruble with some gossan fragments.
2	60°	0-99			None				Brecciated limestone 100-116 feet.
3	45°	0-116	116-124		None				A few thin veinlets of magnetite between 50 and 60 feet.
4	60°	0-142			None				
5	50°	0-81			None				
6	60°	40-66		0-13.5	13.5-18	0.08	0.06	0.06	Gossan soft and porous, variegated.
					18-26	0.02	0.05	0.05	Traces of cassiterite in pannings of sludge.
					26-33	0.02	0.02	0.02	A few irregularly replaced limestone fragments.
					33-40	0.03	0.03	0.03	Hard jaspery limonite, cellular at base.
7	60°	33.5-45		0-12	12-17	9.10	1.82	2.33	Variegated and misaceous gossan.
					17-22	1.81	2.63	2.47	Mottled soft gossan, harder toward bottom.
					22-33.5	0.75	1.46	1.37	Mottled soft gossan.
8	60°	25-78		8-25	None				No core 0-8, probably limestone.
9	60°	0-8, 25-52,		8-25	52-56	0.06	0.39		Hard jaspery limonite, upper 3 inches cellular.
		59-81			56-59	0.17	0.25		Soft gossan with micaceous streaks.
10	90°	0-8,18-54, 66-88		8-18	54-59	6.13			Hard limonite, Sludge 52-59 had 1.36% of Sn.
					59-62.5	5.10	4.59		Soft porous limonite, fine-grained cassiterite.
					62.5-66	0.06	1.12		Sludge possibly salted from above.
11	90°	0-14,30-59, 59.5-112		14-30	59.5-60	0.04	0.03		Interval 59-63 assayed; gossan from 59-59.5 only.
H-1[a]	90°	0-10,25-62.5, 64-84		10-25	62.5-64	Not assayed.			No cassiterite observed in core or pannings of sludge. Only 5 inches of gossan core recovered.

a/ Hole drilled by Hogan and Mallery.

On the surface, the West gossan is a hook-shaped body which extends about 200 feet westward from pit 6 and then about 75 feet northward to the North fault. It has a maximum exposed width of 40 feet, and lenses out at either end. The initial shape of the primary sulfide ore body was probably very irregular in detail, and this was later complicated by the solution and collapse of limestone, migration of iron oxides, and faulting. The gossan dips gently northward and diamond drilling has indicated that it lenses out about 150 feet down the dip. The base of the gossan is exposed, at a depth of 10 feet, in pits 2, 4, 5, 6, and in the Meeke pit. The West shaft passes through gossan containing high grade streaks and pods of cassiterite and intersects limestone at 23 feet. The drift on the 23-foot level follows the base of the gossan eastward and then turns northward across gossan and limestone (Fig. 4). These exposures and the results of diamond drilling indicate that the maximum thickness of the gossan is about 25 feet.

One ore shoot of appreciable size was partially outlined by diamond drilling. This ore shoot is in a northeast pitching synclinal fold at the extreme west end of the West gossan. It is probably less than 30 feet in length at the surface and may average about 8 feet in thickness for 120 feet down the dip. Pit 2 is at the upper end of this ore shoot and drill holes Nos. 7 and 10 cut it at depth. (Table 2.) Drill hole 7 passed through 21.5 feet and hole 10 cut 11 feet of ore. Drill holes Nos. 9 and 6 may delimit the south edge and drill holes Nos. 11 and H-1 appear to approximate the north edge of the ore shoot. There has been no systematic sampling of surface exposures to outline this ore body and to determine its grade accurately. One sample (IRP-27H-43, table 3) representing the upper 4 feet of ore shoot, contained 0.8 percent of tin, according to spectrographic analysis. Two samples (IRP-4H and 5H-43, table 3) from pit 2, representing 4.5 feet on the footwall of the ore shoot, contained 0.35 and 1.03 percent of tin; weighted average 0.63 percent. Individual assays of cores and sludges from diamond drill holes 7, 9, and 10 in this shoot showed 0.06 to 9.10 percent metallic tin (table 2). Weighted averages for short intervals might be on the order of 5 percent, but it is estimated that the entire ore shoot, as described above averages between 1 and 2 percent tin. The Bureau of Mines estimates from diamond drill hole data that there is 1,440 tons of ore, containing 1.68 percent of metallic tin, in this ore shoot.

The remainder of the West gossan contains small scattered pods and streaks of high-grade tin ore which have been observed at intervals along the outcrop from pit 2 to pit 5; some ore was shipped from surface debris at pit 3. High-grade pods and streaks have been observed underground in the West shaft and at three places along the 23-foot level drift (Fig. 4). Such scattered pods cause the results of sampling to be very erratic and consequently accurate estimates of grade are impossible. Samples taken from the walls of the shaft by the Geological Survey and the Bureau of Mines ranged from 0.12 to 2.85 percent tin, and the operators obtained samples assying as high as 19 percent.

Sufficient sampling has been done to show that the bulk of the gossan, exclusive of the streaks and pods of ore, carries little tin. Table 3, giving the results of sampling by both the Bureau of Mines and the Geological Survey shows that many of the samples contained less than 0.1 of 1 percent tin. This figure is exceeded only when high-grade pods are encountered. The small size and richness of these pods probably accounts for most of the apparent differences in sampling by different people. For example, the highest assay obtained by the Bureau of Mines in sampling pits 2, 3, 4, and 5 was 0.04 percent of tin. Yet a $2\frac{1}{2}$-foot channel sample cut by Page in pit 2 contained 1.03 percent. Mallery's composite grab sample of the dumps of these pits contained 1.2 percent.

The Bureau of Mines sampled the west wall of the drift on the 23-foot level at 5-foot intervals. Fourteen of these samples contained less than 0.09 percent of tin; one contained 0.32 percent. Geological Survey spectrographic analyses of splits of these samples showed less than 0.04 percent of tin. The west fork of the drift was not sampled, but panning showed that the gossan contained only a trace of cassiterite. In limestone, near the face of the east drift, a streak of cassiterite with tourmaline and micaceous minerals, several feet long and one-eighth to 3 inches wide, assayed up to 50 percent of tin according to Mallery. Another veinlet of similar mineralogy is exposed in the back of the drift 45 feet from the shaft. A third veinlet rich in cassiterite was observed in limonite on the east wall of the drift. These veinlets were not included in the Bureau of Mines samples from the drift.

The East gossan is irregularly lenticular in shape and is connected with the gossan at the East shaft by a small body of magnetite. It is 100 feet long and as much as 30 feet wide. Like the West gossan it dips gently northward, shallow diamond drill holes beneath the gossan penetrated only barren limestone indicating that it probably extends no more than 10 or 15 feet down the dip (Fig. 3 and table 2).

High grade ore was observed in both limestone and gossan in pit 8. One channel sample across limestone (table 3) assayed 2.43 percent tin over a length of 3 feet. Below this limestone another sample in limestone, 1.7 feet long, was shown by the spectroscope to contain much more than 1 percent of tin. In the surface debris just south and west of this pit Mallery recovered most of the ore for his December 1944 shipment which assayed 48.90 percent tin. On the surface a band of cassiterite-rich gossan extends from pit 8 westward nearly to the collar of drill hole 3. This exposure is 35 feet long and 10 feet wide. It is estimate that this cassiterite-rich gossan may contain 2 percent tin, but the rest of the gossan probably contains 0.1 percent or less of tin.

There are three areas from which placer tin might be obtained: (1) the soil between the Meeke pit, pit 3, and the arroyo, (2) the soil for 300 feet down the slope and southeast of the east gossan, and (3) the soil-covered flat approximately 500 feet southeast of the mine workings.

The Geological Survey sampled the soil in the area below pit 3 with 4 bore holes 6 inches in diameter put down to bedrock. Approximately 533 yards of dirt estimated to contain 0.5 percent tin, and 460 yards estimated to contain 0.1 to 0.5 percent of tin was indicated. Five similar samples of the soil southeast of the East gossan contained 0.96, 0.32, 0.14, 0.15 and 0.12 percent of tin. The first two samples (0.96 and 0.32 percent) represent an area 50 by 50 feet at the south end of the East gossan. Many high-grade nodules have been picked from this dirt, but there remains some 270 yards estimated to contain about 0.7 percent of tin. The other 3 samples represent material ranging from 20 to 48 inches in depth over an area 250 feet long and 70 feet wide, amounting to 2,000 yards of clayey sand containing about 0.14 percent of tin.

The third possible area of placer ground, a flat area below the granite shown on figure 3, and above the brecciated dolomite ledges (Fig. 2), received tin-bearing float from both the East and West gossan areas. The tin-bearing material extends over a triangular area of 90,000 square feet, and probably has an average depth of 3 feet. Panned samples were estimated to contain 0.03 to 0.10 percent of tin. This area is estimated to contain 10,000 yards of clayey soil that might assay 0.05 percent tin. No more than traces of tin have been found at any other area lower down on the slope below the Meeke deposit.

Reserves.--The reserves of tin ore on the Meeke property are not large. In the West gossan the known ore shoot is estimated, on the basis of diamond drilling, to contain at least 1,440 tons of ore which will average 1.68 percent of tin. Geological considerations, plus assays, suggest that there are perhaps an additional 1,000 tons of gossan at the edges of the ore shoot that might contain on the order of 1.00 percent of tin. The main body of gossan exclusive of the ore shoot probably contains about 20,000 tons which would assay about 0.1 percent tin, but in which some small, higher grade pods and lenses may be found.

The East gossan is estimated to contain 700 tons of iron oxides of which 300 tons are estimated to contain 2 percent of tin. The remainder of the body probably contains about 0.1 percent tin, though, as in the case of the West gossan, higher grade pods may be found.

The placer reserves are estimated to be 800 yards containing 0.5 to 1.0 percent, 2,460 yards containing 0.1 to 0.5 percent, and 10,000 yards containing 0.05 percent of tin.

Upper Butler prospect

The Upper Butler tin prospect is in section 30, T. 9 N., R. 17 W., about 200 feet east of the road to the Kelso zinc mine (Fig. 2). It is at an altitude of approximately 3,600 feet, on the north side of a small tributary gulch which opens southward into the valley near the mouth of Alamos Creek. Cassiterite was discovered at the Upper Butler property in 1942 by Willard Mallery, who traced tin-bearing float up the gulch from the valley. Prior to this time small prospect pits had been made on the property in search of iron ore.

Geology.--The Upper Butler tin deposit consists of four bodies of tin-bearing iron oxide formed at the contact with granite by replacement of limestone and subsequent oxidation of the ore body (Fig. 5). The granite is exposed on the slopes north and west of the deposits, partly surrounding a pointed salient of limestone. It is composed of equal parts of quartz and white feldspar intergrown in a semi-graphic texture. The individual grains average one-eighth inch in size, but at the contact they are smaller. Occasional specks of greenish hornblende or biotite, partly altered to chlorite, are scattered through the rock.

White, massive, fine-grained, recrystallized limestone crops out prominently on the steep slopes south and east of the tin deposits. Bedding in the limestone

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

is very indistinct, but appear to dip northeast 35° to 40°. The northern boundary of the limestone is probably a north dipping intrusive contact whose position is controlled in part by the bedding. On the west, the limestone lies against granite which was apparently intruded along a fault between the limestone and hornfels.

Epidote-garnet hornfels is poorly exposed in the gulch east of the ore bodies and on the slope southwest of the granite. In contrast with the massive limestone, it is thinly bedded and includes thin layers of coarse-grained marble. The attitude of the beds in the hornfels varies considerably, probably as the result of minor folding and faulting, but in general the dips are steeply to the north.

Structure.--The boundary of the limestone and granite in the southwestern part of the mapped area (Fig. 5) is probably a fault striking about N. 50° W. and dipping steeply. It may be of post-granite age, but probably was an earlier fault along which the granite was emplaced. A similar pre-granite fault probably caused the apparent offset of the granite contact near the northeast corner of the mapped area. Between these two faults, the intrusive contact along which the tactite bodies were formed appears to dip 30° to 35° N.

Size and grade of the tin deposit.--One large and three small bodies of gossan have been formed by the weathering of iron-rich deposits at the contact of granite and limestone. The large body is about 150 feet long, 15 to 60 feet wide, and has a maximum vertical exposure of 29 feet. The footwall and west end of the deposit are not exposed, but the hanging-wall appears to dip 30° to 35° N. The tin-bearing rock exposed in bulldozer trenches consists mainly of red and brown iron oxides which grade, near the hanging-wall, into green, yellowish, and red clayey material. The red clayey material contains scattered fine-grained colorless tourmaline and micaceous minerals similar to the vermiculite at the Meeke deposit. Some of the clay may have been derived from tactite containing amphibole and ludwigite similar to that at Crowbar Gulch and the Gray Eagle claim. Near the southeast corner of the gossan, the ore consists predominantly of magnetite and red clayey iron oxide. At the northeast corner, in the vicinity of the old pits, the gossan is mainly jaspery limonite. Two small inclusions of limestone, one of which is shown on the map, were found in the gossan.

Assays of samples taken by the Bureau of Mines and by the Geological Survey (table 4) from the bulldozer trench parallel to the footwall of the ore body, suggest that the ore averages about 0.5 percent of tin. Four channel samples taken by the Survey across the gossan body exposed in this trench contained 0.5 to 1.0 percent of tin and samples taken by the Bureau of Mines along the gossan body in the same trench contained 0.36 to 0.89 percent of tin. Visible cassiterite is very scarce, probably because it is masked by iron oxides. However, it is possible that some of the tin may be in other minerals, such as the ludwigite.

The main Upper Butler gossan body is irregular in shape and, as mapped, it covers an area of approximately 3,500 square feet. If its shape is that shown on the sections (Fig. 5), the inferred reserves are about 2,300 tons of ore containing between 0.5 and 1.0 percent of tin.

Table 4. Assay data, Upper Butler Prospect

Geological Survey Samples[a/]

Location of Samples	Sample Number	Type of Sample	Length of sample (feet)		Percent tin
Large tactite body. East - West bulldozer trench.					
N. wall trench. 30 ft. from E. end of tactite.	LRP-31H-43	Vertical channel	4	Rubbly gossan and magnetite.	1.0
Across N. half of gossan, floor of trench at E. end.	LRP-32H-43	Horizontal channel	5	Rubbly gossan and magnetite.	1.0
S. half of gossan S. of LRP-32H-43.	LRP-33H-43	Horizontal channel	3	Rubbly gossan and magnetite.	0.5
30 feet E. of W. end. N. end of channel 2 feet s. of contact.	LRP-34H-43	Horizontal channel	7.5	Rubbly gossan and magnetite.	0.5
Small tactite body at granite contact.					
200 feet NE. of LRP-32H-43	LRP-35H-43	Horizontal channel	2.5	Gossan.	0.5

Bureau of Mines Samples

Large tactite body. Samples along center of bulldozer trench.					
25 to 50 feet from west contact.	442	Horizontal channel	25	Gossan.	0.36
50 to 75 feet from west contact.	443	Horizontal channel	25	Gossan.	0.64
75 to 100 feet from west contact.	443	Horizontal channel	25	Gossan.	0.89

a/ Spectrographic analyses by K. J. Murata, of the Geological Survey Chemical Laboratories. Assays indicate only the order of magnitude of the amount of tin. Moderately strong lines of arsenic were noted in samples LRP-33H-43.

The second largest body of gossan is 100 feet east of the main deposit. It is 50 feet long and 2.5 feet thick. It strikes N. 75° E. and dips 30° NW. One sample cut across the body assayed 0.5 percent of tin. There are two other small gossan bodies. One is along the contact near the northeast corner of the area, and the other is a small inclusion of replaced limestone in the granite. These three bodies together may contain about 150 tons of indicated ore averaging 0.5 percent of tin.

Crowbar Gulch prospect

The Crowbar Gulch prospect includes a number of small tin-bearing tactite bodies along the contact between limestone and granite about 1½ miles southeast of the Meeke deposit. It may be reached by a branch of the dirt road from Alamos Creek to Black Canyon which leads to within 500 feet of the spring at the granite contact in Crowbar Gulch. The prospect is included in the Dunton prospecting permit held by Willard Mallery and Dana Hogan. Exploratory work, done in 1943, consists of four shallow trenches and a 15-foot pit at the eastern end of the deposit.

The following description is based in part on a report by T. P. Thayer, who mapped the deposit in September 1943, and in part on work by Wiese in 1945.

Geology.--All of the tin deposits are in limestone along the intrusive contact of granite and dip 10° to 30° N. The bleached limestone along the contact is similar to that of the other tin deposits of the district, and probably extends 100 to 140 feet outward from the granite although fingers of bleached limestone penetrate some distance farther into the overlying blue limestone. There is a well marked boundary between the bleached and the blue, medium-grained limestone. The granite is a medium-grained gray rock made up almost wholly of quartz and feldspar. Near the contact it is finer-grained, approaching aplite in texture.

Mineralogy.--The tin-bearing tactite bodies contain amphibole, garnet, ludwigite, quartz, cassiterite, magnetite, scheelite, maghemite1/, chlorite, and calcite formed by the replacement of limestone. However, not all these minerals occur in the same body. The only traces of cassiterite were found in concentrates from the panning of large samples. Ludwigite, an iron-magnesium (manganese) borate, was identified by Miss Glass as a common mineral in the two largest tactite bodies, where it is associated with a radial fibrous amphibole, probably pargasite, and magnetite. Miss Glass' work suggests that the ludwigite may contain some of the tin reported in assays of these tactite bodies. Colorless scheelite forms a fine-grained matrix surrounding some of the amphibole and iron oxides in the easternmost tactite body. Garnet and epidote are more common in the tactite at the western end of the deposit. Magnetite in varying amounts is present in all the tactite, in places forming as much as 40 percent of the rock.

Size and grade of the tin deposits.--Two large and eleven smaller tin-bearing tactite bodies have been mapped along the granite contact. The largest, exposed over an area of about 300 square feet, near the east end of the map area, has been explored by three trenches and a pit 15 feet deep. According to chip samples

---

1/ Maghemite, allied to the spinel group, is an isometric, magnetic mineral composed of ferric oxide (Fe_2O_3).

taken by Mallery and others, the tactite contains from 0.15 to 0.90 percent of tin and appears to average about 0.3 percent. The inferred shape of this body at depth is shown in figure 6.

The tin-bearing tactite body in Crowbar Gulch is exposed over an area of about 500 square feet and is reported by Mallery to contain about 0.8 percent of metallic tin. The eleven smaller tactite deposits average about 0.3 percent of tin, according to Mallery.

These tactite bodies would contain a combined total of about 500 tons of rock per foot of depth, if grouped together, and provided they did not change in shape downward. It appears likely, however, that they pinch out within 15 feet of the surface, or about 35 feet down the dip. The quantity of recoverable tin is unknown for part of that shown in assays may be contained in the mineral ludwigite rather in cassiterite.

The eastern tactite body probably contains 4,000 tons with 0.3 percent of tin; the tactite at Crowbar Gulch may contain 1,000 tons with 0.8 percent of tin; and the other tactite bodies probably total 1,200 tons containing an average of 0.3 percent of tin.

Lower Butler prospect

The Lower Butler prospect is about 2,000 feet east of the Upper Butler and within a few hundred feet of the edge of the valley alluvium (Fig. 2). The deposit consists of two small iron-rich tactite bodies in bleached recrystallized limestone adjacent to granite. It was prospected by means of two shallow bulldozer cuts and five small pits (Fig. 7).

The bleached limestone, a massive homogeneous fine-grained rock with no apparent bedding is similar to that at the Meeke, Upper Butler, and Crowbar Gulch deposits. A strong set of joints strike east and dip steeply south. The granite does not crop out, but small fragments of float are numerous in the area mapped as granite.

The tactite is deeply weathered, and consists predominantly of massive brown garnet with variable quantities of fine-grained magnetite, hematite, and limonite. Thin films of malachite and chrysocolla coat fractures in the north tactite body, but no sulfides were seen. No cassiterite was observed in hand specimens and only rarely can it be recovered by panning. Willard Mallery, the discoverer of the prospect, collected one grab sample assying 1.9 percent tin from the surface, but his subsequent assays of other similar samples revealed only traces of tin.

At the south edge of the deposit, barren limonite veins one-half to 1 inch wide fill a series of fractures striking N. 85° E. and dipping 65° SE.

Gray Eagle prospect

The Gray Eagle prospect (or Discovery prospect of Fig. 2), about 300 yards west of the large spring at the head of Alamos Creek, was the first place in the district where tin was found (Fig. 2). This property is on public land, on a mineral claim held by Willard Mallery and Dana Hogan.

A small body of tin-bearing, iron-rich tactite about 6 feet long and 18 inches wide is exposed in a shallow pit at the contact between limestone and granite. Exposures in the vicinity of the deposit are poor, but magnetite float in the gulch above the pit suggests the existence of other similar tactite bodies.

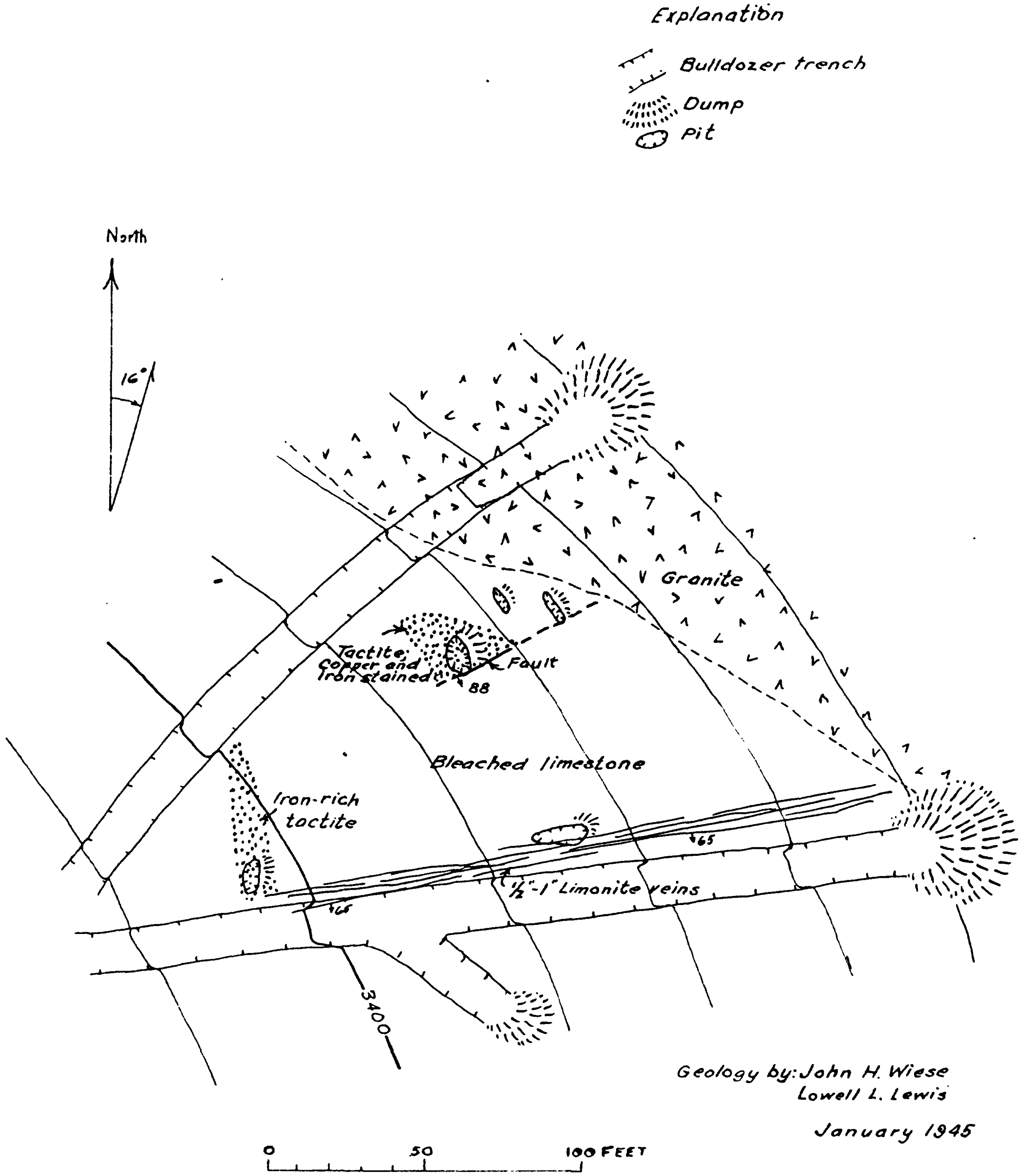
Miss Glass identified the tactite minerals as maghemite (the magnetic form of ferric oxide), magnetite, ludwigite, and an altered amphibole, probably anthophyllite. These minerals, coated by manganese oxide, all have pronounced fibrous structure and are associated with magnetite and small amounts of arsenopyrite and molybdenite. Cassiterite occurs as finely disseminated grains practically invisible in hand specimens but may be recovered by panning. Mallery collected some specimens of this rock which assayed as much as 3 percent of tin; other samples contained less. Some of the tin may be contained in ludwigite and other minerals.

Dunton prospect

The Dunton Prospect (Fig. 2) is about three-fourths of a mile southwest of the Crowbar Gulch deposit. It is on the north edge of a limestone salient that caps the second ridge south of Black Canyon. The deposit, prospected for iron by two bulldozer trenches, is primarily magnetite tactite. Two grab samples taken by Mallery assayed 1.42 and 3.15 percent of tin, but five samples taken subsequently by private engineers contained no tin. Page obtained only traces of cassiterite on panning two grab samples of the magnetite ore exposed in the bulldozer trenches. No cassiterite was observed in place.

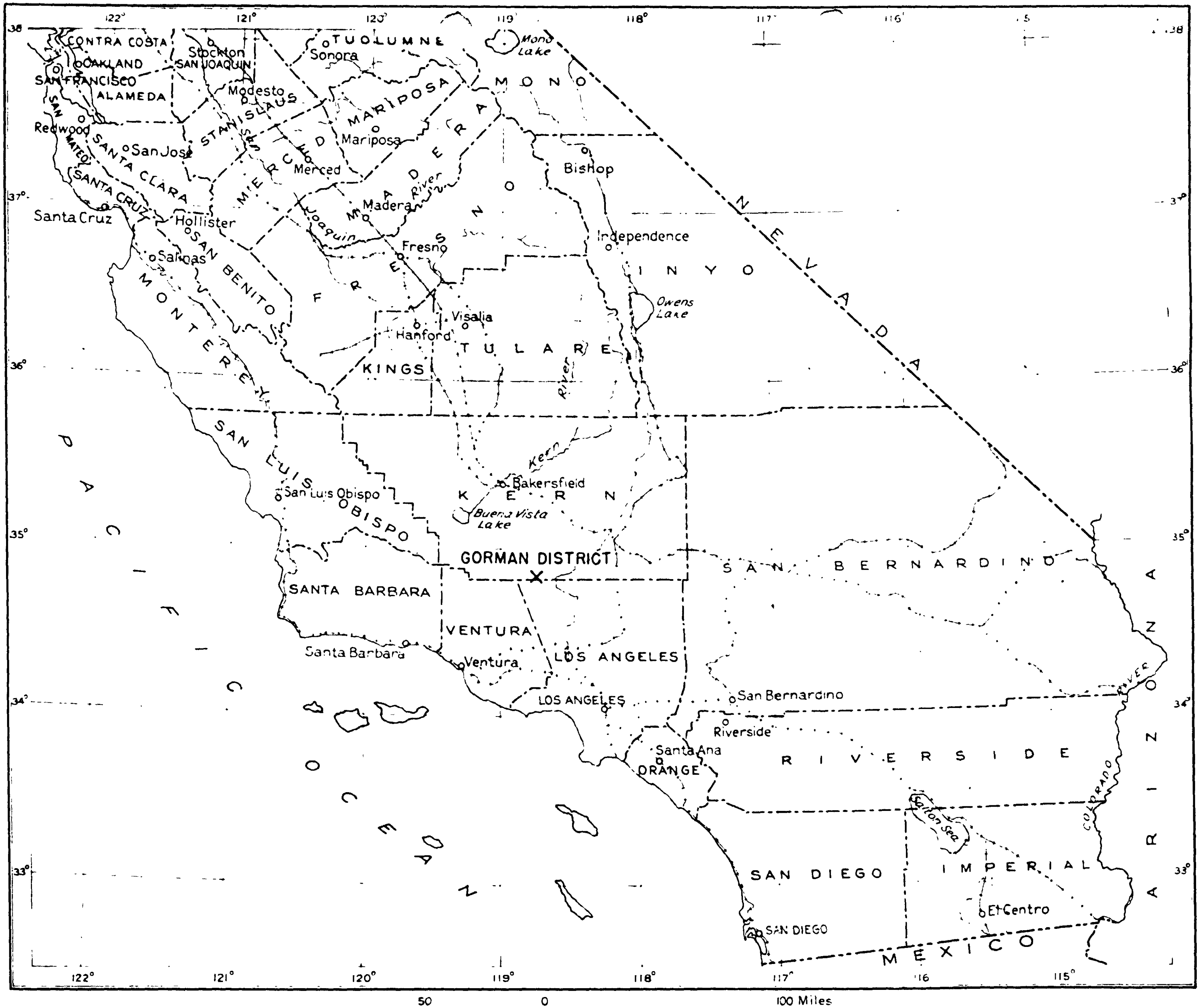
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP FIGURE 7



LOWER BUTLER TIN PROSPECT, KERN COUNTY, CALIFORNIA

Contour interval 10 feet Datum is approximate mean sea level.



INDEX MAP OF SOUTHERN CALIFORNIA SHOWING LOCATION OF THE GORMAN DISTRICT

45-95

Table 3. Assay data, Meeks tin deposit.

Geological Survey						Bureau of Mines			
Location of Samples	Sample number	Type of sample	Length of sample (feet)	Character of material	Percent tin	Type of sample	Length of sample (feet).	Character of material	Percent tin
Pit 2									0.04
Northeast side, above limestone.	LRP- 4H-43	Channel, right angles to contact.	3.5	Hard and soft gossan.	0.35 a/				
Northeast side, above LRP- 4H-43.	LRP- 5H-43	Vertical channel.	2.5	Soft gossan.	1.03 a/				
Note: These samples represent a total thickness of 4.5 feet at the base of the ore shoot. The average, weighted against length, of the samples/ is 0.63 percent.									
Bulldozer trench									
Upper part of ore shoot. North side bulldozer cut 30 ft. west of collar, drill hole 7.	LRP-27H-43.	Vertical channel.	5.0		0.8 b/				
Note: Sample represents a thickness of about 4 feet at top of ore shoot.									
Pit 3									0.04
Top of northwest side.	LRP- 9H-43	Vertical channel.	2.5	Surface debris.	4.99				0.03
Northeast side, below surface debris.	LRP- 8H-43.	Vertical channel	5.0	Soft gossan.	0.06 b/ >0.01				
Pit 4									
Northeast side, from surface downward.	LRP-11H-43	Vertical channel.	5.0	Hard and soft gossan.	0.2				0.04
Northeast side, bottom upward.	LRP-10H-43.	Vertical channel.	5.0	Hard and soft gossan.	0.5				
Pit 5									0.01
Southeast side, between surface debris and limestone.	LRP-15H-43	Vertical channel.	6.0	Hard and soft gossan.	0.09 a/				
Pit 6									0.03
Northwest side, above limestone.	LRP-17H-43	Vertical channel.	5.0	Hard and soft gossan.	0.01 b/				
Pit 7									0.56
Southeast side, above limestone.	LRP-18H-43	Vertical channel.	5.0	Soft gossan.	0.03 b/				
Southeast side, above LRP-18H-43.	LRP-19H-43.	Vertical channel.	3.0	Magnetite.	0.03 b/				
Pit 8									
Southeast corner pit.	LRP-23H-43	Channel across gossan.	1.6	Hard gossan.	>>1.0 b/				
Southeast side, above LRP-23H-43.	LRP-22H-43	Channel across limestone beds.	3.0	Limestone and stringers of cassiterite.	2.43				
Northwest side, surface downward.	LRP-25H-43	Vertical channel.	3.0	Hard gossan.	0.05 b/				
Northwest side, below LRP-25H-43.	LRP-24H-43	Inclined channel.	1.0	Soft yellow gossan.	0.8 b/				
Joint Geological Survey-Bureau of Mines sampling - west wall, crosscut and drift, 23-foot level.									
North wall drift, 5 feet east of shaft.	541	Vertical channel.	5.0	Hard gossan.	<<0.01 b/	Vertical channel.	5.0	Hard gossan.	0.02
Pack, 13 feet east of shaft.	542	Horizontal channel.	3.0	Hard gossan.	0.01 b/	Horizontal channel.	3.0	Hard gossan.	0.02
13-18 feet from shaft.	529	Horizontal channel.	5.0	Hard gossan.	0.02 b/	Horizontal channel.	5.0	Hard gossan.	0.02
18-22 feet from shaft.	530	Horizontal channel.	5.0	Hard gossan.	0.03 b/	Horizontal channel.	5.0	Hard gossan.	0.03
22-27 feet from shaft.	531	Horizontal channel.	5.0	Hard gossan.	0.01 b/	Horizontal channel.	5.0	Hard gossan.	0.08
27-32 feet from shaft.	532	Horizontal channel.	5.0	Hard gossan.	<0.01 b/	Horizontal channel.	5.0	Hard gossan.	0.06
32-37 feet from shaft.	533	Horizontal channel.	5.0	Hard gossan.	0.01 b/	Horizontal channel.	5.0	Hard gossan.	0.06
37-42 feet from shaft.	534	Horizontal channel.	5.0	Hard and soft gossan.	{0.02 b/ 0.018	Horizontal channel.	5.0	Hard and soft gossan.	0.32
42-47 feet from shaft.	535	Horizontal channel.	5.0	Soft gossan.	0.01 b/	Horizontal channel.	5.0	Soft gossan.	0.07
47-52 feet from shaft.	536	Horizontal channel.	5.0	Soft gossan.	<0.01 b/	Horizontal channel.	5.0	Soft gossan.	0.06
52-57 feet from shaft.	537	Horizontal channel.	5.0	Soft gossan.	<0.01 b/	Horizontal channel.	5.0	Soft gossan.	0.01
57-62 feet from shaft.	538	Horizontal channel.	5.0	Soft gossan.	0.01 b/	Horizontal channel.	5.0	Soft gossan.	0.05
62-67 feet from shaft.	539	Horizontal channel.	5.0	Soft gossan.	<0.01 b/	Horizontal channel.	5.0	Soft gossan.	0.02
67-72 feet from shaft.	540	Horizontal channel.	5.0	Soft gossan.	<<0.01 b/	Horizontal channel.	5.0	Soft gossan.	<0.02
West shaft, west side, 25-foot level.	543	Channel, right angles to shaft.	4.0	Soft gossan.	{> .1 b/ 0.51	Channel, right angles to shaft.	4.0	Soft gossan.	2.15
West shaft, west side, 15-foot level.	544	Channel, right angles to shaft.	4.0	Soft gossan.	>> .1 b/ 2.00	Channel, right angles to shaft.		Soft gossan.	2.05
East shaft									
East side from limestone upward.	LRP-36H-43	Channel at right angles to contact.	6.0	Soft gossan.	0.12 a/				
East side above LRP-36H-43.	LRP-35H-43	Channel at right angles to contact.	4.0	Soft gossan.	1.65 a/				

a/ Analyses by Smith-Emery Co., Los Angeles, Calif. Checked by chemical and spectrographic methods on composite samples.

b/ Spectrographic analyses by K. J. Murata, Geological Survey Chemistry Laboratory. Assays indicate only the order of magnitude of the amount of tin. Moderately strong lines of arsenic were noted in samples LRP-11H, 17H, 25H, and 27H-43.

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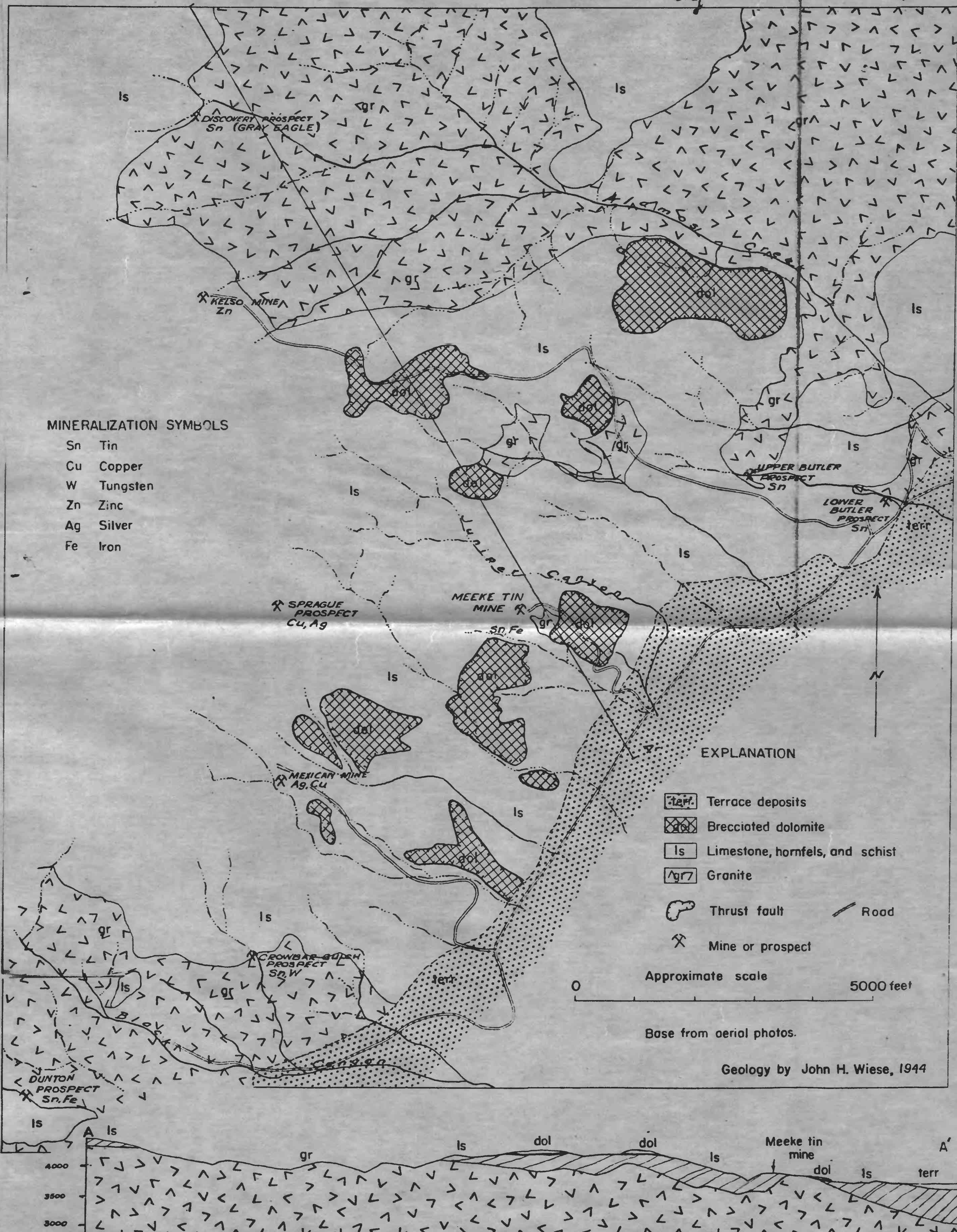
Fig 2.

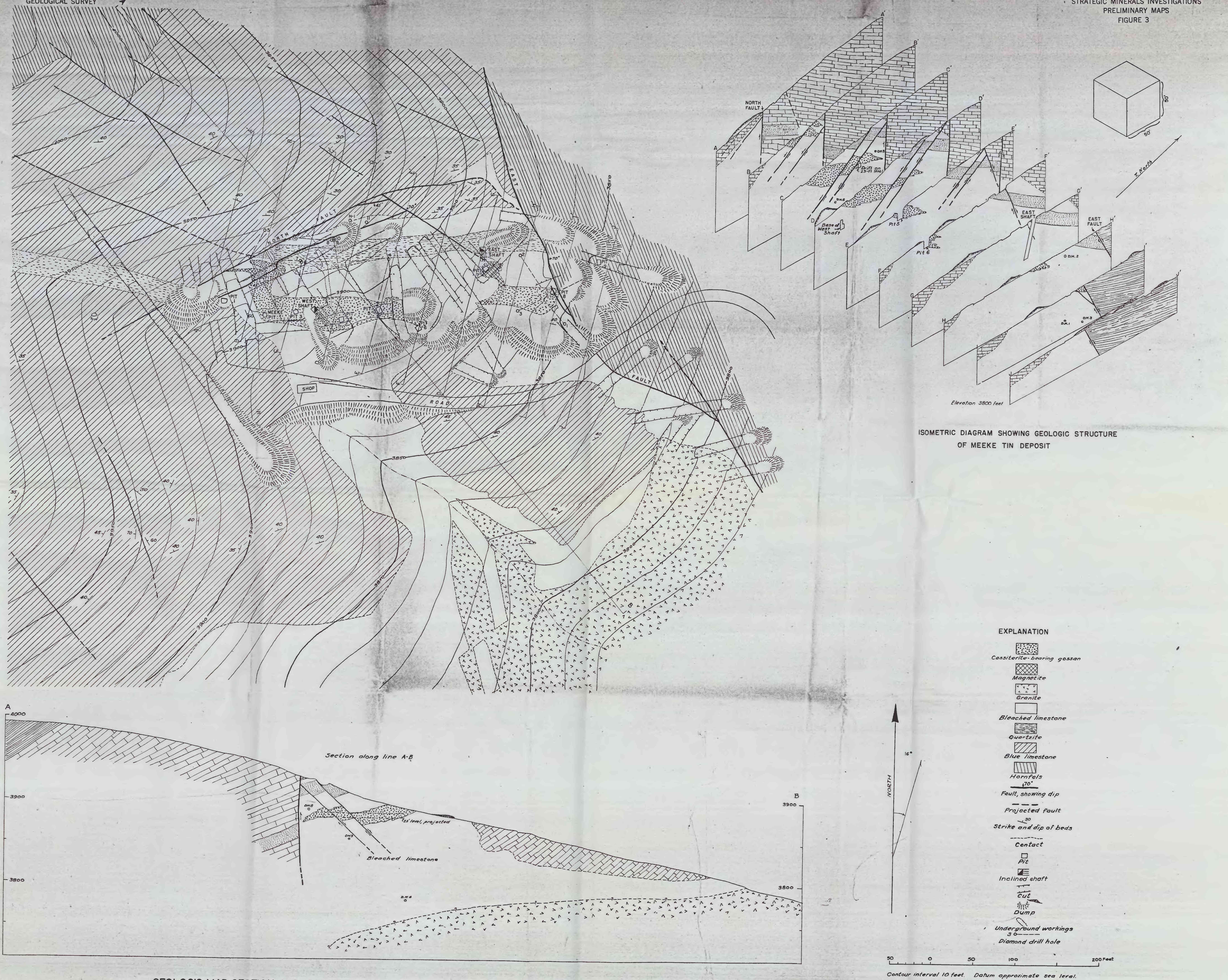
FIGURE 2



GEOLOGIC MAP AND SECTION OF THE GORMAN TIN DISTRICT, KERN COUNTY, CALIFORNIA

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAPS
FIGURE 3



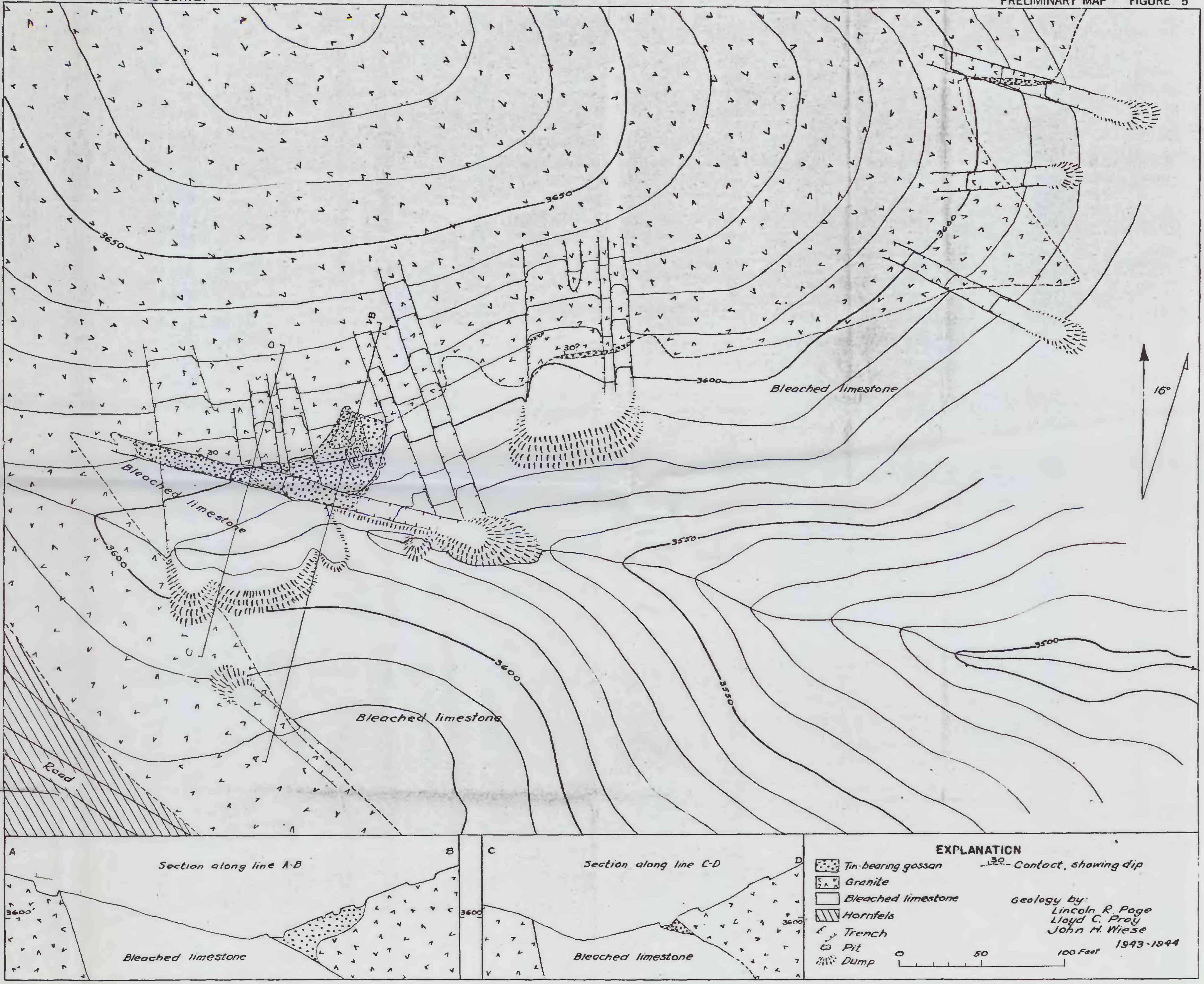
ISOMETRIC DIAGRAM SHOWING GEOLOGIC STRUCTURE OF MEEKE TIN DEPOSIT

GEOLOGIC MAP, SECTION, AND ISOMETRIC DIAGRAM OF MEEKE TIN DEPOSIT, KERN COUNTY, CALIFORNIA

Geology by John H. Wiese
July-September 1944

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP FIGURE 5

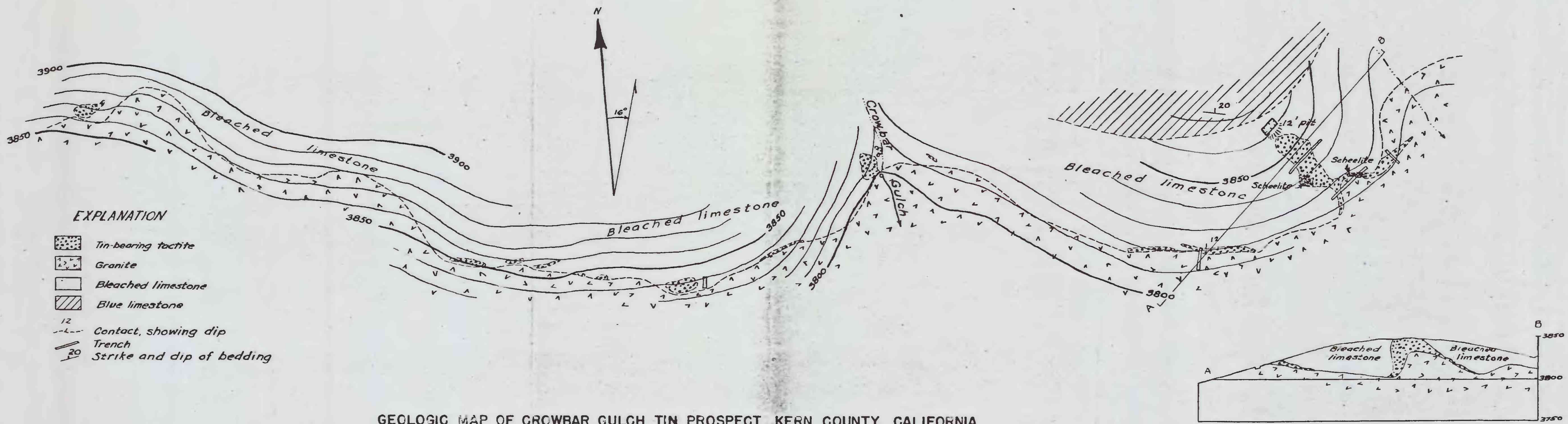


GEOLOGIC MAP AND SECTIONS OF UPPER BUTLER TIN PROSPECT, KERN COUNTY, CALIFORNIA

Contour interval 10 feet. Datum approximate sea level.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP FIGURE 6



GEOLOGIC MAP OF CROWBAR GULCH TIN PROSPECT, KERN COUNTY, CALIFORNIA

SECTION A-B

100 50 0 100 200 300 400 Feet

Contour interval 10 feet. Datum is approximately mean sea level.

Geology by:
T. P. Thayer 1943
Revised by:
John H. Wiese 1944