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ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: BORIANA

ALTERNATE NAMES:

MOHAVE COUNTY MILS NUMBER: 513A

LOCATION: TOWNSHIP 18 N RANGE 16 W SECTION 13 QUARTER SE  
LATITUDE: N 34DEG 56MIN 12SEC LONGITUDE: W 113DEG 54MIN 56SEC  
TOPO MAP NAME: WABAYUMA PEAK - 7.5 MIN

CURRENT STATUS: PAST PRODUCER

COMMODITY:

TUNGSTEN  
COPPER SULFIDE  
MOLYBDENUM SULFIDE  
GOLD LODE  
SILVER  
FLUORINE FLUORSPAR  
BERYLLIUM  
MICA  
LEAD

BIBLIOGRAPHY:

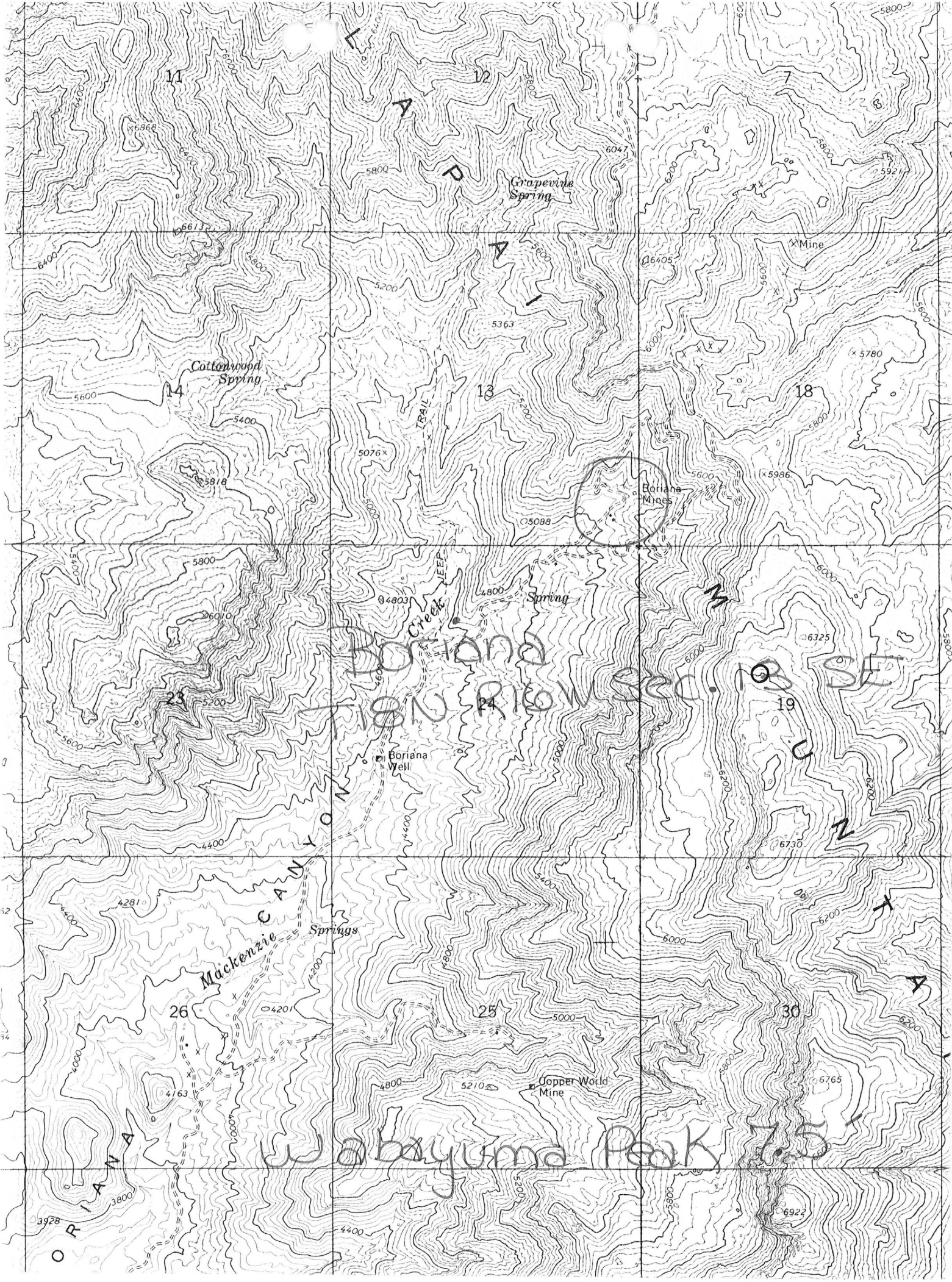
ADMMR BORIANA FILE  
ADMMR MOHAVE CUSTOM MILL PROJECT  
ADMMR AZ INDUSTRIAL MINERAL RPT 2, P 41  
ADMMR AZ FLUORSPAR RPT., P 30  
ADMMR FLUORSPAR RPT GRANT NO. G0254012  
ADMMR BORIANA MINE COLVO FILE  
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UNIT (ISR-21)

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Arizona Department of Mines and Mineral Resources

INFORMATION FROM MINE CARDS IN MUSEUM

ARIZONA

MOHAVE COUNTY

BORIANA MINE

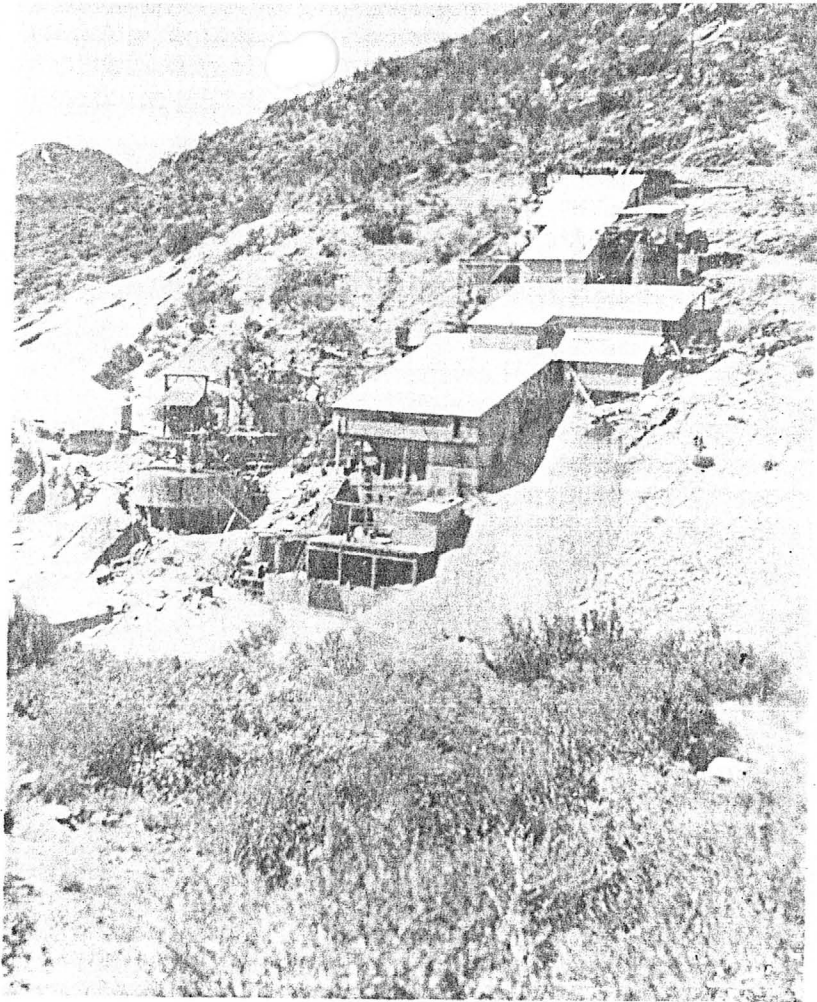
MILS # 513A

0 - AKA's

Boriana (file)

MM-1019 Wolframite & Tungstite  
1020 Smithsonian coated with  
Cronstedtite  
1035 Smithsonian coated with  
Cronstedtite  
1044 Wolframite

Name of Mine or Prospect: Boriana Mine	Township 18N	Range 16W	Section 13 dcc	Priority B
Principal Minerals: Wolframite, Scheelite, Molybdenite	1:250,000 Quad Prescott		7.5' - 15' Quad Wabayuma Peak	
Associated Minerals: Beryl, Fluorite, Quartz, Chalcopyrite	District Cedar Valley		Principal Product Tungsten	
Type of Operation: Underground	County Mohave	State Ar.	Type of Deposit Vein	
Ownership or Controlling Interest: Dye and Bathrick, Kingman, Ar. (1961) <sup>6</sup>				
Access: From Yucca, Ar. proceed 17 miles east on Mackenzie Wash Road, mine is located on topographic quadrangle.				
Structural Control or Geological Association: "The economic minerals occur in narrow quartz veins which follow the foliation of an elongate roof pendant of phyllite in granite." <sup>1</sup> "Fluorite in tungsten bearing quartz-veins in granitic rocks; fluorite forms veinlets and nearly 5% of some veins." <sup>2</sup>				
Age of Mineralization: Precambrian or Laramide				
Production History		Geochemical Analyses		
1915-1943 139,000 tons ore produced 1951-1956 10,000 tons ore reworked dumps 1978 Reopened reworking dumps <sup>5</sup> Thousands of feet of drifts, winzes and raises		1941 1.12% WO <sub>3</sub> 1942 1.12% WO <sub>3</sub> 1946 assays on dumps:  Silver      Gold      Copper      Tungsten 1.3 oz/ton   .01 oz/ton   2.86%      .55% Tr            Tr            .31        .17 0.2          Tr            .36        .21 Tr            Tr            .36        .17 0.3          .01          .36        .20 Tr            Tr            .31        .16		
		Sample I.D. <sup>8</sup> Tin (ppm)      Tungsten  80cj41            < 5            < 2		
References				
1) ABM (1969), Bull. 180, p. 276-281.      5) Mallach (1979), personal communication.				
2) Hobbs (1944), p. 247-264.                6) Dale (1961), p. 73-84.				
3) ADMR file, Phoenix, Ar.                7) Liggett (1979), field reconnaissance				
4) Elevatorski (1978), p. 41.				
8) Exploration Research Associates Incorporated, 1982, Memorandum to William H. Crutchfield, Jr., 8 June 1982				



NUMBER A-10-8

MINE BORIANA

COUNTY MOHAVE CO. YUCCA

FORMAT:  B&W  COLOR  SLIDE  NEGATIVE

SIZE:  S  P  L

SUBJECT MILL

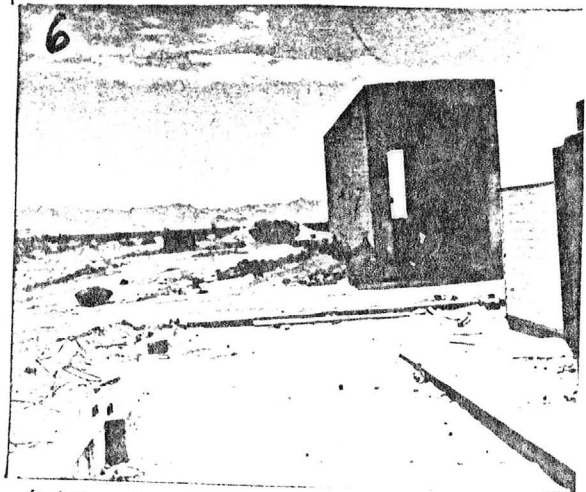
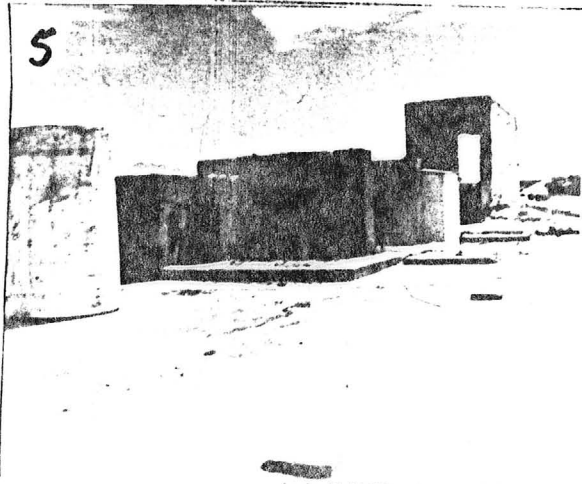
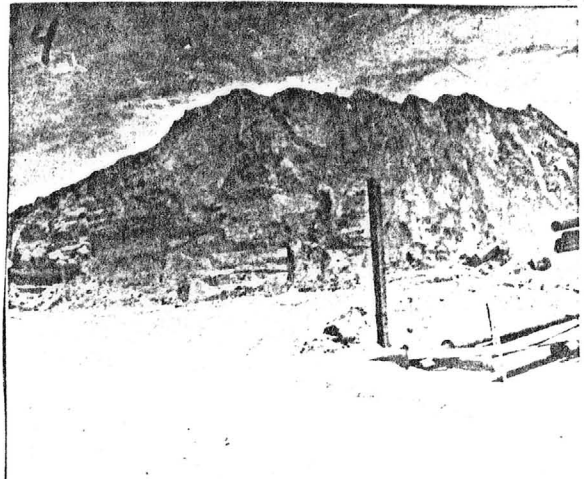
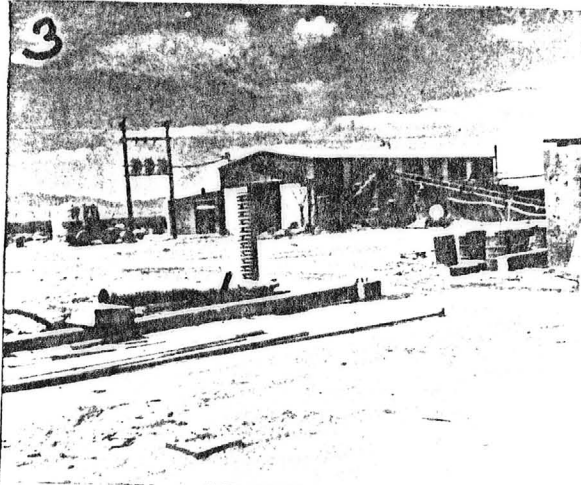
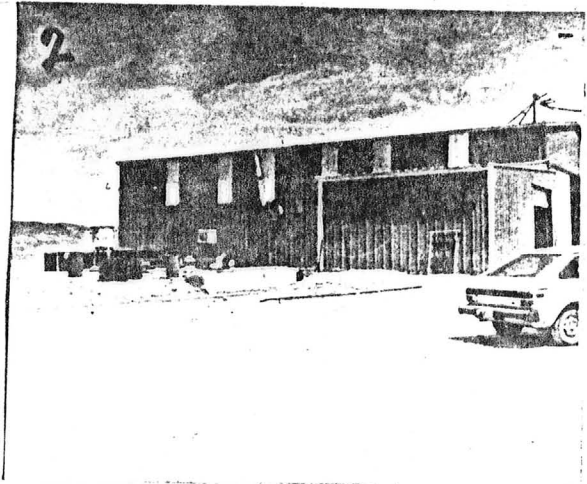
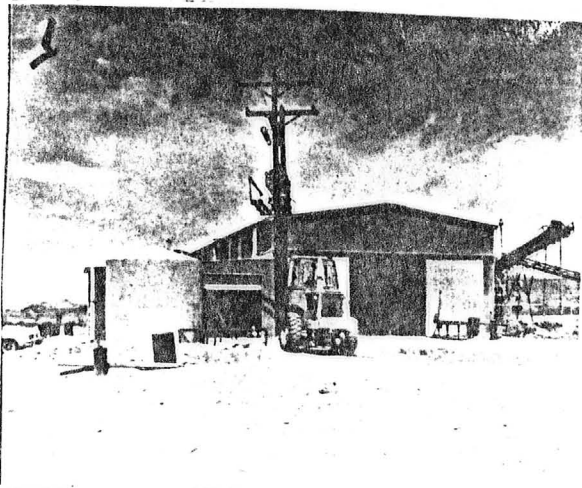
NEGATIVE \_\_\_\_\_

DATE 7-1953

DESCRIPTION \_\_\_\_\_



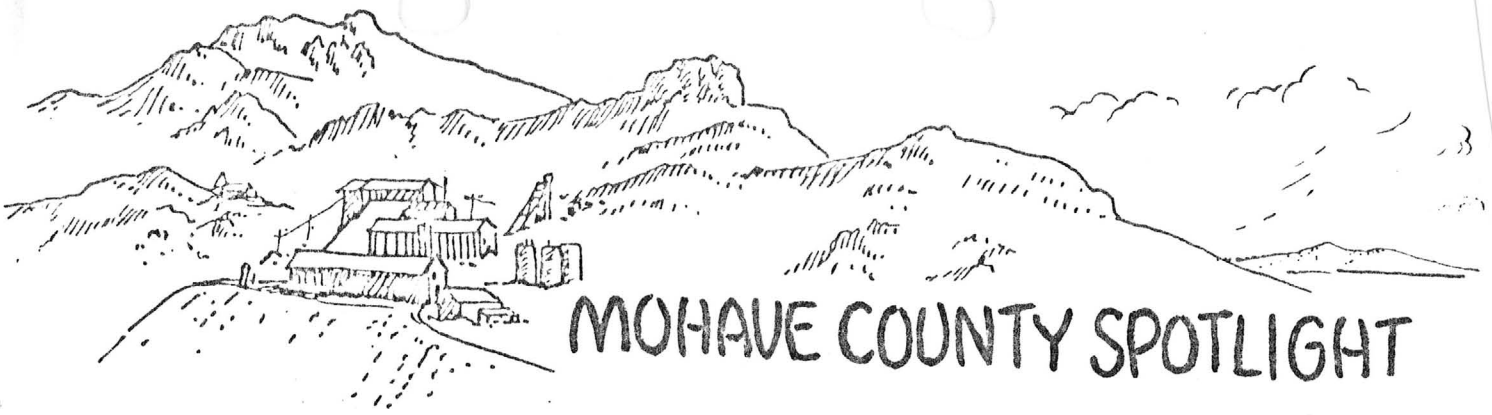




From Roman Malach Photograph Collection: (1) New Boriانا mill on the flats near Yucca, showing one of the entrances, (2) Side view of the Boriانا mill, (3) The other side of the Boriانا mill, where tailings enter for processing, (4) The tailings from Boriانا mine ready for the Boriانا mill, (5) The concrete remnants of the old mill, which stood at the same site, and (6) Other signs of the old mill.

The new Boriانا mill is producing tungsten, where steam is used in the process of extracting tungsten from the tailings.

*Bariana Mine*



Vol. III

June 1979

No. 6

#### GOOD NEWS

During his field trips, Malach is visiting places, where recent attempts were made to reopen mining. A few of such places came to life for a short time and then all the work was stopped, and now the place appears to be abandoned.

On May 7, 1979, Malach visited the Boriana Mine, but found no activities at the mine itself, and the main tunnel caved in. Only two 30 ton capacity trucks were at the tailings. Malach drove back toward Yucca and on the flats where an old mill stood, he located a new flotation mill in operation. According to the mill general manager, this new plant processes 500 tons of tailings from Boriana Mine in 24 hours, recovering tungsten only. It is expected that the supply from the tailings will last up to 2½ years. Then the mill may start operating as a custom ore mill for the recovery of gold and silver. Could be, also, that the Boriana Mine will be reopened.

Small mine operators and other interested people have a good opportunity to learn about this new flotation mill. It could take place of the once proposed custom mill for Mohave County.

Boriana Mining Corporation with the Yucca address operates the new flotation mill and John McFadyen is the general manager.

*Boriana Mine*



then left the mineralized inclined fissure. The fissure was not encountered in the 30-foot drift from the 40-foot level.

The scheelite is associated with garnet, epidote, quartz, and calcite. The ore carries trace amounts of copper oxides.

#### Boriana Mine

The Boriana group of 28 unpatented lode claims is in secs. 7, 18, and 19, R. 15 W., and secs. 12 and 13, R. 16 W., T. 18 N., ranging in altitude from 4,950 to 5,750 feet, in the central part of the Hualpai Mountains. The mine is accessible from Kingman by traveling 20 miles south on paved U.S. Highway No. 66 to Yucca, and 16 miles easterly on a county-maintained dirt road (see fig. 31). Yucca, a station on the Atchison, Topeka and Santa Fe railroad, is the nearest rail point. The property is owned by Dye and Bathrick Mining Co. of Kingman.

The Boriana deposit was discovered before 1914, and was acquired by Yucca Tunsten Co. <sup>28/</sup> in 1915. The company worked the veins from 1915 to 1919 when metal prices declined. The mine was nonproductive from 1919 to 1929, when it was acquired by Boriana Tungsten Co. The company did much development work, built a mill, and maintained production to 1937 when the property was leased to Molybdenum Corp. of America. The mill burned down late in 1937, but in 1938 a new gravity concentration mill of 150-ton capacity was built. Production was resumed in October 1939 and continued to October 1943. The equipment was sold in December 1943 and removed from the property in 1945. In 1946 Dye and Bathrick, the present operators, purchased the property. During 1951 they reequipped the mill and treated ore produced by lessees from the upper mine workings. The hauling of dump ore was started in 1952, and late in the year treatment of ore produced by lessees was discontinued. The mine ore was concentrated elsewhere. This operation continued until 1957, when falling metal prices again rendered it to become unprofitable.

The Boriana mine was the leading producer of tungsten in Arizona in 1915 and from 1933 to 1937. For the 2-year period, 1936-37, its output of ore averaged about 3,000 tons per month. <sup>29/</sup> Approximately 108,500 units of tungsten trioxide was produced from about 1915 to the beginning of 1943. <sup>30/</sup> Production for the 9 months of operation in 1943 is not known. From 1951 through 1956 production amounted to approximately 10,100 units of  $W_2O_3$ , the largest production from any single property in the State of Arizona during this period.

The mine is developed by nine main levels and three sublevels for a total of more than 15,500 feet of level workings. Figures 32 and 33, showing

- <sup>28/</sup> Hobbs, S. W., Tungsten Deposits in the Boriana District and the Aquarius Range, Mohave County, Arizona: Geol. Survey Bull. 940-1, 1941, p. 248.  
<sup>29/</sup> Work cited in footnote 27 (p. 70), p. 12.  
<sup>30/</sup> Work cited in footnote 28 (p. 70), p. 257.

From: Information Circular # 8078 - Tungsten Deposits of Gila, Yavapai and Mohave Counties, Arizona  
 by: V. B. Dale

\*

mine plan and longitudinal projection, are taken from plates 44 and 45 of U.S. Geological Survey Bulletin 940. It presently is filled with water to the 500 level, which was the main haulage adit with its portal near the mill. A large part of the workings above the 500 level are caved and inaccessible. Underground work during the last period of operation included mining pillars of ore between the 0 and 200 levels. The work was conducted by a lessee and a crew of five men. Daily production amounted to 4 or 5 tons of ore containing about 2.0 percent  $WO_3$ . This operation lasted only a short time.

Wallapai Mining obtained a lease from Dye and Bathrick to remove and concentrate the gob used in the stopes below the 500 level, and all gob milled was taken from the 500 level, according to Ray Dye. The cut-and-fill mining method was used in all stopes below the 500 level. The company reconditioned that level to the No. 20 shaft and removed a few thousand tons of gob from a single stope. According to Dye, the gob was estimated to have contained about 7 pounds of  $WO_3$  per ton. While the gob was being pulled, the walls of the stope caved, and the operation was discontinued. The 500 level again is in dangerous condition and considered inaccessible.

Figure 34 shows a flowsheet of the Dye and Bathrick mill. The screening section was designed originally to process 20 tons of ore per hour and yield an estimated 10 tons of sorted ore. The capacity of the concentrator section was 10 tons of ore per hour.

In 1955 the mill was remodeled. A hammer mill and a heavy media separator were added to the circuit, and changes were made in screens. The improved circuit had a capacity of from 25 to 35 tons per hour. The mill operated on an available water supply of 7 to 10 g.p.m. Power was supplied from a 44,000-volt transmission line.

Most of the dump material was transported to the mill with an electrically powered slusher. Some of the dumps were transported by truck a maximum distance of 0.25 mile. Trucks were loaded with front-end loader.

A total of 135,000 tons of dump material was treated by Dye and Bathrick. The mill heads during the first year of operation contained 1.7 pounds  $WO_3$  per ton, and during the subsequent years the mill heads averaged 1.5 pounds  $WO_3$  per ton. Tungsten concentrates contained about 50 percent  $WO_3$  with some copper and iron minerals, and percentage recovery was reported to be in the high 80's. About 2 tons of 18 percent copper concentrates was produced per month. The mill operated 1 to 1½ shifts a day, 6 days a week.

According to Hobbs:<sup>31/</sup>

The mine is an elongate belt of phyllite, striking northeastward and nearly vertical, about half a mile wide, and bordered on both sides by intrusive granite. The ore minerals, scheelite, wolframite, and chalcopyrite, occur in narrow quartz veins, which form composite lodes that follow the foliation of the phyllite.

<sup>31/</sup> Work cited in footnote 28, (p. 73), p. 247.

Two such lodes, separated by about 125 feet of phyllite were being mined in 1943. The vein zones are continuous and the structure is simple. Minor faulting has offset the veins, and the latest movement occurred since the formation of the ore. The veins apparently originate in a small granite stock in the center of the belt of phyllite. A broad ore shoot, which contains the best ore in the mine, plunges gently toward the granite contact. Measured ore in the mine in December 1943 amounted to about 2,400 tons containing 1 to 1½ percent  $WO_3$  and indicated ore amounted to 9,700 tons of a similar grade. It is estimated that about 44,000 tons of ore with an average content of about 1 percent  $WO_3$  lies below the lowest level and between the present workings and the granite contact.

On Page 253 of the Hobbs report is a description of the ore deposits:

- - - These veins also contain chalcopyrite, a few other sulphides, and fluorite. Quartz veins are numerous throughout the phyllite belt, but only those within a zone about 125 feet wide in the west-central part of the belt contain significant quantities of tungsten. The tungsten mineralization is limited, moreover, to that portion of the zone northeast of the main portal of the Boriara mine, all the veins in the southwestern part of the area mapped being essentially barren.

Plate 43 (fig. 35) shows typical outcrops of the larger veins. Many veins too small to map were seen, and many others are undoubtedly concealed by surface debris. The relatively continuous exposure of the ore-bearing veins north of the mine portal is due to their being uncovered in open cuts and surface workings.

The mine workings follow two groups of small veins, known respectively as the west veins and east veins, which are separated by 90 to 135 feet of phyllite. This intervening phyllite contains small subsidiary veins in which there is a little tungsten.

Mention is made of some beryl that was found in the veins on the 700 level and also in the veins which cut the granite on the surface.

Hobbs discusses granite on pages 251 and 252 of his report:

The largest igneous rock body in the Hualpai Mountains is a medium-to-coarse-grained biotite granite, locally porphyritic and composed essentially of feldspar, quartz, and biotite. This granite intrudes the phyllite, which apparently forms a very large roof pendant. - - - North of the ridge crest and only a stone's throw north of the end line of the Boriara claims, a tongue or embayment of granitic rock extends from the main body of granite on the west into the middle of the phyllite belt. This body, which may be called the northern body, consists of a medium-grained rock that is composed essentially of microcline, plagioclase, gray glassy quartz, and biotite. It appears to be a little more sodic than the main granite mass, but

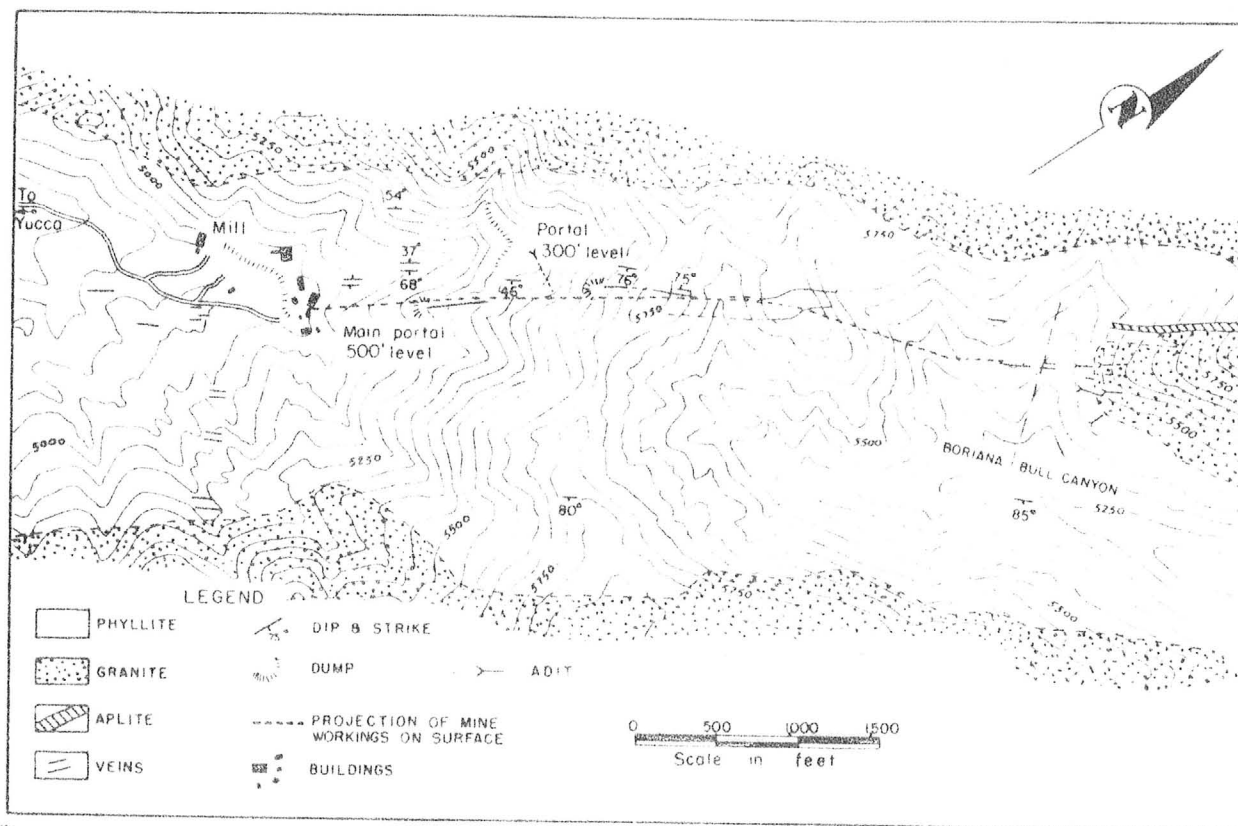


FIGURE 35. - Topographic and Geologic Map, Boriana Mine, Mohave County, Ariz.

the difference is not great enough to show that it is a distinct intrusion. This northern granite body is also exposed at the northeast end of the 700-foot level where it intrudes the phyllite as a series of tongues parallel to the foliation. - - -

The main body of granite is fairly uniform in composition and texture through large areas, but near the contact of the main body with the phyllite the rock shows considerable variation, probably caused by assimilation of phyllite, which generally increased the proportion of dark minerals and thus darkens the rock. The granite encloses numerous xenoliths of phyllite, many of which have been much recrystallized and drawn out into dark streaks. The granite embayment north of the divide, on the other hand, has lost part of its dark minerals, together with some feldspar, having been partly converted to a greisen, doubtless by fumarolic action. This granite, therefore, may represent a curola in which the volatile constituents of the cooling magma were concentrated, a condition that would have a direct bearing on the origin of the Boriana veins, which appear to stem from this mass.

\*  
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OF THE CONTENTS OF THESE DOCUMENTS.

Dr. Wilson<sup>32/</sup> recognized two distinct types of granite:

The Borianna mine is in a belt of schist, locally 1/4 to 1/2 mile wide, that strikes N. 30° to 40° E., dips from about 75° SE. to vertically and extends for several miles across the range. In the vicinity of the mine, this schist is a thinly laminated to blocky gray slate with some sandy phases; abundant fine-grained sericite and chlorite mark its parting planes.

The schist belt is intruded on both sides by coarse-grained biotite granite which grades into gneiss near its contacts. Dikes of aplite and pegmatite cut both the gneiss and schist.

A short distance northeast of the divide the schist and granite are intruded by a stock of medium-grained granitic rock consisting essentially of white feldspar, abundant glassy gray quartz, and biotite; provisionally, it may be classed as a granodiorite or sodic granite. Along its borders it has affected strong silicification and sericitization of the schist and gneiss. Locally, veinlets of quartz and purple fluorite occur in the adjacent gneiss. Here a narrow belt of "greisen," consisting of a foliated fine-grained aggregate of quartz, sericite, and wolframite, parallels the schist and is traceable intermittently for several thousand feet; apparently it represents a shear zone affected by intense hydrothermal alteration. In places this greisen contains sparse tiny veinlets of chalcopryrite and disseminated particles of wolframite, up to 1/2 inch in diameter, encased by thin layers of scheelite. It has been explored by a short adit with some 600 feet of drifts, but apparently these workings did not find the tungsten mineralization to be of commercial grade. Other small greisen zones are found in the granodiorite.

The Geologic Map of Mohave County, Ariz., prepared by the Arizona Bureau of Mines and printed in 1959, clearly delineates the two formations. The older is a Precambrian granite and the later intrusive is an upper Cretaceous granite.

Wilson's description of the veins follows:

As exposed in the mine, the veins are lodes of composite type, made up of two to ten or even twenty parallel quartz veins and stringers, separated by schist, within widths of a few feet to 20 or more feet. Many of them consist of two veins from 4 to 10 inches, or exceptionally 4 feet, wide with narrower veins or stringers in schist between. At least four of the composite lodes have been encountered in the mine within a width of 200 feet.

<sup>32/</sup> Wilson, E. L., *Tungsten Deposits of Arizona*: Arizona Bureau of Mines Bull. 148, pp. 11-14.

- - - Ore minerals in the Borigana mine consist of wolframite, scheelite, and chalcopyrite, together with hematite and a little gold and silver in unknown form. Associated with them, particularly in the northeast workings, are some arsenopyrite and pyrite and inconsequential amounts of molybdenite. Cuprotungstite is reported to have been found near the surface.

Kerr<sup>33/</sup> made a rather detailed examination of the property in 1936. His studies of the mineralogical aspects are very significant, both of this property and the Bull Canyon property which adjoins on the northeast. He states:

The Hualpai Mountains in the vicinity of Borigana contain igneous intrusives which enclose schist and thin platy slate or phyllite. The tungsten deposit is in a slate zone which extends for several miles and is in places half a mile across. The slate is bordered on either side by granite and granite gneiss. The metamorphosed sediments have been cut by quartz veins carrying wolframite and scheelite.

The slate bordering the ore body at Borigana, as shown microscopically, is finely laminated and an intimate mixture of quartz and fine mica. The mica consists of layers of pleochroic biotite interlaminated with muscovite. Occasional pleochroic haloes may be observed in the biotite surrounding minute prismatic nuclei. Apatite is present in small amounts.

The veins represent fissure fillings of various size, striking N. 30° E. and dipping from vertical to 75° E. Possible fillings occur either as single masses of quartz up to 3 feet thick or more frequently as a distributed network of smaller veins. The network may contain from 2 or 3 up to 10 branches spread over a thickness of 3 to 6 feet.

On rare occasions single quartz veins of minable width are found. Ordinarily, however, the vein system as mined consists of two veins 4 to 10 inches thick separated by a foot or more of slate and accompanied by several thin quartz stringers distributed through the bordering rock.

The tungsten minerals have been found along four nearly parallel veins within the Borigana mine. Veins 1, 2, and 3 are within 10 to 30 feet of each other, while vein 4 is 75 to 100 feet east. All contain scheelite and wolframite, although veins 2 and 4 appear to have more pronounced mineralization than 1 and 3. Other veins may occur to the east, but when the property was visited (1936) the region east of the main workings had not been thoroughly explored.

Along the ore shoots the amount of vein quartz mined gives a fair approximation as a basis for computing the tungsten content of

33/ Kerr, Paul F., Tungsten Mineralization in the United States: Geol. Soc. of America, Memoir 15, 1946, pp. 102-104.



the mill feed. The vein quartz also contains a small and consistent amount of titanium. Titanium assays therefore are considered an approximate index of the quartz content of the mill feed and in turn of the tungsten content.

Wolframite and scheelite are both prominent in the quartz veins and occur in disseminated grains or in masses up to several inches across. Occasional specks of chlorite occur in masses of the tungsten minerals. In places, particularly close to the tungsten minerals, fine anhedral of vein feldspar occur. In the thin sections these have indices of refraction below balsam and are free from twinning. Fluorite is occasionally associated with the ore. Chalcopyrite and molybdenite are also present.

Polished surfaces yield lathlike sections of euhedral crystals of wolframite replaced in part by scheelite. The scheelite has entered the wolframite along fractures and cleavages. Various stages may be observed from incipient alteration of small streaks to areas largely scheelite containing small remnant patches of the original wolframite.

Although chiefly suspended in quartz, the tungsten minerals are in places intimately related to vein muscovite. Interlocking boundaries between masses of scheelite and masses of muscovite are common under the microscope. The projections of the muscovite into scheelite show sharp, well-preserved boundaries. This is particularly true near the border of the veins along the micaceous slate. Recrystallization of the mica may have accompanied tungsten precipitation.

Veinlets of sericite cut the vein quartz. Sericite streaks frequently lead to tungsten-bearing areas in the vein and are concentrated near wolframite and scheelite.

In the interstices between scheelite crystals and also in veinlets are flakes of brown, slightly pleochroic mica approaching biotite. Where this mineral is in contact with coarse muscovite it appears to represent a slightly earlier and different stage of mineralization from the muscovite along the walls of the veins accompanying the sericite veinlets.

Ore has been concentrated along the veins at Boriana in a well-defined shoot (fig. 36) established by exploration throughout the mine workings from the surface to below the seventh level. The shoot extends for several hundred feet along each level and is found a considerable distance farther north on each level as the mine is deepened.

The major ore distribution is more or less parallel in the different veins of the Boriana system. The inclination of the shoot is roughly on the order of 35° N. Isolated patches of ore, somewhat

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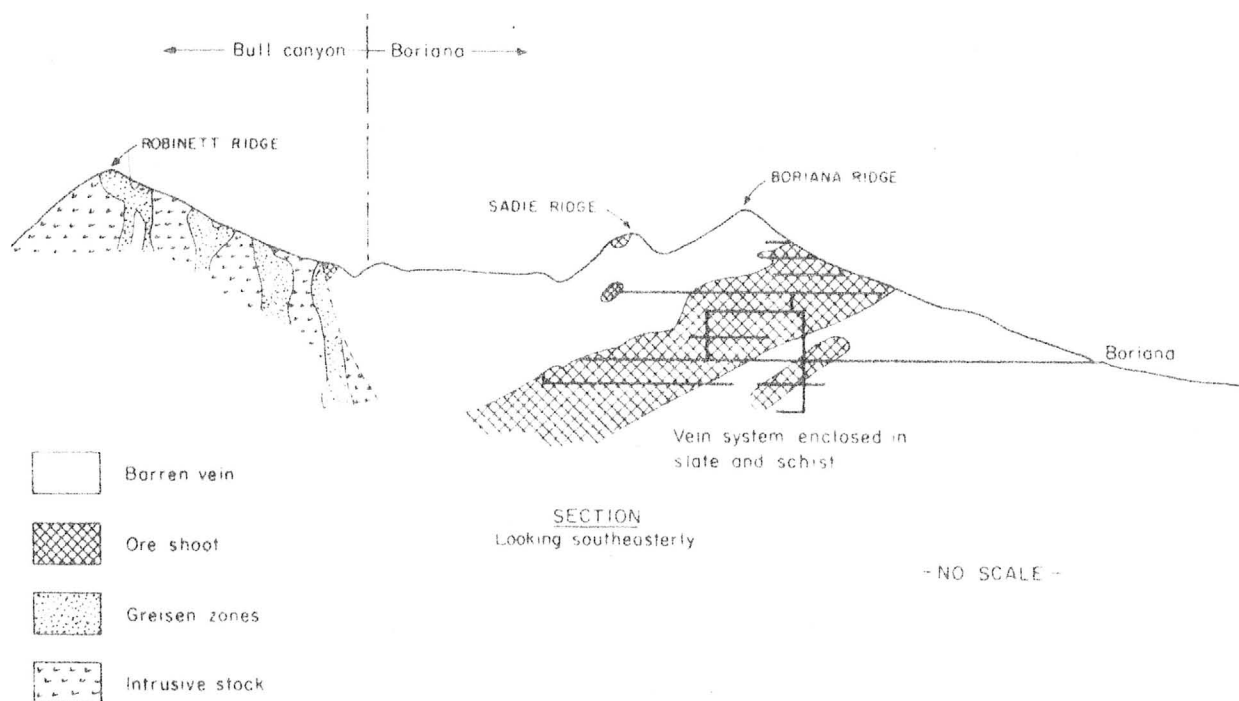


FIGURE 36. - Ore Shoot at Boriana, Ariz.

lenticular in shape, are irregularly distributed on either side of the main ore shoot. The portions of the veins between are either too thin or contain too little tungsten to justify mining.

The Neglected Vein (bordering the slate area west of Boriana). Gneissic structure is prominent in thin sections of the igneous intrusive bordering the slate on the west. Earlier augenlike patches of microcline, quartz, orthoclase, and albite with occasional coarse crystals of biotite and muscovite have been surrounded by gneissic striae of finer crystalline quartz and albite. Occasional specks of wolframite are associated with the biotite.

Not only has flow structure developed but the rock has been considerably fractured. Most of the fractures that apparently accompanied the injection and movement resulting in the formation of the gneiss are healed; most of the later fractures are unhealed. The gneissic zone is several hundred feet thick and is more prominent close to the contact with the slate. It may represent a late phase of the intrusive activity along the margin of the mass of metamorphosed sediments at Boriana.

The so-called Neglected Vein represents a zone of variable width and almost vertical continuation which extends through the gneiss roughly parallel to the contact between the gneiss and the metamorphosed sedimentary series. It is apparently not continuous, but along about the same line for a distance of several thousand feet.

\*



occasional small streaks contain grains of wolframite and scheelite. The material of these zones differs but little from the material of the surrounding gneissic zone into which the tungsten-bearing portions grade both laterally and longitudinally.

It is believed that these zones represent a concentration of the end-stage solutions carrying tungsten mineralization which was precipitated along the margin of the slate. Here destruction of the original granite as shown in thin section is more complete. Quartz is more abundant and more definitely banded. The mica is muscovite and not biotite. Most of the feldspars are replaced or destroyed. Both wolframite and scheelite are scattered in isolated grains through the quartz and muscovite; wolframite exhibits evidence of being the earlier. The boundaries of crystals appear to be controlled by the wolframite crystals replacing the earlier scheelite almost completely in many instances.

#### Bull Canyon Group (Iguana Claims)

The Bull Canyon group of seven unpatented lode claims is in secs. 7 and 18, T. 18 N., R. 15 W., at an average altitude of 5,300 feet. The claims are accessible from the Boriana mine by 3.5 miles of steep, narrow road (see fig. 31).

The Bull Canyon claims were discovered first about 1928 by Jim Craig and William Boke. Dalton Robinette acquired a two-thirds interest by purchase in 1933 or 1934, and later traded a one-third interest to R. Fetis. Boriana Mining Co. held the remaining one-third interest and later acquired the interest held by R. Fetis. In 1946 Boriana Mining Co. sold its interest to Dye and Bathrick. Since 1937, one of the claims has been worked intermittently by Robinette or by lessees. Production during the years 1941 through 1943 amounted to about 30 tons of concentrates that assayed possibly 69 percent  $WO_3$ . Production from 1951 through 1956 was 106 units of tungsten trioxide. Concentrates assayed from 59 to 65 percent.

The property was examined by the Federal Bureau of Mines in 1941 and in 1954. Following is a description from the 1954 report:

The granite exposed on the eastern end of the Boriana property is in contact with phyllite on and near the Bull Canyon claims. The phyllite is in contact with the granite as bands that narrow as they continue to the north. Tungsten mineralization occurs in steeply dipping discontinuous quartz veins, a few inches to 2 feet wide, that are northerly extensions of the veins of the Boriana deposit. The veins are roughly parallel with a strike that changes abruptly from N. 30° to 40° E. in the phyllite to N. 50° to 60° E. in the granite. Wolframite and scheelite, the ore minerals, are irregularly distributed in the quartz. Chalcopyrite, molybdenite, and fluorite are present in minor amounts.

\*

Most of the ore production probably has come from 3 veins, each of which has been developed by 2 adits to an average depth of possibly 75 feet. The adits range in length from about 150 feet to 300 feet. A raise and a few small stopes have been driven from the adits.

The author examined this property during the day and at night of February 18, 1959. The lowest working is an adit about 325 feet long with several hundred feet of crosscuts and a winze said to be 40 feet deep. Some stoping has been done on the narrow quartz vein. This adit has been driven through the schist and phyllite into the intrusive upper Cretaceous granite described previously under the Boriana mine description. This working is referred to as the crosscut adit.

The granite exposed on the property is shown on the recently printed Geologic Map of Mohave County, Ariz., prepared by the Arizona Bureau of Mines. There is scheelite and wolframite disseminated through the southwestern point of the granite. Heaviest concentrations appear to occur on the northwest side of the intrusive. Beryl occurs in places associated with the quartz veins, and in other places in narrow veinlets to as much as 3 inches wide and not associated with any other mineral. The visible beryl occurrences are discontinuous and very sporadic. Where the beryl was observed in association with quartz it was confined to the outer edges of the veins.

Robinette has milled several hundred tons of ore from the quartz veins. He stated that he observed beryl being discharged from concentrating tables in tailing. Most of the tailing has been washed away. Kerr<sup>34/</sup> made a rather intensive study of the property in 1936. His studies of the mineralogical aspects are very significant, both of this property and the Boriana mine which adjoins on the southwest. He states:

North of the main workings at Boriana is a ridge known locally as Robinet Ridge which contains scheelite. Tungsten has been concentrated at this locality under conditions closely approaching direct magmatic crystallization. Scheelite is disseminated through the igneous intrusive, and some of the boundaries between ore-bearing areas and nonore-bearing areas are at times so indistinct and irregular as to be virtually indistinguishable in the field. The only apparent megascopic features are more coarse fresh feldspar cleavage surfaces and more biotite in the nonscheelite-bearing rock. The scheelite-bearing rock is more micaceous and somewhat more stained with limonite.

In the thin section the nonscheelite-bearing rock exhibits remnant phenocrysts of orthoclase, sheared and in part replaced by fine granular quartz and later albite. The early phenocrysts also contain disseminated patches of quartz, albite, and muscovite and form a poikilitic structure. The matrix of the rock is a fresh granular aggregate of quartz, microcline, orthoclase, albite, and

<sup>34/</sup> Work cited in footnote 33, pp. 194 and 195.

\*

muscovite with some biotite. The biotite appears to have been destroyed or altered in a number of places, some of it even going over to chlorite. Occasional grains of accessory zircon and garnet may be observed, and the feldspars are slightly cloudy due to alteration. Although the rock probably originally contained less quartz and correspondingly more feldspar making it perhaps a quartz monzonite, it is now more like a muscovite granite. Associated with biotite in the rock are a few black submetallic specks of wolframite.

In thin section the scheelite-bearing rock exhibits granular aggregates of scheelite with quartz, albite, and muscovite. Coarse-grained albite is about as abundant as quartz. Orthoclase is a minor constituent, and microcline is virtually absent. Stains radiate from former biotite layers replaced by muscovite. These, together with residual specks of wolframite, indicate that regardless of the fresh appearance of the scheelite-bearing rock it is later than the muscovite granite. The zone lacks the topaz usually associated with a greisen, is not quite so highly micaceous as would be expected, and contains more coarsely crystalline albite; otherwise it might be known as a scheelite-bearing greisen. Perhaps one would be justified in calling it a scheelite-bearing mica alaskite. Hobbs (1943) has mapped aplite near this location.

Figures 33, 35, and 36 show information pertaining to the Bull Canyon deposit.

The most recent work on the property has been done in a narrow, sheared zone on the northwest face of the extreme southwest point of the granite, a few feet above the gneiss contact. At this point a zone about 18 feet wide has been opened for a length of 100 feet and to a depth of 15 feet. The zone strikes N. 43° E., and the dip is 15° to 20°. Wolframite and scheelite, in a ratio of probably 1:1, are disseminated through the granite and concentrated along at least two sets of fractures in the zone. According to Robinette, 21 tons of ore was shipped from this working to the Lyell in Barstow, Calif. Thirty-two units of tungsten trioxide was recovered.

Seven samples were collected from this property. They are in no way representative of what may exist. The samples are described in the following tabulation:

Sample No.	Type	FeO, percent	WO <sub>3</sub> percent	Description
15301	Chip.....	$\frac{1}{2}$ 0.01	0.02	25 feet of granite at end of crosscut workings.
15302	Dc.....	$\frac{1}{2}$ .01	.01	From 95-foot trench on top of mountain north of pits.
15303	Grab.....	$\frac{1}{2}$ .01	.02	From pile of waste north of winze in crosscut workings.

See footnote at end of table.

\*

<u>Sample No.</u>	<u>Type</u>	<u>BeO, percent</u>	<u>WO<sub>3</sub>, percent</u>	<u>Description</u>
15304	Grab.....	$\frac{1}{/}$ .01	.30	From faces of four lower dumps northwest of crosscut workings.
15305	Do.....	$\frac{1}{/}$ .01	1.10	From ore piled at the opencut at the southwest point of granite.
15306	Do.....	.02	.32	From faces of dumps above those sampled at 15,304.
15307	Chip.....	$\frac{1}{/}$ .01	.03	From granite outcrops from top of mountain to 175 feet easterly.

$\frac{1}{/}$  Less than.

#### Tungstite Group

The Tungstite group of 16 unpatented lode claims is mainly in sec. 7, T. 18 N., R. 15 W., at an average altitude of 4,000 feet. The claims adjoin the Bull Canyon property on the northeast, and are accessible from the Borianna mine road which passes near the Tungstite camp about one-fourth mile east of the Bull Canyon workings. Mine workings on the Tungstite property are probably one-half mile northeast of the camp at the end of a rough, winding road. (See fig. 31.) The property is owned by J. F. Moore, Box 2, Yucca, Ariz.

These claims were located between 1948 and 1950 when they were worked by a Mr. Watell. During 1951 lessees mined ore for a period of about 4 months. The property was acquired by the present owner on February 2, 1952, and operations were started late in 1952. A small gravity mill installed on the property was removed after treating about 100 tons of ore. An estimated 108 tons of ore treated in the Borianna mill during 1951 yielded 3,000 pounds of concentrates containing 30 percent WO<sub>3</sub>. Reported production from 1951 through 1956 was 137 units of tungsten trioxide.

The Bureau of Mines examined the property in April 1954, and according to the report:

Tungsten mineralization appears to be closely associated with numerous quartz stringers in a green ledge. The "green ledge" is composed of fine to coarse-grained green amphibole. It is 4 to 6 feet wide and is traceable by intermittent outcrops for several hundred feet. At the prospect workings, the ledge strikes N. 10° E. and dips about 80 degrees to the south. Tungsten is present as scattered fine-grained scheelite and as one of the wolframite group minerals.

\*

Bouanna Mine (file)

Mojave County 2/1916

At Copperville, via Yucca, about 28 miles east in the Cedar mining district, great attention is being paid to the Molybdenum deposits and developments are proving highly satisfactory. The mineralized area is about one mile wide and three miles long and over this area many locations have been made and the properties are in vary stages of development. The Francis group comprises six claims and is owned by Shaw and Miller, who have recently bonded them to Fort & Hamme.

The Franklin group of three claims have also been bonded to the same parties, as well as four claims of the Carpenter.

BORIANA

LEWIS A. SMITH

CEDAR VALLEY DIST., MOHAVE CO.

Conference With Raymond Dye, and Bathrick - 9-5-62.

Maps of the mine showed that the ore zone lies in a depressed area of variably greisenized schist between two masses of granite (The Antler Mine lies in the same depressed area to the southwest). The schist is severely altered especially along the borders and in a band 6-20 feet wide in the center. The schist band is about 1500-1600 feet wide. The schist granite contact shows notable shearing parallel to the contact, this being more intense in the schist. The granite is also sheared for some tens of feet out from the contact. The depressed zone could be caused by relatively greater erosion in the more susceptible schist, or by a graben-like structure. It is probable that this topographic expression resulted from a combination of both. Movement definitely occurred on both contacts. The granite schist contact strikes NE and dips NW, placing the granite on top of the schist on the west side of the structure. The contact dips steeply. According to Dye, the Borigana schist zone terminates against granite on the east end and this contact dips 55° SW. A band of intense greisenization follows this contact downward.

The termination of the stopes on the SW side of the mine is on a flat plane which pitches from 35 to 40 degrees to the NE. This pitch is the hade of the deposit. This could be caused by a pre-mineral fault. The bottom level of the mine (the 800 foot level) reportedly runs higher in tungsten than the levels above. The average grade of ore mined and in reserve, according to Dye, was 1.5 percent tungsten, but the 800 level is higher grade. Dye believes that the hade will intersect the cut-off fault, previously mentioned, in depth. This would be a considerably deeper elevation than the lowest mine level. The convergence of the two structures could easily result in higher grade ore than was encountered higher up. The presence of increased molybdenite and chalcopyrite is also encouraging. The zone of mineralization in the center of the schist body ranges up to 200 feet but the strong greisen zone is much narrower. The strong greisen on the cut-off fault is also well mineralized. (A visit to the Antler Mine verified some of the information obtained from Dye.)

The longitudinal section of the mine indicates several thousand feet of lateral work, mostly concentrated in the greisenized zone in the center of the schist belt.

DEPARTMENT OF MINERAL RESOURCES  
STATE OF ARIZONA  
FIELD ENGINEERS REPORT

Mine Boriana

Date August 30, 1953

District 18 miles East of Yucca

Engineer Geo. F. Reed

Subject: News Item

Dye & Bathrick of Kingman owners of the Boriana Mine & Dumps, suffered considerable damage to their equipment from a recent cloud-burst.

They have been milling about 40 tons per day of dump material and hauling concentrates to Bishop for cleaning and sale. They have a crew of about 8 men and have been working on an expansion program to allow screening and milling of about 150 tons of crude dump ore per day.

Leasers Dan Harper and A.D. Allen have been reopening the mine on the 100, 300 and 500 levels. They have cleaned up and mucked out over 2000 feet of tunnels and have milled some ore in the Dye & Bathrick Mill. Concentrates are trucked to Bishop for marketing. About ten men are working on the lease.

Over the mountain in Bull Canyon on the extension of the Boriana Veins, Dalton Robinette and two leasers have been mining and jigging scheelite and wolframite from the quartz veins. Concentrates are sold through Dye & Bathrick.

*George F. Reed*

\*

DEPARTMENT OF MINERAL RESOURCES  
STATE OF ARIZONA  
FIELD ENGINEERS REPORT

Mine Boriana ✓ Date March 25, 1957  
District Cedar Valley Engineer Mark Gemmill  
Subject: Present Activity

The principal activity at the property for some time has been the milling of old mines dumps by the owners Dye & Bathrick. Mr Dye stated about a month ago that they had less than a year operation of dump material left. Although the GSA has not been buying Tungsten for several months, they have continued operation, storing the concentrates, hoping that money would be appropriated to complete the program.

It is quite likely that they shut soon and have already as the chances of restoration of the buying program seem to be diminishing.

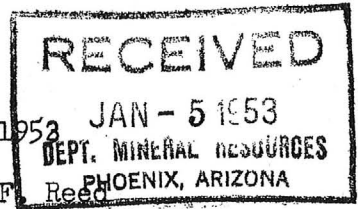
There is no activity in the mine.

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\*



DEPARTMENT OF MINERAL RESOURCES  
STATE OF ARIZONA  
FIELD ENGINEERS REPORT



Mine Boriana Tungsten Date January 2, 1953  
District Cedar Valley, 18 miles by road Engineer Geo. F. Reed  
Subject: East of Yucca, Ariz.

Notes on Marketing of Concentrates and Amt. of Possible Production.

Most of the following was obtained from a conference with Ray Dye and Jack Bathrick who own the Boriana Property. They are running the mill on ore from the (estimated) 150,000 ton dump. Their work to date has been of a pilot and sampling nature. They have leased the mine to Dan Harper, former superintendent of the mine, who with Mr. A.D. Allen, is re-opening the mine with the intention of having Dye & Bathrick mill their ore, also.

The present mill being operated by Dye & Bathrick on dump ore consists of an 8 by 15 jaw crusher, screen, rolls, on closed circuit for crushing, product to fine ore-bin. Fine ore, thru 3/16 inch, goes to Bendalari Jig from which some finished concentrate is obtained on the screen. Fines from the hutch go to tables. Coarse tailing goes to a dewatering screen. Table middlings, fines from dewatering and jig middlings go to a large grind ball mill and then to flotation. Copper concentrate is obtained from flotation (4-#15 Denver Cells) and flotation tails go to a table. Some finished concentrate is obtained from each table and some middling is returned to flotation. Mill capacity is estimated at 2 to 3 tons per hour.

Dye & Bathrick expect to get into steady production by summer of 1953 and hope to produce at the rate of 15 tons per month of 40% WO<sub>3</sub> concentrate ~~per month~~ or more. Their production lately has been only a ton or so per month of average 45% WO<sub>3</sub>. This from testing dump and running 100% through the mill. They expect to screen out plus 2 inch material (with sorting of oversize) or sink float. In either case, mill heads will be raised and production will of coarse increase. Additional water necessary will be obtained from the mine due to operations of Harper & Allen. When and if Harper & Allen begin to produce from the mine, mill heads will increase and production of more WO<sub>3</sub> will presumably result.

Estimated recovery of WO<sub>3</sub> from the 150,000 tons of dump is about 20,000 units. This is based on recovery of slightly less than 3# of WO<sub>3</sub> per ton of dump. The owners estimate a potential production from the mine of another forty to fifty thousand units from ore in place and stope gobs. These figures are obtained from mine maps, gov't reports, etc. Most of the ore in the mine is in-accessable due to caving and flooding at this time. Harper & Allen are repairing in the mine with a small crew and hope to be in production in a small way in the next few months.

Notes on marketing, grade of concentrates, and specifications:

With their present mill setup the concentrates can be made to average above 40% WO<sub>3</sub> and about 5% copper without any trouble. The Tungsten is about evenly divided between Scheelite and Wolframite. Copper is in Chalcopyrite. The present procedure is to haul this in ton lots in their pickup truck about 420 miles to Bishop, Calif. There it is cleaned at the cleaning plant of Benware Corp., and the cleaned and separate Scheelite and Wolframite concentrates are sold to Wah Chang Co. at Bishop. The round trip including a man's time (three days) and truck cost puts a charge of about \$100. against

DEPARTMENT OF MINERAL RESOURCES  
STATE OF ARIZONA  
FIELD ENGINEERS REPORT

Mine Boriana Tungsten

Date January 2, 1953

District

Engineer

Subject:



Page 2

the ton of concentrate. Charges for cleaning the concentrate amount to about \$100.00, also. In other words, the market price is about \$200.00 per ton or say \$5.00 per unit of contained WO<sub>3</sub>.

The resulting products are a scheelite concentrate and a wolframite concentrate that average possibly 58% WO<sub>3</sub> and sometimes 2-300 pounds of reject that may run 10 to 30% WO<sub>3</sub> due to slagging during the roasting process. The Wah Chang buyer at Bishop pays maximum of \$60.00 per unit on the cleaned products above and price goes down a dollar for each percent under 60%, i.e. for 58%, price is \$58.00 per unit. No penalties are charged on the above and no assay charge. Dye states that the cleaning plant is not busy like it was some time ago.

Sampling & Buying Depot:

If the government could ascertain that it was practical to upgrade lots of concentrate assaying 30 to 40% WO<sub>3</sub>, it is believed that the capital outlay needed at Wenden would be very small.

Wah Chang at Bishop opens each sack and takes two samples from it with a sampler made of  $\frac{1}{2}$  inch pipe. The pipe is capped at the bottom with a blunt point and slotted on the sides. While being forced into the sack, the pipe is filled with a  $\frac{1}{2}$  inch rod. Then the rod is pulled out and the pipe is filled with concentrate through the slots. The samples from all sacks are reduced in a regular assay splitter. Weights are determined on a truck scale.

According to Mr. Winters at Wenden Manganese Stockpile, the method the government uses to sample acceptable grade concentrate is also very simple. Concentrate is poured into sacks through a stove-pipe like affair with one splitter slot across the middle which takes out around 10% of the weight through one side as a sample. The resulting 10% is further reduced by pouring into sacks until small enough for an assay splitter.

If either of the above methods were used, the only equipment needed which will not already be available at Wenden would cost not over \$25.00. In addition, of course, safe storage would be required. This may also be available.

Payment for Concentrate:

Wah Chang at Bishop estimates the grade of the concentrate and pays for 80% of the estimated value at once. The balance of the payment is made after assaying and umpiring, if necessary.

Conclusion:

Boriana will produce more Tungsten with or without the help of a buying depot, but any help along that line will result in more net money for mining and milling and especially lower requirements on grade and specifications, will result in faster production and greater over-all production. The mine is now being laboriously re-opened. With a liberal program on prices of concentrate, the wasteful process of shutting down with attendant caving and flooding could be minimized.

\*

George F. Reed

C O P Y  
DEPARTMENT OF MINERAL RESOURCES

News Items

Date October 31, 1952.

Mine Boriana

Location 18 mi. E of Yucca by road

Owner Twp. 18N, Range 15 & 16 W.  
Ray Dye & Jack Bathrick

Address P. O. Box 1069

Kingman, Arizona

Operating Co. Dye & Bathrick own the pro-  
Address perty and are operating the mill on  
dump ore. They have leased the mine  
to Dan K. Harper & A. D. Allen, Gen'l  
Deliv., Kingman. Harper was once Supt.  
Pres. at Boriana, is well known in Ariz.  
Genl. Mgr. Allen is from Alabama.

Mine Supt. Dan Harper

Mill Supt.

Principal Metals Tungsten & Copper

Men Employed Mill --five  
Mine --four, more added soon.

Production Rate Milling 30-40 tons of dump per  
day, mine must be re-opened.

Mill, Type & Capacity Jaw crusher & rolls,  
screens, followed by jig, tables, & regrind &  
flotation of copper from middlings, re-  
tabling of flotation tails.  
Power, Amt. & Type

Boulder Dam Power.

Signed GEORGE F. REED

(Over)

Present Operati Dye & Bathrick are milling  
dump ore without any screening, but plan to  
trommel out coarse material, then pick quartz  
from oversize and mill all fines. Quartz  
will also be good mill feed.

---

New Work Planned Dye & Bathrick will mill  
mine ore for Allen & Harper when it is ready.  
In meantime, & when capacity is available, will  
mill dump ore. The mill as now operating can  
handle 4 or 5 tons per hour of feed.

---

Misc. Notes Seth Johnson & Seth Jr. who have  
been mining nice ore on a lease in upper  
levels, will probably continue their lease.

---

The new operators in the mine are looking  
for 20 or 16 pound rail and a mule trained  
for tramping.

---

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DEPARTMENT OF MINERAL RESOURCES  
STATE OF ARIZONA  
FIELD ENGINEERS REPORT

Mine <sup>✓</sup>Boriana: Copper World: Antler Date Oct 9th 1948  
District Engineer A. C. Nebeker  
Subject: Operations

These properties were visited on Oct 9.

At the Boriana, the Omega Metals Co was just finishing rebuilding the mill and expected to start milling within ten days. Before starting on the Boriana dump they were going to mill some ore from the Tungstenite mine in the Waughtel. 5 men working

The <sup>✓</sup>Copper World was driving a tunnel in to cut new ore found by drilling and were in 750 feet. 10 men working

The <sup>✓</sup>Antler was still on the development stage but not shipping

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209 De

Phoenix, Arizona,  
July 22, 1946.

*Bureau Salvage Dump*

CHAS. A. DIEHL

# ARIZONA ASSAY OFFICE

Mail: P. O. Box 1148

815 North First Street

Phone 3-4001

CERTIFIES That samples submitted for assay by Dept. of Mineral Resources contain as follows per ton of 2000 lbs. Avair.

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MARKS	SILVER		VALUE (oz.)	GOLD		VALUE (oz.)	TOTAL VALUE Of Gold & Silver	PERCENTAGE		REMARKS
	Ounces	Tenths		Ounces	Handths			COPPER	W <sub>2</sub> O <sub>3</sub>	
entrates of dump.	1.3		\$.92	.01		\$.35		2.86	.55	
ig dump idewall	Trace			Trace				.31	.17	
ig dump S.wall	.2			Trace				.36	.21	
1-small dump. ower end.	Trace			Trace				.36	.17	
2-small dump -upper end	.3			.01		\$.35		.36	.20	
3-17' center dump	Trace			Trace				.31	.16	

\$ 30.00

Assayer ARIZONA ASSAY OFFICE

*Chas. A. Diehl*

209 De

Phoenix, Arizona,  
July 22, 1946.

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2-small dump -upper end	.3			.01		\$.35		.36	.20	
3-17' center dump	Trace			Trace				.31	.16	

\$ 30.00

Assayer ARIZONA ASSAY OFFICE

*Chas. A. Diehl*



ENGINEERING EXPORT SERVICE CO.

Equipment available for sale

2521 EAST OCEAN BLVD., LONG BEACH, CALIFORNIA, U. S. A.

~~NEWPORT BRANCH  
1005 WEST 24TH AVENUE  
NEWPORT HARBOR, CALIFORNIA~~

9-9-45

W.D. LINDSAY  
70 BORIANA MINE  
YUCCA ARIZ

DEPT OF MINERAL RESOURCES

PHOENIX ARIZ. ATT: MR. A.P. NEBEKER

DEAR SIR:-

WITH APOLIGIES, I ENCLOSE THE  
CIRCULARS AS THEY MAY BE OF  
INTEREST TO PROSPECTIVE MINE OR  
OPERATORS.

THE EQUIPMENT IS IN EXCELLENT  
CONDITION AND AVAILABLE FOR IMMEDIATE  
DELIVERY

THANKING YOU IN ADVANCE I

REMAIN SINCERELY YOURS

W.D. Lindsay  
W.D. LINDSAY

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NAME OF MINE: BORIANA

COUNTY: MOHAVE

DISTRICT:

METALS: W

W

OPERATOR AND ADDRESS:

MINE STATUS

DATE:

DATE:

5/1/44

Moly. Corp. of Am.  
W.D.Munds, Gen Mgr.  
Kingman, via Yucca

5/1/44

Repairing

12/44  
5/45

Dismantling Mill  
Idle

8/5/43

11/7/44

1/44

3/44

42 MEN WORKING  
CLOSEDOWN/SKELETON  
CREW FOR MAINTENANCE  
REPAIRING  
REPAIRING

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BORIANA

W

Mohave

8 - 12

S 18, T 18 N, R 15 W

W. H. Munds, Yucca unclaimed 10-4-46

'42

\*





Boraine

William D. Lindsay  
Contractor

Telephone 814-43

2521 E. Ocean Blvd.  
Long Beach 3, Calif.

Boraine

Sample

1 Sac 2 Dump.

Concentrations on top of  
Dump. fines blown off.

Hole # 2.

17 feet.

Lower end of small  
Dump.

Hole 2  
19' 6"

upper end small  
Dump.

Hole 3  
17'

Center Big Dump

Sample

14' Side Wall

Lower Big Dump

Sample

3.

\*

8' Side Wall

Big Dump

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↓ Bouzina -

Tailor

700 to 300m total

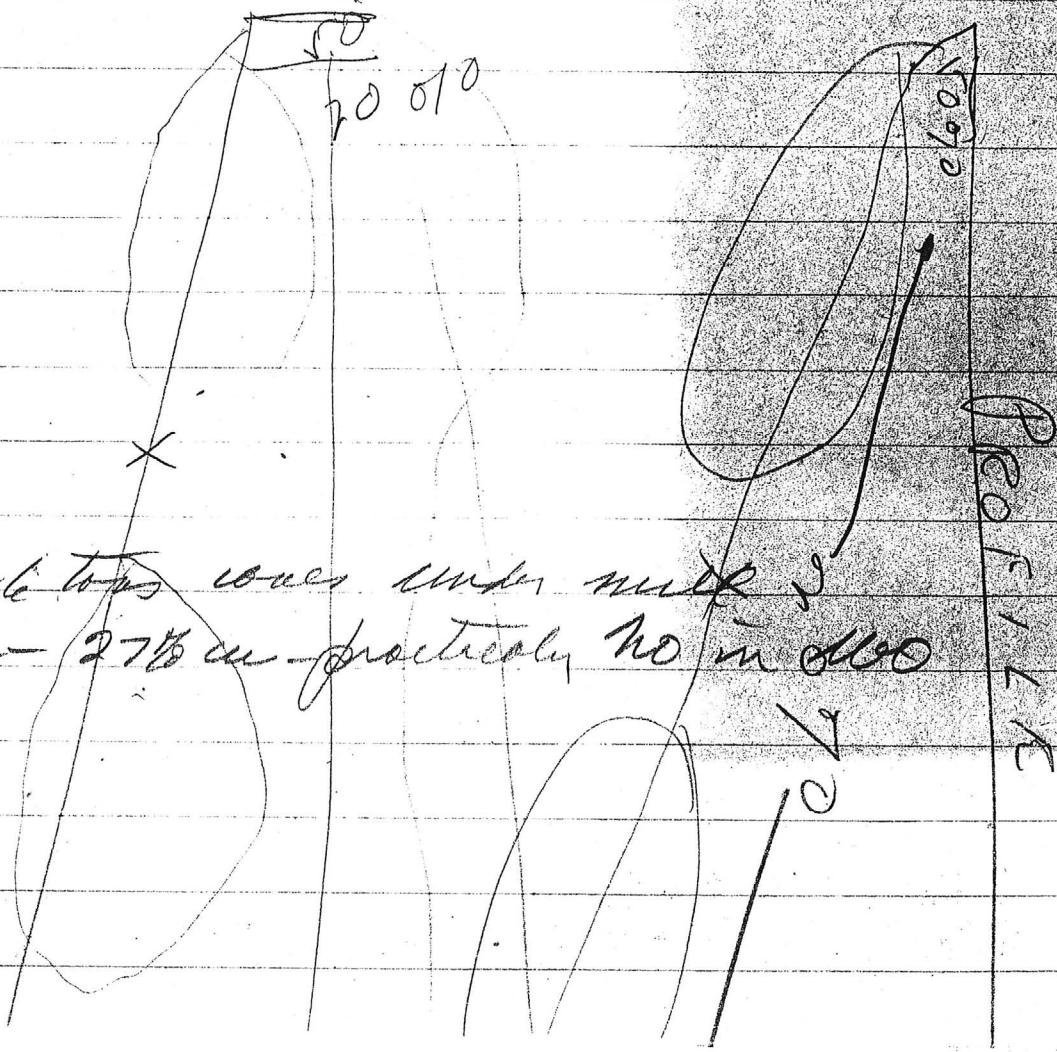
shaved run -

3.00 cu - 100 - 4% Cu

quite abit silver -

Waste pile 3 1/2 mm ton - 1% Au -

20 or - more \$000



506 tons over under mill  
run - 27% Cu - practically no in 1000

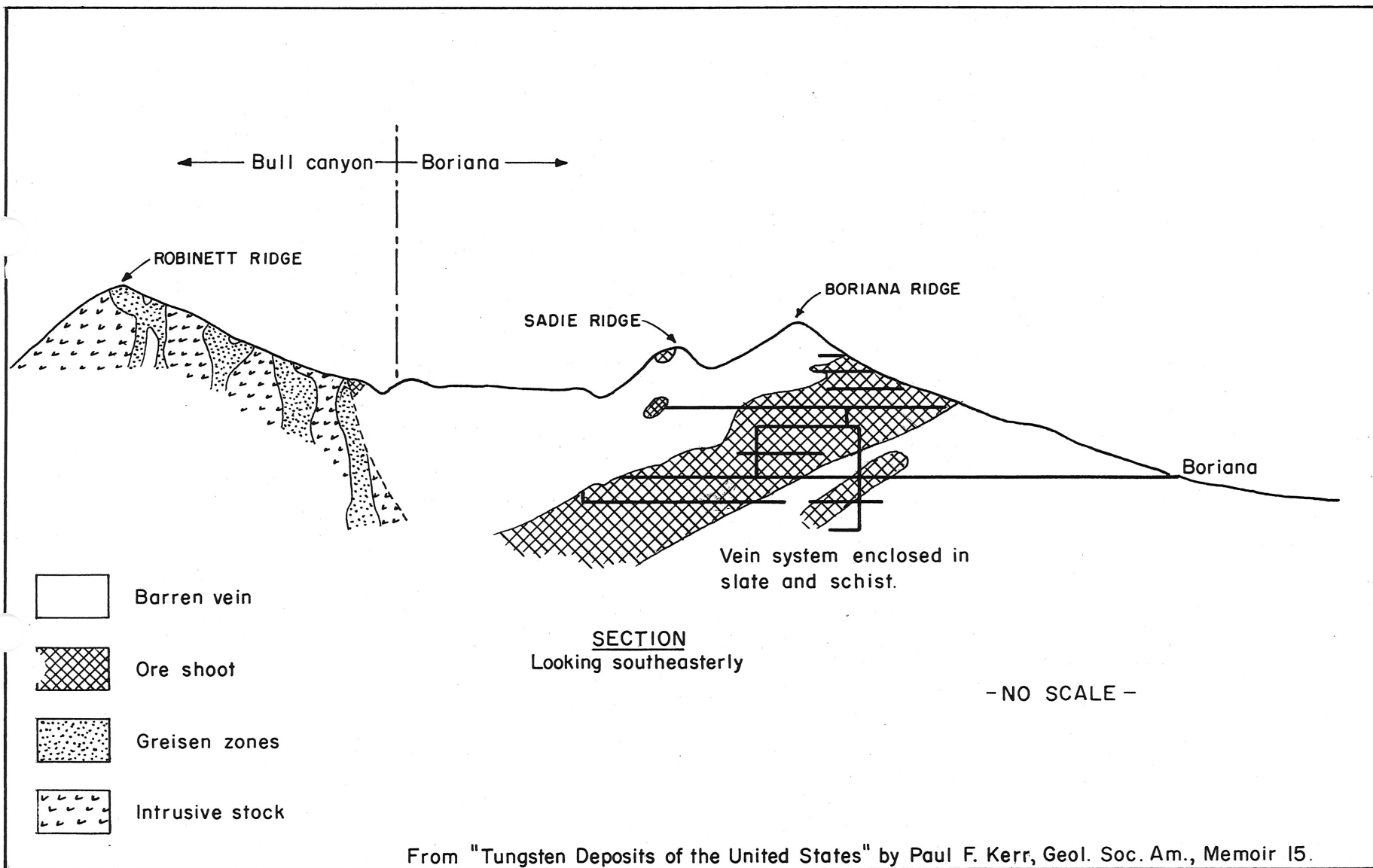


Figure 37-Ore shoot at Boriana, Ariz.

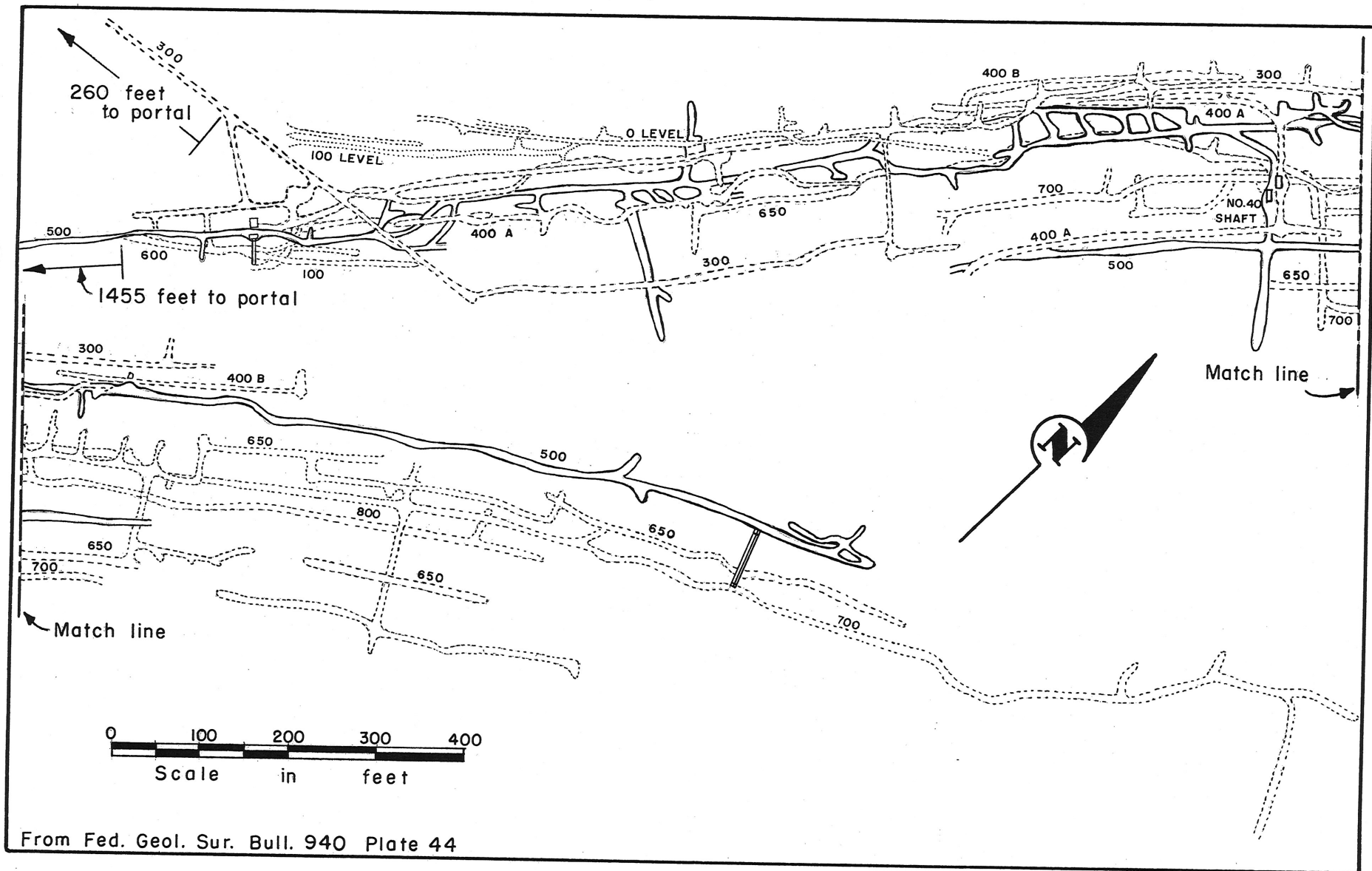


Figure 32. - Plan of underground workings of Boriana mine

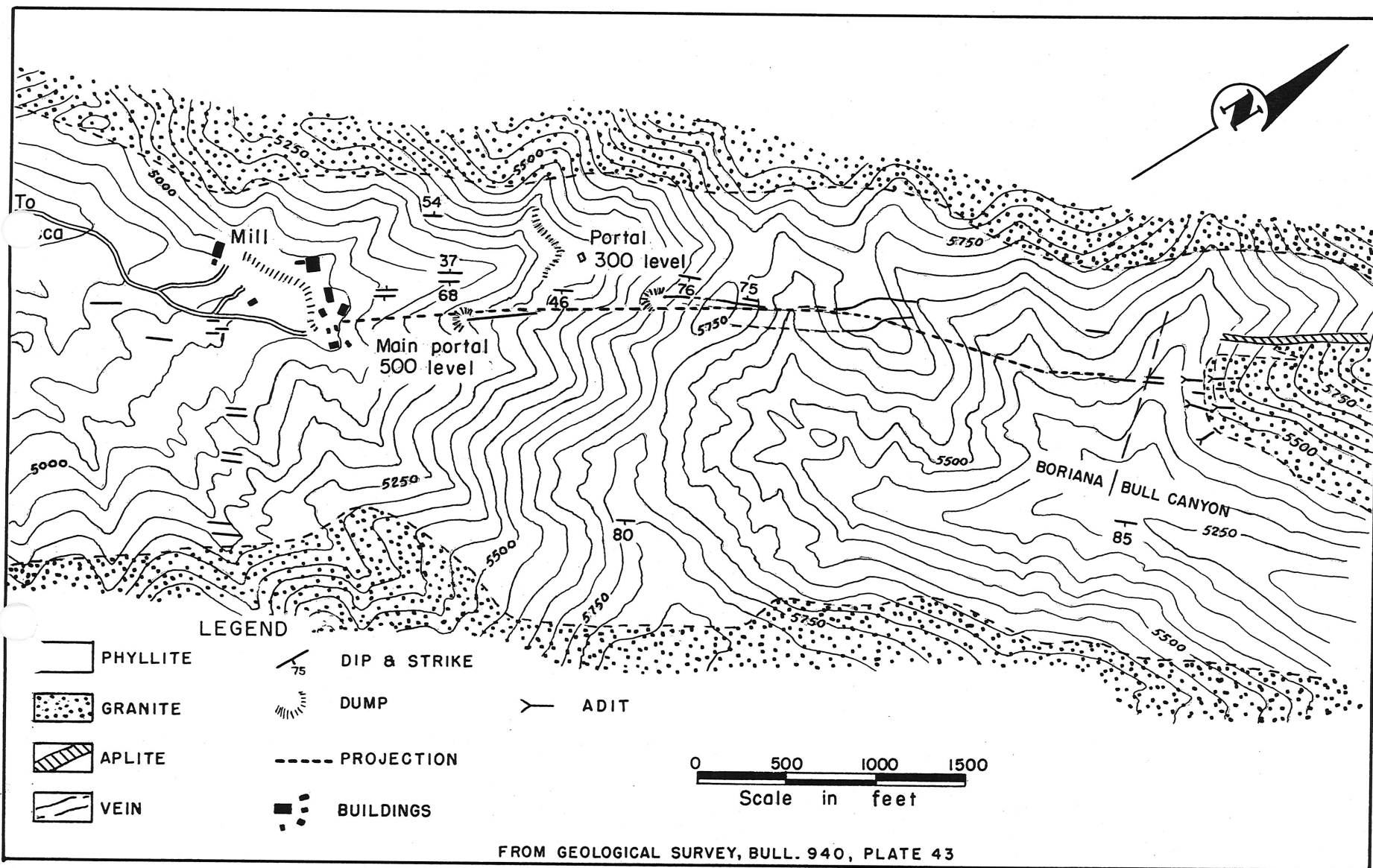


Figure 36.-Topographic and geologic map of Borigana mine, Mohave County, Ariz.

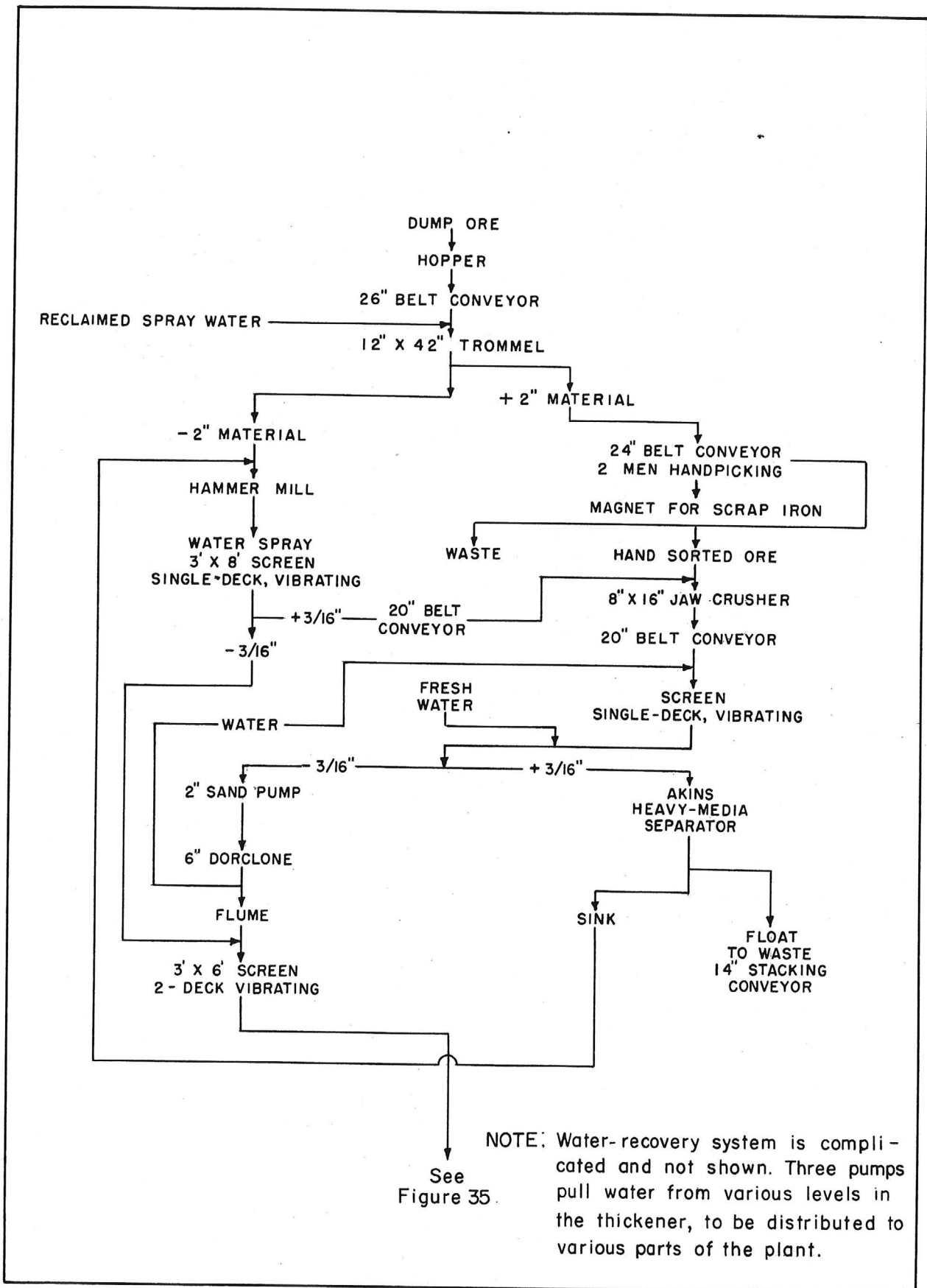


Figure 34-Flowsheet, - Boriana mill.

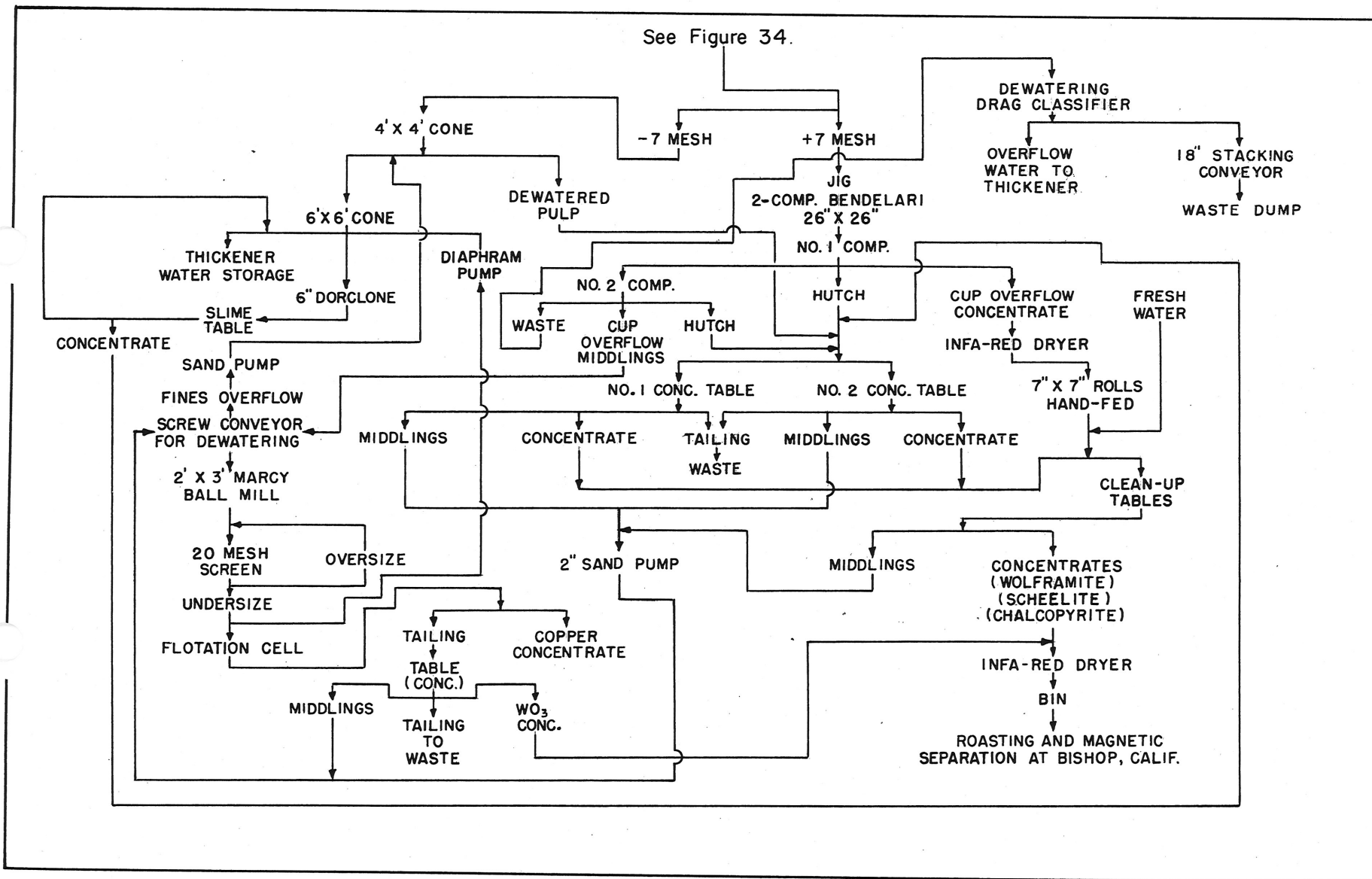


Figure 35.-Flowsheet, - Boriana mill.



# MILL FLOW SHEET BORIANA MILL

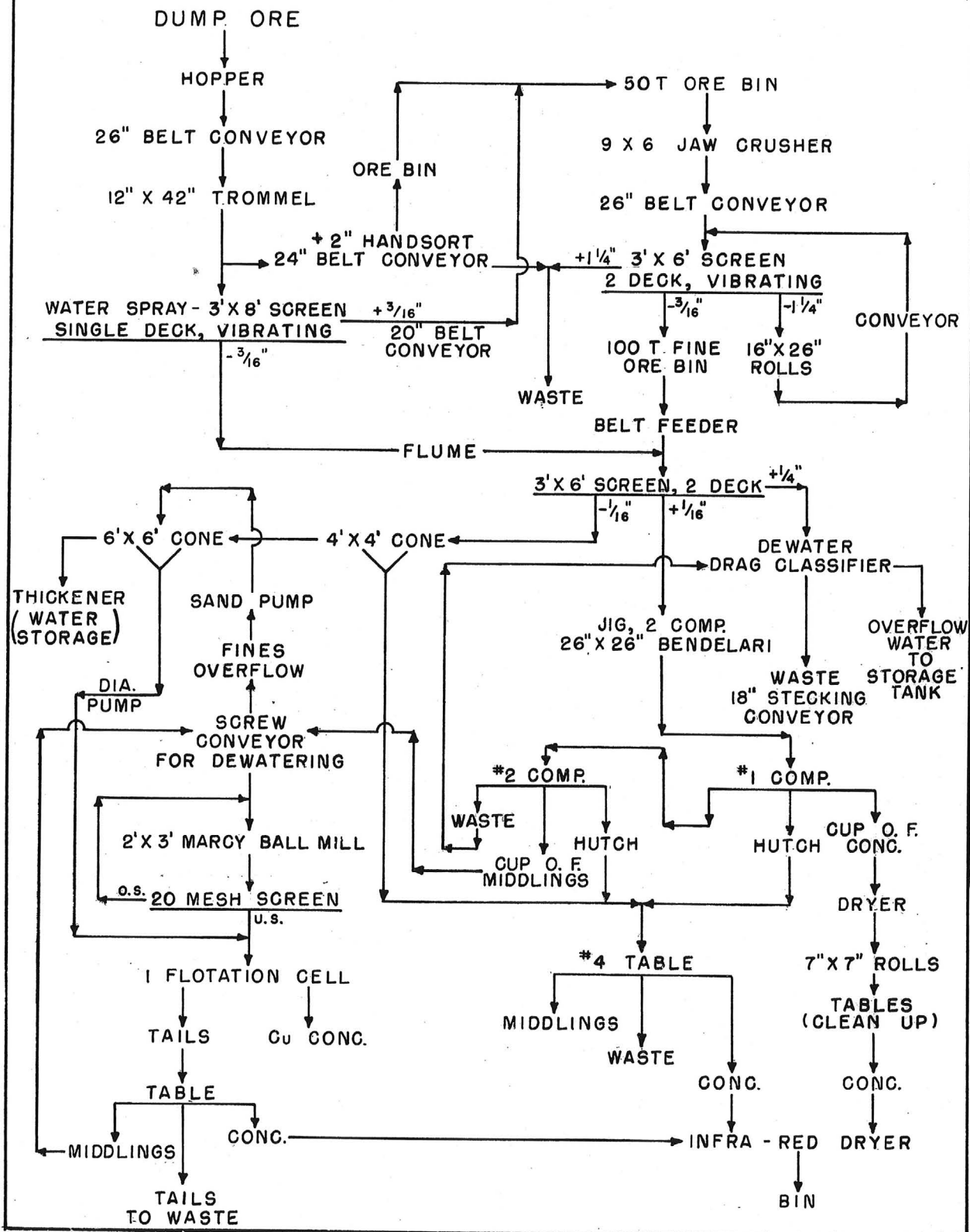


Figure Flowsheet of the Dye and Bathrick mill of Boriana mine  
Mohave County, Arizona

\*

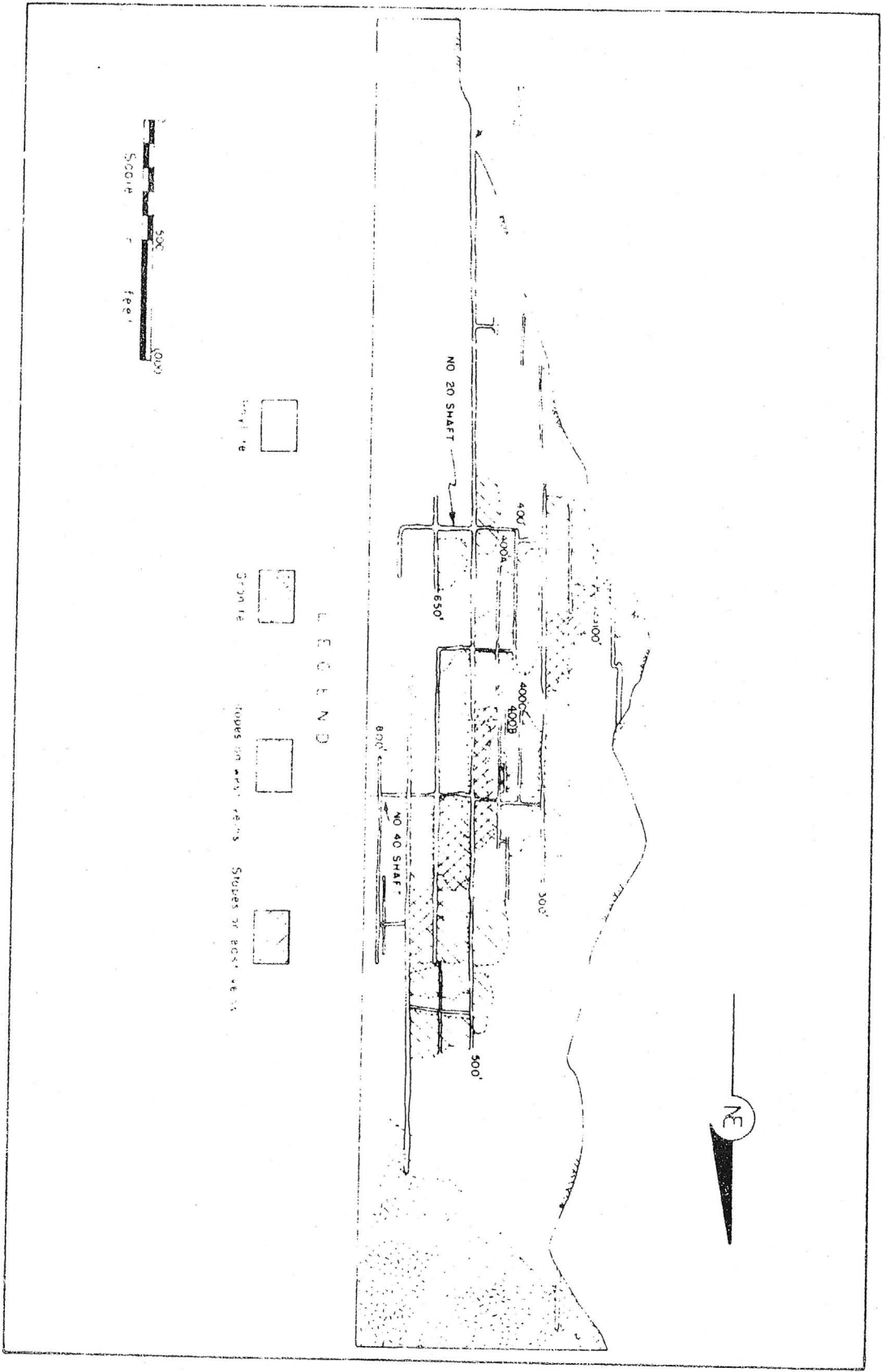


FIGURE 33. - Longitudinal Projection of Boriana Mine Workings.

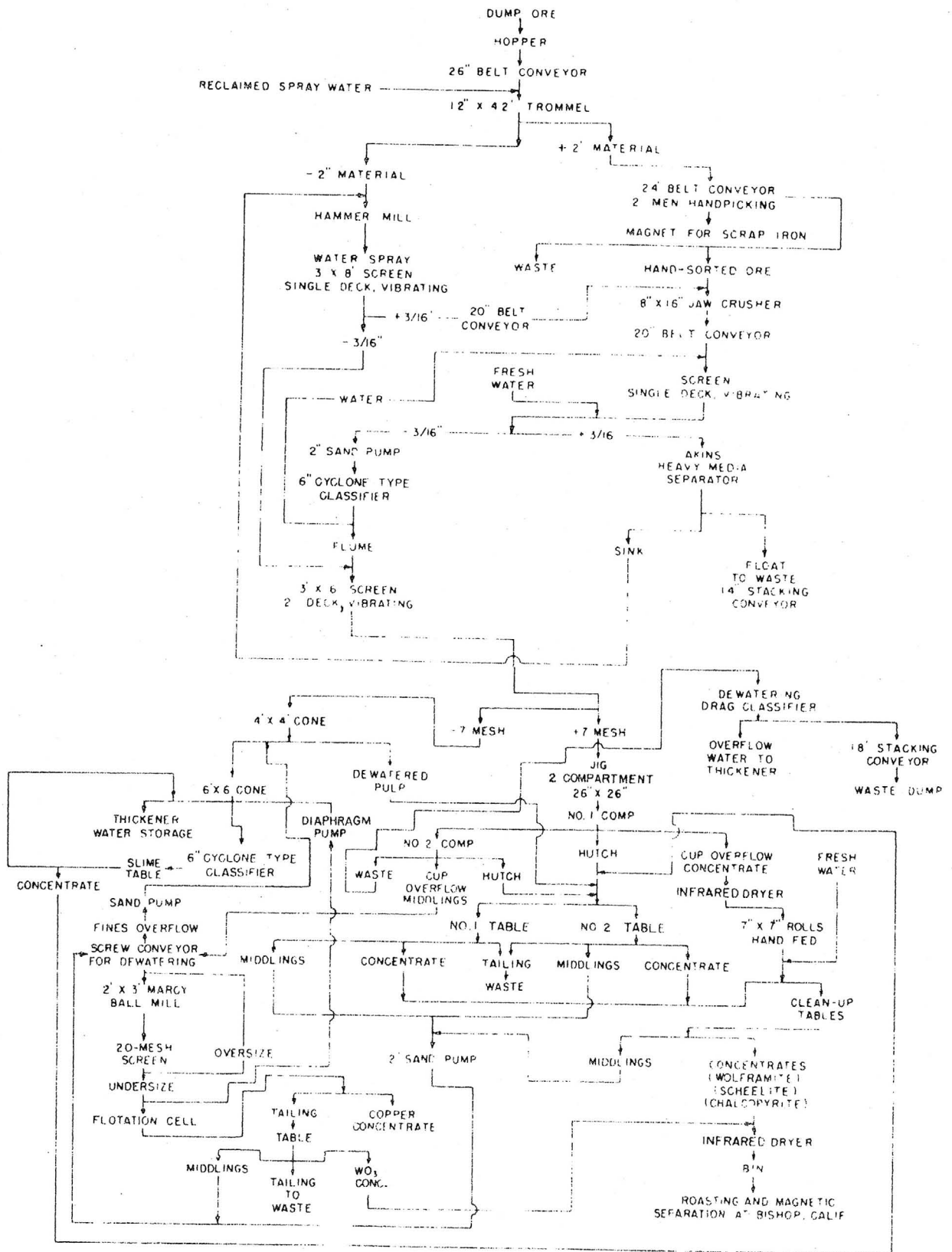


FIGURE 34. - Flowsheet, Boriana Mill.

\*

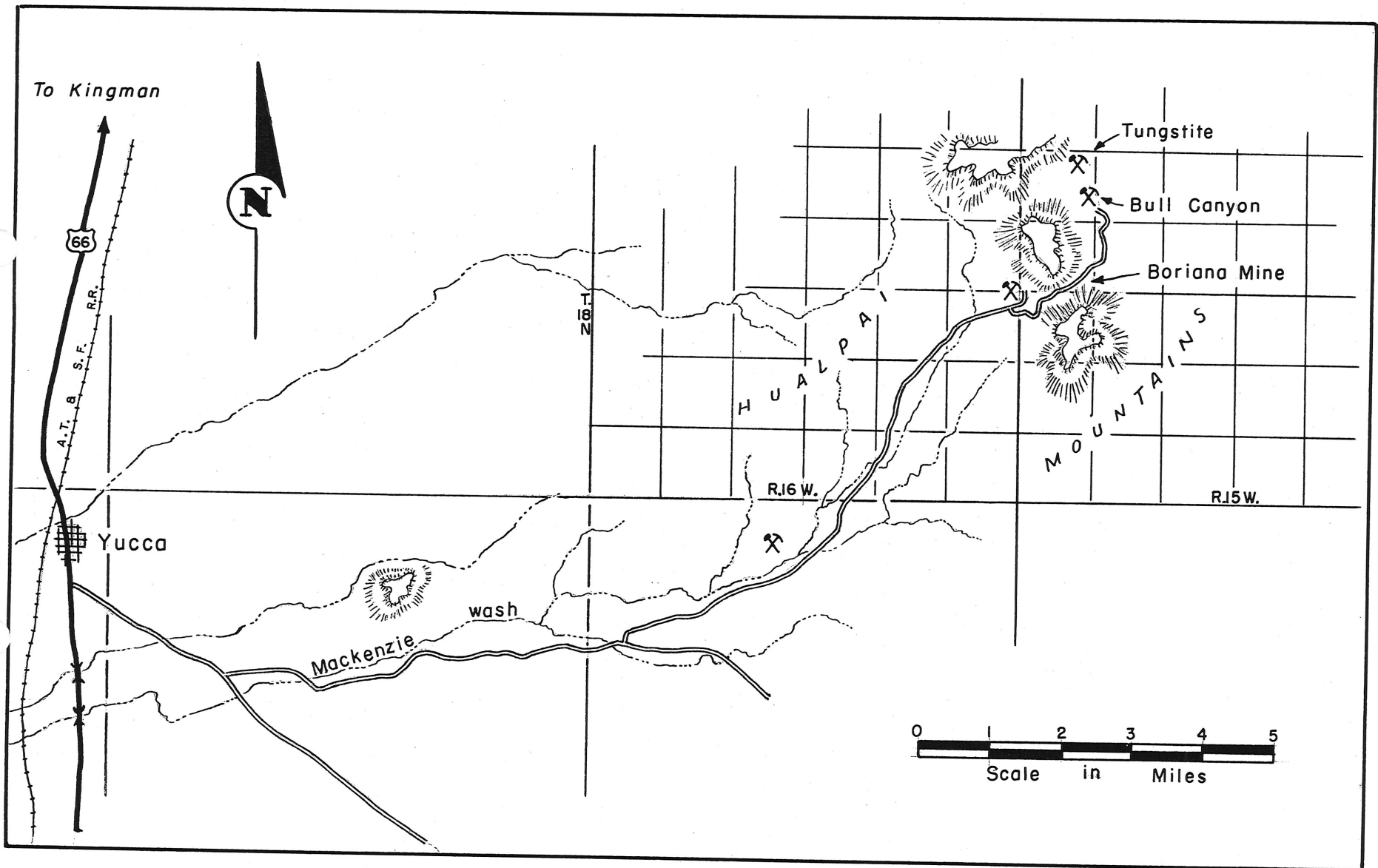


Figure Tungsten deposits in Borianna mine area, Mohave County, Arizona

DEPARTMENT OF MINERAL RESOURCES  
STATE OF ARIZONA  
FIELD ENGINEERS REPORT

Mine Boriana

Date August 30, 1953

District 18 miles East of Yucca

Engineer Geo. F. Reed

Subject: News Item

Dye & Bathrick of Kingman, owners of the Boriana Mine & Dumps, suffered considerable damage to their equipment from a recent cloud-burst.

They have been milling about 40 tons per day of dump material and hauling concentrates to Bishop for cleaning and sale. They have a crew of about 8 men and have been working on an expansion program to allow screening and milling of about 150 tons of crude dump ore per day.

Leasers Dan Harper and A.D. Allen have been reopening the mine on the 100, 300 and 500 levels. They have cleaned up and mucked out over 2000 feet of tunnels and have milled some ore in the Dye & Bathrick Mill. Concentrates are trucked to Bishop for marketing. About ten men are working on the lease.

Over the mountain in Bull Canyon on the extension of the Boriana Veins, Dalton Robinette and two leasers have been mining and jigging scheelite and wolframite from the quartz veins. Concentrates are sold through Dye & Bathrick.

*George F. Reed*

\*

DEPARTMENT OF MINERAL RESOURCES  
STATE OF ARIZONA  
FIELD ENGINEERS REPORT

Mine Boriana ✓ Date March 25, 1957  
District Cedar Valley Engineer Mark Gemmill  
Subject: Present Activity

The principal activity at the property for some time has been the milling of old mines dumps by the owners Dye & Bathrick. Mr Dye stated about a month ago that they had less than a year operation of dump material left. Although the GSA has not been buying Tungsten for several months, they have continued operation, storing the concentrates, hoping that money would be appropriated to complete the program.

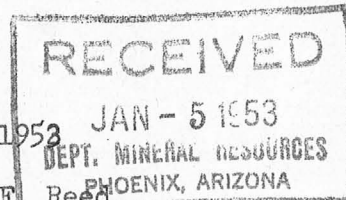
It is quite likely that they shut soon and have already as the chances of restoration of the buying program seem to be diminishing.

There is no activity in the mine.

THE ARIZONA DEPARTMENT OF MINERAL RESOURCES  
MAKES NO REPRESENTATION AS TO THE ACCURACY  
OR COMPLETENESS OF THESE DOCUMENTS.

\*

DEPARTMENT OF MINERAL RESOURCES  
STATE OF ARIZONA  
FIELD ENGINEERS REPORT



Mine Boriana Tungsten  
District Cedar Valley, 18 miles by road  
East of Yucca, Ariz.  
Subject:

Date January 2, 1953  
Engineer Geo. F. Reed

Notes on Marketing of Concentrates and Amt. of Possible Production.

Most of the following was obtained from a conference with Ray Dye and Jack Bathrick who own the Boriana Property. They are running the mill on ore from the (estimated) 150,000 ton dump. Their work to date has been of a pilot and sampling nature. They have leased the mine to Dan Harper, former superintendent of the mine, who with Mr. A. D. Allen, is re-opening the mine with the intention of having Dye & Bathrick mill their ore, also.

The present mill being operated by Dye & Bathrick on dump ore consists of an 8 by 15 jaw crusher, screen, rolls, in closed circuit for crushing, product to fine ore-bin. Fine ore, thru 3/16 inch, goes to Bendalari Jig from which some finished concentrate is obtained on top of the screen. Fines from the hutch go to tables. Coarse tailing goes to a dewatering screen. Table middlings, fines from dewatering and jig middlings go to a re-grind ball mill and then to flotation. Copper concentrate is obtained from flotation (4-#15 Denver Cells) and flotation tails go to a table. Some finished concentrate is obtained from each table and some middling is returned to flotation. Mill capacity is estimated at 2 to 3 tons per hour.

Dye & Bathrick expect to get into steady production by summer of 1953 and hope to produce at the rate of 15 tons per month of 40% WO<sub>3</sub> concentrate ~~per month~~ or more. Their production lately has been only a ton or so per month of average 45% WO<sub>3</sub>. This from testing dump and running 100% through the mill. They expect to screen out plus 2 inch material (with sorting of oversize) or sink float. In either case, mill heads will be raised and production will of coarse increase. Additional water necessary will be obtained from the mine due to operations of Harper & Allen. When and if Harper & Allen begin to produce from the mine, mill heads will increase and production of more WO<sub>3</sub> will presumably result.

Estimated recovery of WO<sub>3</sub> from the 150,000 tons of dump is about 20,000 units. This is based on recovery of slightly less than 3# of WO<sub>3</sub> per ton of dump. The owners estimate a potential production from the mine of another forty to fifty thousand units from ore in place and stope gobs. These figures are obtained from mine maps, gov't reports, etc. Most of the ore in the mine is in-accessable due to caving and flooding at this time. Harper & Allen are repairing in the mine with a small crew and hope to be in production in a small way in the next few months.

Notes on marketing, grade of concentrates, and specifications:

With their present mill setup the concentrates can be made to average above 40% WO<sub>3</sub> and about 5% copper without any trouble. The Tungsten is about evenly divided between Scheelite and Wolframite. Copper is in Chalcopyrite. The present procedure is to haul this in ton lots in their pickup truck about 420 miles to Bishop, Calif. There it is cleaned at the cleaning plant of Benware Corp., and the cleaned and separate Scheelite and Wolframite concentrates are sold to Wah Chang Co. at Bishop. The round trip including a man's time (three days) and truck cost puts a charge of about \$100. against



DEPARTMENT OF MINERAL RESOURCES  
STATE OF ARIZONA  
FIELD ENGINEERS REPORT

Mine Boriانا Tungsten

Date January 2, 1953

District

Engineer

Subject:

Page 2



the ton of concentrate. Charges for cleaning the concentrate amount to about \$100.00, also. In other words, the marketing cost is about \$200.00 per ton or say \$5.00 per unit of contained WO<sub>3</sub>.

The resulting products are a scheelite concentrate and a wolframite concentrate that average possibly 58% WO<sub>3</sub> and sometimes 2-300 pounds of reject that may run 10 to 30% WO<sub>3</sub> due to slagging during the roasting process. The Wah Chang buyer at Bishop pays maximum of \$60.00 per unit on the cleaned products above and price goes down a dollar for each percent under 60%, i.e. for 58%, price is \$58.00 per unit. No penalties are charged on the above and no assay charge. Dye states that the cleaning plant is not busy like it was some time ago.

Sampling & Buying Depot:

If the government could ascertain that it was practical to upgrade lots of concentrate assaying 30 to 40% WO<sub>3</sub>, it is believed that the capital outlay needed at Wenden would be very small.

Wah Chang at Bishop opens each sack and takes two samples from it with a sampler made of  $\frac{1}{2}$  inch pipe. The pipe is capped at the bottom with a blunt point and slotted on the sides. While being forced into the sack, the pipe is filled with a  $\frac{1}{2}$  inch rod. Then the rod is pulled out and the pipe is filled with concentrate through the slots. The samples from all sacks are reduced in a regular assay splitter. Weights are determined on a truck scale.

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Payment for Concentrate:

Wah Chang at Bishop estimates the grade of the concentrate and pays for 80% of the estimated value at once. The balance of the payment is made after assaying and umpiring, if necessary.

Conclusion:

Boriانا will produce more Tungsten, with or without the help of a buying depot, but any help along that line that will result in more net money for mining and milling and especially lower requirements on grade and specifications, will result in faster production and greater over-all production. The mine is now being laboriously re-opened. With a liberal program on prices of concentrate, the wasteful process of shutting down with attendant caving and flooding could be minimized.

George F. Reed

DEPARTMENT OF MINERAL RESOURCES  
State of Arizona  
Field Engineers Report

Mine - Borianna Tungsten

Date - January 2, 1953

District - Cedar Valley, 18 miles by road  
East of Yucca, Ariz.

Engineer - Geo. F. Reed

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The resulting products are a scheelite concentrate and a wolframite concentrate that average possibly 58% WO<sub>3</sub> and sometimes 2-300 pounds of reject that may run 10 to 30% WO<sub>3</sub> due to slagging during the roasting process. The Wah Chang buyer at Bishop pays maximum of \$60.00 per unit on the cleaned products above and price goes down a dollar for each percent under 60%, ie for 58%, price is \$58.00 per unit. No penalties are charged on the above and no assay charge. Dye states that the cleaning plant is not busy like it was some time ago.

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George F. Reed



DEPARTMENT OF MINERAL RESOURCES  
State of Arizona  
Field Engineers Report

Mine - Boriana Tungsten

Date - January 2, 1953

District - Cedar Valley, 18 miles by road  
East of Yucca, Ariz.

Engineer - Geo. F. Reed

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State of Arizona  
Field Engineers Report

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George F. Reed



Boriana Mine (file)

Mojave County 3/1916

At Copperville, via Yucca, about 28 miles east in the Cedar mining district, great attention is being paid to the Molybdenum deposits and developments are proving highly satisfactory. The mineralized area is about one mile wide and three miles long and over this area many locations have been made and the properties are in vary stages of development. The Francis group comprises six claims and is owned by Shaw and Miller, who have recently bonded them to Fort & Hamme.

The Franklin group of three claims have also been bonded to the same parties, as well as four claims of the Carpenter.

COPY

DEPARTMENT OF MINERAL SOURCES

News Items

Date October 31, 1952.

Mine Boriana

Location 18 mi. E of Yucca by road

Twp. 18N, Range 15 & 16 W.  
Owner Ray Dye & Jack Bathrick

Address P. O. Box 1069  
Kingman, Arizona

Operating Co. Dye & Bathrick own the pro-  
perty and are operating the mill on  
Address dump ore. They have leased the mine  
to Dan K. Harper & A. D. Allen, Gen'l  
Deliv., Kingman. Harper was once Supt.  
Pres. at Boriana, is well known in Ariz.  
Genl. Mgr. Allen is from Alabama.

Mine Supt. Dan Harper

Mill Supt.

Principal Metals Tungsten & Copper

Mill -- five  
Men Employed Mine -- four, more added soon.

Production Rate Milling 30-40 tons of dump per  
day, mine must be re-opened.

Mill, Type & Capacity Jaw crusher & rolls,  
screens, followed by jig, tables, & regrind &  
flotation of copper from middlings, re-  
tabling of flotation tails.  
Power, Amt. & Type

Boulder Dam Power.

Signed GEORGE F. REED

(Over)

THE ARIZONA DEPARTMENT OF MINERAL RESOURCES  
MAKES NO REPRESENTATION AS TO THE ACCURACY  
OF THE CONTENTS OF THESE DOCUMENTS.

\*

DEPARTMENT OF MINERAL RESOURCES  
STATE OF ARIZONA  
FIELD ENGINEERS REPORT

Mine <sup>✓</sup>Boriana: <sup>✓</sup>Copper World: <sup>✓</sup>Antler Date Oct 9th 1948  
District Engineer A. C. Nebeker  
Subject: Operations

These properties were visited on Oct 9.

At the Boriana, the Omega Metals Co was just finishing rebuilding the mill and expected to be milling within ten days. Before starting on the Boriana dump they were going to mill some ore from the Tungstenite mine for Mr Waughtel. 5 men working

The <sup>✓</sup>Copper World was driving a tunnel in to cut new ore found by drilling and were in 750 feet 5 men working

The <sup>✓</sup>Antler was still on the development stage but not shipping

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OF THE CONTENT OF THESE DOCUMENTS.

\*

209 De

Phoenix, Arizona,

CHAS. A. DIEHL

July 22, 1946.

*Barren  
Tailings Dump*

# ARIZONA ASSAY OFFICE

Mail: P. O. Box 1148

815 North First Street

Phone 3-4001

CERTIFIES That samples submitted for assay by Dept. of Mineral Resources contain as follows per ton of 2000 lbs. Avoir.

MARKS	SILVER		VALUE (OZ.)	GOLD		VALUE (OZ.)	TOTAL VALUE Of Gold & Silver	% PERCENTAGE		REMARKS
	Ounces	Tenths		Ounces	Hndths			COPPER	W <sub>03</sub>	
			717			\$35.00				
concentrates of dump.	1.3		\$.92	.01		\$.35		2.86	.55	
Big dump sidewall	Trace			Trace				.31	.17	
Big dump S. wall	.2			Trace				.36	.21	
e 1-small dump. lower end.	Trace			Trace				.36	.17	
e 2-small dump "-upper end	.3			.01		\$.35		.36	.20	
e 3-17' center dump	Trace			Trace				.31	.16	

is \$ 30.00

Assayer ARIZONA ASSAY OFFICE

*Chas. A. Diehl*

209 De

Phoenix, Arizona,

July 22, 1946.

*Bucaria Salvage Dump*

CHAS. A. DIEHL

# ARIZONA ASSAY OFFICE

Mail: P. O. Box 1148

815 North First Street

Phone 3-4001

CERTIFIES That samples submitted for assay by Dept. of Mineral Resources contain as follows per ton of 2000 lbs. Avair.

MARKS	SILVER		VALUE (OZ.) <i>712</i>	GOLD		VALUE (OZ.) <i>33.00</i>	TOTAL VALUE Of Gold & Silver	PERCENTAGE		REMARKS
	Ounces	Tenths		Ounces	Hndths			COPPER	W <sub>03</sub>	
concentrates of dump.	1.3		\$ .92	.01		\$ .35		2.86	.55	
Big dump sidewall	Trace			Trace				.31	.17	
Big dump S. wall	.2			Trace				.36	.21	
e 1-small dump. lower end.	Trace			Trace				.36	.17	
e 2-small dump "-upper end	.3			.01		\$ .35		.36	.20	
e 3-17' center dump	Trace			Trace				.31	.16	

THE ARIZONA DEPARTMENT OF MINERAL RESOURCES  
 MAKES NO REPRESENTATION AS TO THE ACCURACY  
 OF THE CONTENTS OF THESE DOCUMENTS.

s \$ 30.00

Assayer ARIZONA ASSAY OFFICE





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OF THE CONTENTS OF THESE DOCUMENTS.

↓ Bouzina -

Tailor

200 to 300 m total

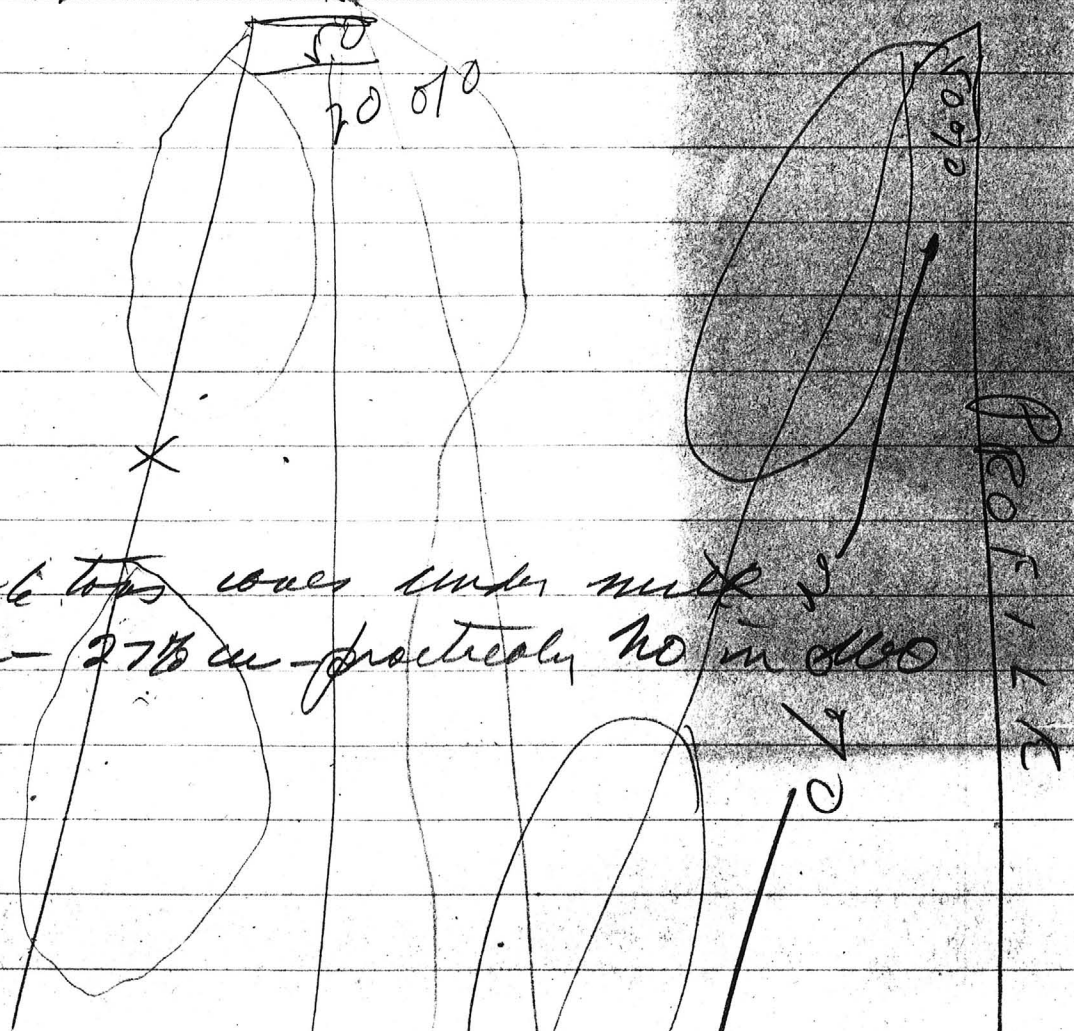
shaved run -

3.00 au - 100 - 4% Cu

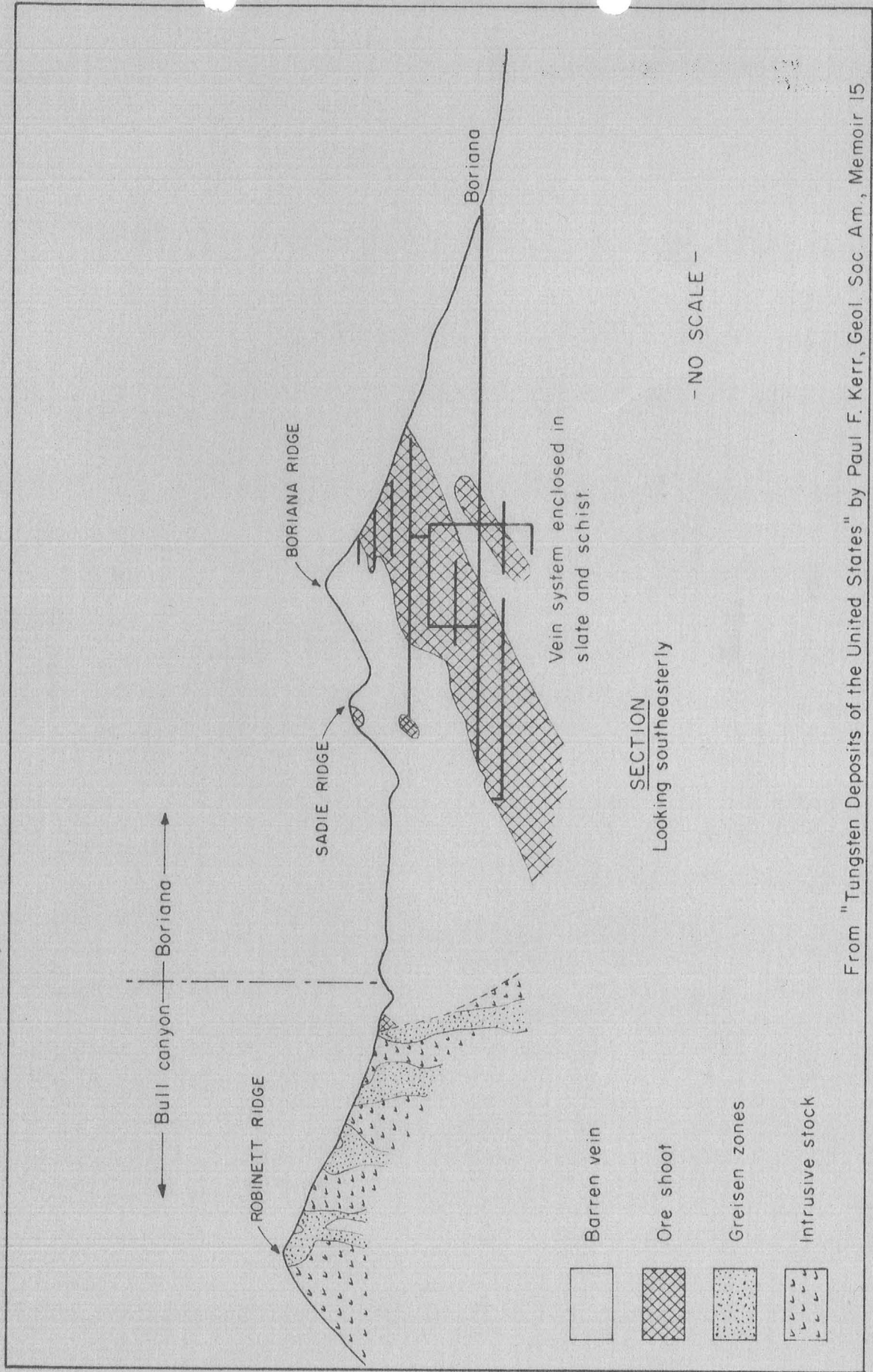
quite obt sites -

Waste pile 3 1/2 MM tons - 1% WO -

20 m - mesh 5000



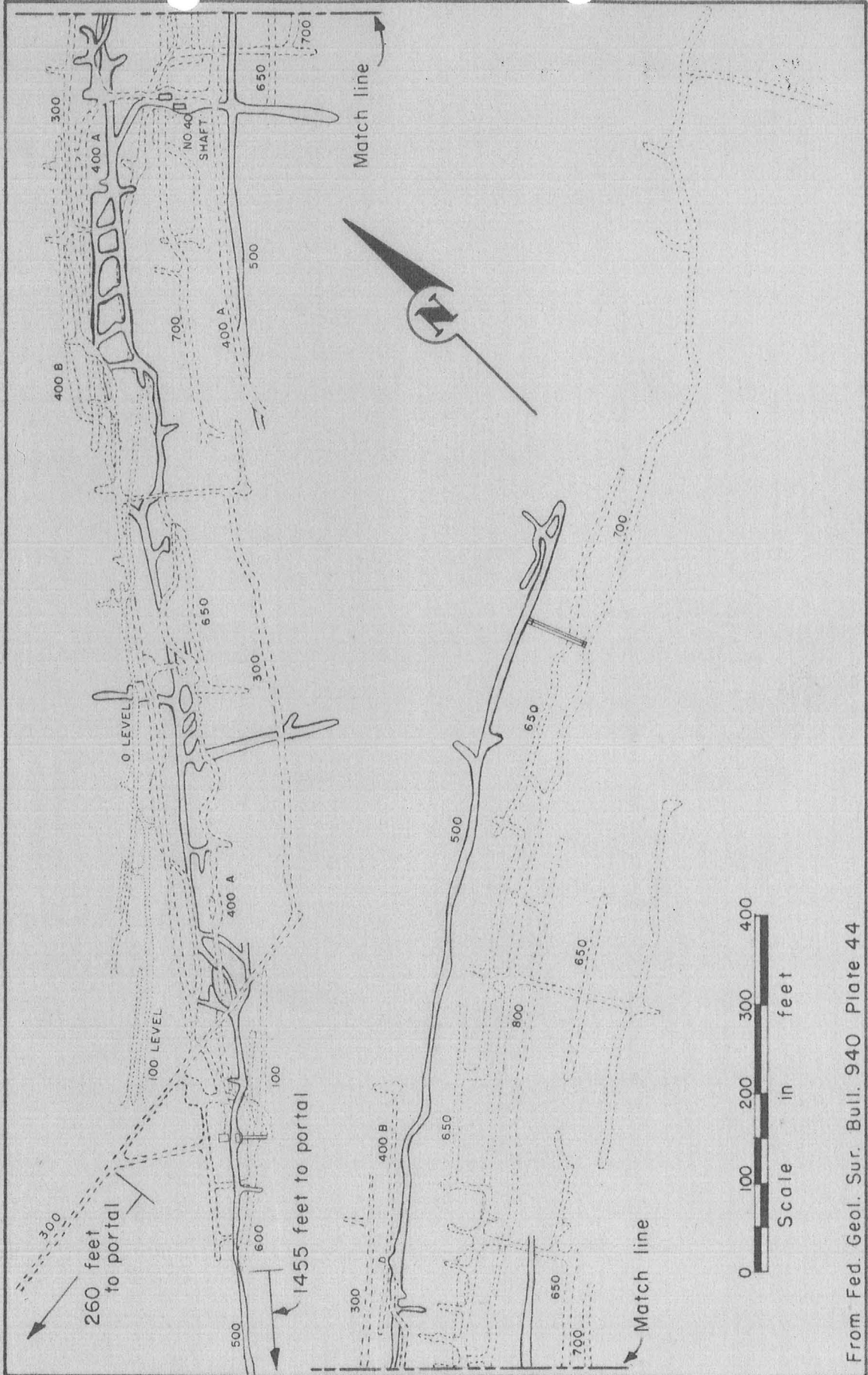
506 tons cones under mill  
run - 27% au - practically no in WO



From "Tungsten Deposits of the United States" by Paul F. Kerr, Geol. Soc. Am., Memoir 15

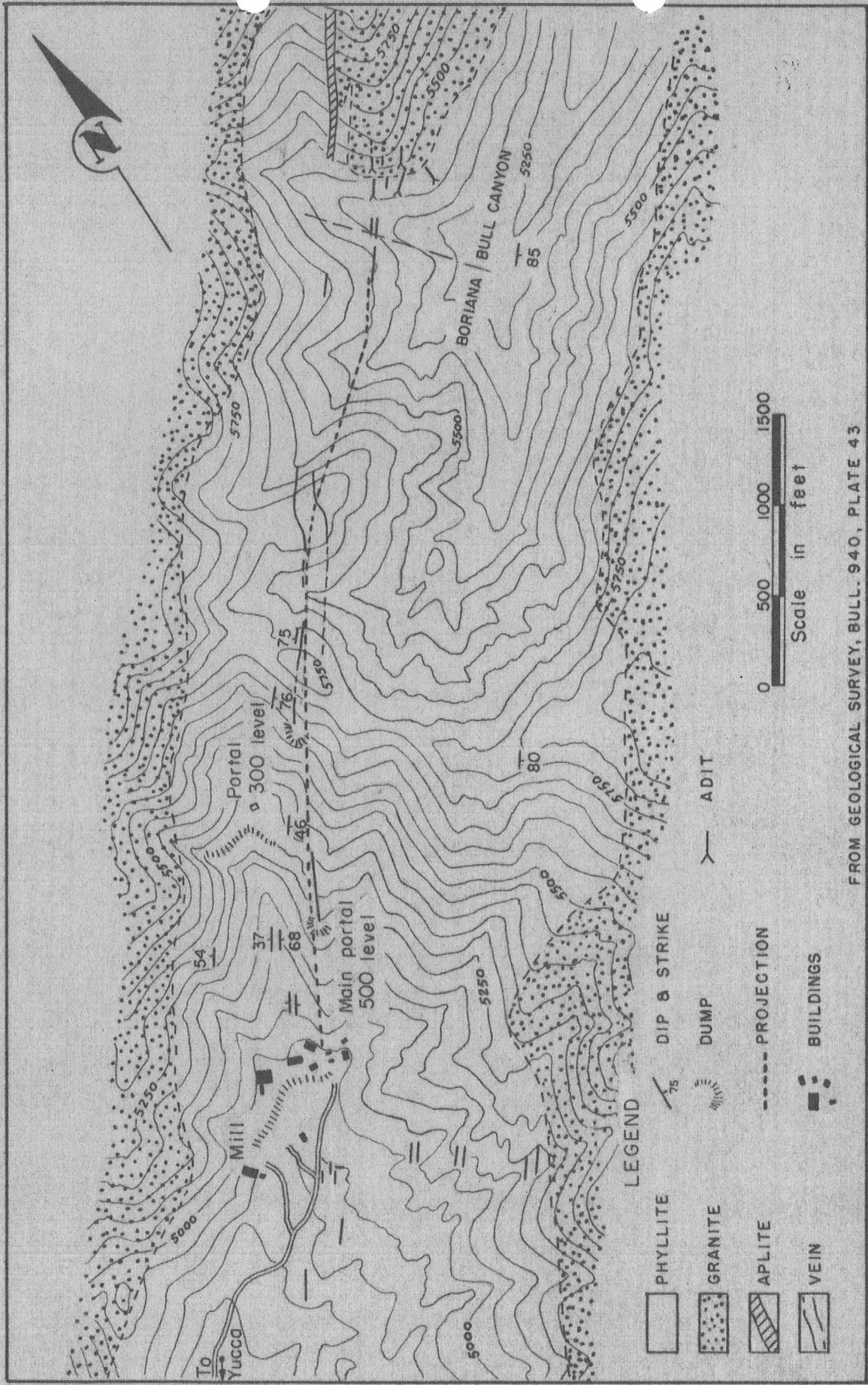
Figure 37-Ore shoot at Boriana, Ariz.





From Fed. Geol. Sur. Bull. 940 Plate 44

Figure 32. - Plan of underground workings of Boriana mine



FROM GEOLOGICAL SURVEY, BULL. 940, PLATE 43

Figure 36.-Topographic and geologic map of Boriana mine, Mohave County, Ariz.



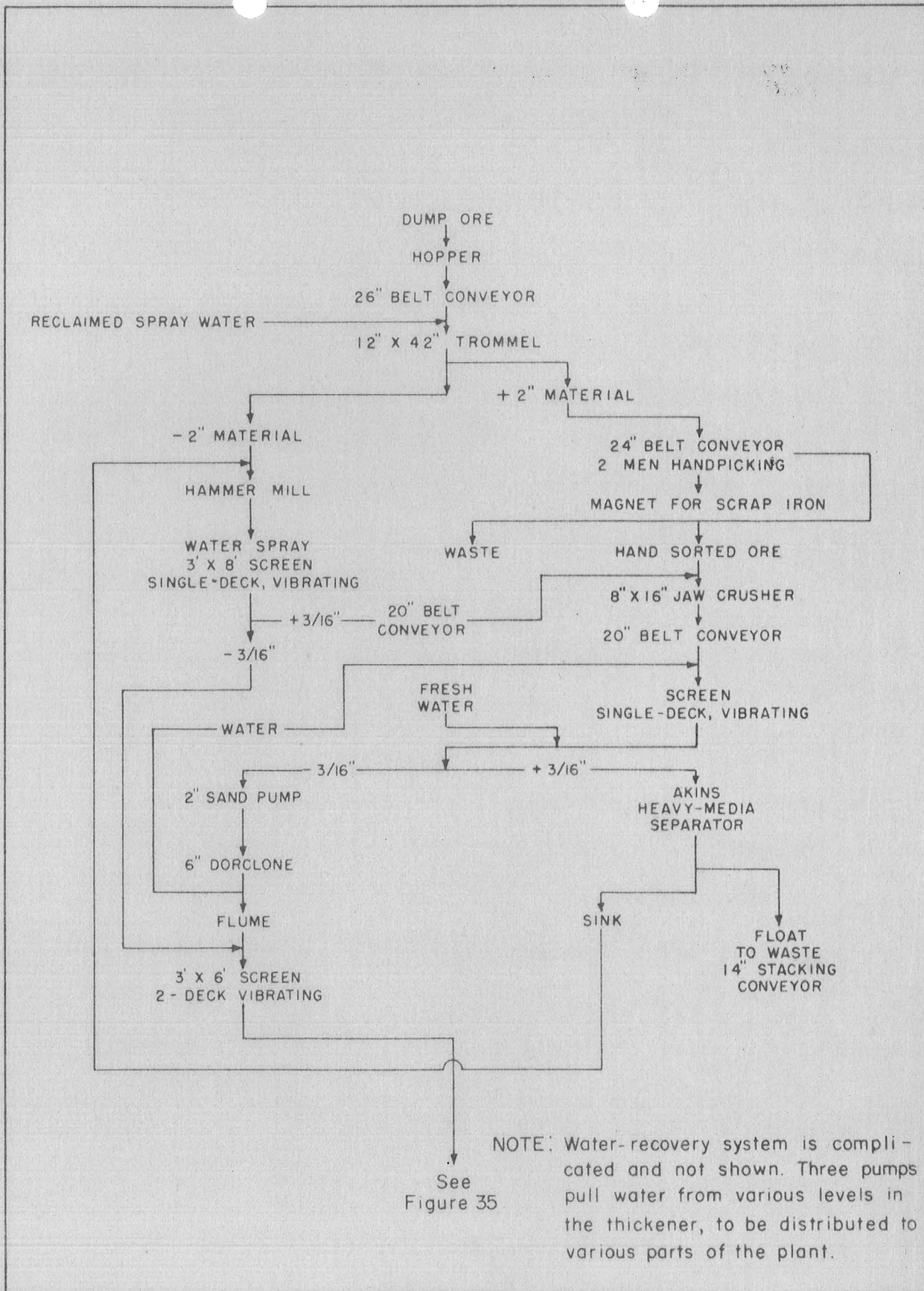


Figure 34-Flowsheet, - Boriana mill.

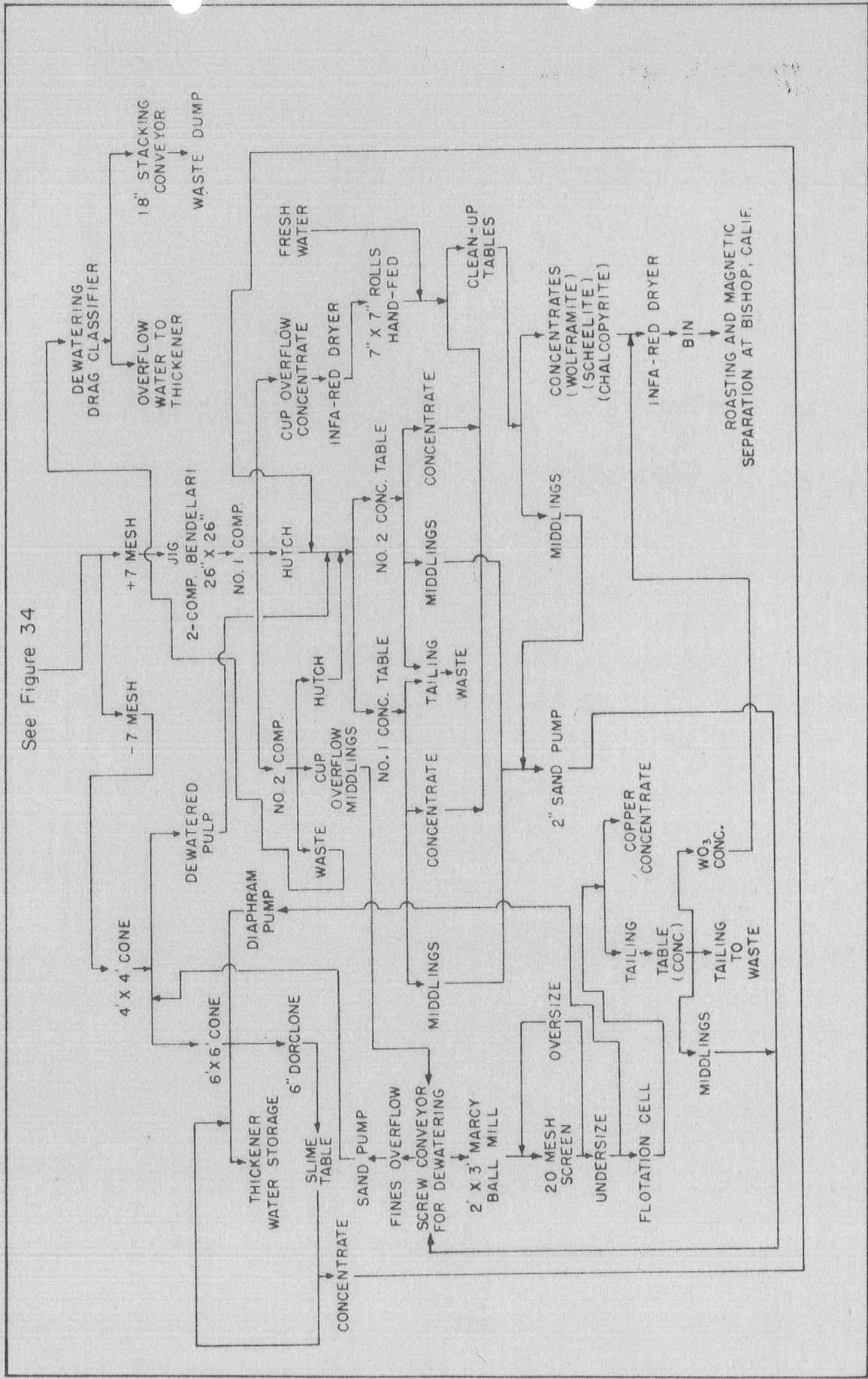
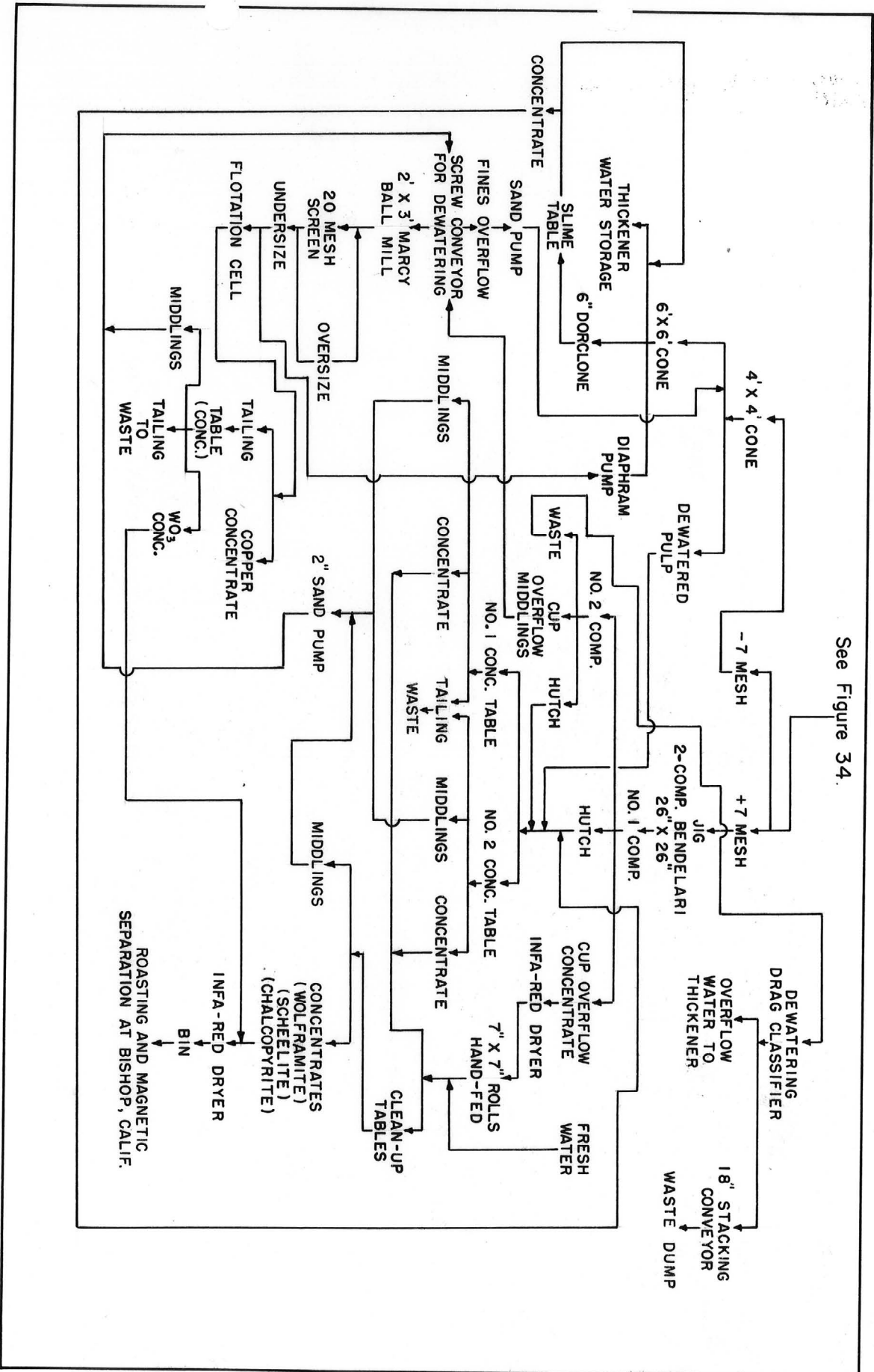


Figure 35.-Flowsheet, - Boriana mill.



See Figure 34.

Figure 35 - Flowsheet, - Boriana mill.

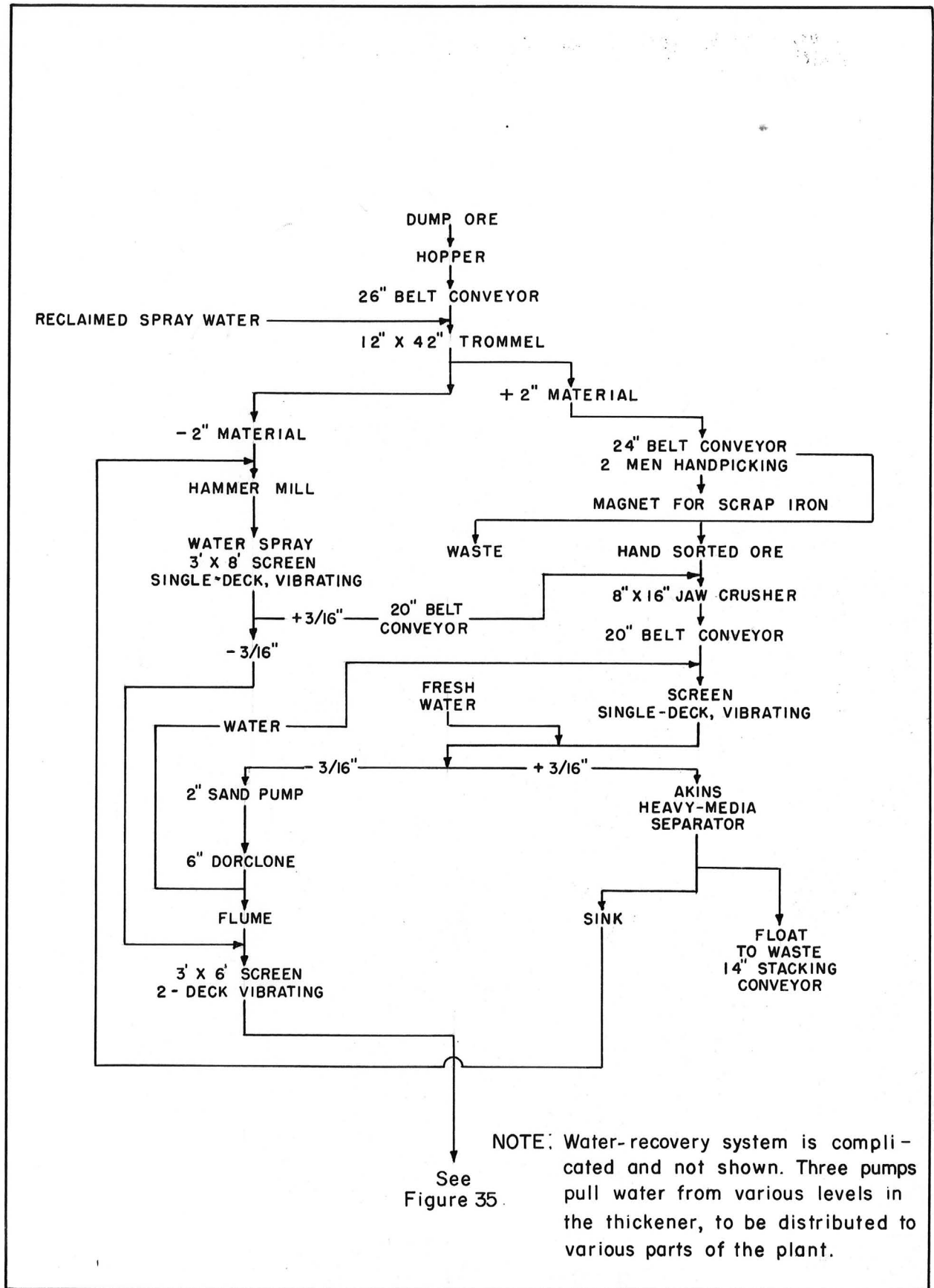


Figure 34.-Flowsheet, - Boriana mill.



# MILL FLOW SHEET BORIANA MILL

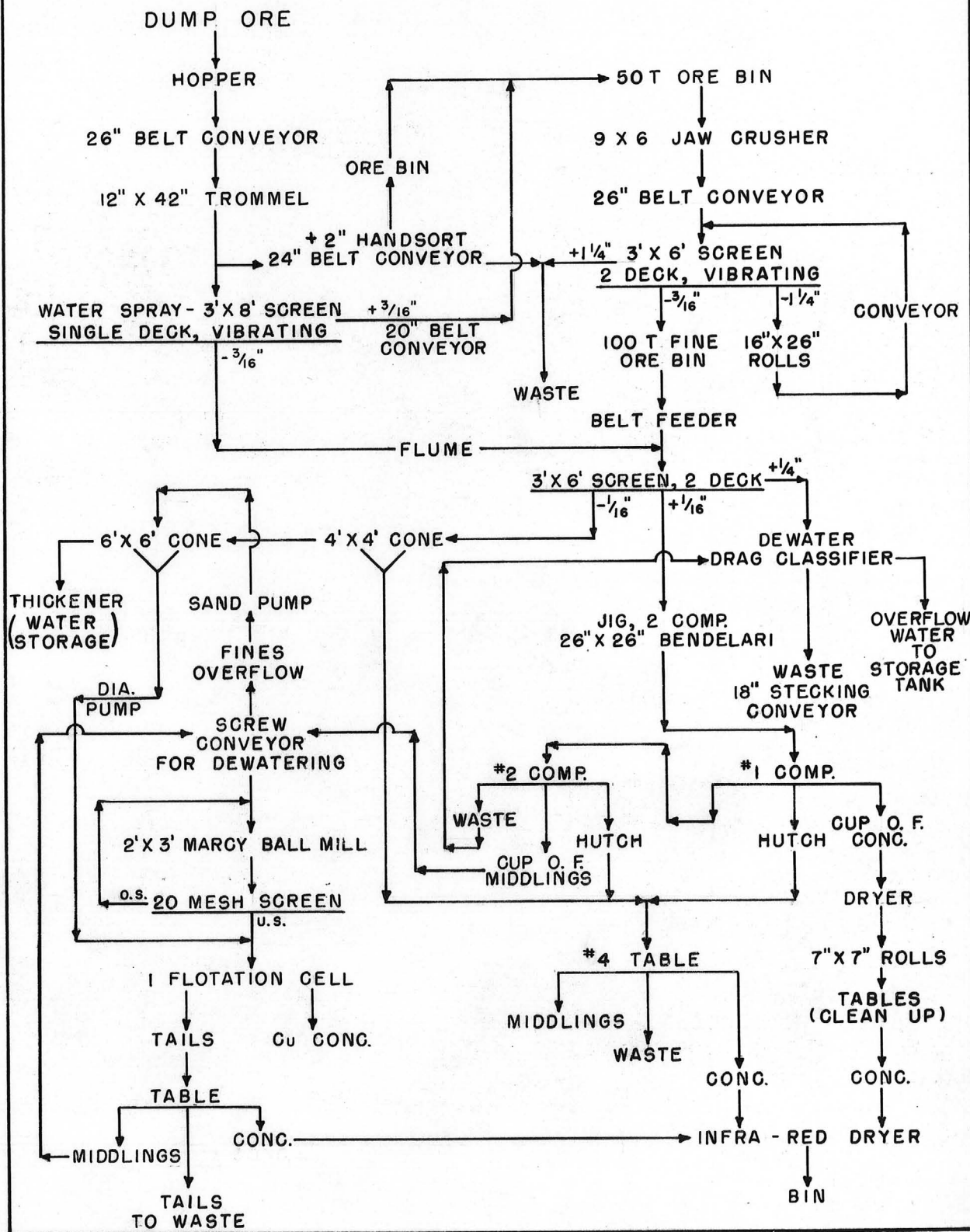


Figure Flowsheet of the Dye and Bathrick mill of Boriana mine  
Mohave County, Arizona

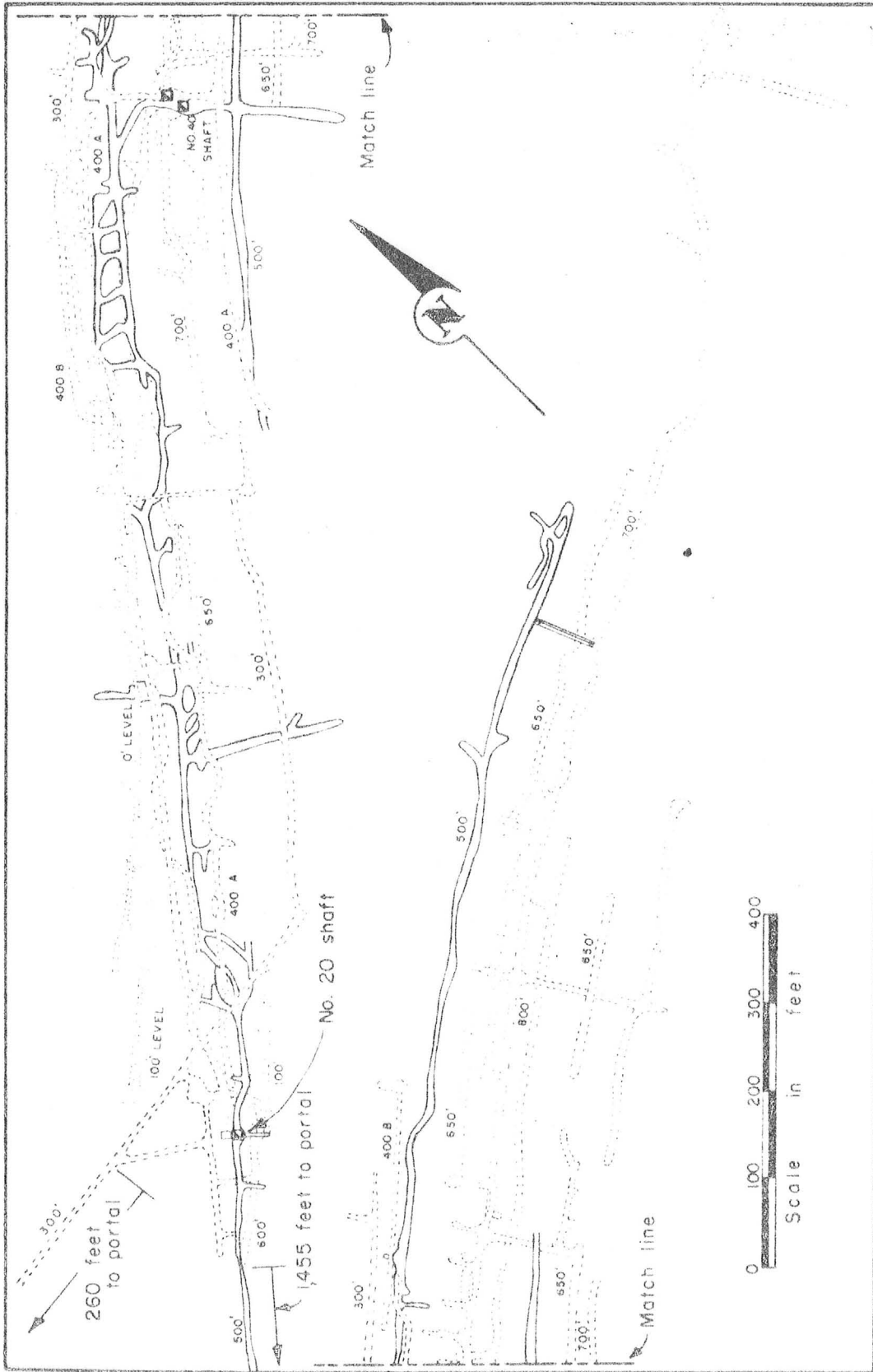


FIGURE 32. - Plan of Underground Workings, Boriana Mine.

\*

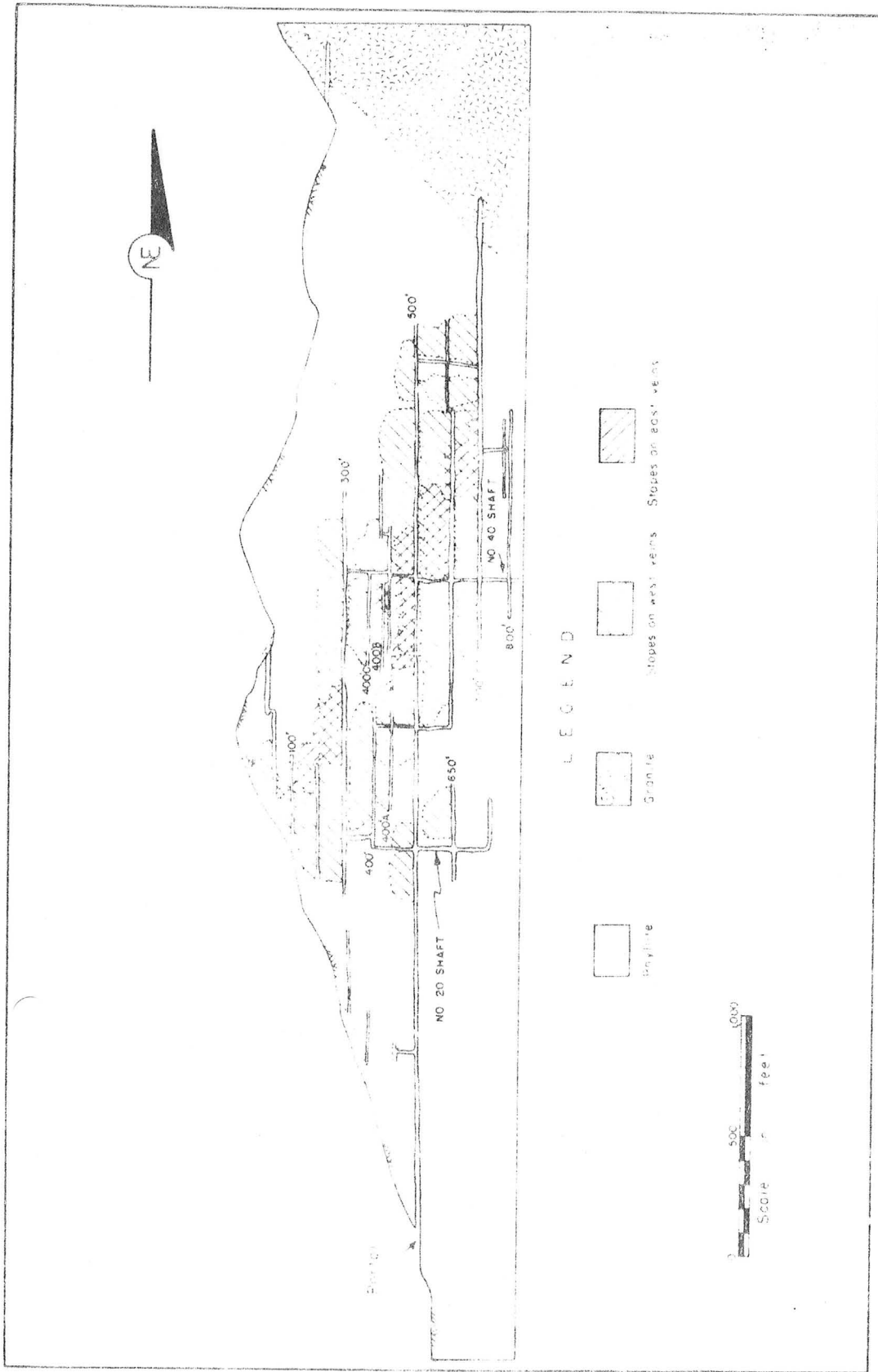


FIGURE 33. - Longitudinal Projection of Boriana Mine Workings.

\*

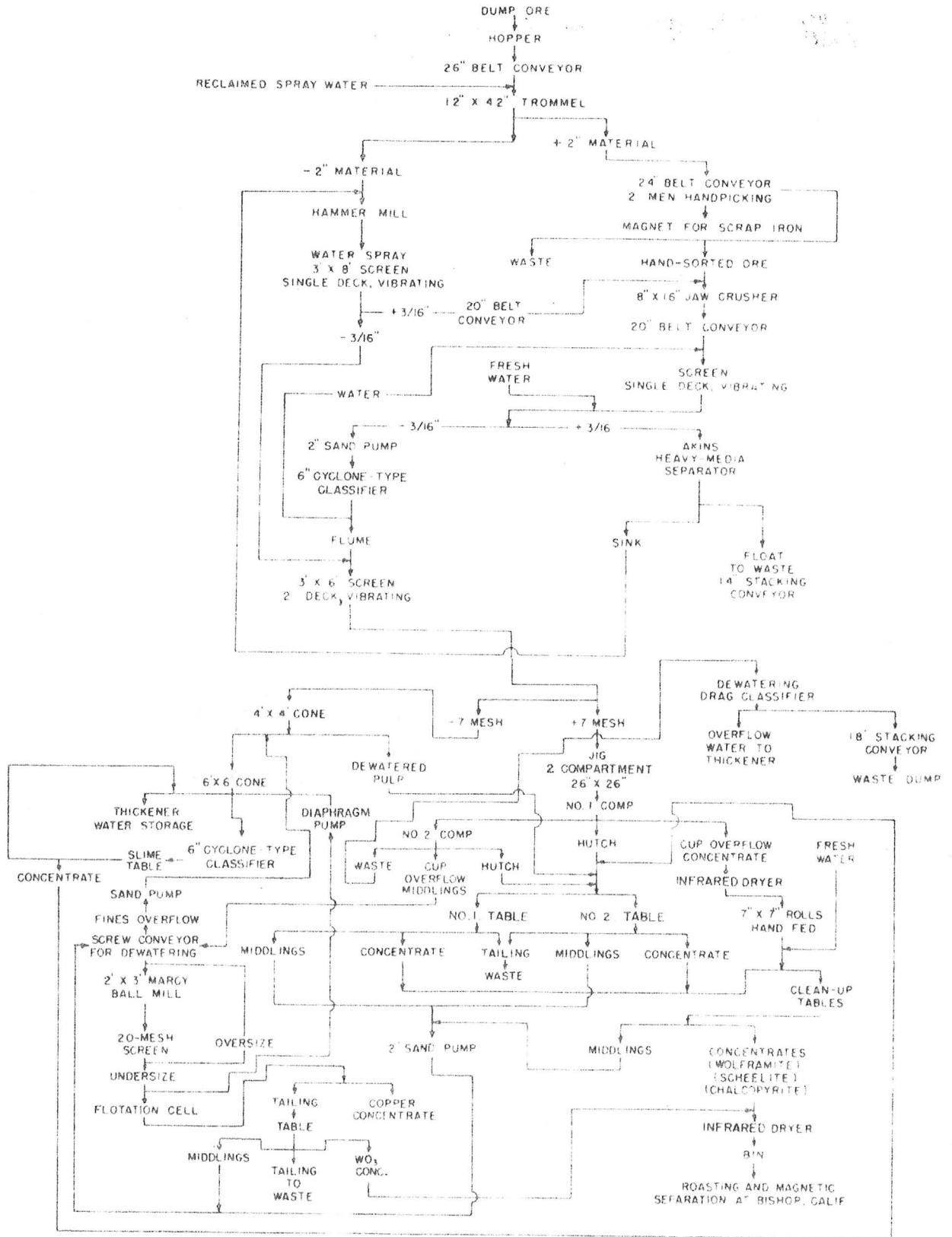


FIGURE 34. - Flowsheet, Boriana Mill.

\*

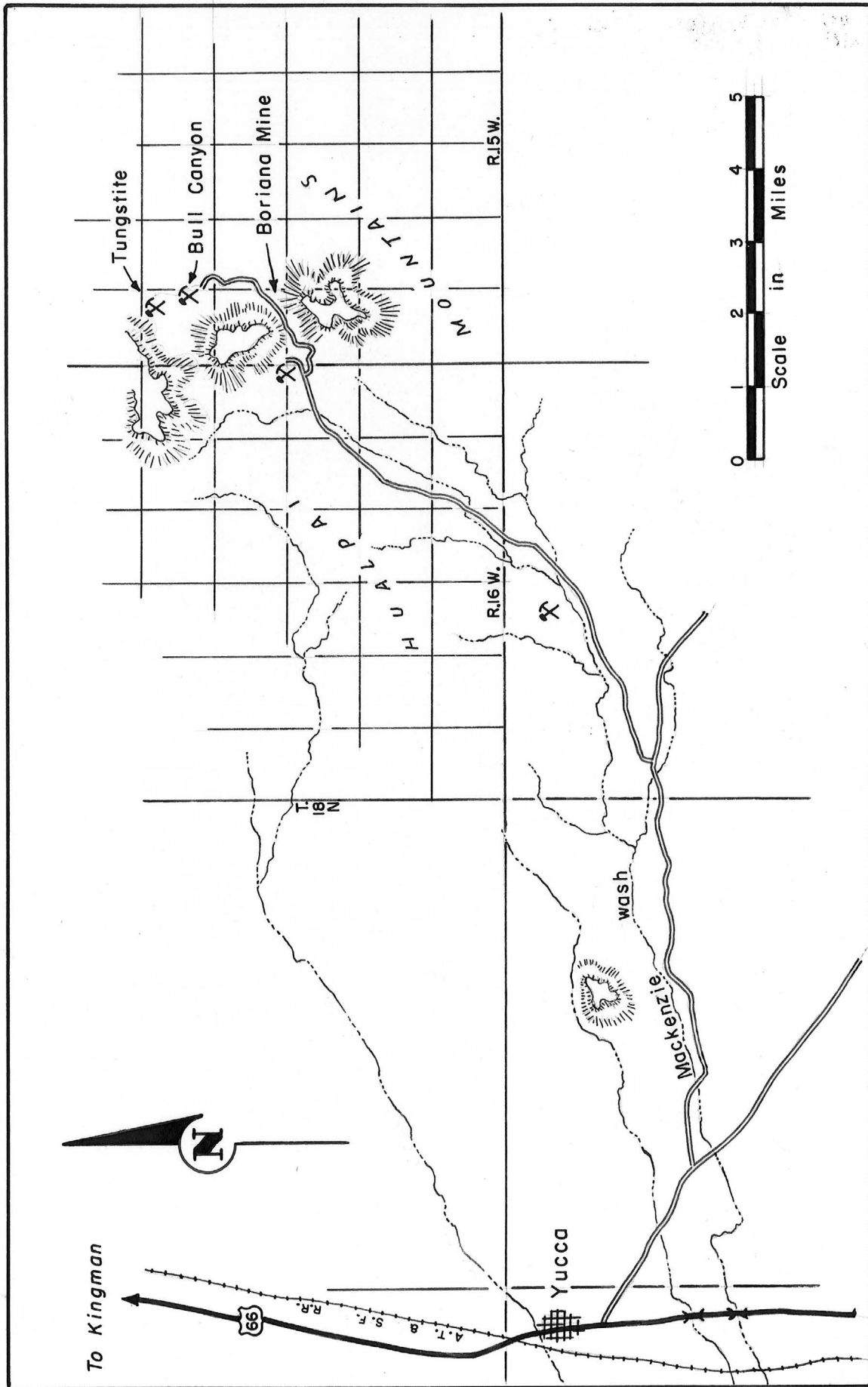


Figure Tungsten deposits in Boriaana mine area, Mohave County, Arizona

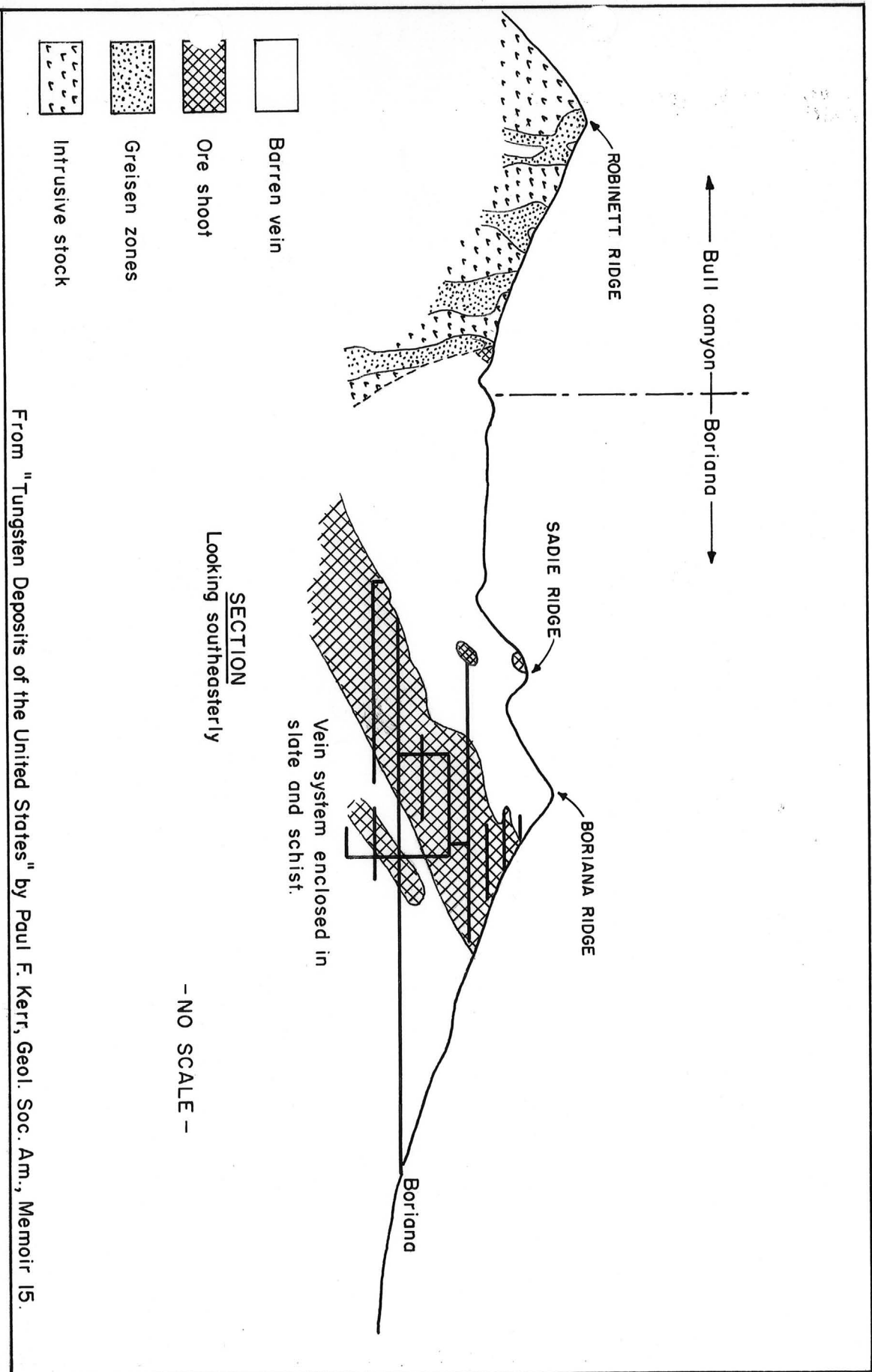


Figure 37-Ore shoot at Borianda, Ariz.

Fig 37



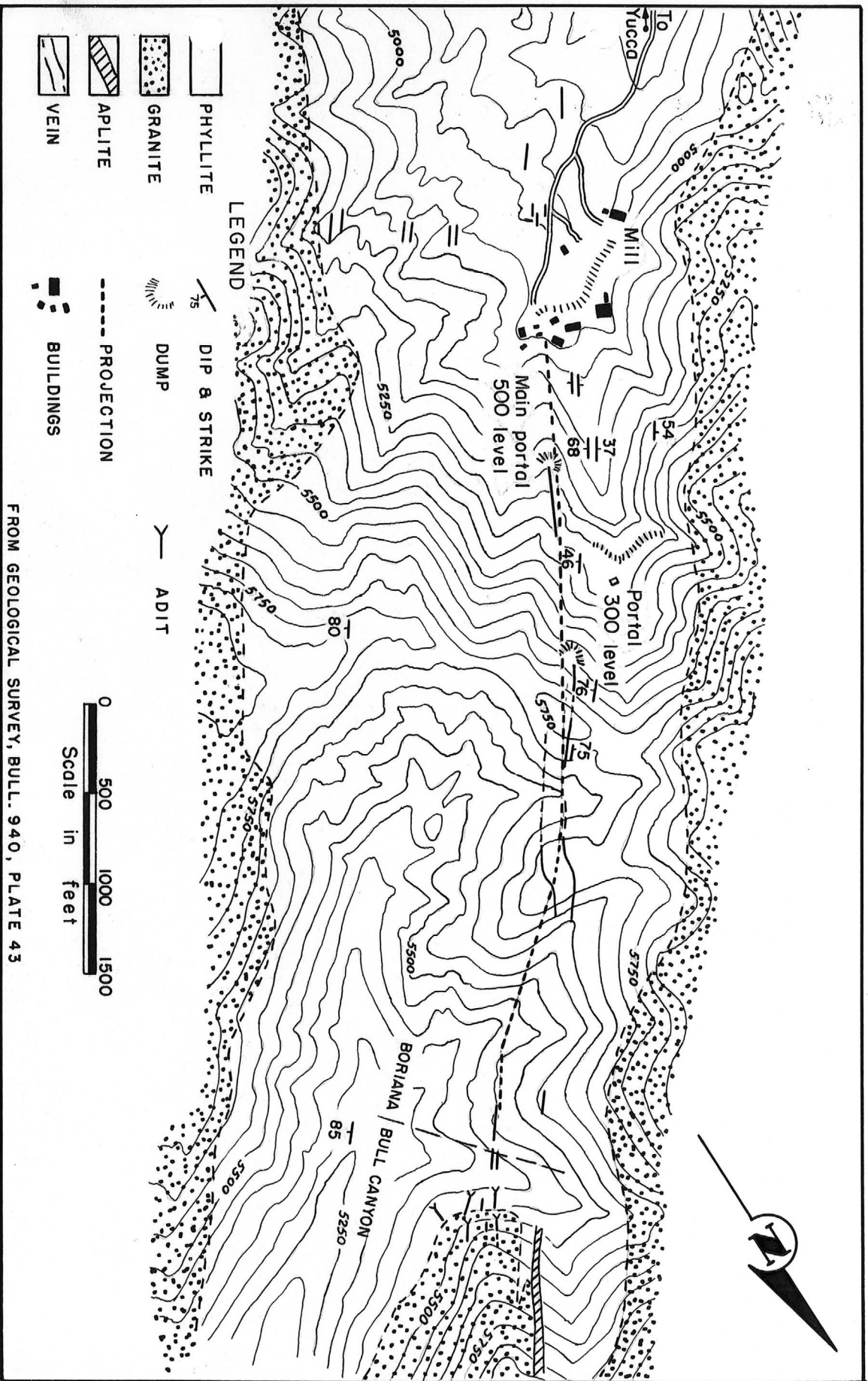
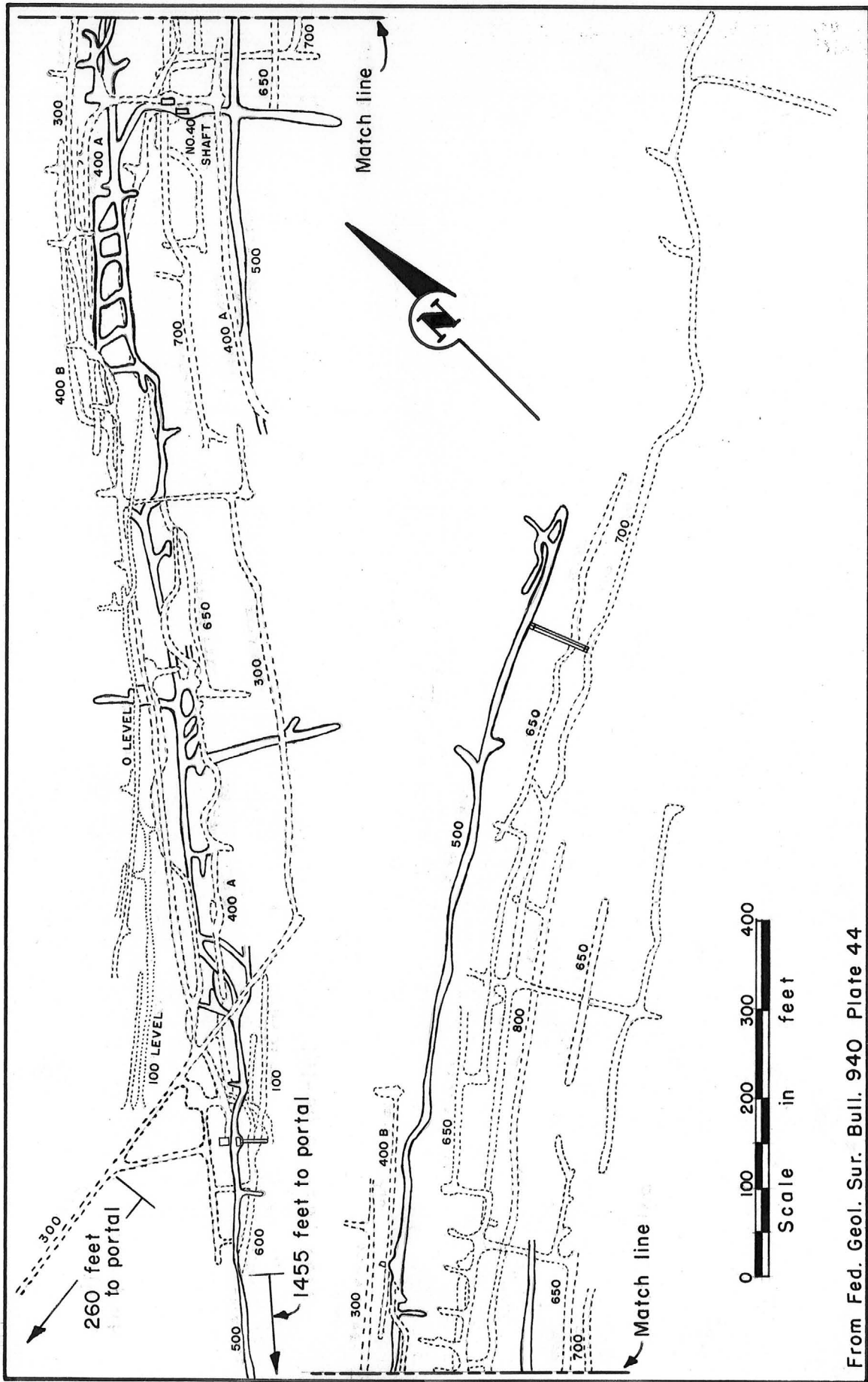


Figure 36.- Topographic and geologic map of Borianda mine, Mohave County, Ariz.

70036

Reference



From Fed. Geol. Sur. Bull. 940 Plate 44

Figure 32. - Plan of underground workings of Boriana mine

Fig 32

Reference