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TABLE 5.

| | Tons milled | Ounces | | Per cent | | |
|---|---|---|---|---|---|---|
| | | Gold | Silver | Lead | Zinc | Iron |
| 1928-30, inclusive | 79,686 | ...... | ...... | ...... | ...... | ...... |
| 1934 | 36,963 | .075 | 6.14 | 5.22 | 5.71 | 1.85 |
| 1935 | 129,374 | .07 | 5.77 | 4.43 | 4.41 | 2.01 |
| 1936 | 141,768 | .06 | 5.21 | 3.51 | 3.50 | 1.80 |
| 1937 | 143,004 | .053 | 5.06 | 2.94 | 2.91 | 1.97 |
| 1938 (to July 1)* | 70,410 | .054 | 4.68 | 3.26 | 3.62 | 1.89 |
| | 521,519† | ...... | ...... | ...... | ...... | ...... |

* Assays shown for 1938 production are subject to correction.
† The copper content in this ore was approximately 0.30 per cent.

### Acknowledgments

A number of persons have worked on the progressive study of these ore deposits, particularly J. P. Lyden, J. M. Conrow, Neil O'Donnell, and Paul R. Murphy, who made many of the geologic observations. Grover J. Duff, E. D. Morton, and their assistants at the mine lived with the problem and offered valuable suggestions that are recorded in this paper. The Arizona Bureau of Mines made several rock determinations and co-operated in many ways.

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# Mammoth Mining Camp Area
# Pinal County, Arizona[87]

By Nels Paul Peterson

### Introduction

The Mammoth mining camp area, which forms part of the Old Hat mining district in Pinal County, Arizona, is about 50 miles northeast of Tucson. The productive claims in the area were located by Frank Schultz between 1879 and 1882. Production began in 1886 and to the end of 1936 amounted to $5,204,000, most of which was gold. In 1916 and 1917 most of the molybdenum produced in the United States came from the Mammoth mines.

### Rocks (Pl. XXXVI)

The oldest formation in the area is the coarse-grained, porphyritic Oracle granite. It is probably the same granite that is overlain by the pre-Cambrian Apache group about 10 miles north of Mammoth. Dikes and irregular bodies of aplite and andesite porphyry intrude the granite.

[87] Paper prepared for the regional meeting of the A.I.M.&M.E. held at Tucson, Arizona, November 1-5, 1938. For a more detailed description of this area, see *Arizona Bureau of Mines Bull. No. 144* (Univ. of Ariz. 1938).



The northern part of the area is covered by a series of lava flows consisting chiefly of basalt flow breccia with some latite and tuff. The lava flows are tilted 45 to 65 degrees NE. Both the granite and lavas are intruded by dikes and sills of rhyolite and a breccia composed of fragmental material derived from all the earlier rocks in a matrix of rhyolite. The largest intrusive body is a sill of rhyolite and breccia intruded between the granite and the overlying lava flows in the southern part of the area. The Mohawk-New Year Mine is entirely within this sill. Gila conglomerate and recent alluvium cover much of the mapped area; the conglomerate is older than the last period of deformation that affected the region.

### Structure (Pls. XXXVII and XXXVIII)

Most of the fractures are premineral. Of these early fractures only the mineralized faults effected much displacement. The most important postmineral faults are the Turtle and Mammoth faults. The Turtle fault strikes N. 70 degrees E. and forms the boundary between the granite and the lava flows, which have been depressed relative to the granite. The Mammoth fault strikes N. 22 degrees W. and depressed the eastern half of the area. It is younger than the Gila conglomerate.

### Ore Deposits

The veins occupy fault fissures of general northwestward strike and steep dip. Movement along them continued at intervals until after the supergene alteration of the ores. Except in the Collins Mine where sulphides occur on the lower levels, supergene oxidation extends below the permanent water table, which is the lower limit of mining development. The scarcity of pyrite, however, largely prevented transportation and enrichment of the metals.

The mineralization is divisible into five stages (Fig. 11). The first three stages, separated only by renewed movement on the vein fault, consist of quartz, specularite, chlorite, pyrite, sphalerite, galena, fluorite, gold, and chalcopyrite. The fourth stage began with leaching along certain channels, followed by deposition of wulfenite and vanadium minerals. The fifth-stage minerals include carbonates, silicates, and sulphides of lead, zinc, and copper, all of which are later than the molybdenum and vanadium minerals. The minerals of the fourth and fifth stages are of a type generally considered as supergene. Those of the fifth stage have clearly resulted from the supergene oxidation of the early hypogene minerals. The origin of the molybdenum and vanadium minerals is not so clear, since no primary source of these metals has been found. The most logical explanation for the mineral relationships in the later stages is that the molybdenum and vanadium minerals are of hypogene origin but were deposited by a different type of solution from those that deposited the earlier hypogene minerals.

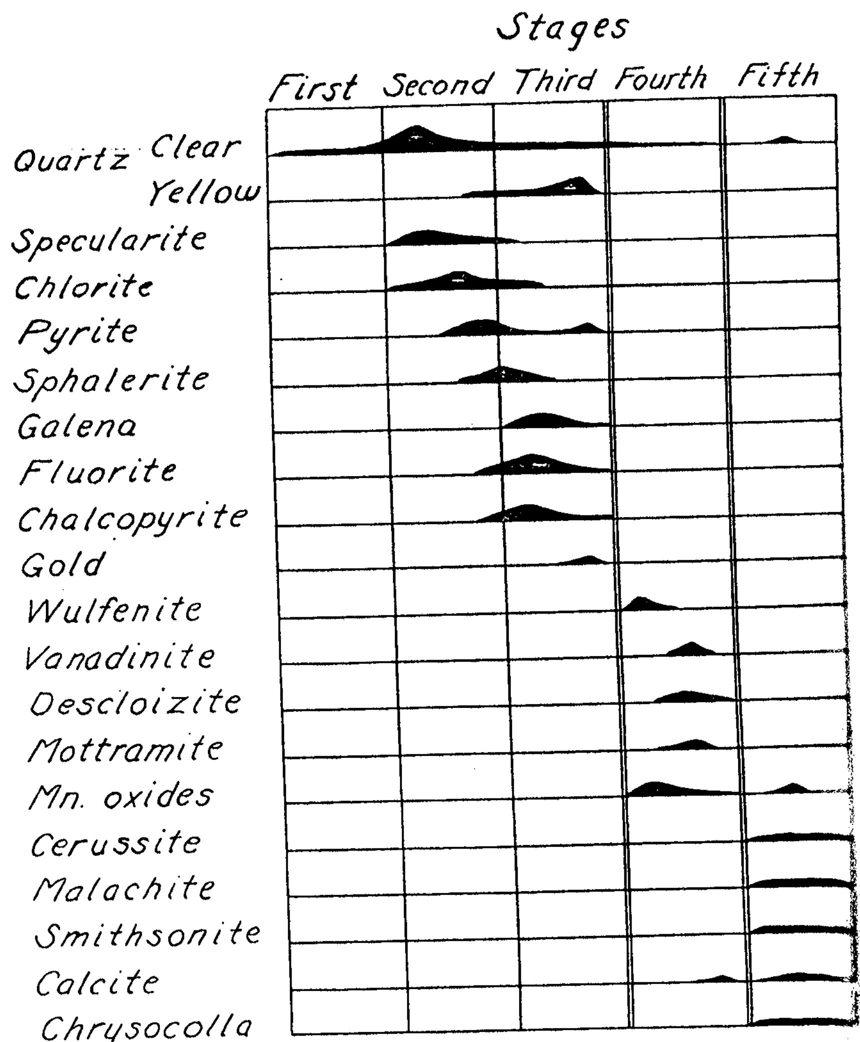



**Figure 11.**—Paragenetic relation of the vein minerals, Mammoth Mine, Pinal County.

The assemblage of minerals and the general character of the veins are both indicative of high temperature deposition at [illegible] low depth.


BIBLIOGRAPHY

Rickard, T. A., Vein Walls, Amer. Inst. Min. Eng., Trans., Vol. [illegible], pp. 214, 233, 234, 1896.

Blake, Wm. P., Report of the Governor of Arizona, pp. 188-90, [illegible]

Stewart, S. O., The Old Hat Mining District, Pinal County, Arizona, Mining and Engineering World, Vol. 36, p. 952, 1912.

Hess, Frank L., Molybdenum, U.S. Geol. Survey Bull. 761, p. 15, 1924.

Wilson, Eldred D., Arizona Lode Gold Mines, Univ. of Ariz., Ariz. Bureau of Mines Bull. 137, pp. 170-74, 1934.

Peterson, Nels Paul, Geology and Ore Deposits of the Mammoth Mining Camp Area, Arizona, Univ. of Ariz., Ariz. Bureau of Mines Bull. 144, 1938.




## Childs-Aldwinkle Mine, Copper Creek, Arizona[88]

By Truman H. Kuhn[89]

### Location

The Childs-Aldwinkle Mine is at Copper Creek, in the western part of the Galiuro Mountains near the center of the Bunker Hill mining district. The camp is accessible by 10 miles of road that branches eastward from the Tucson-Winkelman highway at Mammoth.

### History and Production

The Bunker Hill district was discovered in 1883 by prospectors who were searching for gold and silver. Mining was attempted in 1897-98 by the Table Mountain Copper Company; in 1903-17 by the Copper Creek Mining Company and its successors, the Minnesota-Arizona Copper Company, and the Copper State Mining Company; and in 1907-9 by the Calumet and Arizona Mining Company.[90] Between 1917 and 1933 a little work was carried on by lessees. Production from 1905-16 was approximately 700,000 pounds of copper and $35,000 worth of silver, with a total value of $150,000.[91]

In 1933 the Arizona Molybdenum Corporation, headed by W. C. Rigg, purchased the Childs-Aldwinkle property and began mining molybdenum and copper ore. According to Mr. Rigg, the production of this mine from 1933 to July 1, 1938, was 6,454,321 pounds of molybdenum sulphide, 5,519,140 pounds of copper, 473 ounces of gold, and 19,167 ounces of silver.

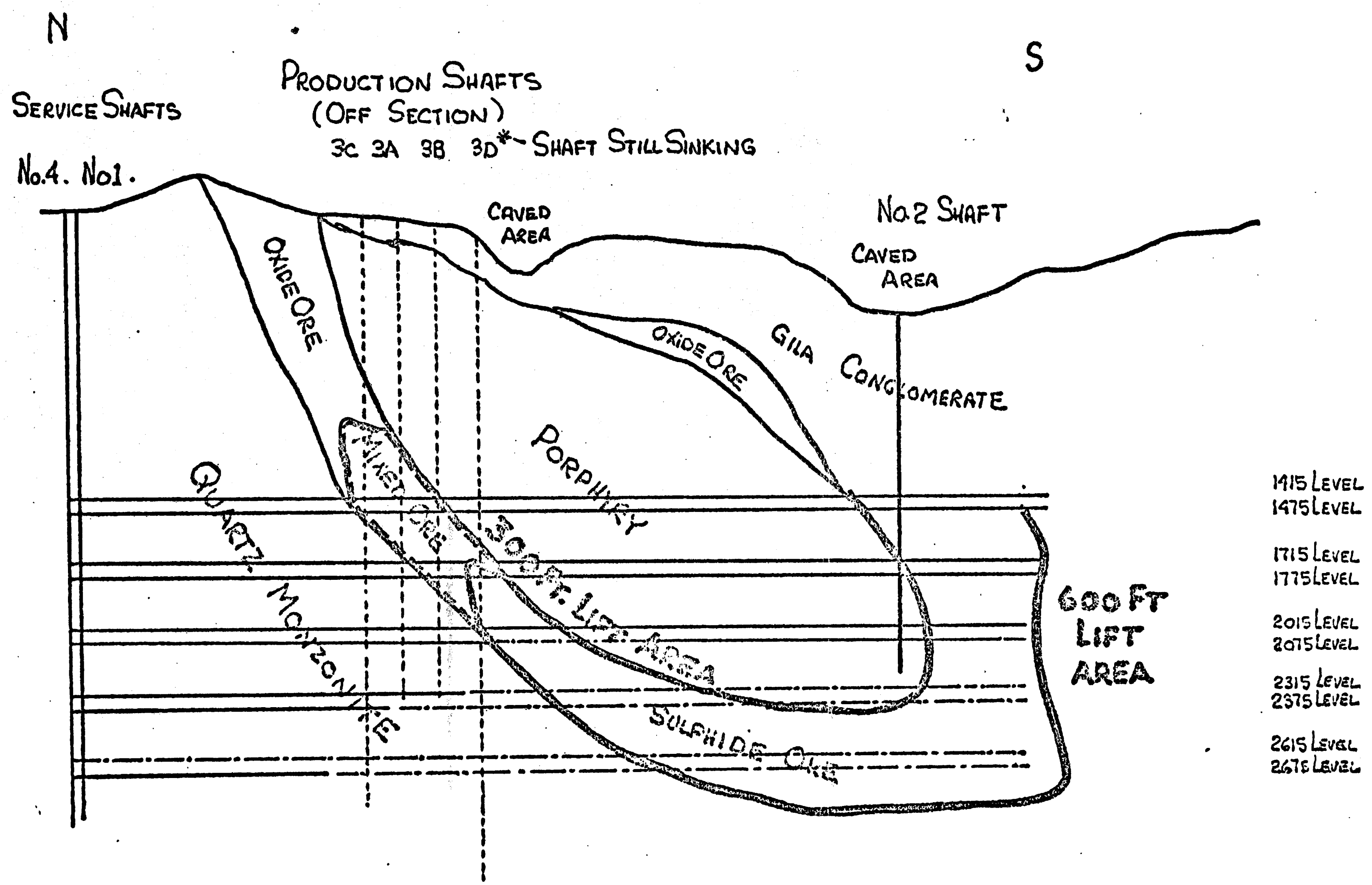
### Rocks

The canyon of Copper Creek, where it crosses the district, forms a small basin floored mainly by light gray granodiorite which in-

[88] Paper prepared for, and originally presented at, the regional meeting of the A.I.M.&M.E. held at Tucson, Arizona, November 1-5, 1938.
[89] Graduate student, University of Arizona.
[90] Historical data largely from unpublished notes of J. B. Tenney.
[91] M. J. Elsing and R. E. S. Heineman, *Arizona Metal Production* (Univ. of Ariz., Ariz. Bureau of Mines Bull. 140, 1936), p. 99.

# Cross Section Through The San Manuel Orebody

Section N 45° W from No.4 Shaft looking N.E.

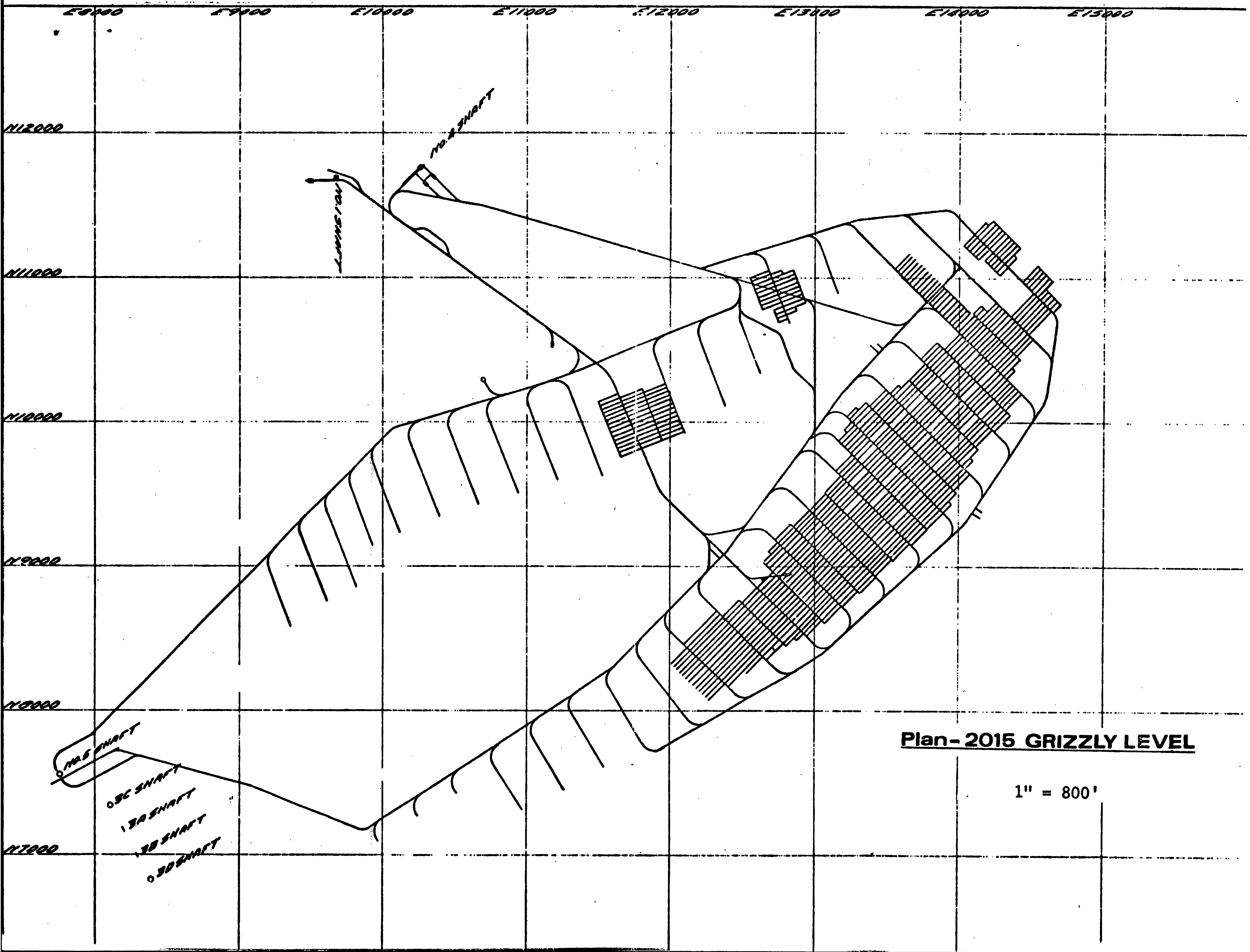



—·—·— Indicates drifts that we are to drive.

Generally Quartz Monzonite surrounds the orebody with Porphyry predominant in the core. Both however contain traces of diabase and rhyolite

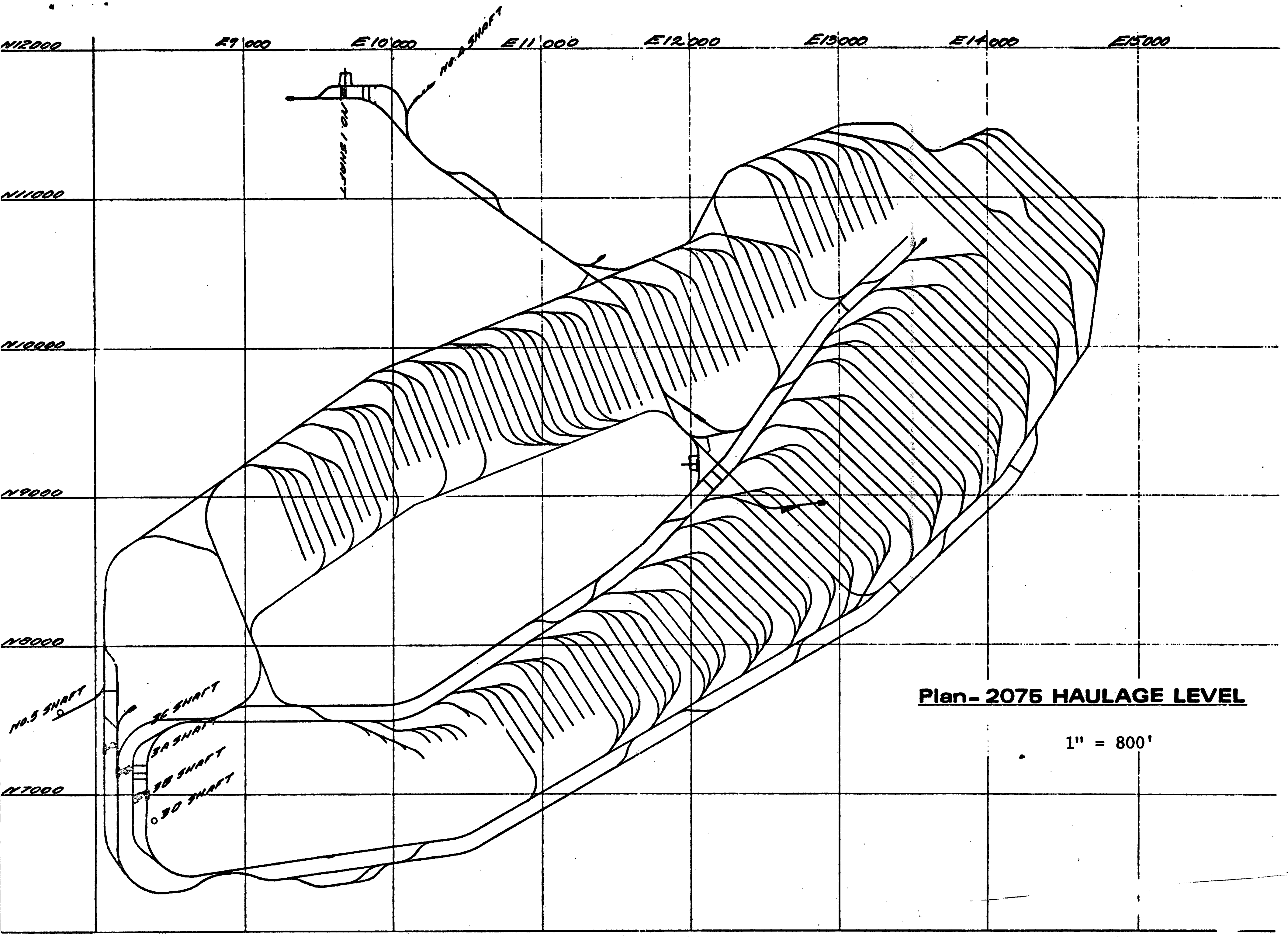
Scale 1" = 800'

Figure 1



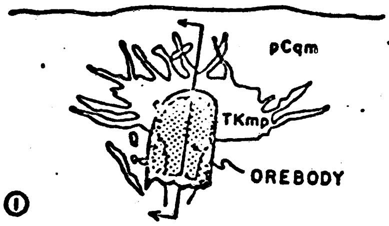

**Plan- 2015 GRIZZLY LEVEL**

1" = 800'

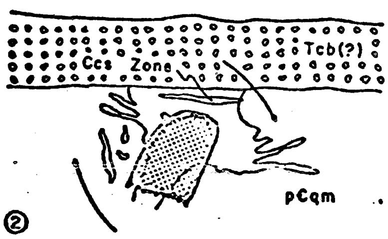



**Plan- 2075 HAULAGE LEVEL**

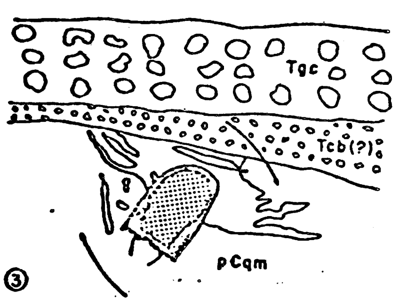
1" = 800'



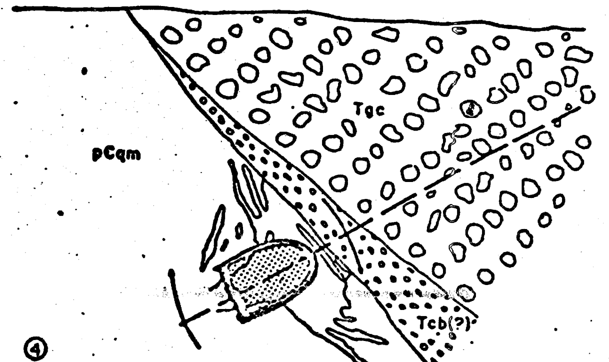

1. Precambrian quartz monzonite (pCqm) was intruded by a Laramide age monzonite porphyry (TKmp) dike swarm. A hollow cylindrical or pipe-shaped orebody with dimensions of approximately 8,000 × 3,500 feet was formed. It was probably nearly vertical and centered on the monzonite dike swarm. (Section line shows position of Figure 7.)



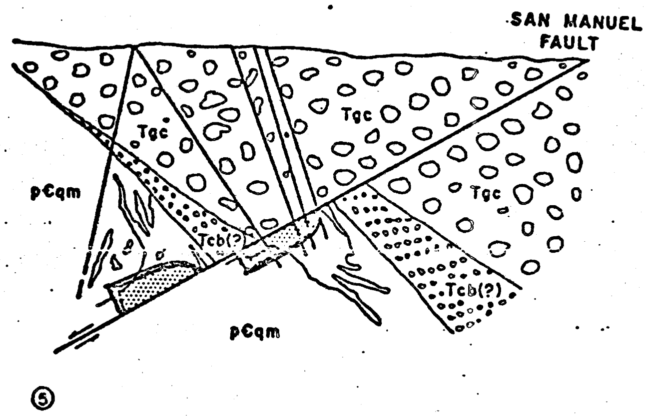

2. Tilting of the orebody was followed by erosion, then deposition of conglomerate and interbedded volcanics (Tcb?). A thin chalcocite blanket (Ccs) was formed at the water table.



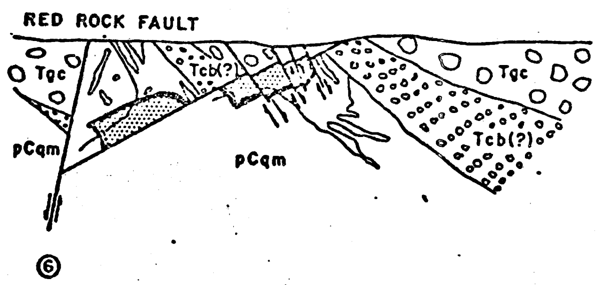

3. Continued tilting was followed by erosion of conglomerate and quartz monzonite and deposition of middle Tertiary Gila Conglomerate (Tgc).




4. Orebody is now at a flat angle due to continued tilting. An erosion surface is cut on the tilted quartz monzonite and Gila Conglomerate. Incipient San Manuel fault is formed.




5. Upper portion of orebody is displaced approximately 8,000 feet down the dip of the San Manuel fault. Some imbricate displacement may have occurred in the Kalamazoo segment.




6. High-angle normal fault displacements produced small offsets in the San Manuel orebody and a large displacement on the Red Rock fault west of the Kalamazoo orebody. Erosion exposed intrusive rocks and a corner of the San Manuel orebody and produced oxidation and limited chalcocite enrichment in the upper portion of the San Manuel orebody.

| MINE | MINING DISTRICT |
|---|---|
| San Manuel (Cu, Mo) (Ag, Au)* | Old Hat |

| COUNTY | STATE | COUNTRY |
|---|---|---|
| Pinal | Arizona | U.S.A. |

| AMS 1° x 2° Topographic Map | U.S.G.S. Topographic Map 30' |
|---|---|
| Tucson | None |
| **U.S.G.S. Topographic Map 15'** | **U.S.G.S. Topographic Map 7-1/2'** |
| Mammoth | Mammoth, Clark Ranch |

AERIAL PHOTOGRAPHY AVAILABLE: (Including photo mosaics)

AMS: Photomosaic 55AM81, sheet 2, (1:250,000). Photography - 1956, 1:50,000, Project 55AM81, Roll 2, Nos. 55-56; Roll 3, Nos. 214 thru 216, 189-190.

USGS: 1945, 1:39,200, Project GS-BR, Roll 1, Nos. 66 thru 72, 76 thru 81, 89 thru 94, 101 thru 107 (includes Tiger Mine area).

GEOLOGIC MAPS AVAILABLE:

Pinal County, 1959, 1:375,000: Arizona Bureau of Mines.
Schwartz, G.M., 1953, (see references), (a) 1:4,800, (b) 1:4,800, (c) other maps and sections.

OTHER MAPS AVAILABLE:

## REFERENCES


Chapman, T. L., 1947, San Manuel copper deposit, Pinal County, Arizona: U. S. Bur. Mines. Rept. of Investigations 4108.

Creasey, S. C., 1950, Geology of the St. Anthony (Mammoth) area, Pinal County, Arizona: Arizona Bur. Mines Bull. 156, p. 63-84.

Schwartz, G. M., 1953, Geology of the San Manuel copper deposit, Arizona: U. S. Geol. Survey Professional Paper 256.

Creasey, S. C., 1965, Geology of the San Manuel Area, Pinal County, Arizona: U.S. Geol. Survey Professional Paper 471, 64. p.

Lovering, T. S., 1950, Dispersion of copper from the San Manuel copper deposit, Pinal County, Arizona: Econ. Geol. V. 45, p. 493-514.


*Ag, Au as by-products.

San Manuel Mine
Old Hat Mining District
Pinal County, Arizona

GEOLOGIC MAPS AVAILABLE (Continued)

Creasey, S. C., 1965, (see references), (a) 1:24,000, (b) 1:24,000, (c) other maps and sections.