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EXAMINATION OF COPPER-URANIUM OCCURRENCES IN THE WILLAHA AREA, COCONINO COUNTY, ARIZONA

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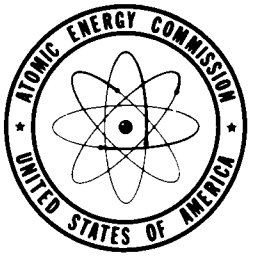

Technical Information Service, Oak Ridge, Tennessee

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ABSTRACT

A study, consisting of field and laboratory work, was undertaken in an endeavor to establish possible structural mineralization controls associated with the copper-uranium occurrences in the Willaha area, Coconino County, Arizona.

Uranium mineralization, apparent at present, is localized along small fissures and vugs and in certain beds and lenses of the middle member of the Kaibab formation (Permian). It is associated with copper and iron oxide staining.

Though no definite ore controls were disclosed by this study, at least a limited program of shallow drilling is warranted on the property. This sub-surface exploration should determine possible extensions of known mineralized areas, explore surface radiometric anomalies, and provide data for the determination of possible guides to ore. Deeper exploration may encounter mineralization in other horizons of the Kaibab limestone.

INTRODUCTION

Location and Accessibility

The Copper No. 1 claim and the Willaha group of claims are located approximately 36 air miles north of Williams, Arizona (Figure 1), in Sections 34 and 35, Township 28 North, Range 1 East (unsurveyed), Gila and Salt River Base Meridian, Coconino County, Arizona.

The property may be reached by travelling east from Williams, Arizona, on U. S. Highway 66 for two miles to the junction of U. S. Highway 66 and State Highway 64, thence north along State Highway 64 for 38 miles to the junction of a dirt road marked "10 X Cattle Co." The property lies seven miles west of this junction along a graded dirt road.

The Atchison, Topeka and Santa Fe railroad has a station at Willaha on its branch line between Williams and Grand Canyon Village. This station, which is not staffed at present, lies about three-quarters of a mile west of Copper No. 1 claim.

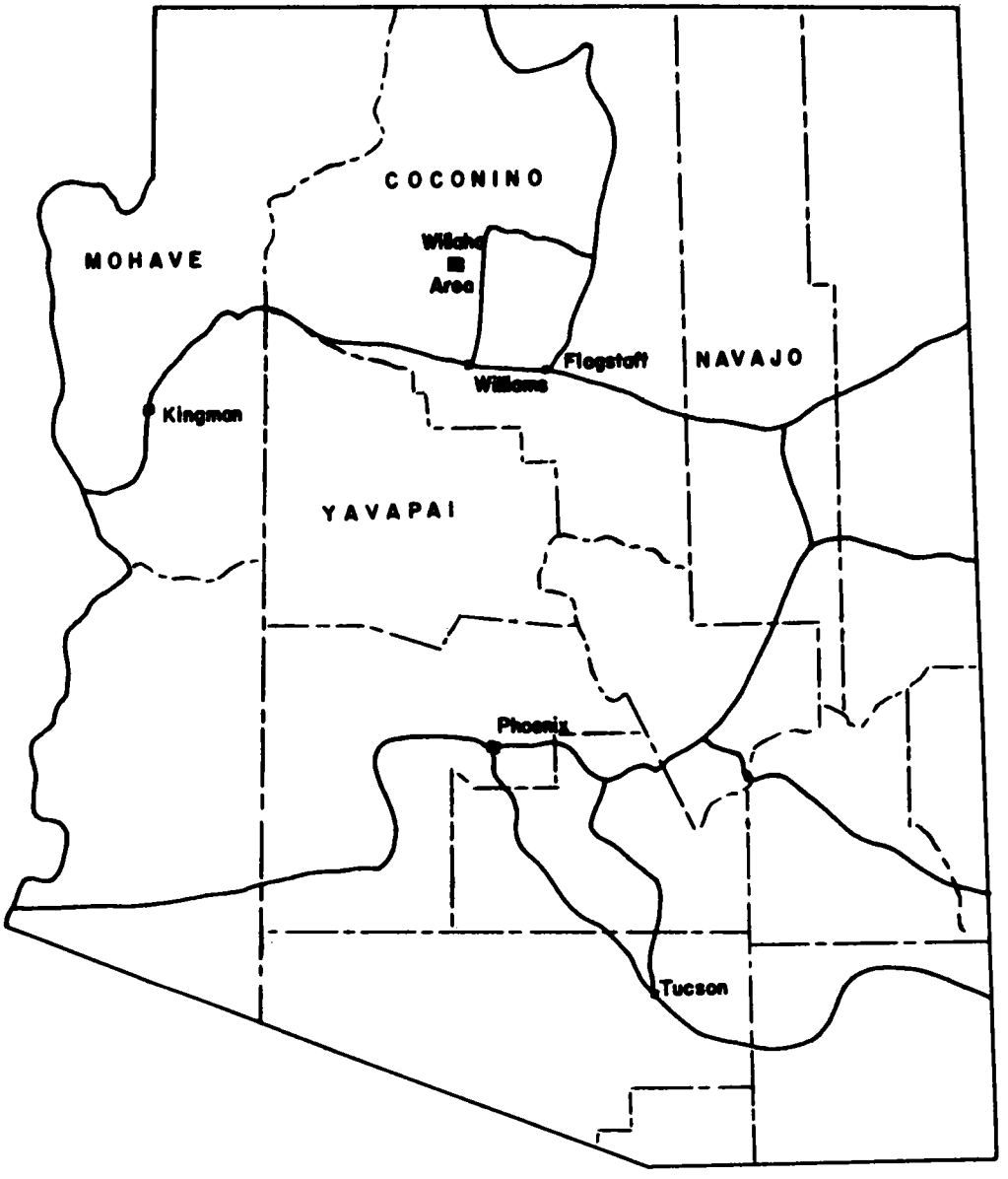


Figure 1

INDEX MAP SHOWING LOCATION OF

WILLAHA AREA, COCONINO COUNTY, ARIZONA

0 50 100 miles

Scope of Study

A study of the property was begun December 1, 1953, and carried on intermittently until March 8, 1954.

The primary purposes of the study were: (1) to locate possible structures controlling mineralization, (2) to determine the source of the minerals, if possible, and (3) to investigate the desirability of an exploration program. The field examination consisted of topographic and geologic mapping (Plates I and II) as well as a complete radiometric survey on a 50-foot grid. An isorad map was constructed (Plates III and IV) to indicate areas of anomalous radioactivity and to denote trends which the mineralization may have followed. An areal map was made showing the spatial relationship of the Copper No. 1 claim and the Willaha group of claims (Plate V). Seven samples (Plates I and II) were collected from selected localities on the property to evaluate radiometric readings and to determine the grade of the material at these localities.

Topography

Topography of the immediate area, as well as that of the regional Kaibab Plateau, is of relatively low rolling hills, shallow basins, and broad valleys. Field observations and mapping indicate the topography is primarily controlled by the geologic structures of the area. One conspicuous topographic feature known as Red Butte, about eight miles northeast of the property, consists of Permian Kaibab limestone at its base, overlain by the Triassic Moenkopi formation and Shinarump conglomerate and capped by Tertiary volcanics.

History

Little is known of the early history of the property except that it was worked for copper ores during the early 1900's. Present workings comprising several prospect pits and some trenching indicate very limited production of copper ore. Since Mr. James Kennedy, Jr., and associates of Williams, Arizona, leased the claim from the State of Arizona in October, 1949, exploration has consisted of extending a few of the existing prospect pits and locating additional areas of anomalous radioactivity.

MINE WORKINGS

Mine workings on the Copper No. 1 claim consist of one prospect pit measuring 20 by 40 feet with a depth of five feet, and two shallow bulldozed trenches located on the west flank of a gently sloping hill (Plate I). The Willaha group of claims has several prospect pits and trenches measuring from one to 15 feet in depth and extending horizontally from three to 50 feet (Plate II). No underground workings or drill holes exist on the entire property.

GEOLOGY

Stratigraphy

According to A. A. Stoyanow (1), the Kaibab limestone is a heterogeneous formation not entirely made up of limestone. An idealized section of the Kaibab limestone prepared by Dr. E. D. McKee and used by Stoyanow is as follows:

Erosion Surface.
Permian. Kaibab formation:

A. Vesicular magnesian limestone with Productus (Dictyoclostus) ivesi, rich in gastropods, pelecypods, and trilobites. 50 feet

Disconformity?

B. Arenaceous limestone with abundant chert layers. Dictyoclostus bassi, D. occidentalis, D. meridionalis, Meekella occidentalis, M. pyramidalis, Chonetes permianus C. subliratus, Composita quadalupensis, and Aviculopecten Coloradoensis. 280 feet

C. Irregularly bedded, most fluvial deposits made up of red and yellow sandstone.

D. Magnesian limestone with abundant faunas of small bellerophontids. Red and yellow sandy beds at base. 130 feet

Total thickness of the Kaibab formation 590

Unconformity.

The presence of arenaceous beds and chert layers suggests the deposit is in Member "B" of Dr. McKee's section which would place the present surface deposit at least 50 feet below the Permian Kaibab limestone and the Triassic Moenkopi formation contact. Remnants of the relatively flat-lying Moenkopi formation overlie the Kaibab limestone at a distance of approximately five miles. This is additional evidence the deposit is located near the top of Member "B" of the Kaibab limestone.

Structure

No prominent structural features are evident on either Copper No. 1 or Willaha group of claims or in the immediate vicinity. What may be regarded as the dominant structure on the property is that of undulating beds producing rolling hills and shallow basins and valleys which are expressed by the topography of the area. Minor and irregular joints, striking in various directions, are very numerous. They may have been produced by slumping of beds overlying solution cavities. There are a few small fissure veins in the large pits on the Willaha group of claims.

It appears probable that there may be a major north-south fault in the gentle valley three-fourths of a mile west of the property in the vicinity of the railroad.

ORE DEPOSITS

From the field study, both radiometric and geologic, it appears that the mineralization is localized in certain beds and lenses, as well as along small fissures and vugs in the Kaibab limestone. These beds and lenses, which appear to be small in horizontal extent, are composed of fine-grained, light brown, arenaceous limestone with nodules of chert along bedding planes. In a few hand specimens a halo is present, chalcocite being the nucleus mineral with concentric but incomplete azurite and malachite bands surrounding the chalcocite core.

Chrysocolla, malachite, and azurite are concentrated in small vugs and veins, and in some portions of the rock, these minerals act as a cementing material. A laboratory study made by the Technical Services Branch, Division of Raw Materials, New York, revealed that: "Intergrown and implanted on the surfaces of copper minerals is a black iron oxide, possibly goethite. Jarosite is common where the iron oxide has been leached." Copper minerals include azurite, malachite, chrysocolla, chalcocite, chalcopyrite, bornite, and covellite. Gangue minerals are calcite and small amounts of quartz. Carbonaceous material is not present on either property.

RADIOACTIVITY

Uranium mineralization, for the most part, is associated with areas of iron oxide staining in fine-grained, arenaceous limestone beds and lenses. A few small veins and vugs stained with iron oxide or coated with hematite contain uranium. Although uranium mineralization does appear to be associated with copper minerals in most cases, one isolated locality, in the bottom of a shallow basin, chemically assaying 0.123 percent uranium oxide, did not reveal either copper mineralization or the presence of iron oxides. A sodium fluoride bead test indicates that some uranium is associated with copper minerals and iron oxides. Mr. LaMar G. Evans of the U. S. Bureau of Mines, Tucson, Arizona, reported that a qualitative sodium bead test for uranium oxide indicated the uranium is associated with hematite, and that a petrographic examination of several thin section "smears" failed to disclose the uranium mineral or minerals. To date no identification has been made of the uranium mineral or minerals; however, a yellow radioactive material becomes apparent after exposure of fresh surfaces to weathering.

The radiometric background reading on the property was 0.010 MR/hr, and maximum readings on Copper No. 1 and Willaha group of claims were 0.20 and 0.34 MR/hr, respectively.

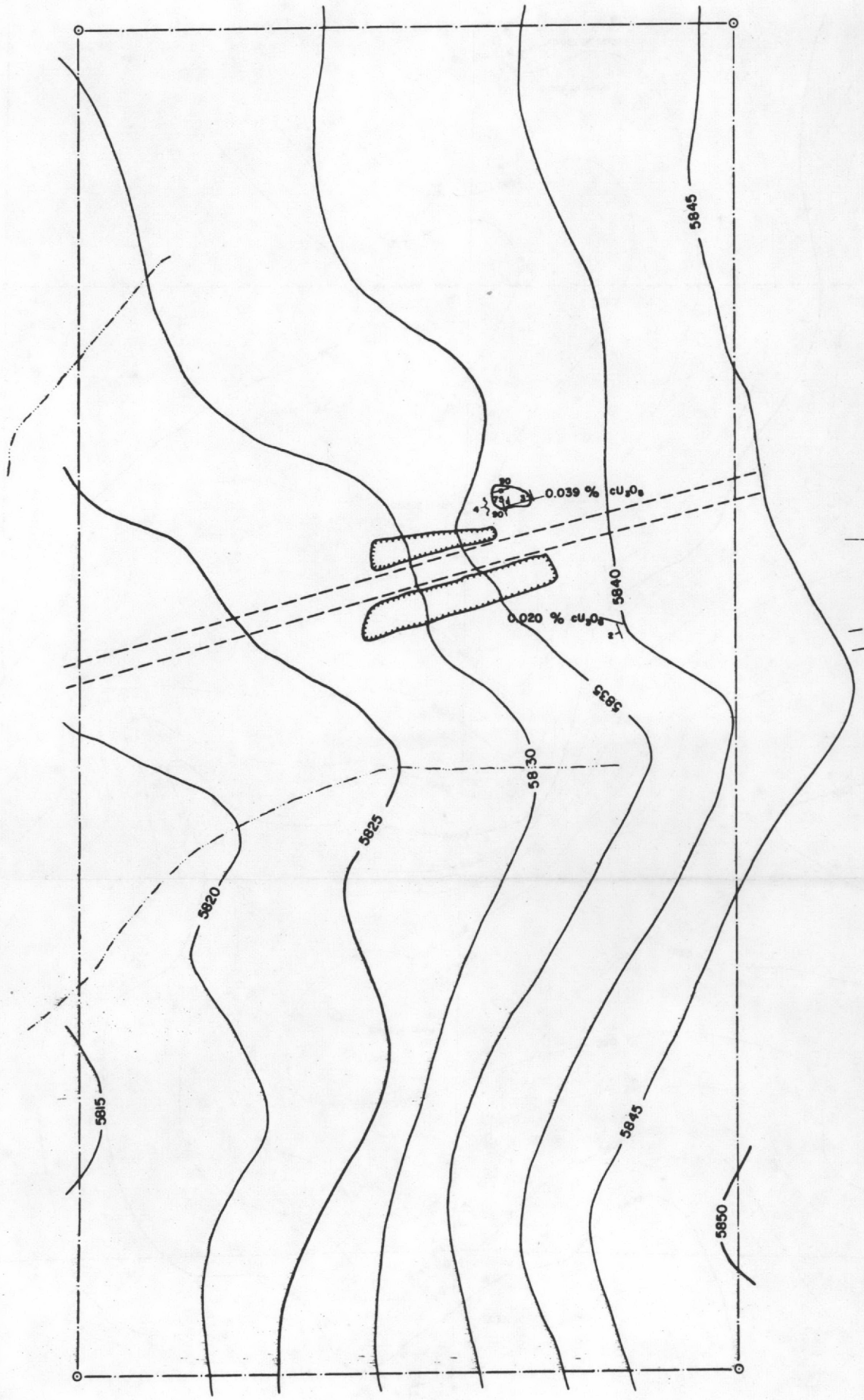
Chemical assays of selected samples collected from the property are indicated on Plates I and II.

CONCLUSIONS

The deposit warrants at least limited exploration, possibly in the form of drilling. Although the mineralization apparent at present is limited, there is the possibility that ore could be developed laterally and in favorable zones at greater depth. Ore controls would probably become more apparent as subsurface information was developed.

BIBLIOGRAPHY

(1) Stoyanow, A. A., Correlation of Arizona Paleozoic Formations: Bulletin of the Geol. Soc. of Am., April 1936, p. 527-529.



LEGEND

- STRIKE AND DIP OF BEDS
- GENERALIZED STRIKE AND DIP OF UNDULATING BEDS
- STRIKE AND DIP OF JOINTS
- STRIKE OF VERTICAL JOINTS
- CLAIM CORNER MONUMENT
- CLAIM BOUNDARY
- PIT
- BULLDOZED TRENCH
- ROAD

TOPOGRAPHIC AND GEOLOGIC MAP

COPPER NUMBER 1 CLAIM

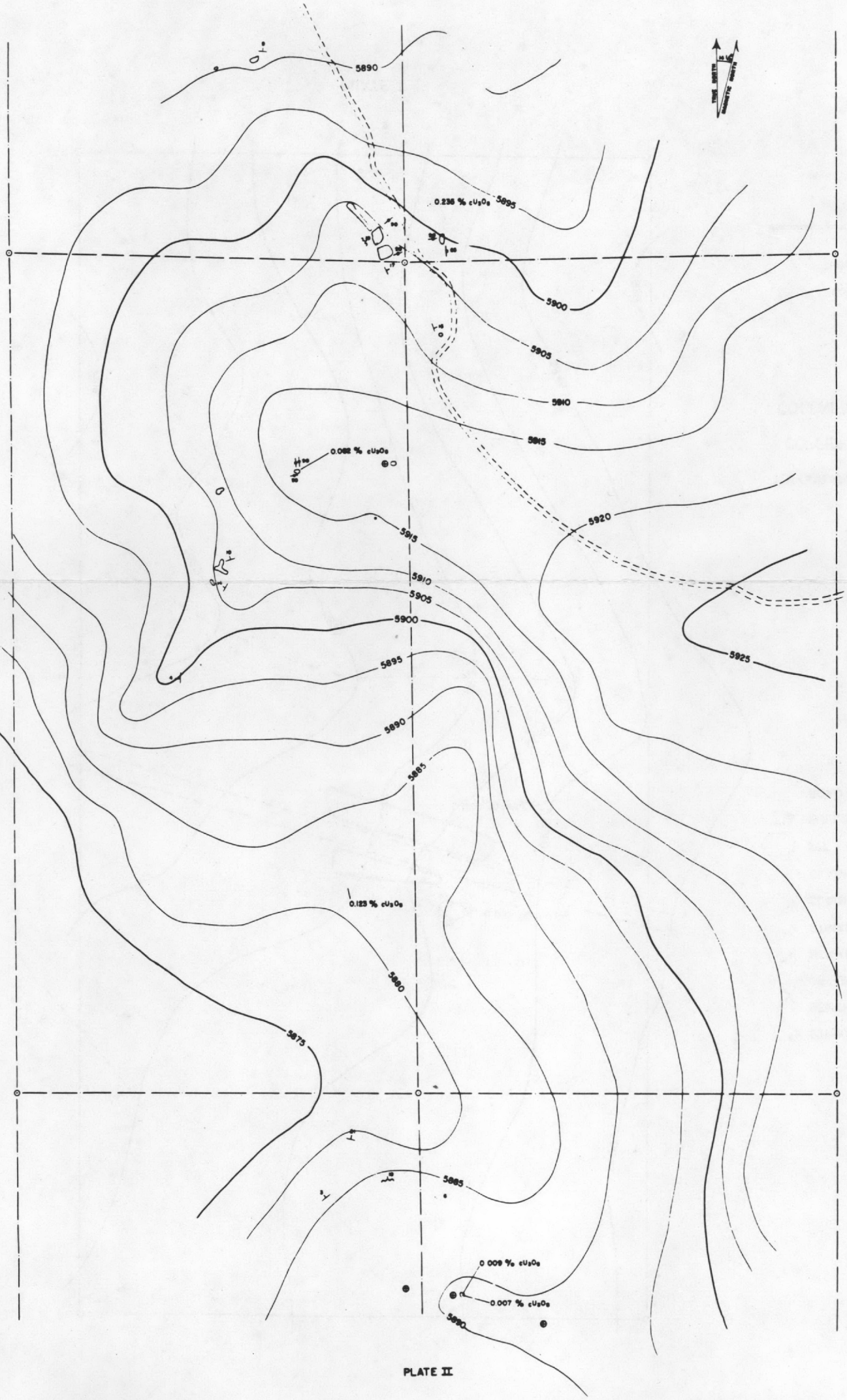
COCONINO COUNTY, ARIZONA

Contour interval: 5 feet

Datum is mean sea level

0 100 200 300 FEET

PLATE I



LEGEND

- STRIKE AND DIP OF BEDS
- HORIZONTAL BEDS
- GENERALIZED STRIKE AND DIP OF UNDULATING BEDS
- STRIKE AND DIP OF JOINTS
- STRIKE OF VERTICAL JOINTS
- CLAIM CORNER MONUMENT
- CLAIM BOUNDARY
- PIT OR OPEN CUT
- ROAD

TOPOGRAPHIC AND GEOLOGIC MAP

WILLAHA GROUP OF CLAIMS

COCONINO COUNTY, ARIZONA

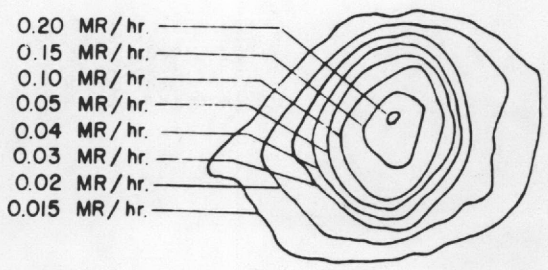
Contour interval: 5 feet

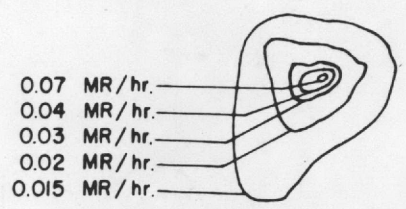
Datum is mean sea level

0 100 200 300

FEET

PLATE II





Note: Background count = 0.010 MR/hr.

PLATE III

ISO-RAD MAP

COPPER NUMBER I CLAIM

COCONINO COUNTY, ARIZONA

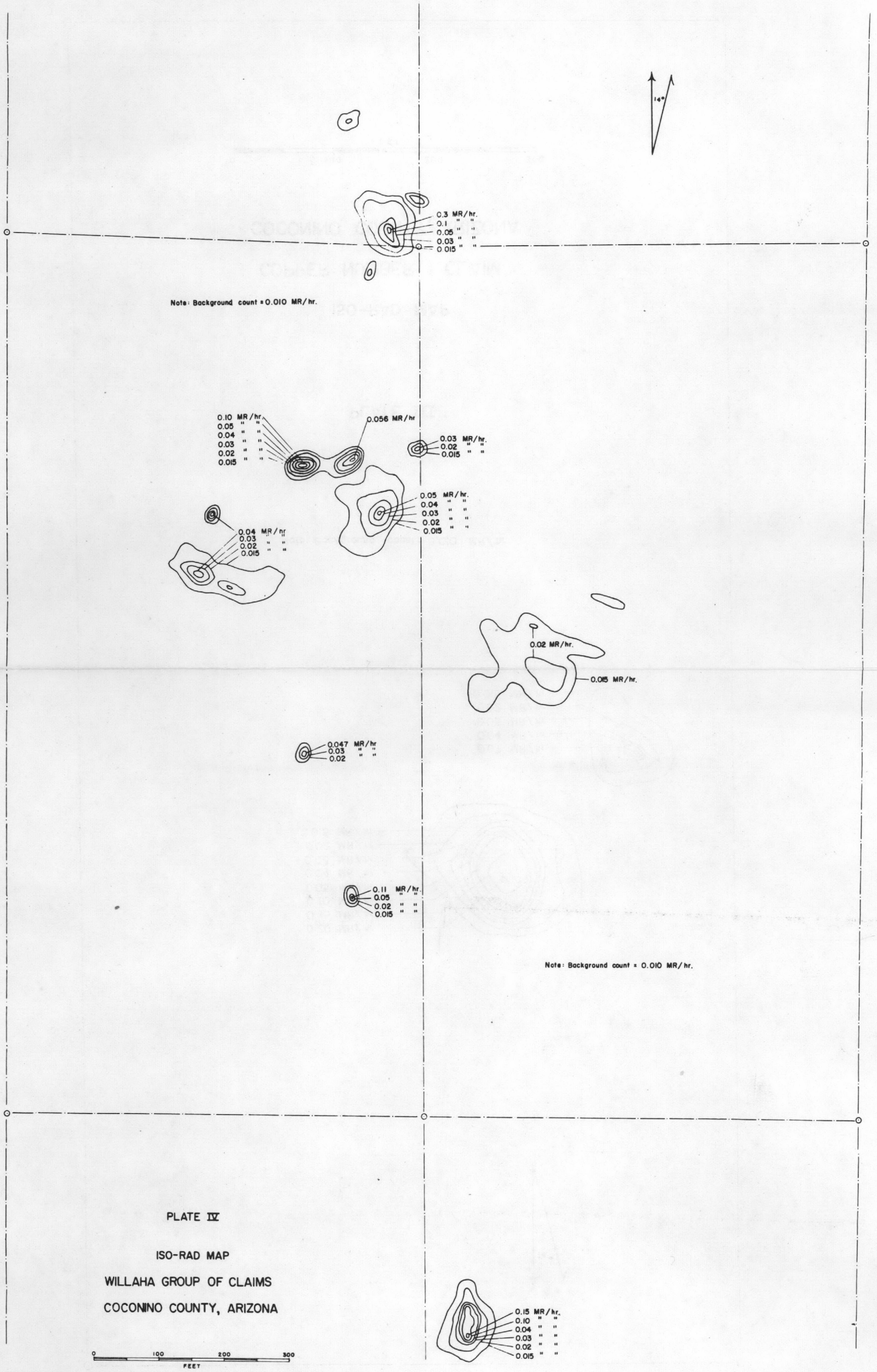


PLATE IV

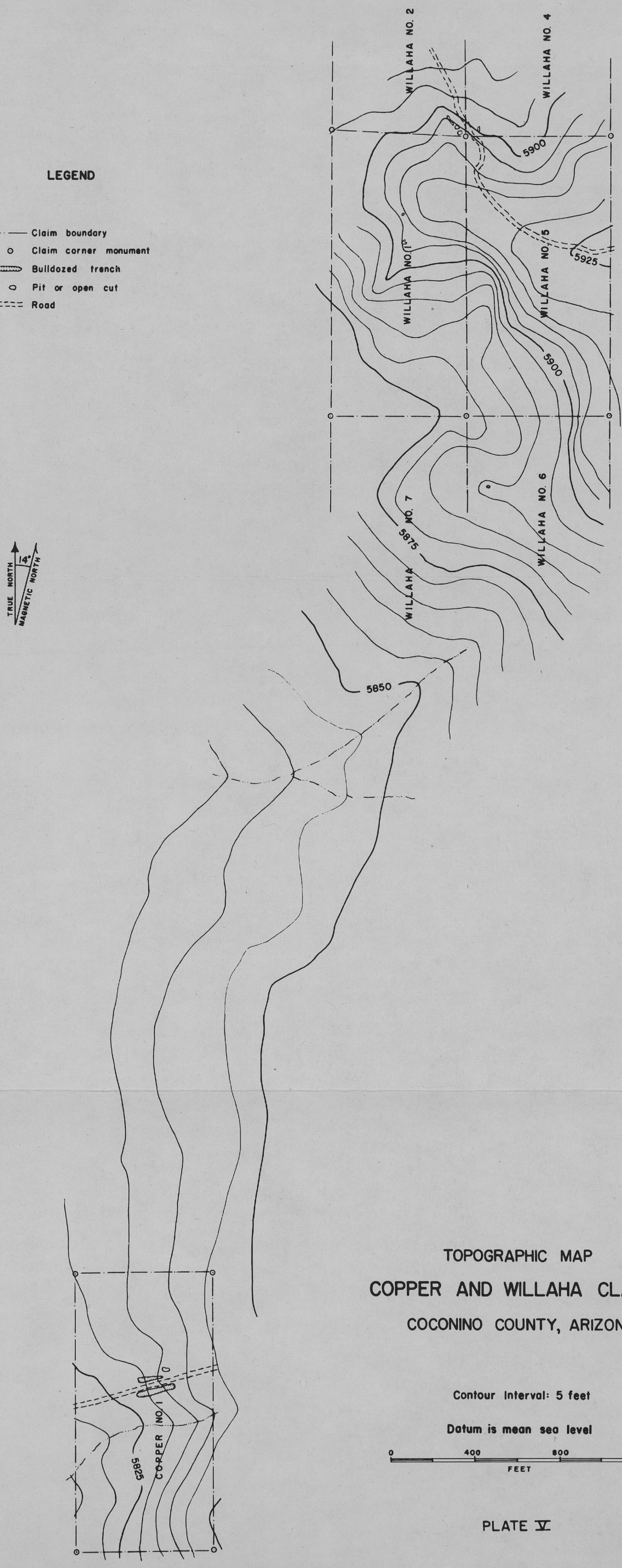
ISO-RAD MAP

WILLAHA GROUP OF CLAIMS

COCONINO COUNTY, ARIZONA

LEGEND

- Claim boundary
- Claim corner monument
- Bulldozed trench
- Pit or open cut
- Road



TOPOGRAPHIC MAP

COPPER AND WILLAHA CLAIMS

COCONINO COUNTY, ARIZONA

Contour Interval: 5 feet

Datum is mean sea level

0 400 800 1200

FEET

PLATE V