CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

The following file is part of the Cambior Exploration USA Inc. records

ACCESS STATEMENT

These digitized collections are accessible for purposes of education and research. We have indicated what we know about copyright and rights of privacy, publicity, or trademark. Due to the nature of archival collections, we are not always able to identify this information. We are eager to hear from any rights owners, so that we may obtain accurate information. Upon request, we will remove material from public view while we address a rights issue.

CONSTRAINTS STATEMENT

The Arizona Geological Survey does not claim to control all rights for all materials in its collection. These rights include, but are not limited to: copyright, privacy rights, and cultural protection rights. The User hereby assumes all responsibility for obtaining any rights to use the material in excess of "fair use."

The Survey makes no intellectual property claims to the products created by individual authors in the manuscript collections, except when the author deeded those rights to the Survey or when those authors were employed by the State of Arizona and created intellectual products as a function of their official duties. The Survey does maintain property rights to the physical and digital representations of the works.

QUALITY STATEMENT

The Arizona Geological Survey is not responsible for the accuracy of the records, information, or opinions that may be contained in the files. The Survey collects, catalogs, and archives data on mineral properties regardless of its views of the veracity or accuracy of those data.

Grand Prize & Ripsey Dist.

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

TO ACCOMPANY MAP GQ-1107

GEOLOGIC MAP OF THE CROZIER PEAK QUADRANGLE, PINAL COUNTY, ARIZONA

By Medora H. Krieger

REGIONAL GEOLOGIC SETTING

The broad regional geologic and structural setting of the Winkelman quadrangle, of which the Crozier Peak quadrangle is the northeast part, is discussed by Krieger (1974). Rocks within the general area range from Precambrian to Holocene, and all units are represented in this quadrangle except the Naco and Quiburis Formations. It is one of the most structurally complex quadrangles within the region.

STRATIGRAPHY

The oldest Precambrian rocks in the area of the larger scale index map are the Pinal Schist and intrusive rocks, largely the Ruin Granite (Oracle Granite of N.P. Peterson, 1938). Batholithic masses of Ruin Granite (1,430 m.y.) were intruded after a period of intense deformation that produced near-vertical east-trending foliation and bedding in the schist. The schist and granite are overlain with profound angular unconformity by Precambrian sedimentary rocks–the Apache Group and the disconformably overlying Troy Quartzite. Diabase, about 1,200 m.y. old (Silver, 1960; Damon and others, 1962), forms sills in the Apache Group and Troy Quartzite, sill-like masses in the schist and granite generally parallel to, and not more than 500 feet below, the pre-Apache surface (Shride, 1967, p. 56), and some dikes. The sills inflated, but did not perceptibly tilt, the Precambrian sedimentary rocks.

After a long period of erosion, Paleozoic formations were deposited paraconformably on the Precambrian sedimentary rocks.

Volcanic rocks of Late Cretaceous age disconformably overlie older rocks in the general area. In the Crozier Peak quadrangle they are the Williamson Canyon Volcanics of andesitic composition and a rhyodacitic to quartz latitic pyroclastic unit recognized only in the northwest part of the Crozier Peak quadrangle. The Williamson Canyon Volcanics have been considered either Late Cretaceous (Willden, 1964) or Late Cretaceous and(or) early Tertiary (Simons, 1964, Creasey, 1965, 1967). They are now considered Late Cretaceous because in the northeast part of the Crozier Peak quadrangle they are intruded by diorite that in the Winkelman 7 ½-minute quadrangle is dated as Late Cretaceous. The rhyodacitic to quartz latitic volcanic units are also considered Late Cretaceous because some of it resembles the Glory Hole Volcanics (Simons, 1964; Krieger, 1968b), which is intruded by granodiorite dated as 69 m.y. (Creasey, 1967).

Late Cretaceous diorite and granodiorite and Late Cretaceous and(or) early Tertiary (Laramide porphyry masses of several lithologic types) intrude the older rocks.

Cenozoic stratigraphy in eastern Pinal County has recently been revised by Krieger and others (1974). In the area of the larger scale index map Tertiary sedimentary deposits, formerly called Gila Conglomerate or Group, are now divided into three formations–in ascending order, the San Manuel, Big Dome, and Quiburis. In addition, Pleistocene and Holocene alluvial deposits, also formerly included in the Gila Conglomerate or Group, overlie these formations.

The San Manuel Formation consists of alluvial, lacustrine(?) and playa deposits, and interbedded andesite and megabreccias. It is Miocene (probably early Miocene) in age. Discordant dates on biotite and sanidine from a rhyodacite tuff bed in its upper part are 18 and 24 m.y., respectively (Joan Engels, written communication, 1968). The San Manuel Formation is unconformably overlain by the alluvial Big Dome Formation. In the Kearny quadrangle an interbedded nonwelded ash-flow yields late Miocene K-Ar ages of 14 m.y. on biotite and 17 m.y. on hornblende (Cornwall and others, 1971, and Banks, 1972). The youngest of these formations, the Quiburis Formation, which consists of an alluvial and a lakebed facies, was deposited in the basin now occupied by the San Pedro River. It contains Hemphillian vertebrate fossils (see Krieger, 1974a), indicating a middle Pliocene age.

STRUCTURE

The major structural features in the Winkelman 15-minute quadrangle southwest of the Gila and San Pedro Rivers are high-angle faults, north-northwest-trending en echelon ridges of steeply dipping to overturned diabase and Precambrian and Paleozoic sedimentary rocks, and low-angle gravity slides. As the tops of the beds in the en echelon ridges always face east, the structures are interpreted as partly eroded roots of a single monoclinal fold later separated by faults, or possibly as a series of monoclinal folds. Locally, the section within an individual ridge is repeated along what appears on a map as a high-angle fault, but which is inferred to be a tilted thrust. Some of the faulting, monoclinal folding, tilting of the thrusts, uplift, and the erosion of large areas now stripped of Precambrian and Paleozoic sedimentary rocks occurred before deposition of the San Manuel Formation, for the oldest unit in that formation in the Putnam Wash quadrangle is composed largely of Precambrian granitic clasts. Intense deformation also occurred after deposition of the San Manuel Formation, for adjacent to the monoclinal ridges, the formation dips steeply though somewhat less than the older rocks. The formation also has been cut by low-angle gravity slides and high-angle faults.

Faults that predate the San Manuel Formation are the thrusts, now tilted to vertical or overturned, and two sets of high-angle faults that trend east-northeast. Some east-northeast-trending faults resemble tear faults related to thrusting.

The Ripsey Wash fault, a tilted thrust, is a multiple-strand fault, in contrast to the Romero Wash fault in the Winkelman 7 ½-minute quadrangle, which is a single

strand fault. The fault zone consists of near-vertical, north-trending, east-facing slivers of basal Apache Group rocks that rest on granite and lie west of granite that underlies the main outcrops of the Apache Group. West of the point where the monoclinal swings abruptly east, successive slivers of basal Apache overlying granite too small to map are repeated in close succession by parallel faults. The long north-trending diabase masses in granite, apparently well below the pre-Apache surface, also suggests repetition by thrusting. Although there is no surface expression of the thrusts, the diabase is inferred to be sill-like masses that were intruded not more than 500 feet below the pre-Apache surface. Exposures in the area of the Ripsey Wash fault are mostly poor; many areas mapped as granite are covered by thin films of alluvium; some may conceal Apache Group rocks.

Faults that postdate the San Manuel Formation are west-dipping, low-angle gravity slides, high-angle, north-northwest-trending faults, and a few east-northeast-trending faults. Some high-angle faults, or some of the movement on them, postdate the Big Dome Formation; a few postdate the Quiburis Formation. The Indian Camp fault in the northeast part of the quadrangle may be a gravity slide similar to a major feature in the Putnam Wash quadrangle.

Although the monoclinal structures may have formed as separate en echelon folds, the alternative suggestion of a single monocline, later separated by faulting, is appealing. In the Crozier Peak quadrangle, the southern end of the ridge of steeply overturned strata swings abruptly east and abuts Ruin Granite, suggesting a strike-slip fault that caused the abrupt change in strike and dip of the Precambrian sedimentary rocks and separated the segment in the Winkelman quadrangle from the one in the Crozier Peak quadrangle. The segments were further separated by north-trending, high-angle faults. How much of the movement on the strike-slip and north-trending faults is older than the San Manuel Formation and how much is younger is uncertain. The fold in the older rocks is reflected in the younger deposits, which also swing east. Additional evidence for major strike-slip faulting is: (1) the east-trending high-angle faults and low-angle shear zones that separate Ruin Granite from diorite and Williamson Canyon Volcanics in the northeastern part of the Crozier Peak quadrangle, and (2) the fractured condition of the rocks in the north east corner of the Crozier Peak quadrangle that extends into the Kearny quadrangle. In this area of at least a square mile, few pieces on the surface are more than 6 inches in diameter and fractures are filled with carbonate, manganese minerals, specular hematite, and locally pyrite. Apache Group rocks are not in a normal sedimentary sequence. Other masses of brecciated rock with attendant chaotic repetition of small masses of Apache Group rocks and granite occur just north and northeast of the Crozier Peak quadrangle.

MINERALIZATION

The Winkelman 15-minute quadrangle, of which the Crozier Peak is a part, is adjacent to three major copper deposits: the San Manuel to the southeast, the Christmas to the northeast, and the Ray to the northwest. Although no economic deposits have yet been found within the 15-minute quadrangle, numerous prospect pits, shafts, and adits have explored the principal mineralized areas, which are in granitic rocks in the southeast corner and in the north-central and northwestern parts of the 15-minute quadrangle. Some of the mineralization may be Precambrian in age, but most of it probably is related to Laramide intrusive bodies.

In the Crozier Peak quadrangle, mineralization is confined to the Ruin Granite and Cretaceous diorite in the northeast part of the area and to Ruin Granite elsewhere. In the northeast corner, brecciated areas are veined with calcite, manganese oxide, specular variety of hematite, and goethite. Pyrite and copper staining is common in diorite. Quartz-sericite alteration with disseminated pyrite and a little copper mineralization is common in the northwest part of the quadrangle. In the southwestern part, two ages of quartz veins were noted: those that are older than the Precambrian diabase and those that are younger, probably of Laramide age. The younger quartz veins strike eastward, generally are 1 to 2 inches wide, locally 12 inches wide, and contain small pyrite cubes (as much as 4 mm). Associated with some of the shear zones and Laramide dikes are veins of calcite; one in the southeast corner of the quadrangle 5 to 10 feet wide, locally 20 feet wide, consists of coarsely crystalline (at least 1 cm) white and brown calcite and finer grained (less than 2 mm) pink calcite. Pink and white calcite are veined by brown calcite that has about the grain size of the pink calcite. X-ray examination proved that all the carbonate is calcite.

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Alluvium (0-15 ft exposed).—Flood-plain deposits along valley bottoms composed of clay, silt, sand, and some gravel; largely unconsolidated.

Talus (0-20 ft).—Veneer of rock debris derived from adjacent bedrock. Many talus deposits, not identified on map, partly cover diabase, upper member of Dripping Spring Quartzite, and Pioneer Formation.

Soil and gravel veneer on pediments and younger terraces (0-25 ft).—Subangular pebbles and cobbles in a generally reddish brown, fine- to coarse-grained matrix. Originally covered wide areas west and south of Ripsey Hill ridge, where present surface is only slightly below the pediment surface. The dark-red-brown soils were developed during one of the pre-Wisconsin interglaciations.

Undifferentiated gravel.— Terrace or pediment gravels, talus, and alluvium; includes isolated exposures of underlying rocks.

SAND AND GRAVEL (0–MORE THAN 100 FT EXPOSED)

Poorly consolidated alluvial gravel and sand composed largely of granules and small pebbles in a finer grained matrix, derived largely from Ruin Granite and related rocks. Concealed in many places by alluvial and colluvial material on valley bottoms and slopes and by red soil developed on upper (pediment) surfaces. Gravels east of Hackberry Wash in the northern part of the quadrangle were deposited in channels that were cut in the San Manuel Formation during the formation of the present drainage system. Sand and gravel in the

```
Text View: B:\pinal                          Col 0          940,032 Bytes          15%
0040210141PLS        GILA & SALT R 001 S013 E18C      SURVEY
0040210141COMMO01    COPPER                             P
0040210141COMMO02    SILVER                             C
0040210141COMMO03    GOLD                               B
0040210141N-NAM01    AMERINCAN
0040210141O-NAM01    RUSSEL HADDY
0040210141OWNER01    OWNER-OP       USA ARIZONA         1944
0040210141O-NAM02    EDWARD L WELSO
0040210141OWNER02    OWNER-OP       USA ARIZONA         1944
0040210141B-BIB 001 ADMR ASTONISHED-FAIRVIEW GROUP FILE
0040210141B-BIB 002 ADMR FILES
0040210142STATE      ARIZONA              PINAL
0040210142IDENT      AURORA CLAIMS                        PROSPECT    EXP PROSPECT
0040210142LOCAT      N325939W1110012ORE BODY 100M   990 10MS
0040210142UTM        12N3650449499688
0040210142TOPOG      TUCSON            NINETYSIX HILL NE7.5 MINMIXED
0040210142BASIN      GILA RIVER             60P
0040210142HUC        00000000
0040210142REFER      ADMR                              M1981
0040210142PLS        GILA & SALT R 005 S013 E15NWSE   SURVEY
0040210142COMMO01                                       P9999
0040210142O-NAM01    CONOCO
0040210142OWNER01    OWNER          USA ARIZONA         1981
1Help   2Unwrap 3       4Hex    5       6       7Search 8Viewer 9       10Quit

Text View: B:\pinal                          Col 0          940,032 Bytes          15%
0040210142O-NAM01    CONOCO
0040210142OWNER01    OWNER          USA ARIZONA         1981
0040210142B-BIB 001 USGS NINETYSIX HILLS NE QUAD
0040210142B-BIB 002 BLM UNPAT MINING CLAIM LEAD FILE 19328
0040210143STATE      ARIZONA              PINAL
0040210143IDENT      AURORA CLAIMS                        SURF-UNDERG DEVEL
DEPOSIT
0040210143LOCAT      N330025W1105945ORE BODY 100M  1012100MS
0040210143UTM        12N3651865500389
0040210143TOPOG      MESA              KEARNY             7.5 MINMIXED
0040210143BASIN      GILA RIVER             60P
0040210143HUC        00000000
0040210143REFER      ADMR                              M1981
0040210143PLS        GILA & SALT R 005 S013 E10C E2   SURVEY
0040210143COMMO01                                       P9999
0040210143O-NAM01    CONOCO
0040210143OWNER01    OWNER          USA ARIZONA         1981
0040210143B-BIB 001 USGS KEARNY QUAD
0040210143B-BIB 002 BLM UNPAT MINING CLAIMS LEAD FILE 43909
0040210144STATE      ARIZONA              PINAL
0040210144IDENT      AURORA PROPERTY                      SURF-UNDERG DEVEL
DEPOSIT
0040210144LOCAT      N331604W1111131ORE BODY  UNK   817100MS
1Help   2Unwrap 3       4Hex    5       6       7Search 8Viewer 9       10Quit
```

Ripsey Dist.

Ripsey Dist

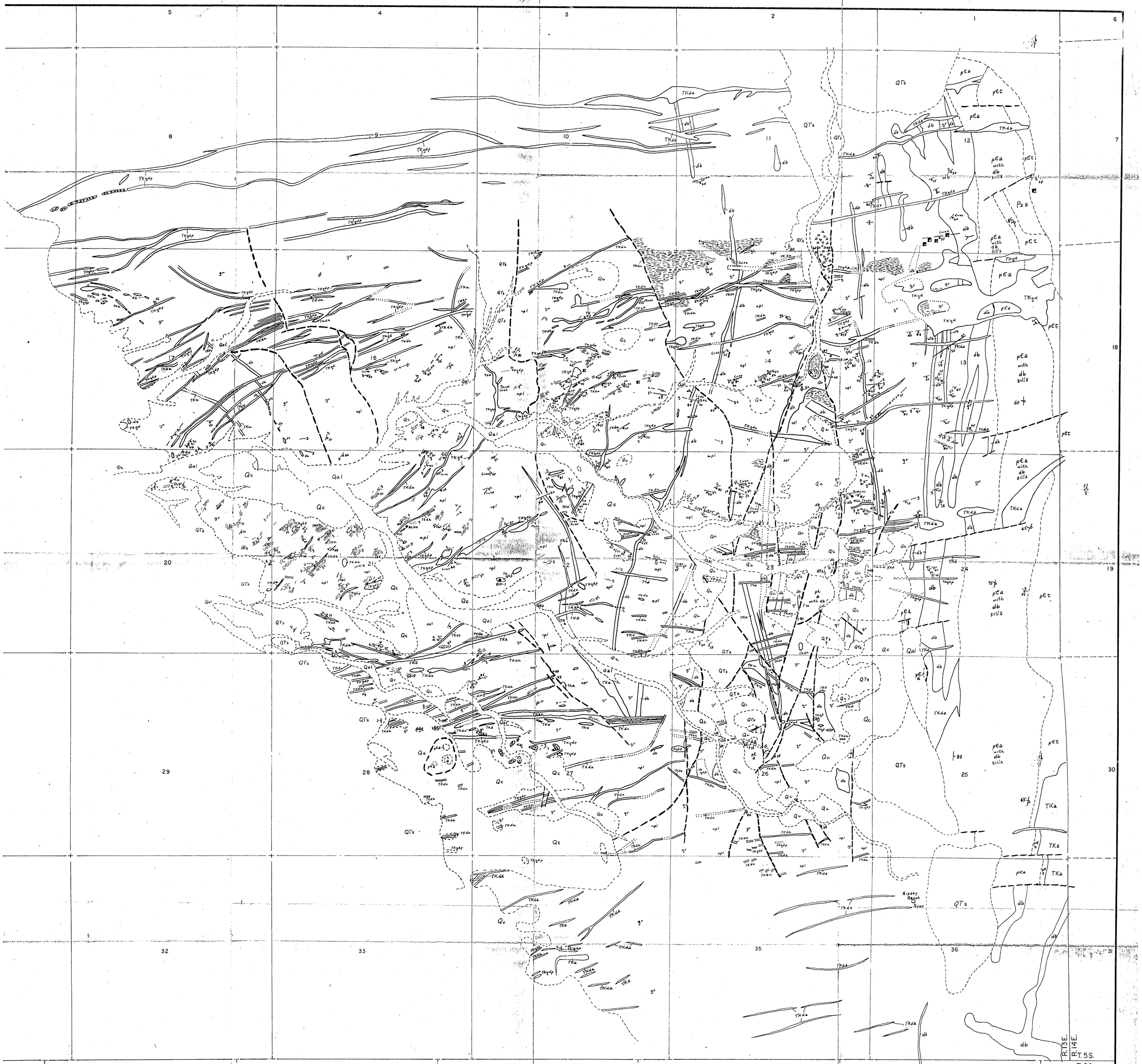
```
Text View: B:\pinal                    Col 0         940,032 Bytes         15%
DEPOSIT
0040210144LOCAT     N331604W1111131ORE BODY  UNK   817100MS
0040210144UTM       12N3680797482123
0040210144TOPOG     MESA              PICKETPOST MTN   7.5 MINNAT FOREST
0040210144BASIN     GILA RIVER             60P
0040210144HUC       00000000
0040210144REFER     ADMR                              M1981
0040210144PLS       GILA & SALT R 001 S011 E11C       SURVEY
0040210144COMMO01                                       P9999
0040210144O-NAM01   AURORA MINING CO
0040210144OWNER01   OWNER          USA ARIZONA          1939
0040210144B-BIB 001 USGS PICKETPOST MTN QUAD
0040210144B-BIB 002 ADMR AURORA MINE FILE
0040210145STATE     ARIZONA              PINAL
0040210145IDENT     AZURITE PROPERTY                    UNKNOWN      UNKNOWN
0040210145LOCAT     N323445W1104900ORE BODY 100M  1219100MS
0040210145UTM       12N3604460517207
0040210145TOPOG     TUCSON            ORACLE            15 MIN STATE
0040210145BASIN     SAN PEDRO RIVER        60E
0040210145HUC       00000000
0040210145REFER     ADMR                              M1981
0040210145PLS       GILA & SALT R 010 S015 E 9C       SURVEY
0040210145COMMO01                                       P9999
1Help   2Unwrap 3       4Hex    5       6       7Search 8Viewer 9       10Quit

Text View: B:\pinal                    Col 0         940,032 Bytes         15%
0040210141PLS       GILA & SALT R 001 S013 E18C       SURVEY
0040210141COMMO01   COPPER                              P
0040210141COMMO02   SILVER                              C
0040210141COMMO03   GOLD                                B
0040210141N-NAM01   AMERINCAN
0040210141O-NAM01   RUSSEL HADDY
0040210141OWNER01   OWNER-OP       USA ARIZONA          1944
0040210141O-NAM02   EDWARD L WELSO
0040210141OWNER02   OWNER-OP       USA ARIZONA          1944
0040210141B-BIB 001 ADMR ASTONISHED-FAIRVIEW GROUP FILE
0040210141B-BIB 002 ADMR FILES
0040210142STATE     ARIZONA              PINAL
0040210142IDENT     AURORA CLAIMS                       PROSPECT     EXP PROSPECT
0040210142LOCAT     N325939W1110012ORE BODY 100M   990 10MS
0040210142UTM       12N3650449499688
0040210142TOPOG     TUCSON            NINETYSIX HILL NE7.5 MINMIXED
0040210142BASIN     GILA RIVER             60P
0040210142HUC       00000000
0040210142REFER     ADMR                              M1981
0040210142PLS       GILA & SALT R 005 S013 E15NWSE    SURVEY
0040210142COMMO01                                       P9999
0040210142O-NAM01   CONOCO
0040210142OWNER01   OWNER          USA ARIZONA          1981
1Help   2Unwrap 3       4Hex    5       6       7Search 8Viewer 9       10Quit

Text View: B:\pinal                    Col 0         940,032 Bytes         15%
0040210142O-NAM01   CONOCO
0040210142OWNER01   OWNER          USA ARIZONA          1981
0040210142B-BIB 001 USGS NINETYSIX HILLS NE QUAD
0040210142B-BIB 002 BLM UNPAT MINING CLAIM LEAD FILE 19328
0040210143STATE     ARIZONA              PINAL
0040210143IDENT     AURORA CLAIMS                       SURF-UNDERG DEVEL
```

Ripsey Dist.

4/13 R x B



PRECAMBRIAN

- db — Diabase dikes
- pCa — Apache group sediments : mostly Dripping Spring Quartzite, local Mescal limestone
- apl / gr — Medium to coarse grained granite-quartz monzonite (gr); cut by aplite pods and dikes

SYMBOLS

- Dike and intrusive contacts, dotted under cover
- Outcrop boundary of sedimentary rocks
- Inferred fault with local, exposed dip and plunge of slickensides
- Dip of sedimentary beds
- Mineralized vein with local copper oxide, goethite or hematite; local chalcocite (cc), sphalerite (sp) and galena (gl); with dip where exposed
- Mineralized fractures and shear zones with breccia (▲) and quartz veins (qv)
- Breccia zones, usually mineralized, possibly small pipes
- Pervasive sericite or phyllic alteration usually mineralized
- Diamond core drill hole

g to diorite or
) (gd, gdp)

N

0 500' 1000' 2000'

1:12,000

SURVEY	
REFERENCE	
NOTES AND REVISIONS	

RIPSEY HILL PROSPECT

GEOLOGIC MAP

STATE	COUNTY	SCALE	CONTOUR INTERVAL
ARIZONA	PINAL	1 : 12,000	

CONTINENTAL OIL COMPANY
MINERALS DEPARTMENT
METALLICS DIVISION
TUCSON, ARIZONA

DATA BY	DATE	SIZE	FILE NO.
R. LORING	12/77		E 033-4a
DRAWN BY	DATE	PROJ FILE NO.	

FIGURE 3