Geologic map of the Mammoth 7 ½' Quadrangle, Pinal County, Arizona

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Arizona Geological Survey

Digital Geologic Map 67 (DGM-67), version 2.0

Sheet 1 of 2

September 2018

1:24,000 scale

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Map Unit Descriptions

Miscellaneous Quaternary Units

- **Plowed areas** - Historically or actively plowed fields, irrigated pastures, and other lightly disturbed ground.
- d — **Disturbed ground (upper Holocene)** - Areas substantially modified by mining and other human activity. Original geologic features are obscure.
- collapsed ground — **Area of collapsed ground above underground ore-removal zone at San Manuel mine** - Area of collapsed ground above underground block-caving ore-removal zone at San Manuel mine.
- dc — **Disturbed and collapsed ground, undivided** - Disturbed and collapsed ground associated with the San Manuel Mine.
- mine dump — **Waste rock produced by mining** - Rock debris derived from ore-deposit overburden (mine waste).
- mine tailings — **Mine tailings** - Tailings derived from processing ore from the San Manuel mine.
- heap-leach pad — **Former heap-leach pad for oxide copper ore derived from the San Manuel ore body** - Former heap-leach pad for oxide copper ore derived from the upper part of the San Manuel ore body, now landscaped to resemble a hill.
- Qtc — **Quaternary talus and colluvium** - Unconsolidated to weakly consolidated, very poorly sorted, angular, weakly bedded to massive, angular rock debris deposited at the base of bedrock slopes.

San Pedro River Alluvium

- Qycr — **Active river channel deposits** - Unconsolidated, very poorly sorted sandy to cobbly beds in active river channels.
- Qyaf — **Flood channel and low terrace deposits** - Unconsolidated sand, gravel, and silt deposits on bars, low terraces, and flood channels.
- Qysf — **Historical river terrace deposits** - Unconsolidated sand, gravel, and silt deposits on low terraces inset below the abandoned early historical floodplain.
- Qysf — **Latest Holocene to historical river deposits** - Silt, clay, sand, and minor gravel deposits underlying the early historical floodplain.
- Qysf — **Late to early Holocene San Pedro terrace deposits** - Silt, clay, sand, and minor gravel terrace deposits slightly above the early historical floodplain.
- Qlsf — **Late Pleistocene river terrace deposits** - Gravelly, sandy river terrace deposits from 5 to 20 m above the active river channel.
- Qlsf — **Middle to late Pleistocene river terrace deposits** - Higher intermediate terraces composed of a mix of river gravel, sand, silt, and clay from 15 to 35 m above the active river channel.
- Qlsf — **Early to middle Pleistocene river gravel terraces** - Isolated deposits covered with well-rounded river gravel from 30 to 60 m above the active river channel.

Piedmont Deposits

- Qyc — **Active tributary channel alluvium** - Unconsolidated, very poorly sorted sandy to cobbly ephemeral piedmont-tributary channel deposits.
- Qy$_3$ — **Latest Holocene alluvium** - Ephemeral tributary-channel deposits and low-lying piedmont channel terraces flanking active drainages.
- Qy$_2$ — **Late Holocene alluvium** - Planar terrace deposits located along incised drainages, broad low-relief distal fan deposits onlapping onto Holocene river alluvium, and infrequently active tributary-drainage deposits.
- Qyaf — **Late Holocene alluvial fan** - Active portions of young fan deposits exhibiting distributary drainage patterns.
- Qy$_1$ — **Early to late Holocene alluvium** - Broad, low-relief, undulating fan and sheet-flood deposits exhibiting widespread, shallow braided-drainage patterns.
- Ql$_3$ — **Late Pleistocene alluvium** - Gravelly and sandy late Pleistocene fan and terrace deposits with light to moderately developed orange-colored soils.
- Ql$_2$ — **Middle to late Pleistocene alluvium** - Gravelly and sandy middle to late Pleistocene fan and terrace deposits with moderately developed orange-colored soils.
- QTa — **Quaternary-Tertiary alluvium** - Sand and gravel alluvial deposits capping Quiburis-age and older deposits in topographically elevated areas.

Basin-Fill Deposits

- Tqc — **Late Miocene to Pliocene Quiburis deposits, conglomeratic facies** - Gravelly to sandy, moderately to strongly indurated alluvial fan deposits.
- Tqs — **Late Miocene to Pliocene Quiburis deposits, sandflat facies** - Moderately indurated distal alluvial-fan sandstone and silty sandstone (sandflat facies), lacustrine silty strata, and gypsiferous fine sandy to silty lake-margin deposits.
- Tql — **Late Miocene to Pliocene Quiburis deposits, lacustrine facies** - Fine-grained, laminated playa and lacustrine deposits.

Miocene San Manuel Formation

- Tst — **San Manuel Formation, Tucson Wash Member** - Conglomerate and conglomeratic sandstone derived from Cloudburst and Galiuro Volcanics. Paleocurrent directions, indicated by clast imbrication, are dominant southwesterly (Dickinson, 1993).
- Tsk — **San Manuel Formation, Kannally Member** - Conglomerate and conglomeratic sandstone derived largely from Oracle Granite. Paleocurrent directions, indicated by clast imbrication, are dominantly east-northeast (Dickinson, 1993).
- Tsc — **Weakly to moderately indurated, volcanic-lithic conglomerate** - Volcanic-lithic conglomerate derived from Cloudburst Volcanics but less indurated that Cloudburst Formation. Possibly equivalent to Tucson Wash Member of the San Manuel Formation. Exposed in small areas near the Tiger Mine.

Oligocene to lower Miocene igneous and sedimentary units

- Tri — **Intrusive rhyolite** - White to light gray, very fine-grained rhyolite, with 1-2% phenocrysts of quartz, feldspar and trace biotite.
- Trix — **Intrusive rhyolitic breccia** - Rhyolite, monolithologic breccia derived from rhyolite, and heterolithologic breccia derived from rhyolite, mafic volcanic rocks (Cloudburst volcanics), and Oracle Granite.
- Trx — **Intrusive rhyolite and rhyolite breccia, undivided** - Intrusive rhyolite and rhyolite breccia, undivided.
- Tcs — **Cloudburst Formation, sedimentary unit** - Conglomerate and sandstone representing alluvial fan to braidplane facies (Dickinson, 1993). This unit is typically volcanic-lithic and includes breccia derived from Cloudburst volcanics and, locally, from Oracle Granite.
- Tcsg — **Cloudburst Formation, granitic sediment facies** - Conglomerate and breccia derived from Oracle Granite and interbedded with Cloudburst volcanics. This unit includes conglomerate with mixed volcanic and granitic clasts.
- Tcv — **Cloudburst Formation, volcanic unit** - Massive, crystal-poor to slightly porphyritic, medium to dark gray lava flows and autobreccia, and less abundant volcanic-lithic breccia and massive conglomerate.
- Tcvc — **Cloudburst Formation, massive volcanic conglomerate** - Massive to crudely bedded, polymict boulder conglomerate with mafic volcanic clasts and minor Oracle granite grus and clasts.
- Tcvs — **Cloudburst formation, volcanic, volcaniclastic, and brecciated rocks, undivided** - Undivided mafic lava flows, rhyolite intrusions, and massive breccia derived from highly variable proportions of rhyolite, Cloudburst volcanics, and Oracle Granite.
- Tcmf — **Cloudburst formation, mafic fragmental rock** - Massive monolithologic fragmental rock derived from mafic Cloudburst volcanics.
- md — **mafic dike** - Mafic dike containing fine- to medium-grained plagioclase phenocrysts, possibly with hornblende and/or biotite. Age is uncertain but dikes are suspected to be related to the Cloudburst volcanics.
- cc — **Undesignated crystalline carbonate** - Bedded and brecciated cherty limestone of unknown age.

Laramide units (upper Cretaceous and lower Tertiary)

- Kaf — **American Flag Formation** - Conglomerate with clasts of Oracle Granite and volcanic rocks overlain by intermediate volcanics and lava autobreccia (Force, 1997).
- TKgp — **Granodiorite porphyry - Granodiorite porphyry** with abundant plagioclase up to 7 mm, less common biotite and hornblende, in a fine-grained gray groundmass that contains fine quartz and K-feldspar as well as plagioclase and mafic minerals (Creasey, 1965).

Proterozoic units

- **Aplite dikes** - Light cream or buff colored, fine to medium grained aplite dikes.
- Yd — **diabase** - Dark greenish gray to olive gray to black, fine to medium grained **diabase** forming dikes within Oracle Granite.
- Yo — **Oracle Granite** - Porphyritic, medium- to coarse-grained biotite granite ("quartz monzonite" of Creasey [1965]).
- Yoa — **Oracle Granite, alaskitic** - Equigranular, medium to coarse grained, pale gray alaskite that forms an irregular intrusion in the northwestern part of the map area.
- Yogd — **Oracle Granite, granodioritic** - Medium-grained, gray granodiorite containing biotite and hornblende.

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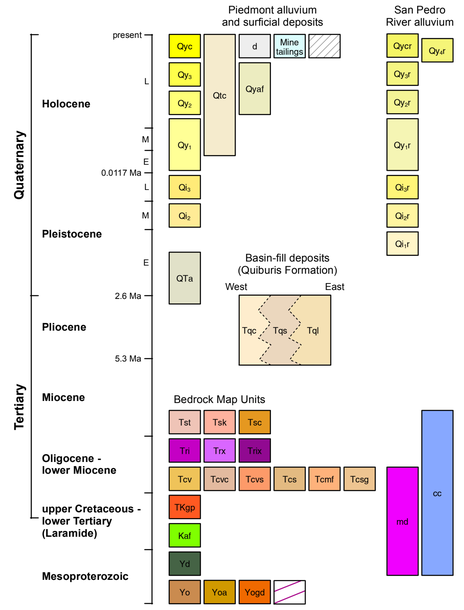
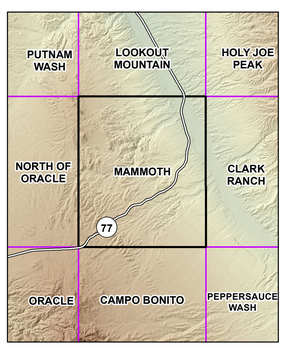
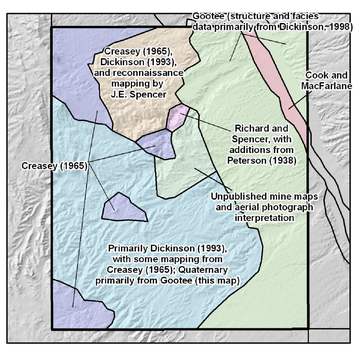
Correlation of map units

Not all uppermost Holocene anthropogenic units are shown



Location of map area





SCALE 1:24,000

1 0.5 0 1 Miles

1 0.5 0 1 Kilometers

0 1000 2000 3000 4000 5000 Feet

CONTOUR INTERVAL 40 FEET

Topographic base map derived from the Mammoth 7.5' USGS topographic quadrangle map originally with NAD27 datum. Reprojected to UTM NAD83 datum (zone 12) using iGage All Topo Maps V9. UTM NAD 83 grid and lat-lon markers produced using ESRI ArcMap v. 10.4.

9.7° TRUE NORTH MAGNETIC NORTH

Approximate mean declination, 2018

Map Symbols

- Horizontal bedding
- Inclined bedding showing strike and dip
- Inclined bedding showing strike and dip, approximate
- Apparent dip of inclined bedding
- Minor fault or vein orientation showing strike and dip
- Fault attitude
- Slickenside (fault-surface striae)
- Contact, accurate
- Contact, approximate
- Contact, concealed
- Contact, gradational
- Contact, approximate and inferred
- Mafic dike
- Quartz vein
- Intermediate dike
- Fault, accurate
- Fault, approximate
- Fault, concealed beneath surficial units
- Fault, approximate and inferred
- Detachment fault, accurate
- A A' cross section location

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