GEOLOGIC MAP OF THE TORTOLITA MOUNTAINS, PINAL AND PIMA COUNTIES, ARIZONA

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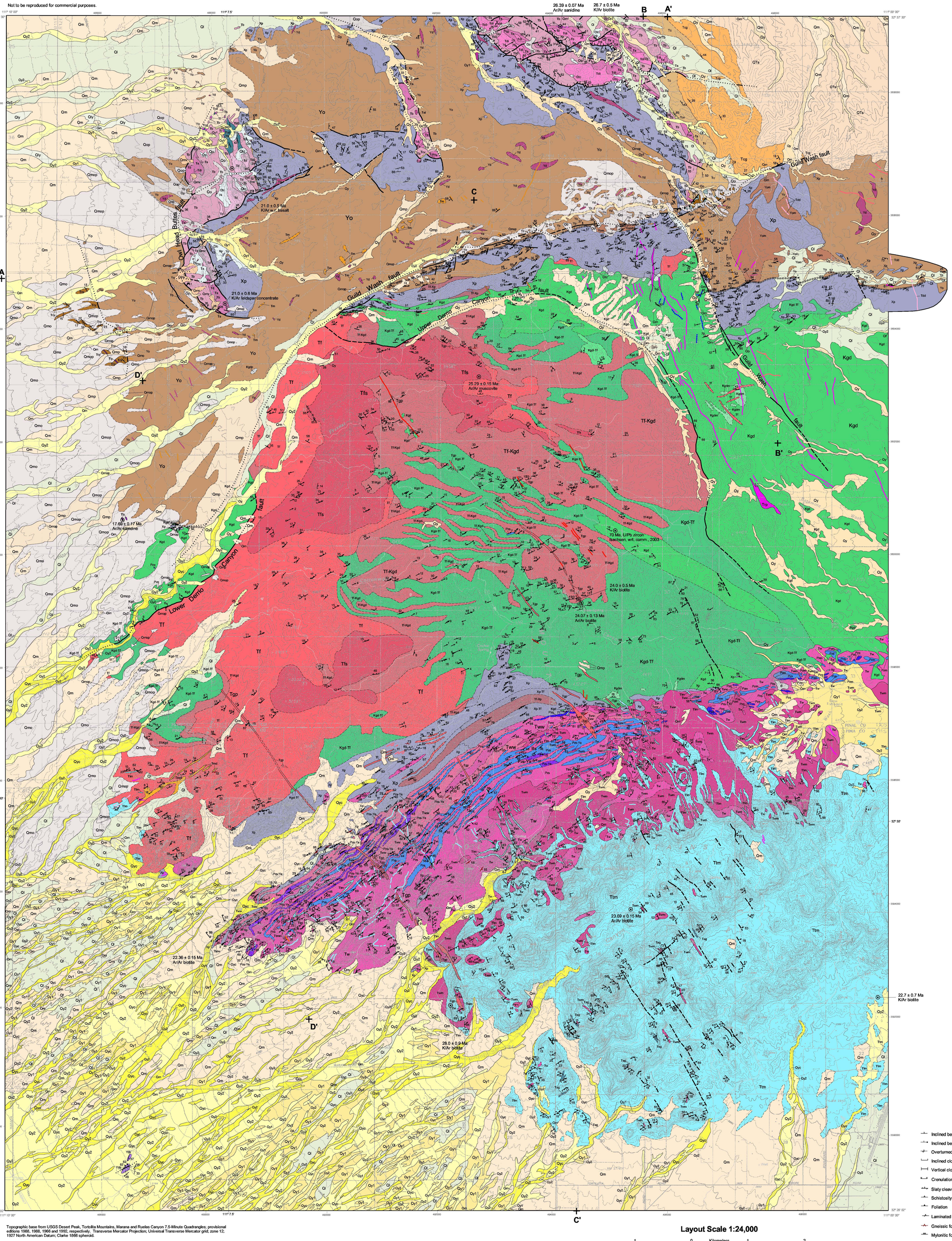

Quaternary Unit Descriptions

- d — Disturbed
- Qtc — Colluvium
- Qyc — Modern river channel deposits (< ~1 ka)
- Qy2 — Late Holocene alluvium (< ~2 ka)
- Qy1 — Holocene alluvium (~2 to 10 ka)
- Qy — Holocene Alluvium, undifferentiated (< ~10 ka)
- Qly — Holocene to Late Pleistocene alluvium (~2 to 130 ka)
- Ql — Late Pleistocene alluvium (~10 to 130 ka)
- Qm — Middle Pleistocene alluvium (~130 to 750 ka)
- Qmp — Middle Pleistocene alluvium over pediment
- Qmo — Middle to Early Pleistocene alluvium (~500 ka to 1 Ma)
- Qmop — Middle Pleistocene alluvium over pediment
- Qmv — Middle Pleistocene alluvium with volcanic clasts (130-750 ka)
- Qo — Early Pleistocene alluvium (~750 ka to 2 Ma)
- Qop — Early Pleistocene alluvium over pediment (750 ka-2 Ma)
- QTs — Early Pleistocene to Pliocene alluvium (~1 to 5 Ma)
- QTc — Talus and colluvium (Holocene and Pleistocene)
- Qr/Tb — Holocene and Pleistocene regolith alluvium derived from basalt

Bedrock Unit Descriptions

- Tcy — Younger Conglomerate (Miocene) – Thin- to thick-bedded, pebbly sandstone, pebble-cobble sandy conglomerate and sandstone, typically in tabular-planar sets. Clasts are dominated by schist and granite with 0-20% mafic volcanics (>50 m thick).
- Tty — Younger tuff (Miocene) – Phenocryst-poor, white nonwelded tuff containing sparse lithic lapilli of granite and schist (0-5 m thick).
- Tby — Basalt of Three Buttes (mid-Tertiary) - Basalt flows and dikes that contain <1% dark, glassy clinopyroxene up to 30 mm in diameter and <1%, untwinned, white to clear feldspar crystals up to 15 mm in diameter. Dated at 21 ± 0.5 Ma. Equivalent to unit Tbl on the Chief Butte Quadrangle (DGM-22). Shown here in cross-section only.
- Tcg — Granite-clast conglomerate (mid-Tertiary) – Massive to very thick-bedded, boulder-cobble, granite-clast (coarse-grained, K-feldspar porphyritic) conglomerate that contains up to 10% clasts of mafic volcanics and/or schist (0-600 m thick).
- Tc — Polymict conglomerate (mid-Tertiary) – Thin- to thick-bedded, reddish sandy matrix, cobble-pebble, rare boulder, clast-supported, conglomerate and pebbly sandstone containing sub-angular to rounded clasts of schist and granite (>75%) and mafic to intermediate volcanics (0-200 meters thick).
- Yox — Oracle Granite breccia (mid-Tertiary deformation of a Mesoproterozoic unit) – Strongly fractured, medium- to coarse-grained, K-feldspar porphyritic biotite granite forming massive outcrops of monomict, angular to sub-angular, pebble- to boulder-sized clast-supported breccia.
- Xpx — Pinal Schist breccia (mid-Tertiary deformation of a Paleoproterozoic unit) - Strongly fractured, sericitic phyllite and schist of massive outcrops of monomict, angular to sub-angular, pebble- to cobble-sized clast-supported breccia with red sandy to silty matrix.
- Tcv — Volcaniclastic conglomerate (Oligocene) – Thin to thick-bedded, reddish sandy matrix, cobble-pebble conglomerate and sandstone containing greater than 80% volcanic clasts, locally with subordinate clasts of granite and schist (0-30 meters thick).
- Tcd — Dacitic clast conglomerate – breccia (Oligocene) Dominantly monomict dacite clast conglomerate and breccia, typically thick-bedded to very thick-bedded or massive with poorly defined bedding (0-120 meters thick).
- Td — Dacitic lava (Oligocene) – 5-10% plagioclase-porphyritic, biotite-phyric dacite lava (0-200 meters thick).
- Tcs — Schist clast conglomerate (Oligocene) -- Monomict, medium-to thick-bedded, clast-supported, red sandy matrix, pebble-cobble schist-clast conglomerate (0-30 meters thick).
- Tdi — Hypabyssal dacitic rocks (Oligocene) - Phenocryst-poor, plagioclase- and biotite-phyric hypabyssal dacitic petrographically identical to the dacitic lava flows in the Owl Head Buttes area (Td).
- Tai — Hypabyssal andesitic rocks (Oligocene) - Small stocks of hypabyssal andesite similar in composition to andesite lava unit (Ta).
- Tt — Welded rhyolitic tuff (Oligocene) – Moderately welded rhyolitic ash-flow tuff containing 10% phenocrysts of plagioclase, sanidine, quartz, and biotite (0-15 meters thick).
- Ta — Andesitic lava (Oligocene) - Mafic to intermediate lava flows characterized by phenocryst assemblages dominated by plagioclase (1 mm - 6 mm) with subordinate pyroxene and olivine phenocrysts (0-120 meters thick).
- Tb — Basaltic andesite lava (Oligocene) – Amalgamated mafic lava flows characterized by phenocryst assemblages of 2-15% pyroxene, + olivine (0.3 mm - 4.0 mm), and subordinate plagioclase (typically <1.5 mm) (0-600 meters thick).
- Tb0 — Aphyric basaltic andesite lava (Oligocene) - Massive, crystalline matrix aphyric mafic lava (0-100 meters thick).
- Tdd — Dacite dikes (mid-Tertiary) - A swarm of north-striking dikes up to 4 m wide intrude the Carpas Wash Shear zone along the eastern edge of the map.
- Tm — Mafic dikes and small stocks (Mid-Tertiary) - Fine- to medium-grained mafic dikes and stocks with variable amounts of plagioclase (10-60%) and mafic minerals, typically chloritic altered.
- Tgp — Granite porphyry dikes (Mid-Tertiary) - Medium-grained syenogranite to alkali feldspar granite dikes up to 50 meters but generally less than 15 meters thick.
- Trp — Rhyolite porphyry dikes (Mid-Tertiary) - Phenocryst-poor rhyolite porphyry dikes containing less than 10% phenocrysts of feldspar (1-4 mm), quartz (1-3 mm), and sparse biotite.
- Tag — Aplite granite dikes (Tertiary) - Aplite granite dikes intrude the Tortolita Mountains Granite.
- Ttm — Tortolita Mountains Granite (Tertiary) - Medium-grained, equigranular granite containing 5-12% biotite.
- Ttmm — Tortolita Mountains Granite, mafic phase (Tertiary) - Rare dikes less than 3 meters wide of fine-grained, equigranular, weakly protomylonitic granite with up to 35% biotite.
- Tww — Pluton of Wild Burro Canyon, western phase (Tertiary) - Medium- to coarse-grained, equigranular, <10% biotite granite occurs along the northwestern margin of the pluton.
- Xp-Tww — Pinal Schist with 5-35% pluton of Wild Burro Canyon dikes (Paleoproterozoic and Tertiary) - Sericitic to psammitic schist cut by leucogranite dikes.
- Twm — Pluton of Wild Burro Canyon, mafic phase (Tertiary) - Medium- to fine-grained 30-60% biotite and hornblende, quartz monzodiorite to monzodiorite and diorite concentrated along the southeastern margin of the pluton of Wild Burro Canyon.
- Tw — Pluton of Wild Burro Canyon (Tertiary) - The main and oldest phase of a composite pluton consisting of medium- to coarse-grained, K-feldspar porphyritic quartz monzonite to quartz syenite with 15-30% biotite and hornblende.
- Tmd — Diorite dikes (Tertiary) - Fine- to medium-grained diorite dikes and small elongate stocks.
- Tf — Granite of Fresnal Canyon, composite unit (Tertiary) - Medium- to coarse-grained leucogranite with abundant (>5%) pegmatite. Leucogranite ranges from muscovite-garnet bearing to muscovite-biotite and magnetite, ± garnet bearing. Pegmatite consists of K-feldspar granite with minor muscovite, garnet and rare biotite.
- Tfs — Granite of Fresnal Canyon (Tertiary) - Medium-grained, muscovite, garnet, + biotite leucogranite distinguished from map unit Tf by paucity of pegmatite dikes and pods (< 5%).
- Tf-Kgd — Granite of Fresnal Canyon with less than 65% pluton of Chirreon Wash enclaves (Cretaceous + Tertiary) – A composite unit consisting of pluton of Chirreon Wash intruded by abundant dikes of the granite of Fresnal Canyon.
- Tf-Xp — Granite of Fresnal Canyon with less than 65% Pinal Schist enclaves (Paleoproterozoic and Tertiary) - Pinal Schist intruded by granite of Fresnal Canyon.
- Xp-Tf — Pinal Schist with between 5-35% granite of Fresnal Canyon dikes (Paleoproterozoic and Tertiary) - A composite unit consisting of Pinal Schist intruded by abundant dikes of the granite of Fresnal Canyon.
- Kgd — Pluton of Chirreon Wash (Cretaceous) – Medium-grained, equigranular granodiorite to monzogranite containing 15-30% biotite, hornblende, minor clinopyroxene, and opaque minerals. A sample of pluton of Chirreon Wash (sample CAF 02-2666) yielded a U-Pb zircon date of 69.6 ± 0.6 Ma (Clark Isachsen, written comm., 2003).
- Kgd-Tf — Pluton of Chirreon Wash with between 5-35% granite of Fresnal Canyon dikes (Cretaceous + Tertiary) – Pluton of Chirreon Wash intruded by granite of Fresnal Canyon.
- Kgdm — Pluton of Chirreon Wash, mafic phase (Cretaceous) – Fine- to medium-grained granodiorite containing >35% mafic minerals.
- Kgdl-Tf — Leucocratic phase of the pluton of Chirreon Wash with less than 35% granite of Fresnal Canyon dikes (Cretaceous + Tertiary) - Medium-grained, equigranular monzogranite containing less than 15% biotite intruded by granite of Fresnal Canyon.
- Kgdl — Pluton of Chirreon Wash, leucocratic phase (Cretaceous) – Medium-grained, equigranular monzogranite containing <15% mafic minerals.
- Kgdp — Granodiorite porphyry (Tertiary) – One small body of granodiorite porphyry on the piedmont south of Owl Head Buttes in the northwest part of the map area.
- Pzq — Quartzite (Paleozoic) - Thin- to thick-bedded or banded, gray, vitreous quartzite with sparse interbeds of calc silicate schist and rusty sericitic schist.
- Pzm — Marble (Paleozoic) - Massive, light gray marble.
- Pzs — Metasedimentary rocks (Paleozoic) - Quartzite, calcsilicate schist, sericitic schist, and marble.
- Pzs-Ys — Metasedimentary rocks (Mesoproterozoic to Paleozoic) - Quartzite, calc silicate schist, sericitic schist, and marble with lenses of fine- to medium-grained amphibolite.
- Yd — Diabase (Mesoproterozoic) - Mafic dikes and pods displaying diabase texture or interpreted to be associated with nearby mafic dike with diabase texture.
- Yds — Dripping Spring Quartzite (Mesoproterozoic) - Thin- to thick-bedded, fine- to medium-grained, moderately sorted, pink, feldspathic quartz sandstone.
- Yo — Oracle Granite (Mesoproterozoic) - Medium- to coarse-grained, K-feldspar porphyritic, biotite granite.
- Yom — Oracle Granite, medium-grained equigranular phase (Mesoproterozoic) - Medium- to coarse-grained, equigranular to slightly quartz-porphyritic granite with up to 15% biotite.
- Xpr — Pinal Schist, aphyric rhyolite lava (Paleoproterozoic) - Aphyric rhyolite lava flow interbedded with quartzose psammite.
- Xp — Pinal Schist (Paleoproterozoic) - Laminated to thin-bedded siltstone and thin- to medium-bedded sandstone interbedded with mudstone north of Carpas Wash Shear zone. Quartz veined sericitic schist and coarse-grained schist to thin-banded quartzofeldspathic sillimanite gneiss to the south.

Structural Symbols

- Inclined bedding
- Inclined bedding w/tops
- Overturned bedding
- Inclined close disjunct cleavage
- Vertical close disjunct cleavage
- Crenulation cleavage
- Slaty cleavage
- Schistosity
- Foliation
- Laminated differentiated foliation
- Gneissic foliation
- Mylonitic foliation
- Protomylonite foliation
- Weak protomylonite foliation
- Ultramylonite foliation
- Mylonitic stretching lineation
- Discrete mylonite zone
- Mylonitic stretching lineation, directed down plunge
- Inclined joint
- Vertical joint
- Mineral lineation
- Lineation at intersection of bedding and cleavage
- Intersection lineation in dikes
- Minor anticline fold axis
- Minor syncline fold axis
- Slickenline lineation
- Minor fault
- Fault surface orientation
- Dike
- Fractures
- Crenulation lineation
- Sample location for geochronology analysis
- Contact, accurate
- Contact, approximate
- Contact, concealed
- Fault, accurate
- Fault, approximate
- Fault, concealed
- Low-angle fault, accurate
- Low-angle fault, approximate
- Low-angle fault, concealed
- Thrust fault, accurate
- Thrust fault, approximate
- Thrust fault, concealed
- Gradational contact
- Flow boundaries in unit Td
- Scratch contact
- Shear zone
- Vein, accurate
- Vein, approximate
- Dacite dikes (Tdd), accurate
- Mafic dikes (Tm), accurate
- Granite porphyry dikes (Tgp), accurate
- Rhyolite pophyry dikes (Trp), accurate
- Tortolita Mountains Granite dikes (Ttm), accurate
- Tortolita Mountains Granite dikes (Ttm), approximate
- Tortolita Mountains Granite mafic dikes (Ttmm), accurate
- Granite of Fresnal Canyon dikes (Tf), accurate
- Leucogranitic dikes, accurate
- Diabase dikes (Yd), accurate

Topographic base from USGS Desert Peak, Tortolita Mountains, Marana and Ruelas Canyon 7.5-Minute Quadrangles; provisional editions 1988, 1988, 1966 and 1992, respectively. Transverse Mercator Projection; Universal Transverse Mercator grid, zone 12; 1927 North American Datum; Clarke 1866 spheroid.

Layout Scale 1:24,000

1 0 Kilometers 1 2
1000 0 Meters 1000 2000
1 0 1 Miles
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 Feet

contour interval 40 feet

Location Map

Mapping responsibility
1. Charles A. Ferguson
2. Brad J. Johnson
3. David J. Maher
4. Wyatt G. Gilbert
5. Stephen M. Richard
6. Jon E. Spencer
7. Banks et al., (1977, USGS MF 864)
8. Steven J. Skotnicki
9. Ann Youberg
10. Demsey et al.,(1993, AZGS OFR 93-14)

Correlation of Map Units

Digital cartography by Richard A. Trapp, Erin M. Moore, Charles A. Ferguson and Jon E. Spencer.

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