

GEOLOGIC MAP OF THE BOUNDARY CONE 7 1/2' QUADRANGLE, MOHAVE COUNTY, ARIZONA

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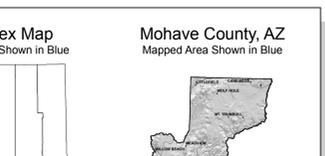
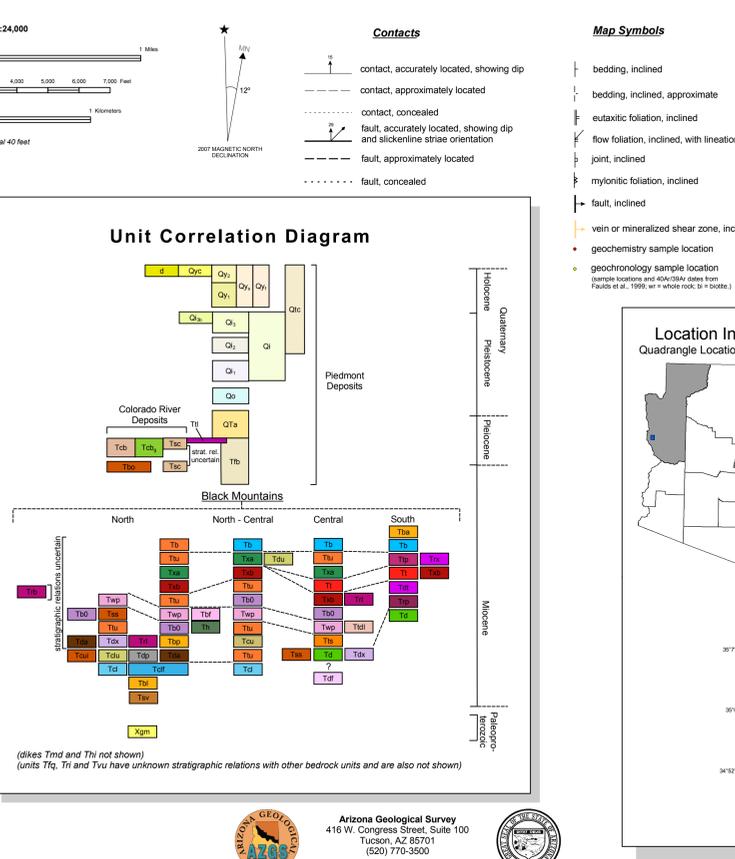
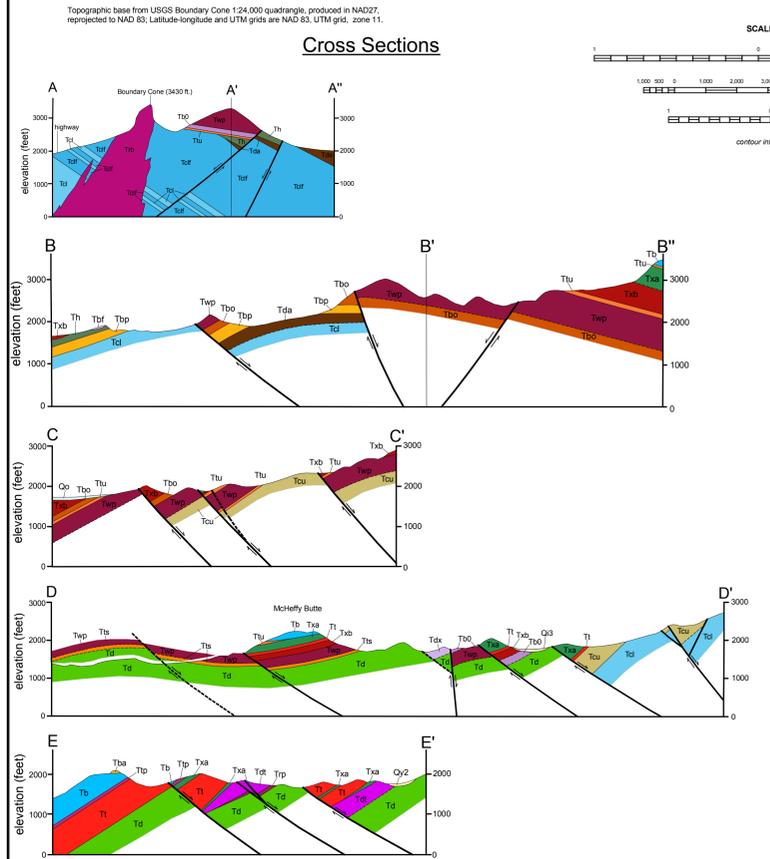
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Geologic Map Units

Late Miocene to Quaternary Deposits	
d	Disturbed ground Mine dump
QtC	Colluvium and talus, undivided Coarse, very poorly sorted hillside deposits.
Qy₀	Modern sand and gravel deposits associated with active channels of tributary washes Very poorly sorted sand, pebbles, cobbles, boulders and minor silt deposits in active channels of tributary washes. Gravel class consist of mixed volcanic rocks.
Qy₂	Late Holocene sand, pebble, cobble, boulder, and silt deposits in active stream channels, low terraces, and alluvial fans Very poorly sorted sand, pebble, cobble, boulder, and silt deposits in small stream channels, low terraces, and alluvial fans. No desert pavement or soil development.
Qy₁	Late to early Holocene deposits on channel bars, terraces and active alluvial fans Very poorly sorted sand, pebble, cobble, boulder, and silt deposits in gravel bars, low terraces, and alluvial fans. Desert pavement and soil development are weak.
Qyf	Holocene piedmont alluvium, fine-grained Thin, fine-grained Holocene alluvial deposits in swales on high remnant early Pleistocene fan deposits.
Qys	Holocene sandy channel and fan deposits Young sand deposits derived from older Colorado River deposits, reworked by tributary washes into young channels and alluvial fans.
Ql₃	Late Pleistocene alluvial fan and terrace deposits Poorly sorted mixtures of silt, sand, pebbles, cobbles and boulders on relict alluvial fans and stream terraces. Soil development is weak but desert pavement development is moderate to strong, with relatively smooth surfaces and brown to dark brown rock varnish.
Ql₂	Late Pleistocene alluvial fan and terrace deposits, younger member Poorly sorted mixtures of silt, sand, pebbles, cobbles and small boulders on alluvial fans and stream terraces. Soil development is moderate and pavement development is strong, with smooth surfaces and brown rock varnish.
Ql₁	Middle to late Pleistocene alluvial fan deposits Dissected relict alluvial fan deposits consisting of poorly sorted sand, pebbles, cobbles, and boulders, with minor silt and clay. Soil development is moderate and pavement development variable depending on local surface preservation.
Ql	Middle to late Pleistocene piedmont alluvium, undivided High, dissected relict alluvial fan deposits consisting of poorly sorted sand, pebbles, cobbles, and boulders, with minor silt. Soil development is variable, but commonly consists of cemented petrosols between or near the surface.
Qo	Middle to early Pleistocene alluvial fan deposits High, dissected relict alluvial fan deposits consisting of poorly sorted sand, pebbles, cobbles, and boulders, with minor silt. Soil development is variable, but commonly consists of cemented petrosols between or near the surface.
QTa	Late Pliocene to early(?) Pleistocene alluvial fan High, deeply dissected relict alluvial fan deposits consisting of poorly sorted cobbles, sand, pebbles, and boulders, with minor silt. Soil development is variable, but commonly consists of cemented petrosols between or near the surface.
Tt₁	Early Pliocene ash-fall tephra A thin (<1 m), discontinuous, white to gray tephra bed, that is typically exposed within fine tributary gravels of unit Tt ₁ at elevations ranging from 1240 to 1180 feet. One exposure of a tephra that is probably correlative with this unit is present at 1400 feet elevation near the southeast corner of the map area (west edge of section 3). Samples from this tephra have been identified as the ~4 Ma Lower Nomaiki tephra (House et al., 2005).
Tcb	Early Pliocene river and tributary deposits In the middle and lower piedmont below about 1100 ft above sea level (asl), this unit consists primarily of Colorado River sand, gravel, and silt. Above that level, piedmont deposits predominate, but locally Colorado River sand and gravel is present up to 1300 ft asl. River deposits and tributary alluvium clearly interfinger in some locations. (Unit informally named "bedload alluvium" by House et al. (2005).
Tcb_g	Early Pliocene river deposits, gravelly member Unit contains a substantial component of cobbles, pebbles, and small boulders in addition to quartz-rich medium to coarse sand.
Tsc	Early Pliocene marginal river and/or lake deposits Very poorly lithified, very fine sand and silty sand, locally calcareous. Unit locally grades upward into pebbles to cobble conglomerate.
Tfb	Late Miocene to middle Pliocene alluvial-fan deposits Very old tributary-fan deposits exposed in the middle and lower portions of high, eroded ridges. Deposits typically are poorly sorted to very poorly sorted, including angular to subangular cobbles, pebbles, sand and boulders, with minor silt and clay.
Tbo	Latest Miocene to Early Pliocene lake deposits of the House Formation One to three-inch-thick, pale white to buff-colored, very fine mud and silt to sandy silt, weakly to very weakly consolidated. Generally this unit rests on erosion surfaces on well lithified volcanic rocks near the southeastern corner of the map area.
Early to Middle Miocene Bedrock Map Units	
Ttrb	Boundary Cone rhyolite Massive, resistant, rhyolite intrusion that contains 10-15%, 1-3 mm quartz, and <5%, 1-2 mm feldspar.
Tba	Basaltic trachyandesite Basaltic lava containing sparse phenocrysts of plagioclase and/or mafic phenocrysts. Analysis of a single sample indicates that this rock unit is a basaltic trachyandesite according to the classification system of Le Bas et al. (1986).
Tb	Upper basaltic lava Basaltic lavas dominated by 2-7% mafic phenocrysts of pyroxene and olivine ranging in size from 0.5-3.0 mm. Subordinate plagioclase phenocrysts are typically less than 1.2 mm. Nine major element analyses of this unit all fall in the basalt field of Le Bas et al. (1986).
Tmd	Mafic dike
Ttu	Bedded pyroclastic rocks and volcanoclastic sedimentary rocks A generic unit of bedded and massive pyroclastic rocks, and variably pumiceous volcanoclastic rocks that are present between defined volcanic units at several levels in the stratigraphic sequence.
Txa	Trachyte of McJelly Butte Lava containing 10-20%, 2-4 mm euhedral plagioclase phenocrysts, and 2-5%, 1-4 mm clumps of pyroxene or hornblende phenocrysts, and 1-2%, biotite phenocrysts up to 2 mm diameter. Five out of six chemical analyses indicate classification as trachyte.
Tt	Peach Springs Tuff Densely welded ash-flow tuff containing 12-20%, 0.5-4.0 mm phenocrysts of sanidine and plagioclase, with much larger and much more abundant sanidine than plagioclase. Unit also contains up to 2%, 0.5-2 mm quartz, and 1-3%, 0.5-1.5 mm biotite, and sparse hornblende and sphene (<1 mm).
Trh	Rhyolite lava Glassy, phenocryst-poor, partly autoclastic lava flows with possible stretched flame and glass shards.
Trx	Phenocryst-rich rhyolite lava Very glassy, partly autoclastic lava flows with up to 40%, <8 mm feldspar (mostly sand-sized), and <5%, <1 mm biotite.
Tri	Rhyolite lava Rocks of this unit contain 3-5%, 1-4 mm quartz and <1%, <2 mm biotite.
Ttp	Dacitic, lapilli, ash-flow tuff Tuff of this unit is only mapped just east of the edge of the Boundary Cone 7.5' Quadrangle.
Trp	Rhyolite lava Rhyolite lava containing 3-5%, 1-3 mm phenocrysts of feldspar and quartz, and very sparse mafic phenocrysts, probably mostly biotite. A single geochemical analysis indicates that a rhyolite composition (classification of Le Bas et al., 1986).
Txb	Basaltic trachyandesite Medium gray, vesicular lava with 4-6%, 1-4 mm plagioclase (locally up to 10 mm plagioclase), 2-7%, 0.5-3 mm, dark rounded (clayey?) and 3-5% pale-green alteration product after orthopyroxene(?). Two chemical analyses indicate classification as a basaltic trachyandesite (classification of Le Bas et al., 1986).
Ttd	Dacitic, lapilli, ash-flow tuff Tuff of this unit is only mapped just east of the edge of the Boundary Cone 7.5' Quadrangle.
Tbo	Trachybasalt A suite of phenocryst-poor (< 2%), to nearly aphyric basaltic lava containing very sparse plagioclase and/or mafic phenocrysts (<1 mm, but rarely up to 2 mm). Analysis of a single sample indicates that this rock unit is a trachybasalt according to the classification system of Le Bas et al. (1986).
Tbp	Basaltic andesite Phenocryst-poor lava flows containing 0.5-3% (rarely up to 5%), 1-2 mm, greenish, variably altered pyroxene and possibly olivine. Plagioclase phenocrysts sparse to absent.
Twp	Lava of Wrigley Peak (Miocene) Phenocryst-poor lava flows that contain <1%, <2 mm biotite, <1% <1 mm plagioclase, and 2-3%, <2 mm iron oxides also olivine or pyroxene. Unit is characterized by abundant, closely spaced fractures (commonly 1-3 cm) that change orientation by many tens of degrees over tens of meters and result in weathering into thin slabs and sheets. The average of three geochemical analyses indicates that the rock is a trachyte (classification of Le Bas et al., 1986).
Tdt	Lapilli tuff (Miocene) Lapilli tuff containing 10-20%, 1-3 mm, plagioclase phenocrysts, 1-2% biotite phenocrysts, and 2-10% heterogeneous volcanic lithic clasts.
Tdu	Phenocryst-rich dacitic lava Dacitic lava containing 25-30%, 1-8 mm, but mostly 2-4 mm, euhedral blocky plagioclase and potassium feldspar, and 1-5%, 1-3 mm biotite.
Tss	Sandstone and conglomerate (volcanoclastic)
Tts	Tuff and reworked tuff Pale white tuff, fuscous sandstone, and volcanoclastic sandstone and pebble to, rarely, cobble conglomerate. This unit contains the zeolite described by Gray et al. (1999).
Td	Dacite Pale gray lava with 4-5%, <2 mm biotite, <2%, <1 mm, acicular hornblende, and 5-9%, 1-5 mm plagioclase (and possibly K-feldspar) that is locally up to 6 mm. Average of four geochemical analyses is slightly in the dacite field of Le Bas et al. (1986) but very close to the andesite field.
Tdf	Phenocryst-rich dacitic lava Fine-grained dacitic lava containing 10-25% phenocrysts of <2 mm plagioclase and 1-3%, <2 mm, altered biotite(?).
Tbf	Biotite feldite Feldite characterized by 2-3%, 1-2 mm, brassy biotite phenocrysts.
Th	Hornblende feldite Feldite with conspicuous, 3-7%, acicular, euhedral hornblende phenocrysts, 1-6 mm long.
Thi	Hornblende feldite dike
Tdp	Coarse andesite Compositional porphyritic andesite containing 15-20%, 2-6 mm plagioclase and 1-3 mm, mafic phenocrysts.
Tda	Dacitic lava of Alcyone Mine Dark gray, fine-grained matrix, moderately phenocryst-rich dacitic lava that contains 7-15%, 1-6 mm phenocrysts of euhedral, tabular to equant plagioclase.
Tfq	Quartz porphyry feldite
Tdx	Heterolithic, clast-supported dacitic breccia
Tcu	Upper dacitic lava of Cook Mine Dark gray, fine-grained matrix, phenocryst-rich dacitic lava containing 15-35% euhedral tabular to equant plagioclase phenocrysts with 2-5%, 2-6 mm euhedral, strongly altered hornblende phenocrysts.
Tcu_i	Intrusive dacite of Cook Mine Unit consists of 3-50 m thick dikes of gray to purplish-gray, crystalline matrix dacite porphyry containing 15-25% phenocrysts of euhedral, mostly equant plagioclase.
Tclu	Upper flow unit of the lower dacite of Cook Mine
Tcl	Lower dacitic lava of Cook Mine This is a compositionally variable unit that typically consists of massive lava containing 10-30%, 1-8 mm plagioclase phenocrysts, and 1-10%, 1-3 mm mafic phenocrysts. The chemical analysis of this unit yielded classification as an andesite, and another indicates trachyte (classification of Le Bas et al., 1986).
Tclf	Dacitic fragmental rocks of Cook Mine Generally massive fragmental rock dominated by clasts of one or more varieties of the phenocryst-rich dacite family of lava types. Unit contains 10-40%, 1-10 mm plagioclase, 0.1-1 mm, 5-10% hornblende, and biotite.
Tbi	Older basalt Dark gray, phenocryst-poor lava with 1-3%, 1-2 mm mafic phenocrysts including brown altered olivine and green pyroxene.
Tsv	Sandstone and lapilli tuff or scoria
Tvu	Volcanic rocks, undivided
Proterozoic Bedrock Map Units	
Xgm	Crystalline rocks, undivided (early Proterozoic) Gneissic and granitic rocks.

Note - see accompanying text document for more complete geologic unit descriptions, mapping methods and references.



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