Geologic map of the Arizona part of the Gene Wash 7 ½' Quadrangle, Mohave and La Paz Counties, Arizona

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Arizona Geological Survey

Digital Geologic Map 110 (DGM-110), version 2.0

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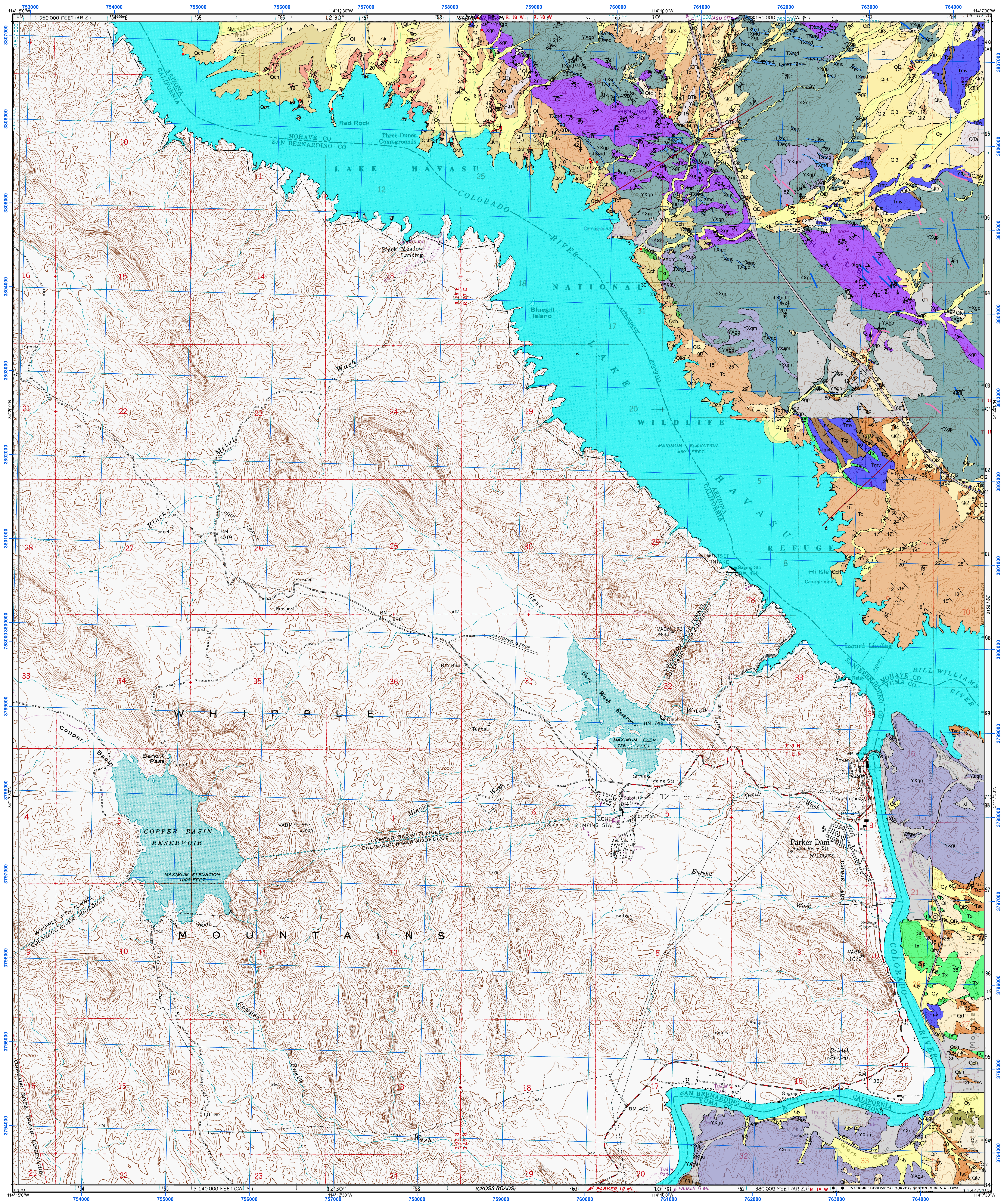
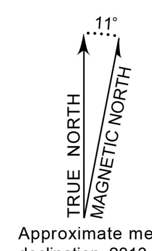
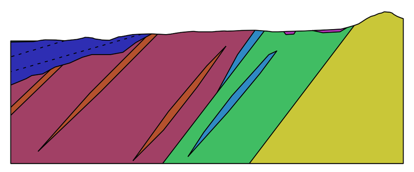


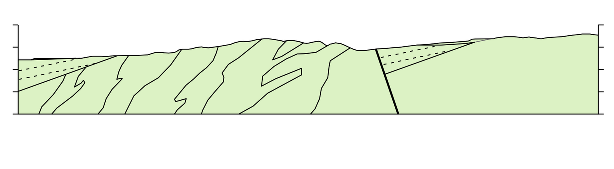
Scale 1:24,000

Topographic base map derived from Cibola 7.5' USGS topographic quadrangle map originally with NAD27 datum. Reprojected to UTM NAD83 datum (zone 11) using iGage All Topo Maps V7. UTM NAD 83 grid and lat-lon markers produced using ESRI ArcMap v. 10.2.



Approximate mean declination, 2013





Description of map units

w — **Water** - Lakes and rivers

d — **Disturbed ground** - Areas where human activity has covered or disupted rock units and contacts. Includes areas covered by asphalt, fill, and buildings.

Qtc — **Colluvium and talus** - Very poorly sorted, angular to subangular, locally derived gravel, sand, silt and clay deposits on hillslopes. Deposits are derived from underlying or adjacent bedrock outcrops, or older alluvial deposits capping eroded ridges. Locally bouldery talus deposits with minimal fine matrix.

Piedmont Deposits

Qy — **Young alluvium** - Very poorly sorted gravel, sand and silt deposits in small channels, low terraces, and lake-margin alluvial fans. Soil development is weak to none, with minimal or no rock varnish on surface clasts.

Qi_3 — **Younger intermediate alluvial fan and terrace deposits** - Gravel and sand deposits with moderate to tight desert pavements, dark rock varnish, forming relict alluvial fans and intermediate terraces. Weakly cohesive to loose silt, sand, pebbles, cobbles, locally small boulders, Soil development is weak to moderate.

Qi_2 — **Intermediate alluvial fan and terrace deposits** - Gravel and sand deposits, with minor silt and clay, associated with moderately dissected relict alluvial fans and intermediate terraces. Rock varnish and pavement development is variable, quite dark with tight pavements on well-preserved surfaces and much lighter-colored on more eroded surfaces.

Qi_1 — **Older intermediate alluvial fan deposits** - High dissected gravelly alluvial fan deposits and dissected terrace deposits. Alluvial fan remnants are deeply eroded, with limited preserved fan surface remnants. Soil development ranges from strong on well-preserved surfaces to weak to moderate on eroded slopes. Near the Colorado River, this unit includes some rounded river gravel and quartz-rich sand.

Qi — **Intermediate alluvial deposits undivided** - Stream terrace and relict alluvial fan deposits with weak to strong soil development.

QTa — **Old remnant alluvial fan deposits** - High gravelly alluvial fan deposits capping ridges. Deeply dissected, no original fan surface preserved. QTa deposits are a few meters thick in most areas, but locally are up to 10 m thick. Deposits overlie a variety of older units, including bedrock and tilted sedimentary deposits.

Colorado River Deposits

Qch — **Chemehuevi Formation** - Quartz-rich sand, silt and clay deposits draped over bedrock and older deposits. Locally includes well-rounded, lithologically diverse pebbles and cobbles in a quartz-rich sand matrix. These deposits record a period of major aggradation by the Colorado River in the late Pleistocene (Malmon et al., 2011).

QTss — **Very fine grained sand** - Unlithified sand and silt. Likely deposited by the Colorado River. High above Lake Havasu, so probably Pliocene to Quaternary in age, and associated with either the Bouse Formation or Bullhead Formation. Unit is well sorted with little silt at one location (UTM 763143E 3802515N, NAD 83, elevation 600 ft) and poorly sorted and silty at another location (UTM 764466E 3805681N, NAD 83, elevation 950 ft).

Tbf — **Basin fill** - Generally consists of tan fanglomerate that is younger than underlying tilted units and older than overlying basalt.

Tilted upper Oligocene to Middle Miocene rock units

Ts — **Sandstone and pebbly sandstone** - Light orange-brown feldspathic sandstone (probably mostly arkosic arenite), medium-bedded, fine- to coarse-grained (typically medium-grained mode), moderately sorted, containing local pebbly beds and conglomerate. The unit contains two or more intervals of white tephra and pumiceous sandstone, locally up to 6 m thick. One of the intervals consists of several layers interbedded with pebbly sandstone (UTM 758183E 3806970N, NAD83). Another contains ~10% <1-mm fragments of biotite (UTM 757261E 3806829E, NAD83). The unit gradationally overlies conglomerate of unit Tc.

Tc — **Conglomerate and conglomeratic sandstone** - Generally consists of pale tan, poorly sorted, poorly lithified conglomerate and conglomeratic sandstone. Clasts are typically subrounded to subangular, 1-30 cm diameter (locally up to 1 m), and consist of probably locally derived crystalline (especially unit YXgp) and volcanic rocks (especially unit Tmv). Bedding includes channelized conglomerate lenses that reflect proximal alluvial fan depositional environments. Unit is generally tilted 5-30 degrees.

Txt — **Talus breccia** - Unstratified, unsorted, framework-supported, monomict breccia composed of subangular pebbles, cobbles, and local boulders apparently derived from immediately adjacent Proterozoic rocks, in sandy to pebbly matrix of similar composition.

Tt — **Tuff** - Approximately 1-m-thick, friable, white tuff, with <2%, <<1mm biotite.

Tsc — **Sandstone and conglomerate** - Red to reddish tan to tan sandstone and conglomerate, poorly to moderately lithified, with clasts up to 50 cm diameter. Clasts commonly consist of granitic and gneissic rocks, and matrix appears arkosic in hand samples. Unit is generally tilted 20-70 degrees.

Tmv — **Volcanic rocks** - Mainly mafic to intermediate vesicular lava flows and flow breccias, typically crystal poor but locally containing up to 15%, <12-mm feldspar. Pyroxene and olivine are typically oxidized, but black pyroxene phenocrysts, <3 mm, locally compose up to 3% of the rock. Sanidine was identified at one location (UTM 762459E 3805030N, NAD83), suggesting diversity of volcanic rock compositions within the unit. Sandstone and conglomerate beds, some containing granitic and metamorphic clasts, are present locally.

Tx — **Rock avalanche breccia** - Massive shattered bedrock forming sheets and lenses within sedimentary strata. Tx(gr) indicates breccia derived from granitic rocks; Tx(Mzs) indicates breccia derived from calc-silicate metasedimentary rocks of the Triassic Buckskin Formation (Reynolds and Spencer, 1989); Tx(q) indicates breccia derived from quartzite.

Tcg — **Conglomerate and conglomeratic sandstone, lower unit** - Tan to orangish tan to red, generally weakly lithified conglomerate with less common conglomeratic sandstone and sandstone. Clasts are up to 20 cm, locally to 50 cm, are subrounded and consist primarily of granitic and high-grade metamorphic rocks. Unit is associated with mafic volcanic rocks of map unit Tmv.

Plutonic and metamorphic rocks

Tfd — **Felsic dikes** - In most exposures this unit consist of crystal poor to almost aphyric dikes with up to 3%, <5mm quartz, and <<1%, <<1mm biotite. Locally, felsic dikes included in this unit contain up to 10% biotite and 30%, <2mm feldspar. The northwest orientation and hypabyssal character of this unit is interpreted to indicate an Oligocene to Miocene age.

TXmd — **Mafic dikes** - **Mafic dikes** of variable composition, including fine grained diorite with ~75%, <3 mm hornblende, ~25%, <2 mm plagioclase, and diabase to pyroxenite(?) dikes with 50% to 100%, <3 mm pyroxene(?). Mineralogical variations are substantial but were not examined in detail. Some of the dikes display weakly gneissic to recrystallized mylonitic texture like the host Paleoproterozoic gneiss and granite.

YXqm — **Quartz monzodiorite** - Porphyritic quartz monzodiorite, quartz monzonite, granodiorite, or monzogranite. Fine-grained with 10-20% K-feldspar >3 mm including sparse (<1%) K-feldspar megacrysts up to 2 cm, 10% or more fine-grained quartz, 25-30% fine-grained biotite +/- other mafic minerals. Fine-grained groundmass is composed of feldspar (looks like both plagioclase and K-feldspar), quartz, and biotite.

YXgp — **Megacrystic granite** - Texturally variable, medium to fine grained, porphyritic to equigranular biotite granite. Unit contains 5-15% mafic mineral aggregates with mostly biotite. K-feldspar forms 3-20 mm (locally to 30 mm), tabular megacrysts, with 1:2 to 1:3 aspect ratios. K-feldspar megacrysts are locally crudely aligned, and local textural variations impart a weakly layered character suggestive of multiple intrusions. The unit is locally affected by recrystallized mylonitic foliation, which is widespread west of Highway 95 but is mainly in discrete shear zones a few meters to 20 m thick east of the highway..

YXgu — **Granitic and gneissic rocks, undivided** - This unit consists of granitoid rocks, mafic dikes and hypabyssal intrusions, and weakly to moderately banded gneiss. Locally includes pegmatites and small felsic intrusions. Southeast of Lake Havasu rocks of this unit are pervasively shattered and oxidized so that mafic phenocrysts are typically altered to iron oxides.

Xgn — **Gneiss** - Felsic to intermediate, light gray, heterogeneous, fine-grained gneiss, locally with intrafolial isoclinal folds and cross-cutting pegmatites. **Gneiss** locally contains megacrystic granite of map unit YXgp that is weakly to strongly foliated concordant to gneissic layering, and both are thought to be of similar Paleoproterozoic age. A recrystallized mylonitic foliation locally affects this unit and mafic dikes suspected to be of Mesoproterozoic age, so the mylonitic fabric is suspected to be Mesozoic.

Introduction

The Gene Wash 7 ½' Quadrangle is located south of Lake Havasu City, and includes part of Mohave and La Paz Counties, western Arizona, and San Bernardino County, California. Only the Arizona part of the Quadrangle was mapped for this study. The Quadrangle encompasses part of the Aubrey Hills in Arizona, a segment of the lower Colorado River corridor including Parker Dam and southern Lake Havasu, and the northeast flank of the Whipple Mountains in California. Geologic mapping in Arizona was done under the joint State-Federal STATEMAP program, as specified in the National Geologic Mapping Act of 1992, and was jointly funded by the Arizona Geological Survey and the U.S. Geological Survey under STATEMAP assistance award # G13AC00374. Mapping was compiled digitally using ESRI ArcGIS software.

Surficial geology

Surficial geologic units were mapped using field observations, stereo aerial photographs, digital orthophotographs and/or georeferenced satellite imagery, and digital elevation models (DEMs). Relative ages of alluvial deposits were estimated using characteristics of clast weathering, soil development, carbonate accumulation, and position in the landscape (Gile and others, 1981; Machette, 1985; Bull, 1991; Birkland, 1999). Soil development and carbonate accumulation begin once a deposit is isolated from active alluvial processes. As a result, the degree of soil development and carbonate accumulation are one of the criteria used to identify the approximate ages of surficial units.

Younger alluvial deposits have little to no soil development, retaining the original grey or brown color of the alluvial sediments, and no carbonate accumulation. Clasts in these deposits have no weathering rinds or surface patinas and thus appear brighter and fresher than older clasts. Young alluvial surfaces often retain original depositional characteristics such as bars and swales. Conversely, older alluvial deposits have better developed soils that appear orange or red in color, with soil horizons reflecting clay and carbonate accumulations. Clasts in older alluvial deposits often exhibit darkened weathering rinds or some degree of oxidation (orange surface patina), and thus appear darker on the ground and in aerial photographs. Preserved alluvial surfaces may be smooth and flat (Qi3), becoming more rounded and coarser with age (Qi2). The oldest alluvial surfaces (Qi1) are often eroded, rounded ridges with no soils preserved and the carbonate horizon exposed.

Strata related to the Colorado River

Aggradation of Colorado River sediments following deposition of the Bouse Formation led to Pliocene aggradation of sandy and silty river sediments of the Bullhead alluvium. These deposits have been largely removed but are present at scattered locations up to several hundred feet above the modern river.

Bedrock geology

Bedrock in the Gene Wash 7 ½' Quadrangle consists of upper Oligocene to lower Miocene basalt, conglomerate, and sandstone that overlie Proterozoic granitic and gneissic rocks, as in surrounding areas (Davis et al., 1980; Sherrod, 1988; Spencer and Reynolds, 1991; Howard et al., 1999). These rocks are all tilted to the southwest. The stratigraphically lowest Tertiary sediments are tilted up to vertical, with generally progressively gentler dips up-section. The sedimentary and volcanic rocks were deposited during normal faulting and related tilting above the regional Whipple-Buckskin-Rawhide extensional detachment fault.

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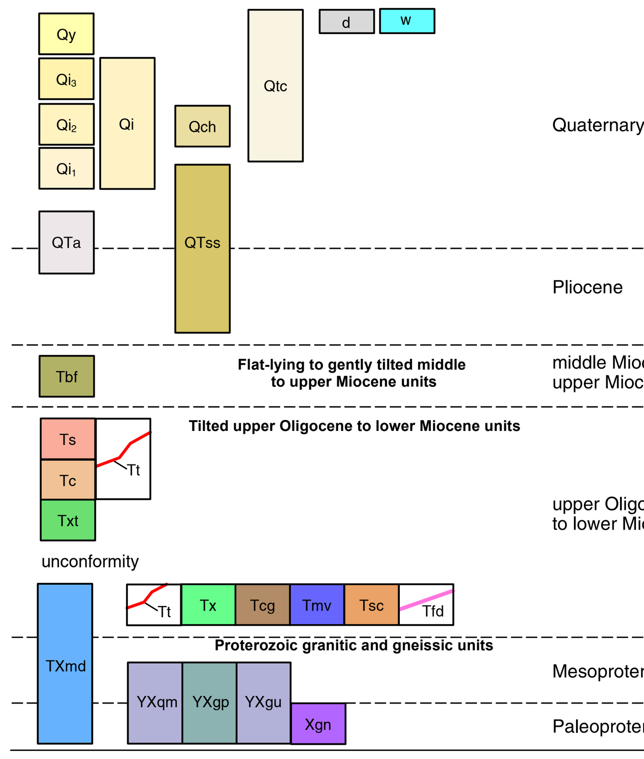
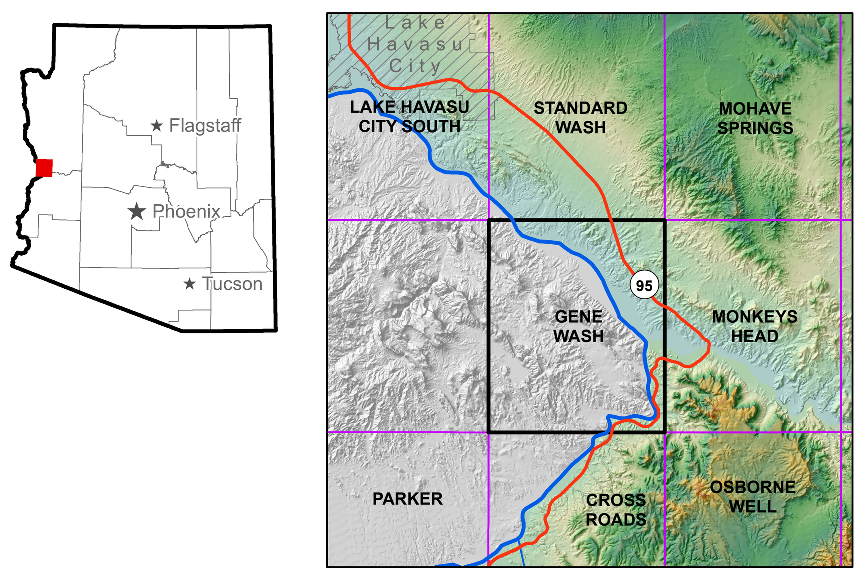
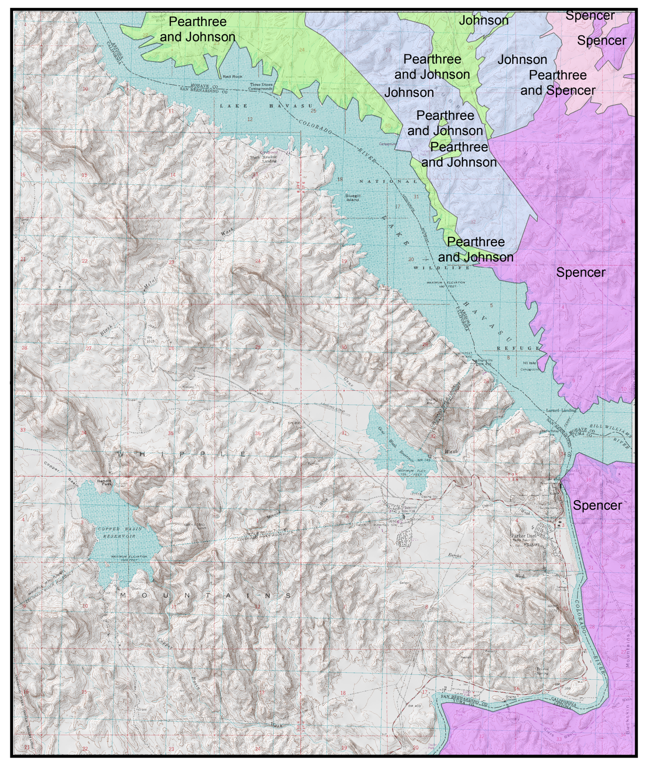
Correlation of map units



Location of map area



Sources of map data



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