Geologic Map of the Aubrey Peak 7 ½' Quadrangle, Mohave County, Arizona

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Unit Descriptions

BIG SANDY RIVER DEPOSITS

Qy3r - Active floodplain banks and terrace deposits (Holocene) - Active river channel, shallow bar floodplain deposits. Unconsolidated, moderately to poorly sorted sand with some gravel. Clast lithologies consists of various granitoids, volcanics, schist and rare quartzite. Vegetation generally absent in active channels. Channel banks consists of mesquite, cottonwood, tamarisk, willow, ash and dense shrubs.

Qy2r – Low floodplain river terraces (Holocene, recent) – Unconsolidated gravel, sand, silt and some clay found adjacent to active river channel and floodplain deposits. Surfaces are about 2 to 3 m above the active channel and have well-developed bar and swale microtopography. Vegetation is light to moderate with commonly willow and juvenile mesquite and tamarisk. Soil is absent to weakly developed. Qy2r surfaces typically persist during flooding events, although can be eroded or abandoned, and in some areas of the floodplain Qy2r has at least two subunits although were not differentiated, rather meandering scrolls were outlined within Qy2r where former channels were.

Qy1r – Low river terraces along modern floodplain margin (Holocene) – Low river terrace deposits consisting of unconsolidated gravel, sand, silt and some clay found 2 to 5 m above modern floodplain, and more heavily vegetated than younger deposits. Vegetation consists of a chapparal of cottonwood, mesquite, creosote, acacia, yucca, prickly pear, shrub, and grasses. Deposits consist of sand, moderately well sorted, micaceous and loamy, with slight undulating microtopography. Some salt encrustations where shallow groundwater is present. Gullies are common along Qy1r banks formed from headward erosion adjacent to the river floodplain. Qy1r deposits interfinger with Qy1 deposits, and Qy3 tributary deposits commonly form poorly developed alluvial fans on Qy1r surfaces.

Qi3r – Lowest-intermediate river terraces and alluvium (late Pleistocene) - Low-lying terraces along the modern Big Sandy River consisting of unconsolidated to lightly consolidated boulders, gravel, sand and silt with minor clay. Unit Qi3r terrace deposits form linear, flat terraces elevated 5 to 10 m above the modern river, with minimal dissection, and are commonly capped by Qi3 piedmont deposits. Locally, this unit can be divided into similar landforms separated by 1 to 3 m elevation in the northeastern portion of the quadrangle. Qi3r deposits exhibit light to moderate argillic and calcic soil development and are up to 5 m thick. Locally, residences are developed on Qi3r surfaces along the river corridor and tributary mouths, and some deposits have been mined for aggregate.

Qi2r – Low to high intermediate river terraces and alluvium (Pleistocene) – Unconsolidated to weakly consolidated boulders, gravel, sand, silt and minor clay found in terrace deposits elevated 15 to 25 m above the modern Big Sandy River. Clasts consist of primarily Proterozoic crystalline lithologies and Cenozoic volcanics. Qi2r deposits are commonly capped by Qi2 piedmont deposits and are found up to 1.6 km (1 mile) west of the modern river. At least two divisions of Qi2-age deposits are recognized, and earlier Qi2r deposits are thought to represent

aggradational terrace fill deposits up to 15 to 18 m thick. Younger Qi2-age deposits and accompanying Qi2r deposits are commonly strath terrace deposits 2 to 5 meters thick positioned lower in the landscape relative to earlier Qi2 deposits. Clasts include diverse lithologies and are well-rounded relative to local piedmont alluvium.

Qi1r – High-intermediate river alluvium (Pleistocene) – Limited to one exposure in the quadrangle immediately west of Hwy 93 (259,300 E, 3,853,700 N) approximately 35 m above the modern wash. Unconsolidated to weakly consolidated silt, sand, gravel and boulders, with minor clay. Deposits are generally light orange brown and clasts are moderately sorted, subrounded to rounded, with moderate sphericity. Clasts include diverse lithologies and are well-rounded relative to local piedmont alluvium.

PIEDMONT DEPOSITS

Qy3 – Active channel, bar, and low terrace deposits (Holocene) – Moderately to poorly sorted, unconsolidated silt, sand and gravel deposits of active ephemeral washes and alluvial fans on the piedmont west of the Big Sandy River. This unit is characterized by fluvial channels, low terraces, and bars composed of locally derived alluvium. Terrace margins are typically elevated about 0.5 to 1 m above active washes and mantled with fine sand and silt. Soil development is absent to minor. Channel deposits are unvegetated to lightly vegetated but in-channel bars and adjacent terraces are vegetated by creosote, acacia, palo verde, and small shrubs. Juniper are present in the upper piedmont. Channels are prone to flooding during moderate to large precipitation events with scouring and bar deposition and lateral erosion of banks.

Qy2 – Low terrace deposits along larger active washes (Holocene) – Alluvial deposits and surfaces related to active ephemeral washes that are frequently active or relatively recently abandoned and not laterally extensive. Deposits are composed of poorly to moderately sorted and bedded coarse sand and gravel and commonly capped by silt and sand elevated from 1 to 2 m above active washes. Terraces may be paired or unpaired and well-preserved deposits exhibit bar and swale micro-topography. Rock varnish, clay accumulation, soil carbonate accumulation, and soil development is absent to minor. Vegetation includes creosote, acacia, cholla, mesquite, graythorne, and small shrubs.

Qy1 – Low terrace deposits along inactive portions of active channels (Holocene) – The youngest, likely fully abandoned alluvial deposits and surfaces elevated about 1 to 3 m above active washes and inset into extensive Pleistocene alluvial deposits. These deposits are unconsolidated and consist of poorly to moderately sorted sand and gravel reworked from older alluvium. Surfaces may or may not have relict depositional micro-topographic bars and channels. Laterally extensive deposits exhibit weakly integrated drainage networks of small distributary channels with thin splays of active sheetflood alluvium. Qy1 terraces in the upper piedmont are coarser and occasionally exhibit debris flow channel and levee morphology and mild rock varnish. Soil development is weak with incipient carbonate accumulation, very minor clay accumulation with light varnish on gravel and larger clasts. Vegetation consists of creosote, desert broom, acacia, cholla, yucca, prickly pear, palo verde, mesquite, and small shrubs. Juniper and joshua tree are also present in the upper piedmont.

Qi3 – Low-intermediate piedmont deposits (late Pleistocene) – Broadly planar terrace and fan deposits elevated from 5 to 10 m above modern washes. Deposits consist of unconsolidated to weakly consolidated grusy gravel, sand, and silt with minor clay. Qi3 deposits in the middle and lower piedmont are laterally extensive, overlie basin fill alluvium, and are inset below older, higher-standing alluvial deposits and often include reworked, calcium carbonate-coated clasts derived from older deposits. Near the mountain front and within narrow canyons, deposits include large cobbles and boulders in narrow terraces deposited atop bedrock or consolidated basin fill alluvium. Some Qi3 surfaces are characterized by a low relief (1 to 2 m), extensive rolling terrain of well-rounded elongate hills due to dissection along many small channels in a dendritic drainage network. Qi3 deposits range from 1 to 4 m thick and exhibit light to moderate, stage II to III- soil carbonate development with a mildly to moderately developed argillic horizon, moderate rock varnish and pavement formation. Vegetation includes ocotillo, palo verde, joshua tree, creosote, cholla, acacia, and small shrubs.

Qi2 – Low to high intermediate piedmont deposits (Pleistocene) – Broadly planar to moderately rounded terraces and fan deposits capping underlying basin fill alluvium. Qi2 deposits are elevated from 15 to 30 m above modern washes and are moderately to deeply dissected by internal drainage networks. Some Qi2 surfaces are characterized by a moderate relief (2 to 4 m), extensive rolling terrain of well-rounded elongate hills due to dissection along many small channels in a dendritic drainage network. Well-preserved planar surfaces are more extensive in the upper piedmont and are limited to isolated, high-standing, remnant abandoned fan surfaces in the lower piedmont. Deposits consist of grusy cobbles, gravel, sand, and silt up to 15 to 18 m thick in some areas interpreted as fill terraces. Soil development includes moderately to strongly developed argillic horizons, stage III to IV calcic development, moderate to strong rock varnish and pavement formation. Qi2 deposits along the river corridor interfinger with and overlie Qi2r deposits and are up to 18 m thick in some areas. Vegetation includes ocotillo, creosote, greythorn, yucca, prickly pear, palo verde, joshua tree, juniper, and saguaro.

Qi1 – High-intermediate piedmont deposits (Pleistocene) – Unconsolidated to weakly consolidated boulders, grusy gravel, sand and minor silt and clay, in well-rounded alluvial deposits elevated about 35 m above modern washes. Qi1 deposits are equivalent to Qi1r deposits and exhibit moderate to strong argillic and stage III to IV calcic soil development.

BASIN FILL UNITS

Neogene Sedimentary Rocks

Nbf – Conglomerate southwest of Aubrey Peak (Miocene and Pliocene) – Medium orange-gray, angular to subrounded, very poorly sorted, boulder-cobble granite conglomerate with minor schist and gneiss located in far southwest corner of the quadrangle west of the Hualapai Mountains. Matrix is micaceous and sandy, grus like, massive to crudely bedded, sand- and clast-supported, with a horizontal to gentle southerly-southeast dip. Imbrication to south and southwest. Clasts dominantly granitic with some granodiorite, pegmatite and megacrystic granite. Unit Nbf erodes into linear well-rounded ridges flanked and mantled with Pleistocene colluvium and alluvial terraces.

Big Sandy Formation

Nbs – Sandy lithofacies (Miocene and Pliocene) – Tan, massive, well-sorted, unconsolidated to moderately consolidated sand and silt with subordinate mud and gravel located near the valley axis commonly exposed underneath Quaternary terrace deposits. Occasional bright white limestone marker beds up to 0.5 m thick are laterally continuous but not traceable between washes (e.g. central Natural Corrals wash; indicated by marker bed line on map). Bedding is laterally continuous and planar-tabular with ripples, flutes, and occasional pea and pebble intraclasts. Poorly preserved teepee structures and soft sediment deformation present locally. Fine-sand & silt dominated section weathers to "Badlands" topography. Type exposure west of I95 at the mouth of Natural Corrals Wash. Beds are locally tilted and/or deformed Natural Corrals Wash. Maximum exposed thickness is ~28 m.

Nbb – Basalt flows and dikes (Pliocene) - Black, poorly- to non-vesicular basalt dikes and flows exposed in the east-central map area. Basalt has <5 cm euhedral amphibole xenocrysts, <8 cm olivine + pyroxene glomerocrysts, 5% ~0.5-1 cm olivine phenocrysts, and sparse <3 cm plagioclase phenocrysts, in an aphanitic groundmass. Flows display crude semi-vertical columnar joints and associated thermal contraction cracks perpendicular to columnar jointing, or flows are non-jointed with spheroidal weathering. Basalt dikes intrude Big Sandy Formation (Nbc) and basalt flows are interbedded with or cap Big Sandy Formation (Nbc).

Nbc – Conglomerate lithofacies (Miocene and Pliocene) – Tan to gray, poorly to moderately consolidated conglomerate, sand, and silt with minor clay, found generally adjacent to mountain ranges, deeply dissected by modern washes. Clasts consist of very poorly sorted, angular pebbles, cobbles and boulders derived from Proterozoic basement, primarily of granitic composition (Xg) and Cretaceous igneous rocks (Kr, Kmz, and Kqm). Locally, unit Nbc has a high percentage of angular aplite cobbles. Percent of gravel, cobbles, and boulders is highly variable in individual outcrops, but transition from conglomeratic sandstone to conglomerate to boulder conglomerate is predictable over 5-7 km from east to west towards the base of the Hualapai Mountains. Unit Nbc is matrix- and clast-supported and has bedding ranging from thin, crude to massive with multidirectional trough cross bedding common. Nbc erodes into well-rounded ridges capped with a gravel lag, where boulders can be up to several meters across. Maximum exposed thickness is at least 330 m (comprising high western fans).

OTHER SURFICIAL DEPOSITS

d – Disturbed areas (recent) – Heavily disturbed ground due to extensive excavation, construction of earth dams and berms, road shoulders, and paved Highway 93.

Qtc – Talus and Colluvium (Quaternary) – Unconsolidated to moderately consolidated colluvium and talus hillslope deposits with varying degrees of soil development on moderate to steep slopes that typically overlie basin-fill and bedrock map units.

CRETACEOUS INTRUSIVE UNITS

Kr – Aphyric rhyolite dikes (Cretaceous) – White, virtually aphyric rhyolite dikes, that appear both massive, and faintly flow-banded.

Kmz – Monzonitic dikes (Cretaceous) – Phenocryst-rich dikes containing 40-60% phenocrysts of feldspar (plagioclase>K-feldspar), with 1-5% <3mm biotite and lesser hornblende and pale to medium grey groundmass. Quartz phenocrysts <2mm are sparse to absent, and phaneritic varieties contain a few % quartz.

Kqm – Quartz monzonite porphyry (Cretaceous) – The quartz monzonite porphyry contains 40-70% white to light grey groundmass and 30-60% phenocrysts of feldspar (plagioclase > K-feldspar, but locally subequal), 10-15% (locally 20%) mafic minerals (biotite >> hornblende), and 5-20% quartz eyes. Feldspar phenocrysts can rarely reach 1.5 cm in length and are typically K-feldspar where porphyritic. The quartz monzonite porphyry is weakly magnetic where alteration is minimal or absent. Outrops can appear white to buff in color due to surficial weathering.

PROTEROZOIC IGNEOUS AND METAMORPHIC ROCKS

Yd – Diabase (Mesoproterozoic) – Diabase occurs as both dikes and sills based on the diversity of orientations, are up to ~15-20 m in width, and up to ~1 km in length and intrude all other Proterozoic units. The diabase dikes have sharp contacts with the Precambrian units and are easily mappable on the ground and through satellite imagery, except where they intrude similarly colored Proterozoic units. Weathered surfaces range from dull black to brown, and in some cases, extreme weathering results in a terra rosa appearance. Equigranular in texture with plagioclase laths up to 3-4 mm long, and including augite, olivine, and minor biotite. A diabase dike sampled northwest of the Diamond Joe stock yielded a U-Pb date on baddeleyite of 1088 ± 3 Ma (Bright et al., 2014).

Xlg – Leucogranite and pegmatite (Paleo- to Mesoproterozoic) – Aplitic to coarse-grained leucogranite and pegmatite dikes, commonly occurring within and along the margins of other igneous and metamorphic rocks. There are likely multiple generations of leucogranites and pegmatite dikes, with clear evidence that at least some leucogranites must have intruded prior to local folding.

Xbp – Burch Peak Batholith – The Burch Peak batholith was named by Loghry and Heinrichs (1980). The Burch Peak batholith is a medium- to coarse-grained, porphyritic biotite-rich quartz monzonite gneiss with distinctive blue-grey, crowded K-feldspar phenocrysts. Additionally, biotite content varies from outcrop to outcrop, producing lightly colored or darkly colored gneiss. All varieties were mapped as one single unit. In thin section, microcline, perthitic microcline, and lesser amounts of orthoclase were identified. Additionally, biotite, minor chloritized biotite, quartz, strained quartz, and minor plagioclase were also observed. In the Devil's Canyon area, the Burch Peak batholith becomes locally migmatized, with the intensity of the migmatization varying from outcrop to outcrop.

Xm – Undifferentiated metamorphic rocks - Mixed metamorphic rocks.

Xg – Granite and gneiss - Medium- to coarse-grained granite containing 2-7% biotite, and garnet-bearing gneiss with 5-20% biotite. Mylonitic granite "schist" and biotite schist is present in some areas. This unit contains sporadic xenoliths of metasediments and is intruded by both pegmatite and diabase dikes. K-feldspar phenocrysts range in size from ~1 cm and up to ~6 cm in length, while widths are typically less than 2 cm.

References

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