Geologic Map of the eastern half of the Hibernia Peak 7 ½' Quadrangle, Mohave County, Arizona

by

Victor H. Garcia and Lisa A. Thompson

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University of Arizona
1955 East Sixth Street, Suite 205, Tucson, Arizona 85721

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Unit Descriptions

SURFICIAL DEPOSITS

d – Disturbed areas (Holocene) – Areas heavily disturbed by human activity including extensive excavation, construction of earth dams and berms, and road shoulders.

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.

Qy3 – Active channel, bar, and low terrace deposits (Holocene, recent) – Moderate to poorly sorted, unconsolidated silt, sand and gravel deposits along active ephemeral washes.

Qy2 – Low terraces along active tributaries (Holocene, recent) – Low terraces and alluvial deposits along active ephemeral tributaries that are typically only active during moderate to large flooding events. Unconsolidated, moderately to poorly sorted silt and fine to coarse sand with common gravel and cobble bars. Surfaces are typically elevated 1 to 2 m above active channels with microtopography consisting of swales and overflow channels. Moderately dense vegetation on these surfaces includes juvenile to mature creosote, desert broom, acacia, and prickly pear.

Qy1 – Low abandoned terraces along active tributaries (Holocene) – The youngest, likely abandoned tributary terraces elevated approximately 1.5 to 3.5 m above active ephemeral tributaries. Unconsolidated silt to fine sand with some remnant cobbles. Clasts are angular to rounded. Colluvium from adjacent slopes commonly merge with Qy1 surfaces. Qy1 surfaces are commonly planar with remnant paleo-microtopography. Headward-eroding gullies are present on margins adjacent to active washes. Soil development is weak to absent with very light argillic development and slight reaction to HCl. Moderately dense to dense vegetation consists of mature acacia, creosote, mesquite, cholla, yucca, and prickly pear.

Qy – Low intermittent tributary deposits, undifferentiated (Holocene) – Intermittent tributary deposits that often form planar surfaces with some swale microtopography. Deposits are most common in tributaries on shallow-relief regions of the piedmont, and can form broad surfaces that interfinger with Qy3, Qy2, and Qy1 deposits at the confluence of tributaries. Argillic development is absent to minor. Sheetwash and minor channelized flow can occur on these surfaces. Vegetation consists of creosote and other small shrubs and ranges from sparse to moderately dense.

Qi – Intermediate piedmont deposits, undivided (Pleistocene) – Unconsolidated to weakly consolidated deposits of silt, sand, and gravel with rare boulders. Deposits comprise abandoned alluvial terraces of uncertain age formed on bedrock and basin fill deposits.

BASIN FILL DEPOSITS

Big Sandy Formation

Nbc – Conglomerate lithofacies (Miocene and Pliocene) – Poorly exposed boulder and mega-boulder conglomerate and breccia. This unit is defined by its reddish soil and very large sub-angular to sub-rounded boulders (routinely up to 4m). Where it is exposed, the deposit is clast-supported, and weakly thick-bedded to massive. Clasts reflect the metamorphic and plutonic rocks seen along the east flank of the Hualapai Mountains including locally up to 25% clasts of crumbly medium- to coarse-grained granite resembling the Wheeler Wash Granite (exposed in the northerly adjacent Dean Peak quadrangle). Sharply overlies the Tule Wash formation.

Tule Wash formation

Worley (1979) assigned tilted Miocene strata of the eastern Big Sandy Valley to three formations: Bull Canyon, Tule Wash, and Burro Wash. Doing so facilitated description and sedimentological interpretation of the strata, but Worley noted that stratigraphic relationships between the three units were uncertain. Gootee and Johnson (2023) abandoned two of those unit names and assigned all the tilted Miocene units to the Tule Wash formation. We follow that nomenclature here. Some stratigraphic relationships remain uncertain, therefore our map units within the Tule Wash formation are based on lithofacies rather than interpretation of stratigraphic position. There are several representative sections of this formation and its lithofacies located in the Tule Wash quadrangle (Scarborough and Wilt, 1979; Worley, 1979).

Nts – Sandstone lithofacies (Miocene) –Light gray to tan weathering, largely calcareous-cemented sandstone and pebbly sandstone in the northeast, grading to pebble-cobble, sparsely boulder conglomerate and pebbly sandstone to the west and southwest. The strata are gently dipping to horizontal throughout the map area with northerly to northwesterly gentle (<5°) dips in the northeast, and in upper Bull Canyon, and gentle southerly to southeasterly dips in the east-central part of map area. In the northwest, the dips are essentially horizontal except in the vicinity of the formation's east-facing (10-20°) depositional onlap with underlying crystalline basement of the Hualapai Mountains where it dips up to 15° to the east. Dark gray, non-calcareous shale sparsely exposed near the base of the formation. Nts is in gradational contact with unit Ntc and clasts and clast proportions are very similar to those seen in unit Ntc.

Ntc – Conglomerate lithofacies (Miocene) – Light gray to tan weathering, calcareous cemented, pebble-cobble-boulder conglomerate, pebbly sandstone, and sandstone containing sub-angular to rounded clasts of granitic gneiss (30-80%), paragneiss (0-30%), pegmatite (1-25%), vein quartz (<5%), amphibolite schist (0-20%), gray, porphyroblastic schist (0-5%), medium- to coarse-grained, 7% biotite, equigranular granite (0-15%) and up to 30% porphyry; quartz-phyric porphyry (light), and plagioclase-biotite porphyry (dark). The formation dips gently to the west or southwest throughout the map area (with one exception; a small sliver of steeply west-tilted, brown-weathering, pebble-cobble, clast-supported conglomerate bounded below by a probable low-angle, east-dipping normal fault (with gneissic footwall), and gently dipping upper Tule Wash Formation conglomerate in upper Blue Tank Wash.

BEDROCK UNITS

Neogene plutonic rocks

Nri – Aphyric rhyolite (Oligocene-Miocene?) – Rusty weathering, light gray aphyric rhyolite dikes, seen only in the southeast.

Nl – Lamproite (Neogene) – Dark fine-grained dioritic matrix, biotite-rich (20-35%) mafic dikes seen in three places to cut the plagioclase-biotite porphyry (TKp), and quartz porphyry dikes (TKq).

Cretaceous - Paleogene plutonic rocks

PEKg – Granite dikes (Late Cretaceous - Paleogene) – Medium-grained, equigranular granite with 5% biotite. (one dike - polygon actually - only, in southeast), clearly is cut by ne-striking faults.

PEKq – Quartz porphyry (Late Cretaceous - Paleogene) – Quartz porphyry dikes and stocks. Dikes and/or stocks up to 100m wide consisting of light-weathering, fine-grained granitic matrix porphyry with phenocrysts of plagioclase and thick-feldspar (10-25% <6mm), quartz (5-15% <5mm), and biotite (1-5% <3mm). The core zones of the fatter dikes are granitic and may contain up to 25% 3cm euhedral K-feldspar phenocrysts. Many of the dikes include undifferentiated discrete <5m thick, plagioclase-biotite porphyry border dikes and/or border zones of gradually more mafic (quartz-absent, biotite-rich) border zones.

PEKp – Plagioclase-biotite porphyry (Late Cretaceous - Paleogene) – Dikes up to 25m thick of fine-grained, granitic matrix (with 0-3% interstitial quartz), plagioclase (5-50% <5mm), biotite (2-7% <2mm) porphyry. Thicker dikes always include quartz porphyry cores.

PEKh – Hornblende porphyry (Late Cretaceous - Paleogene) – Dikes <5m thick of dark green, very fine-grained dioritic matrix porphyry with 1-10% hornblende phenocrysts up to 5mm long.

Jurassic-Paleoproterozoic rocks

JYg – Coarse-grained granite (Mesoproterozoic – Jurassic) – Coarse-grained, equigranular, 1-4% biotite granite. In the southwest this granite includes conspicuous, blocky <10m enclaves, locally in "exploded" stockwork like swarms, of fine- to medium-grained, equigranular, 5-10% biotite quartz monzodioritic granitoid which seem to be older than the granite.

Jyqm – Quartz monzonite – quartz monzodiorite (Mesoproterozoic – Jurassic) – Fine-to medium-grained, biotite-rich, generally equigranular quartz monzonite to quartz monzodiorite occurs in one small stock, a few west- northwest-striking dikes, and as "exploded" stockwork-like enclaves in the coarse-grained granite (Jyg), and as dikes and small plutonic bodies that do not intrude the Coarse-grained granite. These rocks are seen only in the southwest between the heads of Hair Clipper and Hibernia canyons.

Yd – Diabase (Mesoproterozoic) – Fine- to medium-grained and rarely coarse-grained diabase occurring in dikes up to 30m thick.

Yxp – Cross-cutting pegmatite (Proterozoic) – Swarms of south- or west-dipping, coarse-grained pegmatite dikes that prominently cut across compositional banding and foliation in host gneissic rocks.

Paleoproterozoic, gneissic fabric metamorphic rocks

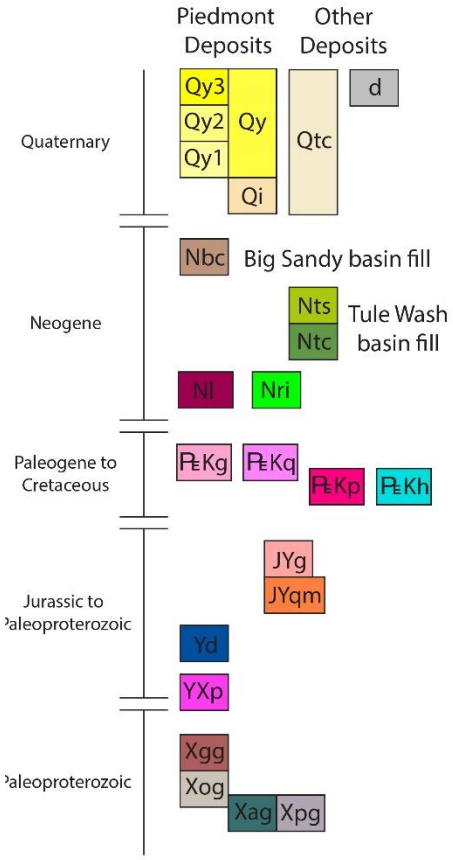
Xgg – Granite gneiss (Paleoproterozoic) – This unit is a light brown to brownish grey, medium-grained, well foliated, equigranular granite gneiss to quartz monzonite to quartzofeldspathic paragneiss, and biotite schist. Intruded by abundant pegmatite, hornblende, and biotite hornblende dikes. It has a mineralogical composition of 20-30% quartz, 40-60% K-feldspar, 0-25% plagioclase, 5-15% biotite. Locally contains potassium feldspar porphyroblasts (~10 mm long and ~3 mm wide). Unit also includes aplite and pegmatite phases, which appear to be transitional to the granite gneiss. Mineralogically similar to the Granite Gneiss of Vuich (1974), medium-grained Granite (1337 ± 38 Ma) and Rattle Snake Hill Granitic Gneiss of Kessler (1976), and the Democrat Gneiss of the Democrat mine.

Xog – Orthogneiss (Paleoproterozoic) – Dominated (60-80%) by a protolith of coarse-grained, biotite-rich (7-15%), quartz monzonite or granodiorite with 0-35% plagioclase phenocrysts up to 2cm. Ranges from weakly foliated granitoid to strongly foliated, dominantly homogeneous orthogneiss. Gneiss locally appears banded either with foliation-parallel bands defined by high strain gradients, or because the rock includes up to 20% intra-foliated domains of banded, garnet-bearing paragneiss (Xpg), amphibolite schist or medium- to coarse-grained, or hornblende gabbroic orthogneiss (Xag). Up to 25% of the unit consists of foliation-parallel, or approximately foliation-parallel, non-foliated to weakly foliated, coarse-grained pegmatite or medium- to coarse-grained leucogranite (<2% biotite) dikes.

Xpg – Paragneiss (Paleoproterozoic) – Paragneiss consists of alternating bands (30-80%) biotite-rich (20-50%) coarse-grained schist or gneiss and aplitic, weakly foliated leucosomes (20-70%). Leucosomes commonly appear as fine-grained, weakly foliated aplite, which may be igneous or possibly sedimentary (arkosic sandstone?) protolith. Garnet as porphyroblasts up to 10cm, or in <2cm spherical aggregates with biotite, quartz, and feldspar. Unit includes up to 35% orthogneiss and/or amphibolite schist or hornblende gabbro.

Xag – Amphibolite schist/gneiss (Paleoproterozoic) – Coarse-grained hornblende gabbro with generally lesser but ubiquitous amphibolite schist and gneiss. The unit contains up to 35% felsic orthogneiss (Xog), and paragneiss (Xpg).

Figure 1. Correlation of map units.



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