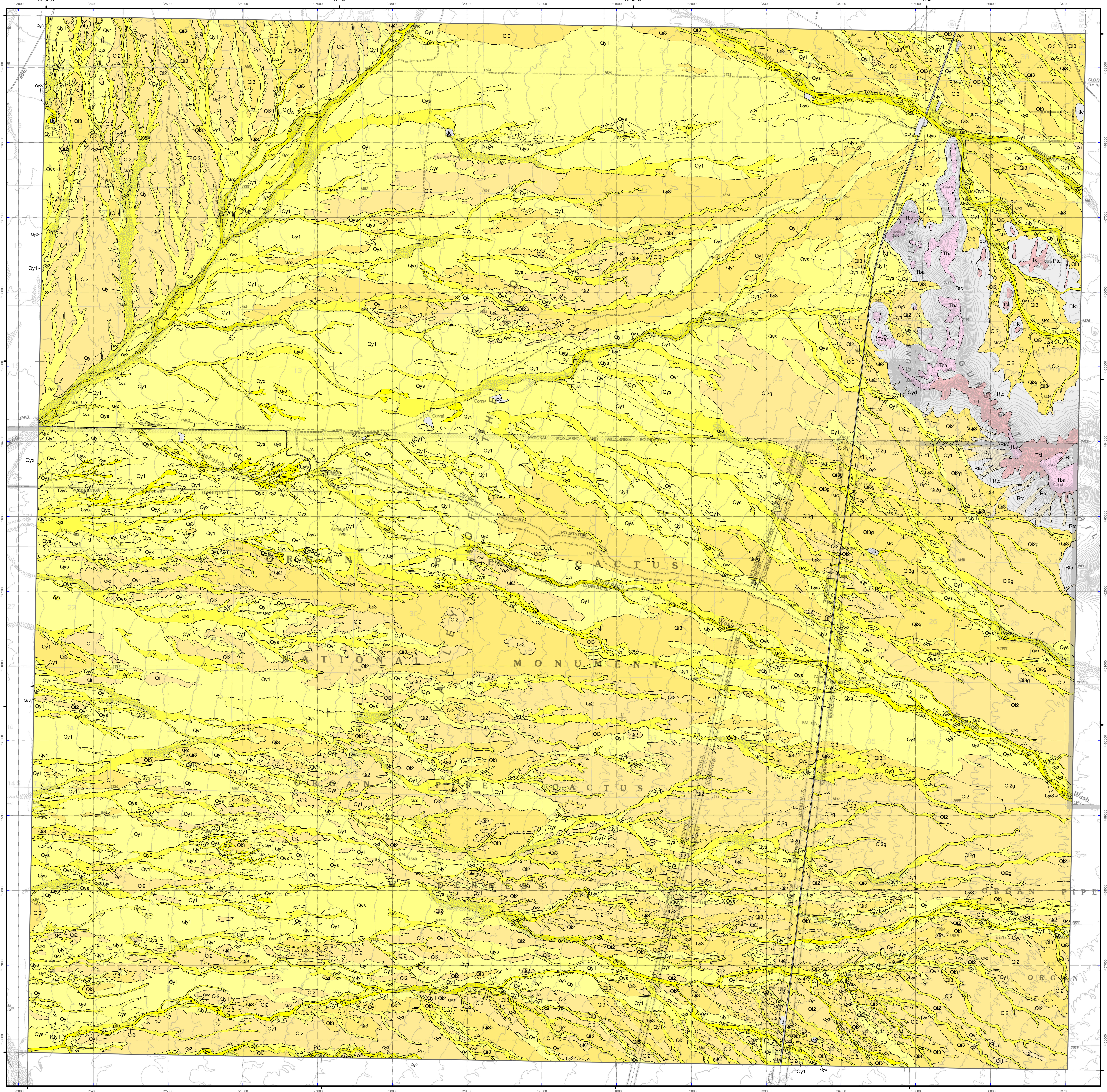


GEOLOGIC MAP OF THE ARMENTA WELL 7 ½'QUADRANGLE AND PART OF THE GUNSIGHT 7 ½' QUADRANGLE, ORGAN PIPE CACTUS NATIONAL MONUMENT, PIMA COUNTY, ARIZONA

Arizona Geological Survey Digital Geologic Map (DGM-72)

By
Jeri J. Young and Philip A. Pearthree

March 2012

Citation for this map:
Young, J.J., and Pearthree, P.A., 2012, Geologic map of the Armenta Well 7 ½' Quadrangle and part of the Gunsight 7 ½' Quadrangle, Organ Pipe Cactus National Monument, Pima County, Arizona: Arizona Geological Survey Digital Geologic Map DGM-72, version 1.0, scale 1:24,000.

This research was funded by the National Park Service Geologic Resources Division.

Introduction

This geologic map covers the part of the Valley of the Ajo and the part of the Gunsight Hills, within and adjacent to Organ Pipe Cactus National Monument in southwestern Arizona. The map depicts the late Cenozoic surficial deposits in the valleys and middle Cenozoic volcanic rocks in the hills. Production of this new geologic map is the product of a cooperative research agreement between the National Park Service and the Arizona Geological Survey, and was funded primarily by the National Park Service. All surficial geologic mapping is new for this project. Bedrock geology is modified from Skinner et al (2008). Mapping was compiled digitally using ESRI ArcGIS software, over a digital orthophoto base (National Agricultural Imagery Program, 2007).

Organ Pipe Cactus National Monument is located in the Basin and Range Province of southwestern Arizona, on the U.S. – Mexico border. Nearly all of the area covered by this map is underlain by late Cenozoic, valley-filling clastic sedimentary deposits that are as much as 1600 feet thick in the central part of the map area (Richard et al., 2007). These consist mostly of sandstone and conglomerate in alluvial fans that flank the valley and fine-grained deposits in the valley axis. The valley is covered by relatively thin surficial deposits ranging in age from early to middle Pleistocene to modern. The Valley of the Ajo is part of the Gila River drainage and has undergone very little incision during the Quaternary, and thus the valley topography is relatively smooth. In general, upper piedmont areas are dominated by moderately coarse, incised Pleistocene alluvial fan deposits; young, relatively fine-grained deposits are prevalent on the lower piedmonts and along Cuerda de Lena Wash. Extensive, complex distributary drainage systems in middle piedmont areas are outlined by the extent of late Holocene deposits. In these areas, this geologic map indicates areas of potential flood hazards due to complex flow paths and widespread sheetflooding.

Bedrock is exposed only in the Gunsight Hills, and consists of Miocene volcanic rocks that were erupted as part of the Oligo-Miocene volcanism that swept across Arizona from east to west. Volcanic rocks in the map area consist of the regionally extensive Childs latite and related volcaniclastic rocks, and basaltic andesites that cap most ridges in the Gunsight Hills. The generally more erodible Childs latite is probably widespread in the hills and ridge slopes, but is commonly are covered by colluvium or talus derived from upslope, or in situ weathered regolith.

References

Richard, S.M., Shipman, T.C., Greene, L.C., and Harris, R.C., 2007, Estimated Depth to Bedrock in Arizona, v 1.0: Arizona Geological Survey Digital Geologic Map DGM 52, 9 p. text, scale 1:1,000,000.

Skinner, L.A., Haxel, G., and Umhoefer, P.J., 2008, Geological Reconnaissance at Organ Pipe Cactus National Monument, Arizona: Northern Arizona University, Unpublished Digital Data, 1:24000 scale. (NPS GRI Source Map 75008)

Map Unit Descriptions

Piedmont Deposits

Qyc — **Modern channel deposits** - Deposits in active, open channels of washes that are large enough to depict at the map scale. This unit is composed of moderately-sorted sand and silt, with common pebbles and some cobbles in the lower piedmont areas, to poorly-sorted sand, pebbles, cobbles and boulders in the upper piedmont areas. Channels are incised less than 2 m below adjacent late Holocene terraces and alluvial fans. Channel morphologies generally consist of a single-thread, deep, high-flow channel or multi-threaded, shallow, low-flow channels with adjacent gravel bars. There is no soil development in these deposits.

Qyx — **Areas of active arroyo development** - Areas of fine-grained deposits undergoing erosion due to arroyo development. Includes flat-bottomed, steep-sided channels with sand and fine-gravel deposits, and eroded slopes; also includes some areas between gullies where remnants of the pre-incision deposits are preserved. Arroyos are generally developing in Qys or Qy3 deposits.

Qy3 — **Smaller active channels, bars, and low terraces** - Deposits associated with active channels, and bars and low terraces along washes and adjacent, recently active sheetflood areas. In upper piedmont areas, channel sediment is generally poorly-sorted to very poorly-sorted sand and pebbles, but may include cobbles and boulders. Terrace surfaces commonly are mantled with silt, sand, and gravel. On lower piedmont areas, young deposits consist predominantly of moderately-sorted silt, sand, and fine gravel, including some pebbles and cobbles in channels. Channels typically are incised less than 1 m below adjacent terraces and fans, but locally incision may be as much as 2 m. Channel morphologies generally consist of a single, moderately deep high-flow channel or multi-threaded, shallow, low-flow channels with adjacent gravel bars and finer floodplain deposits. Terraces and sheetflood areas commonly have planar to gently undulating surfaces and are covered primarily with fine-grained deposits with minor gravel concentrations. Soil development is minimal.

Qy2 — **Young terrace deposits** - Deposits found on floodplains and low terraces adjacent to active channels, or drainageways that receive occasional inundation. On middle and lower piedmonts, deposits typically consist of sand, silt, and clay, with local channel gravel deposits. On upper piedmonts, deposits typically consist of sand to small boulders capped with sand and finer deposits on terraces and other areas subject to overbank flooding. Qy2 surfaces are gently undulating where fine-grained, but have up to 1 m of local topography between gravel bars and adjacent, finer-grained swales. Surfaces typically are light brown to gray in color, and surface gravel has very weak to no desert varnish. Soil development associated with Qy2 deposits is weak with no clay accumulation and minimal to stage I carbonate accumulation.

Qys — **Young sheetflood deposits** - Laterally extensive sand and silt with minor fine gravel and clay deposits. Soil development is weak to none. Channels or swales are small, uninicised or minimally incised, and discontinuous. Vegetation consists of creosote and other small bushes, with some small trees locally along swales.

Qy1 — **Young terrace and alluvial fan deposits** - Terrace and alluvial fan deposits with weak but evident soil development. Qy1 deposits are generally poorly sorted sand, pebbles, cobbles, silt and boulders. Qy1 surfaces are typically 0.5 to 3 m higher than adjacent younger surfaces. Qy1 surfaces are generally planar where fine-grained, but undulate between coarse gravel bars and adjacent swales in the middle and upper piedmont, with local surface relief up to 1 m. Surfaces typically are covered with lightly varnished gravel lag to loose, weakly varnished desert pavement, especially in swales. In lower piedmont areas, Qy1 surfaces typically are mantled with a loose to moderately packed, moderately varnished pebble lag. Surface color is brown to slightly reddened (10 to 7.5 YR), and is darker than fresh fluvial deposits of younger units. Carbonate is present throughout the soil profile, but in some exposures gravel coatings are thin but continuous at about 0.5 m depth (stage II).

Qyd — **Young debris flow deposits** - Coarse, very poorly sorted deposits on steep hillslopes and along some washes within and near the mountains. Deposits consist primarily of small to medium boulders, cobbles, pebbles and sand. Typically, the coarse deposits form linear levees paralleling small washes or irregularly shaped piles representing debris flow snouts. Surface boulders and cobbles have minimal to moderate rock varnish. This unit also includes areas of erosion (debris flow scars) on hillslopes that are spatially associated with debris flow deposits.

Qy — **Holocene deposits, undivided** - This unit is mapped where it is not feasible to subdivide Holocene alluvium at 1:24,000 scale. It probably includes mainly Qy2 and Qy1 deposits.

Qi3 — **Younger intermediate alluvial fan and terrace deposits** - Weakly to moderately dissected alluvial fan and terrace deposits with moderate soil and desert pavement development. Deposits consist of poorly sorted cobbles, pebbles, and sand, with lesser amounts of silt, clay and boulders. Qi3 surfaces typically are planar but relict gravel bars are evident and stand slightly higher than surrounding surfaces. Surfaces commonly are covered with loose to moderately packed desert pavements with weak to moderate varnish. Soils are slightly reddened (7.5YR) but clay accumulation is minimal (cambic horizons); underlying calcic horizons include thin to moderately thick, discontinuous to continuous carbonate coatings on gravel and soft carbonate nodules (stage II to III). Some Qi3 soils are not reddened and may represent a somewhat younger set of deposits that were not mapped separately. Qi3 surfaces are generally less than a few meters above active channels, but near the mountains may be as much as 10 m higher than active channels..

Qi3g — **Younger intermediate alluvial fan deposits, granitic member** - Weakly to moderately dissected alluvial fan and terrace deposits with moderate soil and desert pavement development. Deposits typically have more pebble-sized gravel, and more feldspar and quartz grains than other Qi3 deposits.

Qi2 — **Intermediate alluvial fan deposits** - Moderately dissected alluvial fan and terrace deposits with moderate to strong soil development and strong but variable desert pavement development. Deposits typically consist of poorly sorted cobbles, pebbles, and sand, with lesser amounts of silt, clay and small to medium boulders. Well-preserved planar Qi2 surfaces typically have well-varnished, tight pebble and cobble pavements, although areas without desert pavements are common. Surface carbonate fragments from underlying soil horizons are uncommon. Soils are reddish brown to brown (5 to 7.5YR), with obvious clay accumulation in strong cambic or weak argillic horizons up to 0.5 m thick. Calcic horizon development ranges from carbonate nodules (stage III), thick gravel coatings (stage III), and weakly cemented petrocalcic horizons with incipient laminar horizons (stage IV). Near the mountains Qi2 deposits are dominated by cobbles and boulders, and surfaces may be up to 5 m above active channels. On the lower piedmont, deposits are sandy with substantial gravel, locally including small boulders, and surfaces are typically less than 2 m above active channels.

Qi2g — **Intermediate alluvial fan deposits, granitic member** - Moderately dissected alluvial fan and terrace deposits with moderate to strong soil development and strong but variable desert pavement development. Deposits typically have more pebble-sized gravel, and more feldspar and quartz grains than other Qi2 deposits.

Qi — **Intermediate deposits, undivided** - This unit is mapped in mountain valleys and on the fringes of bedrock ridges where it was not feasible to subdivide Pleistocene alluvial surfaces. It includes elements of Qi2 and Qi3, but probably not Qi1.

Qi1 — **Older intermediate alluvial fan deposits** - Moderately to deeply dissected relict alluvial fans with strong calcic horizon development. Deposits are poorly sorted, containing cobbles, pebbles, sand and boulders with minor silt and clay. Landforms are moderately to deeply eroded, and typically form gently rounded ridges with relatively limited planar remnants approximating the original fan surface. Carbonate fragments derived from underlying petrocalcic horizons are common on surfaces, giving them a light color on the ground and on aerial photographs. Active channels are incised up to 10 m below these surfaces. Soils are brown to yellowish red (7.5 to 5YR), with weakly to moderately cemented petrocalcic horizon development and some laminar carbonate (stage IV to V).

Bedrock

Rtc — **Hillslope deposits and regolith** - This unit includes several different types of weathered bedrock, including granite, Oligo-Miocene felsic volcanic rocks and associated volcanoclastic sediments, and basalt. It also includes extensive areas of locally derived hillslope colluvium and coarse boulder and cobble talus.

Tba — **Basaltic andesite flows and flow breccias** - Porphyritic, medium-gray to black basaltic andesite with reddish, oxidized flow margins. Individual flows are approximately 2-10 m thick and are usually separated by an oxidized basal flow breccia and a vesicular, glassy upper margin; minor lenses of pyroclastic rocks occur between flows and at the basal contact of the unit; thick soil horizons exist between some flows. Phenocrysts compose about 5 to 15% of the rock and consist of subhedral olivine (0.5-2.5 mm), partially- or completely-altered to iddingsite (prominent in hand specimen), minor euhedral to subhedral plagioclase, twinned clinopyroxene, and rare orthopyroxene. A glomeroporphyritic texture is common. The groundmass is pilotaxitic to intergranular composed of plagioclase feldspar, clinopyroxene, magnetite, and occasional, slightly devitrified brown glass. Basaltic andesite is the youngest bedrock unit in the Growler Mountains and forms minor dikes observed intruding all other units; whole-rock K-Ar ages of 14.4±0.7 Ma (Miller, written comm., 1981) and 15±2.2 Ma (Eberly and Stanley, 1978) have been determined for samples collected at or near the exposed top of this unit.

Tcl — **Latite** - Augite latite flows, flow breccia, flow agglomerate, minor hypabyssal, and more silicic tuffaceous rocks characterized by megacrystic plagioclase phenocrysts. Fresh surfaces are gray to black, or maroon in iron-oxide stained; weathered surfaces are tan, brown, or purple. Stratigraphically lower flows are thicker, more massive, and less weathered, whereas higher flows are typically thinner and more oxidized. Although flow sequences can vary rapidly in texture and appearance over short vertical and lateral distances, lower flows are typically darker and tend toward blue or gray hues, whereas higher in the section red or brown hues are common. Individual flows are evenly bedded, vesicular to (less commonly) massive and dense, and generally lack internal flow features. Outcrops are typically craggy to blocky. K-Ar isotopic dates from rocks above and below this unit indicate thatit was was deposited over a very short time in the Early Miocene (~18 Ma) (Tosdal and Miller, unpub. data, 1983).

Other Units

d — **Disturbed areas** - This unit depicts areas that have been profoundly disturbed by human activity and underlying geologic units cannot be observed. Mapped mostly along State Route 85. Distrubed areas include charcos, Highway 85 and dirt roads that significantly alter geologic units.

dc — **Charcos and stocktanks** - disturbed areas, charcos and stocktanks

Line Symbol Descriptions

- contact, accurately located
- contact,approximately located
- fault, accurately located
- fault, approximately located
- fault, concealed

Projection Information:
North American Datum of 1983.
1000-meter Universal Transverse Mercator grid tics, zone 12, shown in blue.

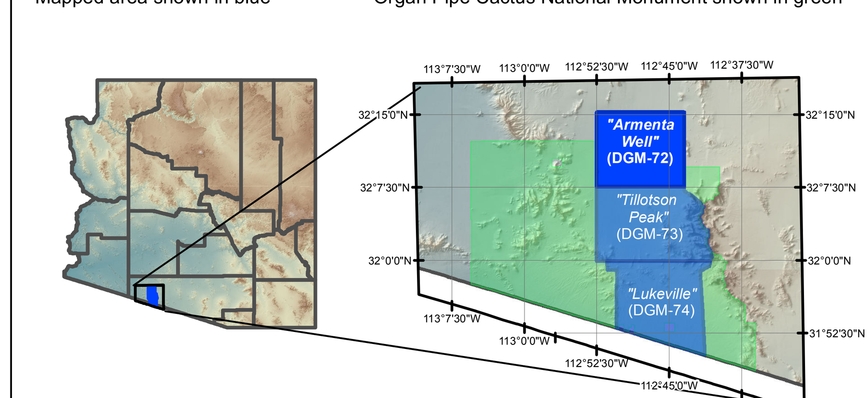
Topographic base from USGS 1:24,000 Quadrangle Series.
Seamless basemap generated using iGage All Topo Pro software.
Hillshade generated from NED 10m Digital Elevation Model.
Contour interval = 10 feet.

MN
10.8°
2011 MAGNETIC NORTH DECLINATION

SCALE 1:24 000
1 0.5 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0.5 0 1 KILOMETER

Location Map

Mapped area shown in blue — Organ Pipe Cactus National Monument shown in green



Acknowledgments

The authors appreciate the support of Bruce Heise and Tim Connors of the Geologic Resources Division of the National Park Service. The staff members of Organ Pipe Cactus National Monument were extremely helpful and supportive of our mapping efforts, and did their best to assure our safety while working in this border region. We especially appreciate the care and assistance of Sue Rutman and Tim Tibbets. We gratefully acknowledge field assistance from Jennifer Pollakis, Doug Pippel, Heather Dunphy, Brian Gootee, and Mimi Diaz. Ryan Clark created GIS tools that facilitated the development of this digital geologic map. Janel Day, Mitch Levine and Genevieve Pearthree produced the final map and digital information products.

Arizona Geological Survey
416 W. Congress Street, Suite 100
Tucson, AZ 85701
(520) 770-3500
www.azgs.az.gov