Topographic base from USGS 1:24,000 Quadrangle Series; generated using iGage All Topo Pro software
Contour interval: 10 feet

Projection: UTM Zone 12N
Datum: NAD83

TRUE NORTH
MAGNETIC NORTH
10.8°
APPROXIMATE MEAN DECLINATION, 2011

scale 1:24,000

1000 500 0 1000 2000 3000 4000 5000 6000 7000 Feet

1 0.5 0 1 Miles

1 0.5 0 1 Kilometers

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Map Unit Descriptions

Qy_3 **Active channel deposits (Latest Holocene)** - Deposits in active, open channels of washes that are large enough to depict at 1:24,000 scale. This unit is composed of moderately-sorted sand and silt, with common pebbles and some cobbles in the western part of the quadrangle, to poorly-sorted sand, pebbles, and cobbles in the eastern part of the quadrangle. 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; locally, channels are multi-threaded and very shallow. There is no soil development in these deposits.

Qyx **Areas of active arroyo development (Latest Holocene)** - 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.

Qy_3 **Channel and low terrace deposits (Latest Holocene)** - Unconsolidated sand, silt and gravel deposits associated with active drainages, including small channels, adjacent gravel bars and low terraces. Deposits consist primarily of sand, pebbles and cobbles and in channels, and sand, silt, pebbles and cobbles in low terrace deposits and in unincised valley axes. Channel deposits are light-colored; fine-grained terrace deposits generally are brown to gray. Vegetation typically is relatively dense and includes trees and smaller bushes.

Qy_2 **Low terrace deposits (Late Holocene)** - Unconsolidated sand, silt and gravel deposits with weak soil development associated with broad valley floors and low terrace. Channels included in this unit are very small and discontinuous. Deposits are predominantly sand and silt, but in upper piedmont areas include cobbles and small boulders. Topographic relief across Qy_2 surfaces is generally very low.

Qys **Young sheetflood deposits (Late Holocene)** - Laterally extensive sand and silt with minor fine gravel and clay deposits. Soil development is weak to none. Channels or swales are small, unincised or minimally incised, and discontinuous. Surface topographic relief is minimal except were incised by active washes and arroyo gullies; modern washes are incised up to 1.5 m below Qys surfaces.

Qy_1 **Young alluvial fan and terrace deposits (Early to late Holocene)** - These deposits are unconsolidated and loose silt and gravel size clasts with a light to medium gray-brown soil.

Qy **Undivided young deposits (Holocene)** - Undivided Holocene alluvial terrace or fan deposits, typically used where land surface is obscured by human activity

Qi_3 **Intermediate alluvial fan and terrace deposits (Late Pleistocene)** - Moderately dissected alluvial fan and terrace deposits with moderate soil development. Deposits consist of poorly sorted pebbles, sand, and cobbles, with lesser amounts of silt, and clay. Qi3 surfaces typically are planar with rounded margins, but if sufficiently coarse, relict gravel bars are evident and stand slightly higher than surrounding surfaces. Surfaces commonly are covered with loose to moderately packed gravel lags 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). Qi3 surfaces are less than a few meters above active channels.

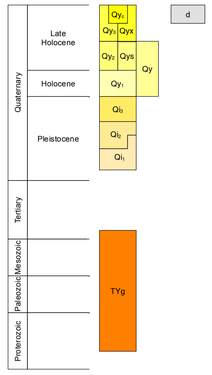
Qi_2 **Older intermediate alluvial fan and terrace deposits (Middle to late Pleistocene)** - Moderately dissected alluvial fan and terrace deposits with moderate to strong soil development and variable desert pavement development. Deposits typically consist of poorly sorted cobbles, pebbles, and sand, with lesser amounts of silt, clay and small 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, thick gravel coatings (stage III), and weakly cemented petrocalcic horizons with incipient laminar horizons (stage IV). Qi2 surfaces are typically less than 3 m above active channels.

Qi_1 **Eroded older fan deposits (Early to middle Pleistocene)** - Moderately to deeply dissected relict alluvial fans with strong calcic horizon development. Deposits are poorly sorted, containing cobbles, pebbles, sand, silt and clay. Landforms are moderately 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 5 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).

TYg **Medium to coarse-grained granite (Proterozoic or Tertiary)** - Poorly exposed, medium- to coarse-grained foliated biotite granite or granodiorite with minor hornblende, abundant yellow-green sphene, and manganese veins. Mostly medium-grained, locally coarse-grained, and contains subhedral phenocrysts of light gray feldspar, abundant clear-gray quartz, and biotite. Locally, the rock contains up to 3-cm-long phenocrysts ofK-feldspar. This unit is deformed by a pervasive weak to strong foliation. Two-to-five-cm-wide leucocratic granitic dikes locally intrude the rock. The dikes are oriented parallel to the foliation plane in the granite and are themselves foliated. (modified from Skotnicki, 1999)

d **Disturbed ground (modern)** - Areas where the surface has been substantially altered or obscured by human activities. Includes major paved roads and stocktanks.

Unit Correlation Diagram



Line Symbol Descriptions

accurately located contact

approximately located contact

concealed contact

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GEOLOGIC MAP OF THE CACTUS FOREST 7 ½' QUADRANGLE, PINAL COUNTY, ARIZONA

Arizona Geological Survey Digital Geologic Map DGM-95, version 1.0

Scale 1:24,000

By
Philip A. Pearthree

October 2012

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Introduction

This geologic map covers part of the middle Gila Valley in Pinal County southeast of Florence, Arizona, and west of the Ninetysix Hills. The map is almost entirely covered by Quaternary surficial deposits, and these are depicted in detail on this map. In addition, there are 2 low bedrock hills near the eastern margin of the quadrangle whose geology was previously interpreted by Skotnicki (1999). Although the surficial geology of this area had been mapped on a reconnaissance basis (Pearthree et al, 1988), all of the surficial geologic mapping shown on this map is new. This geologic map is the product of research under the National Cooperative Geologic Mapping Program, with funding provided by the U.S. Geological Survey and the Arizona Geological Survey. Mapping was compiled digitally using ESRI ArcGIS software, over a digital orthophoto base (National Agricultural Imagery Program, 2010) and a 7 ½ U.S. Geological Survey topographic base.

The Cactus Forest quadrangle is in the Basin and Range province in central Arizona. The quadrangle is almost entirely underlain by variably thick, late Cenozoic, valley-filling clastic sedimentary deposits. Bedrock is exposed in hills just east and south of the quadrangle, and locally along the eastern margin of the quadrangle; bedrock is probably less than a few hundred feet deep all along this margin. This is the approximate western limit of a broad pediment that flanks the Ninetysix Hills. The basin deepens dramatically in the northern and western parts of the quadrangle, with deposits as thick as 3200 ft (Richard et al., 2007). Although these deposits are not exposed, presumably they consist of distal alluvial fan gravels and sands in the eastern and southern parts of the quadrangle, and finer-grained axial valley deposits in the central and western parts of the quadrangle. Surface altitude ranges from 1580 ft above sea level in the northwest to 2200 ft asl on top of the largest bedrock hill in the east. This area drains west and northwest to the Gila River, which has incised moderate amounts into older Quaternary deposits in this region (Huckleberry, 1997), but its tributaries in the Cactus Forest quadrangle have incised modestly during the Quaternary. Thus, the valley topography is generally fairly smooth, with active washes incised 10 ft or less below surrounding alluvial surfaces. The principal exception to this generalization is in the northern ¼ of the quadrangle, where washes drain more directly to the Gila River. In this area eroded landforms quite extensive although incision is not very deep, and older Quaternary deposits are widely exposed. In areas to the south, upper piedmont areas in the east are dominated by gravelly, incised but generally well-preserved Pleistocene alluvial fan deposits; young, relatively fine-grained deposits are prevalent in the western 2/3 of the quadrangle.

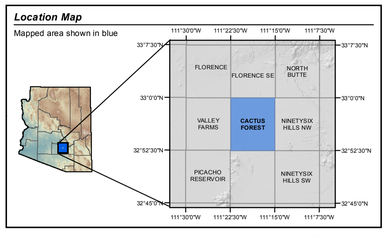
Surficial geologic map units on this map were differentiated based on physical characteristics of the deposits (sediment size and character) and geomorphic surface characteristics associated with the deposits. Differences in the primary physical characteristics of surficial deposits result from differences in rock types in drainage basins, distance from uplands, and differences in the size and character of the stream system that transported the sediment. In this quadrangle, nearly all of the deposits are derived from granitic and metamorphic rocks exposed in hills to the east and south, so deposits are not differentiated on the basis of clast lithologies. Surficial deposits are subsequently altered by processes of weathering, inputs of fine dust from the atmosphere, soil development, and local erosion, so the character of the surface and near-surface portion of the deposits is related to the length of time that the deposits have been exposed at the surface. Drawing upon these age-related changes, the primary structure of the mapping scheme employed in this map is deposit age, with additional information about the spatial distribution of the deposits and particle size distributions that are characteristic of the deposits. In addition, a map unit outlining areas of active arroyo development is based almost entirely on its geomorphic expression.

Several characteristics evident on aerial photographs and on the ground were used to differentiate and map various alluvial surfaces in the Cactus Forest quadrangle. The color or tone of alluvial surfaces on aerial photographs is primarily controlled by soil color, rock varnish and desert pavement, and vegetation type and density. Significant soil development begins on an alluvial surface after it becomes isolated from active flooding and depositional processes (Gile et al., 1981; Birkeland, 1999). Over thousands of years, distinct soil horizons develop. Two typical soil horizons in Pleistocene alluvial sediments of Arizona are reddish brown, clay-enriched cambic and argillic horizons and white, calcium-carbonate-rich calcic horizons. As a result, older alluvial surfaces characteristically are reddish-brown if well-preserved, or light-colored if more eroded, in the field and on color aerial photographs. Younger surfaces typically are gray or brown in color. Differences in the drainage patterns between surfaces also provide clues to surface age. Young alluvial surfaces that have been subject to relatively recent flooding commonly display distributary or tributary channel patterns, and young surfaces may have very little developed drainage if sheetflooding predominates. Dendritic tributary drainage systems incised well below the surrounding landscape are characteristic of older surfaces. Topographic relief between adjacent alluvial surfaces and the depth of entrenchment of channels can be evaluated using stereo-paired aerial photographs and topographic maps. Young flood-prone surfaces are nearly flat or gently undulating and are typicall less than 5 feet above channel bottoms. Active channels are entrenched 3 to 10 feet below older, inactive alluvial surfaces, and these surfaces typically are more or less rounded by erosion depending on surface age and the amount of local incision.

Ages of all map units were roughly estimated through correlations to deposits and alluvial surfaces with similar characteristics in the southwestern U.S. (e.g., Gile et al, 1981; Machette, 1985; Pearthree and Calvo, 1987; Bull, 1991; Huckleberry, 1997). Soil development provides a basis for crudely estimating ages of surficial deposits. For example, in soils less than a few thousand years old, calcic horizon development consists of fine white filaments of calcium carbonate (typical of Qy_2 and Qya deposits). Soil horizons closer to the surface may exhibit a bit of soil structure, but no detectable increase in clay content. Somewhat older soils have thin but obvious calcium carbonate coatings on pebbles and cobbles and slight clay increase in shallow soil horizons (typical of Qy_1 and Qi_3 deposits). Older deposits may have soil horizons partially or completely cemented with calcium carbonate (caliche; typical of Qi1 deposits) and distinctly reddened horizons with some increase in clay content immediately beneath the surface.

The distribution of young deposits on these piedmonts provides a reconnaissance-level assessment of areas that may be prone to flooding, because they are the cumulative record of deposition in many large floods over the past few thousand years. This assertion is based on a simple premise – that fluvial systems erode, deposit, or rework existing deposits during floods. The spatial distribution of young deposits across piedmonts and the character of the modern channel networks together record recent fluvial behavior, and thus provide important clues regarding the potential for flooding. Areas with the deposits that were emplaced most recently (Qy_3, Qy_2, Qyx) are most prone to flooding. Adjacent young geologic units that are slightly higher in the landscape (Qy2, Qys) are likely prone to inundation in large floods. Areas of older Holocene deposits (Qy_1) and the youngest Pleistocene deposits (Qi_3) are moderately incised and generally are not subject to inundation. Flood hazards are generally low in areas covered by older Pleistocene deposits (units Qi_2, Qi_1) and bedrock hillslopes (unit TYg). Drainage systems in these areas typically are tributary in nature and topographic confinement is sufficient to contain flood flows to channels and immediately adjacent terraces.

In the eastern and northern parts of the quadrangle where flood flows are confined by local topography, corridors of young deposits are quite thin. The typical set of surficial deposits includes Qy_3 or Qy_2 in the lowest areas, fringed by slightly higher, relatively narrow Qy_2 terraces. Lateral topographic confinement is provided by incised older Holocene (Qy_1) or Pleistocene (Qi_1, Qi_2, Qi_3) alluvial fan or terrace deposits. Piedmont areas where lateral topographic constraints decrease or widen dramatically are characterized by laterally extensive suites of young deposits. Channels that are large enough to depict at the map scale are a very small part of the active fluvial systems in the distributary portions of the piedmonts. More extensive Qy_3 deposits contain many smaller channels, but also include low bars, low terraces, and other overbank areas that are subject to shallow flooding. Adjacent areas that have been subject to shallow sheetflooding, and possibly changes in channel position, during large floods in the past few thousand years are mapped as Qys. Areas that were recently subject to sheetflooding but are now being eroded are mapped as Qyx; surface flow obviously becomes reconfined in these incised channel networks. Typically, channel networks within the areas mapped as Qy_3, Qyx and Qys are discontinuous, with narrow, commonly moderately incised reaches and expansion reaches where channels diverge and in some areas disappear completely.

Location Map

Mapped area shown in blue