GEOLOGIC MAP OF THE TUCSON SE 7.5' QUADRANGLE, PIMA COUNTY ARIZONA

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Arizona Geological Survey Digital Geologic Map 43 (DGM-43), version 1.0

November, 2004

Citation for this map: Shipman, T.C., 2004, Geologic Map of the Tucson SE 7.5' Quadrangle, Pima County, Arizona: Arizona Geological Survey Digital Geologic Map 43 (DGM-43), 1 sheet, scale 1:24,000.

Research supported by the U.S. Geological Survey, National Mapping Program, under USGS award #03HQAG0114.
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Introduction

The Tucson SE 7.5' quadrangle is located southeast of the city of Tucson, Arizona, between Wilmot and Houghton Roads and bisected by Interstate 10. Regionally, the map area is southwest of the Pantano Wash. Portions of this map area have been developed since the most recent aerial photography; therefore these areas were mapped from the air photos and ground checked where possible. These areas are outlined on the map by thick, dotted red lines. Field work was carried out between November, 2003 and June, 2004. The surficial deposits were mapped using aerial photos from digital orthoquad photos, color aerial photos, and field mapping.

This report also includes descriptions of various geologic hazards and surficial geology within the mapped area. The surficial geologic map itself provides a substantial amount of information about the aerial distribution of various geologic hazards in this area, because some hazards correlate with surfaces of different ages. Soil characteristics that may impact human structures, including clay content, carbonate accumulation, and potential for compaction, vary with each surface. Flooding in the past can be relatively predicted using the age and elevation of the surface with respects to regional drainage. This map should be used as a guide for more in-depth investigation in the potential for geologic hazards within the mapped area.

Geomorphic Setting

The dominant geomorphic feature within the Tucson SE 7.5' quadrangle area is a relict alluvial fan surface, which radiates from the eastern side of the Empire and Santa Rita Mountains. Ridges developed within this relic alluvial fan confine modern drainage into the Pantano and Santa Cruz Washes. Valley bottoms in the northern portion of the mapped area are flat in most cases with local zones of incision. In the southern half of the mapped area, large portions of the Q_{ls} surfaces are dissected within the valley bottoms. Dissection in the mapped area represents a recent shift in the depositional regime, as evidenced by the punctuation nature of the dissection.

Large flat terraces located along the northeastern portion of the mapped area are associated with Pantano Wash. These terraces are located high on the edges of the present day river valley and do not experience any significant flooding. However, they do tend to have concentrations of clay which can create some geologic hazards.

Flat valley bottoms

Low ridges throughout the mapped area are composed of the oldest deposits (QTcg). The valley bottoms have minimal topography and are flat-bottomed. This might be due to a relatively stable base-level, which provided accommodation for sediment to fill in the v-shaped valley and developed into the present morphology. Cross-sections of the valleys, located in incised washes, reveal buried soil horizons which correspond to older units exposed through out the mapped area. This evidence suggests that the soils have been buried repeatedly by pulses of aggredation. Accumulation within these valleys is punctuated by phases of soil development and dissection. The most recent phase of accumulation has created the flat bottoms within the valleys.

The surficial deposits found in the mapped area represent two major phases of aggradation and degradation. The first phase of aggradation includes the Qi_1 and Qi_2 surfaces, which covered much of the QTcg deposits. Then a phase of degradation occurred with the formation of the present day interfluves, which are partly filled by a younger phase of aggredation.

Geologic Hazards

Problem soils

According to the Natural Resource Conservation Service (NRCS) maps, there is a high percentage of the shrink/swell soil located along terraces associated with the Pantano Wash. Shrink/swell soils expand when saturated with water, once this water evaporates the clays shrink back to their pre-saturated volume. The change in volume can cause walls and foundations to crack and roads and sidewalks to warp (Harris and Pearthree, 2002). Shrink/swell soils are associated with Qi1 map unit.

Collapsing soils are common in the Tucson Basin (Farmer and Glynn, 1990). Collapsing soils are believed to develop from deposition from sheet flooding which deposits its sediment load rapidly. This rapid deposition can leave the clay relatively loosely compacted. Subsequent wetting of this surface can cause compaction of the soil. Farmer and Glynn (1990) report collapsing soils that are susceptible to greater than 5% compaction associated with the Qi3 map unit.

Flooding

Intense late summer, early fall and winter rains can produce dramatic floods in this area. During the winter large regional storms are long lasting, which saturate the soil and cause flooding. Summer storms produce a high rate of precipitation in a short period of time which causes flooding as flash events. Knowledge of the two types of flooding should be taken into consideration when assessing flood potential.

The younger alluvial deposits Qy and Qyc represent areas that have undergone major flooding over the last 10,000 years or less. Particular attention must be paid to these areas when assessing flooding potential. Wide flat bottom valleys may be susceptible to sheet flooding at some points along the valley bottom. Indicators for the presence of sheet flooding are lighter color soils, absence of high interfluves, and presence of old trees.

Incision and dissection is prevalent in the southern portions of the map area. Diversion by humans and natural stream capture processes have left abandoned stream channels that also may be subject to flooding during large storm events yet appear to be unrelated to contemporary drainage.

Streets flood due to their directions across regional drainages. North-south roads that are perpendicular to regional drainages have a high potential for flooding of wash crossings during heavy precipitation.

Other state and federal agencies have designated the flood zones on the mapped area. Most of the map area is outside of the FEMA designated 100 year floodplain, however there is a zone east of Kolb Road and north of Interstate 10 which is in the 100 year floodplain. FIRM (Flood Insurance Rate Map) has designated much of the wash area north of Interstate 10 and between Kolb and Rita Roads, as the 100 year floodplain. Retention basins have been established in some of the areas established as the 100 year floodplain since the FIRM mapping.

Unit Descriptions

d — **Disturbed –** Areas when the ground has been heavily disturbed and original deposits obscured.

Qyc — **Modern channel deposits (<~ 1 ka) –** This unit includes only active, open channels of tributary washes on the piedmonts that could be delineated at a scale of 1:24,000. Unit Qyc is composed of moderately-sorted sand, gravel, and pebbles with some cobbles in the lower piedmont areas to poorly-sorted sand, gravel, pebbles, and cobbles in the upper piedmont areas. Channels are generally incised less than 0.5 meter below adjacent 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. The channels are flood prone and are subject to deep, high velocity flow during moderate to large flood events. Channels are subject to scouring and bar deposition. Banks are subject to lateral erosion. There is no soil development in this fluvially active unit and little or no vegetation within the channels.

Qyd — **Incised Holocene deposits (<~ 10 ka) –** Unit Qyd represents areas where Qy and some Q_{ls} units are dissected. Dissection is punctuated along certain drainages which is different from most of the drainages within the Tucson Basin which have been incising since the late 1880s. The drainages are connected to other incised drainages, suggesting that this will become more wide-spread in the future.

Qy — **Holocene alluvium (< 10 ka) –** Unit Qy is composed of Holocene alluvium deposited over late to middle Pleistocene alluvium (units Q_{i2} and Q_{i3}) by sheetflow. The Holocene alluvium is less than 1 meter thick and composed of well sorted, fine grained clay loam. This unit may cover older units in the valley bottoms and on large flat-topped relic fan surfaces. Qy surfaces are generally planar with local surface relief up to 0.5 meter where the surface has been beveled or dissected. This unit may be flood prone during large events, but inundation is generally shallow sheetflooding. Soil development is minimal with some disseminated carbonate not visible. Soil color is typically brown (7.5YR 4/3) and buff to light tan on the air photos. This surface is dominated by mesquite, grasses, low crowned palo verde, and cholla.

Q_{ls} — **Late Pleistocene alluvium (~10 to 130 ka) –** Unit Q_{ls} is composed of late Pleistocene alluvium deposited within incised valleys into the unit QTcg. The late Pleistocene alluvium is less than 2 meters thick and composed of silty clay. Pebble to cobble sized clasts floating within a fine grained matrix are commonly found within outcrops of Q_{ls}. Q_{ls} surfaces are planar with some dissection and beveling near the edges; incision is less than 1 meter. Q_{ls} surfaces may be subject to inundation in especially large floods in the valley bottom where topographic relief is minimal. Soil development is moderate with some desert pavement, disseminated globular to nodular stage I-II fibrous carbonate, and minimal granular peds. Soil color is typically pink (7.5YR 7/3) and tan to pinkish red on the air photos. This surface is dominated by creosote, desert broom, cholla, and barrel cactus. Surface remnants are found on the sides of the valleys and within the valley bottoms.

Q_{i2} — **Middle Pleistocene alluvium (~130 to 750 ka) –** Unit Q_{i2} is composed of middle Pleistocene alluvium deposited outside of valleys incised within QTcg and inside valleys incised into Q_{i1}. The middle Pleistocene alluvium is less than 4 meters thick and composed of silty clay. . Pebble to cobble conglomerate lenses occur within a layered, fine grained matrix. Flooding on the Q_{i2} surface is confined within the incised channels with some sheetflow contributing to the general drainage. Q_{i2} surfaces edges are minimally beveled and incised 1.5 to 2 meters. Soil development is moderate to mature, stage II-III nodular carbonate, and columnar peds. Soil color is typically reddish yellow (5YR 7/6) and pinkish to red on the air photos. This surface is dominated by creosote, cholla, and barrel cactus.

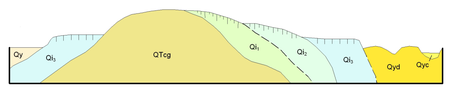
Q_{i1} — **Early Pleistocene alluvium (~750 ka to 1 Ma) –** Unit Q_{i1} is composed of early Pleistocene alluvium deposited on top of QTcg. The early Pleistocene alluvium is less than 8 meters thick and composed of grüss with silty clay to clay fines. Q_{i1} surfaces are more prominent in the northern portion of the map area with some exposures in the southeastern portion of the map. Q_{i1} surfaces are dissected and rounded hills with 5 meters of incision. Flooding on Q_{i1} surfaces are confined within the incised channels. Soil development is mature with moderate desert pavement, stage IV to V laminar secondary carbonate, and blocky medium sized peds. Soil color is typically red (2.5 YR 4/6) and reddish with white patches on the air photos. This surface is dominated by cholla, palo verde trees, and prickly pear.

QTcg — **Quaternary to late Tertiary alluvial fan deposits –** Alluvium composed of interbeded sandstones and conglomerate, less than 10 meters thick. The conglomerate is composed of cobble to pebble size clasts of sandstone, metasediments, and granite, with a carbonate matrix. Flooding on the QTcg is confined to the valley bottoms with some sheetflow. Soils on the ridges are poorly preserved due to long term erosion. QTcg is a pinkish gray (5YR 7/2) at the outcrop and whitish on the air photo. This surface is dominated by creosote and ocotillo.

Map Legend

- Contact, accurate
- Contact, approximate
- Outline of presently disturbed areas, mapped using aerial photographs that pre-date recent disturbance.
- Exxon well

Schematic for the surficial geologic stratigraphy for Tucson SE quadrangle



Immature to mature soil development

SCALE 1:24,000

1 0.5 0 1 miles

1,000 500 0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 Feet

1 0.5 0 1 Kilometers

contour interval 10 feet

MN 11½°

N

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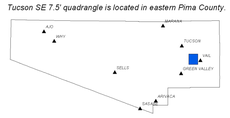
Location Index Map

Tucson SE 7.5' quadrangle is located in eastern Pima County.



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Topographic base from USGS 7.5' Tucson SE quadrangle, compiled from imagery dated 1966; revised from imagery dated 1992. Map edited in 1995. UTM zone 12, NAD 83. Reprojected to NAD 27.
Magnetic declination 11.5° east of true north. Contour interval 10 feet.