Geologic Map of the Three Points 7 ½' Quadrangle, Pima County, Arizona

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Arizona Geological Survey

Digital Geologic Map 04, v. 2

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Introduction

This report describes the geology, geomorphology, and geologic hazards in the Three Points 7½' quadrangle, on the southwestern fringe of the Tucson metropolitan area in unincorporated Pima County (Figure 1). The map area is located in the transition between the upland, moderately dissected Altar Valley to the south and the broad, undissected basin called Avra Valley to the north. The community of Three Points (also called Robles Junction) lies on the approximate boundary between these two geographic areas. The map includes a 15-km-long reach of Brawley Wash, which cuts through the map area from southwest to northeast. Brawley Wash heads just south of the U.S. – Mexico border and drains all of Altar and Avra valleys before joining the Santa Cruz River northwest of Tucson. About 60 percent of the Three Points quadrangle consists of the northwestern piedmont of the Sierrita Mountains. The quadrangle also includes a small part of the northwestern piedmont of the Coyote Mountains and the southern fringe of the Roskruge Mountains. The quadrangle is generally undeveloped, and is currently used primarily for grazing. Some low-density suburban development has occurred around the community of Three Points and on the Sierrita and piedmont to the south. Much of the floodplain and low terraces of Brawley Wash have been developed for agriculture. The Three Points quadrangle will likely experience much more urban/suburban development in the next few decades. This map and report may be of use in avoiding or mitigating geologic hazards in this area.

This geologic mapping in the southwestern portion of the Tucson area is part of continuing efforts by the AZGS to map the geology of the Phoenix – Tucson urban corridor. This map builds on and complements previous surficial geologic mapping efforts in the Tucson area (McKittrick, 1988; Jackson, 1989; Demsey and others, 1993; Field and Pearthree, 1993; Klawon and others, 1999; Pearthree and Biggs, 1999). The current mapping effort was conducted in conjunction with geologic mapping in the adjacent San Pedro quadrangle to the west (Ferguson and others, 2000) and the Corcoraque Butte (Skotnicki and Pearthree, 2000) and West of Avra (Pearthree and others, 2000) quadrangles to the north. This report is organized into a brief introduction and explanation of mapping methods, unit descriptions, a summary of the geologic and geomorphic framework of the area, and a discussion of geologic hazards. Ray Harris digitized the map information and provided quality control for the map compilation, and Tim Orr generated the final linework and map layout. Ray Harris contributed to the section on land subsidence and earth fissures. Mapping was conducted as part of the STATEMAP Program of the U.S. Geological Survey, contract #99HQAG0171. Mapping was revised and the geodatabase updated as part of the National Geological and Geophysical Data Preservation Program

Several weather stations close to the Three Points area, including a number in nearby Tucson, Arizona, have operated during intervals over the past century. The station at the University of Arizona in the central Tucson basin has records from 1894 to the present, whereas stations to the northwest of the quadrangle at Silver Bell (1906- 1974) and Red Rock (1893-1973) provide data for the northern Avra Valley area. Using the records of seven stations in the greater Tucson metropolitan area, the average recorded daily maximum temperature was 83.9° F / 29°C, and the average daily minimum was 54.0° F / 12°C (Western Regional Climate Center, 1999). Average annual precipitation for the area is about 10-12 inches (250-300 mm), with slightly more than 50% falling during the July through September monsoon thunderstorm

Methodology

The surficial geology of the project area was mapped using black-and-white aerial photographs taken in 1974, with field checking of unit boundaries, and field observations of soils and stratigraphy. The physical characteristics of Quaternary alluvial surfaces (channels, alluvial fans, floodplains, stream terraces) evident on aerial photographs and in the field were used to differentiate their associated deposits by age. Surficial deposits of this quadrangle were then correlated with similar deposits in this region in order to roughly estimate their ages. Original mapping was done over aerial photos and compiled on the 7 ½' quadrangle map. The map compilation was then digitized and the final map was generated from the digital data.

Alluvial surfaces of similar age have a distinctive appearance on aerial photos and on the ground because they have undergone similar post-depositional modification. This allows for the mapping, correlation, and rough age estimation of Quaternary deposits and alluvial surfaces in this region. Surfaces of a similar age have different physical characteristics than both younger and older surfaces. Terraces and alluvial fans that are less than a few thousand years old, for example, still retain clear evidence of the original depositional topography, such as of bars of coarse deposits, swales (troughlike depressions) where low flows passed between bars, and distributary channel networks, which are characteristic of active alluvial fans. Young alluvial surfaces have little rock varnish on surface clasts and have little soil development, and they are minimally dissected. Old fan surfaces, in contrast, have been isolated from substantial fluvial deposition or reworking for hundreds of thousands of years. These surfaces are characterized by strongly developed soils with clay-rich argillic horizons or cemented calcium-carbonate horizons or both. They have well-developed tributary stream networks that are entrenched 1 to 10 m below the fan surface, and typically have strongly developed varnish on surface rocks. The ages of alluvial surfaces in the southwestern United States may be roughly estimated based on these surface characteristics, especially soil development (Gile and others, 1981; Bull, 1991). In this map, late Cenozoic surficial deposits are subdivided based on their source (axial valley stream and smaller tributary washes on piedmonts) and estimated age of deposits. Surface and soil characteristics were used to correlate alluvial deposits and to estimate their ages. Surface pits and exposures along cut banks were used to assess soil characteristics associated with deposits of different ages and from different sources. Soils and surfaces documented in the map area were generally correlated with soils and surfaces described in Quaternary mapping studies of adjacent areas conducted by Katzer and Schuster (1984), Jackson (1989), Demsey and others (1993), Klawon and others (1999), Pearthree and Biggs (1999), Skotnicki and Pearthree (2000), and Ferguson and others (2000). These correlations were also used to estimate the ages of surficial deposits in the map area. The surficial geology of most of the quadrangle was mapped by P. Pearthree; the piedmont of the Roskruge Mountains in the northwestern part of the quadrangle was mapped by Steve Skotnicki. Limited bedrock exposures in the northwestern part of the Three Points quadrangle were mapped by Wyatt Gilbert and Charles Ferguson. They identified rock types and collected rock samples from selected outcrops. The bedrock exposed in this quadrangle is relatively simple, consisting of middle Tertiary trachyandesite and late Tertiary basalt. Samples of each of these bedrock units were sampled and dated by the K/Ar method in the 1960's (Bikerman, 1967; 1968).

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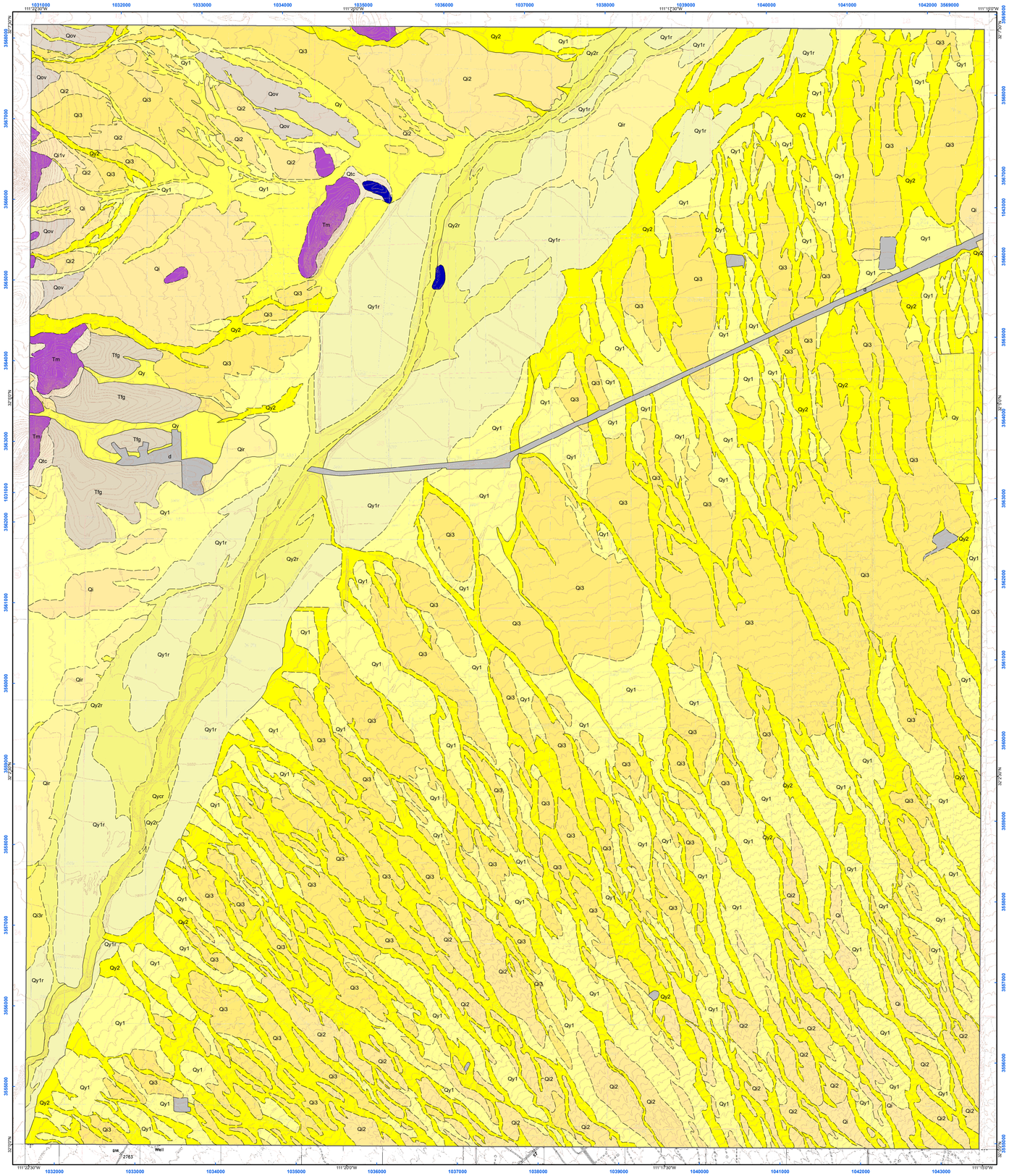

SCALE 1:24,000

1 0.5 0 1 Miles

1 0.5 0 1 Kilometers

0 1100 2200 3300 4400 5500 Feet

CONTOUR INTERVAL 40 FEET

TRUE NORTH

MAGNETIC NORTH

9.4°

Approximate mean declination, 2019

Topographic base map derived from theThree Points 7.5' USGS topographic quadrangle map originally with NAD27 datum. Reprojected to UTM NAD83 datum (zone 11) using iGage All Topo Maps V9. UTM NAD 83 grid and lat-lon markers produced using ESRI ArcMap v. 10.4.

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Map Explanation

Geologic Symbols

Contact, accurate

Contact, approximate

Geologic Map Units

Axial Stream Deposits

- Qy_0r — Modern river channel deposits - Late Holocene
- Qy_2r — Proximal floodplain deposits - Late Holocene
- Qy_1r — Distal floodplain and low terrace deposits - Holocene
- Qyr — Floodplain and low terrace deposits in agricultural areas - Holocene
- Qi_5r — Intermediate terrace deposits - Late Pleistocene
- Qi_r — Remnant older river deposits on the basin floor - Late Pleistocene to Middle Pleistocene

Piedmont Alluvium

- Qy_2 — Youngest channel and low terrace deposits - Late Holocene
- Qy_1 — Young alluvial fan and low terrace deposits - Holocene
- Qy — Undifferentiated young alluvium - Holocene
- Qi_5 — Young intermediate alluvial fan and terrace deposits - Late Pleistocene
- Qi_5v — Younger intermediate alluvial fan and terrace deposits, volcanic clasts - Late Pleistocene
- Qi_2 — Intermediate alluvial fan and terrace deposits - Middle Pleistocene to Late Pleistocene
- Qi_2v — Intermediate alluvial fan deposits, volcanic clasts - Middle Pleistocene to Late Pleistocene
- Qi — Undifferentiated intermediate alluvial fan and terrace deposits Middle Pleistocene or Late Pleistocene
- Qi_1v — Older intermediate alluvial fan deposits dominated by volcanic clasts - Middle Pleistocene
- Qov — Old alluvial fan deposits dominated by volcanic clasts - Early Pleistocene
- Tfg — Very old alluvial fan gravel - Late Miocene to Pliocene

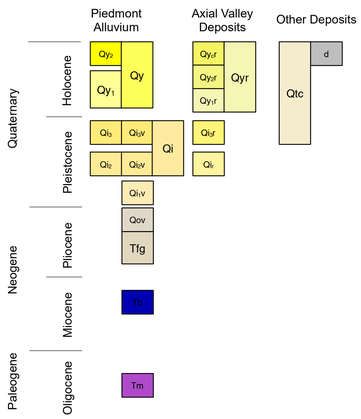
Bedrock

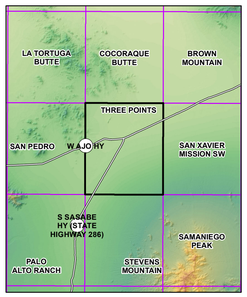
- Tb — Basalt of Brawley Wash - Late Miocene
- Tm — Trachyandesite lava - Late Oligocene

Other Units

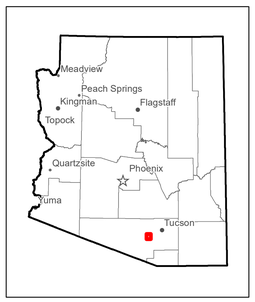
- d — Disturbed areas - Modern
- Qtc — Hillslope colluvium and talus - Quaternary

Correlation Diagram





Arizona Geological Survey Digital Geologic Map DGM-04
Geologic map of the Three Points 7 1/2' Quadrangle



Location of map area