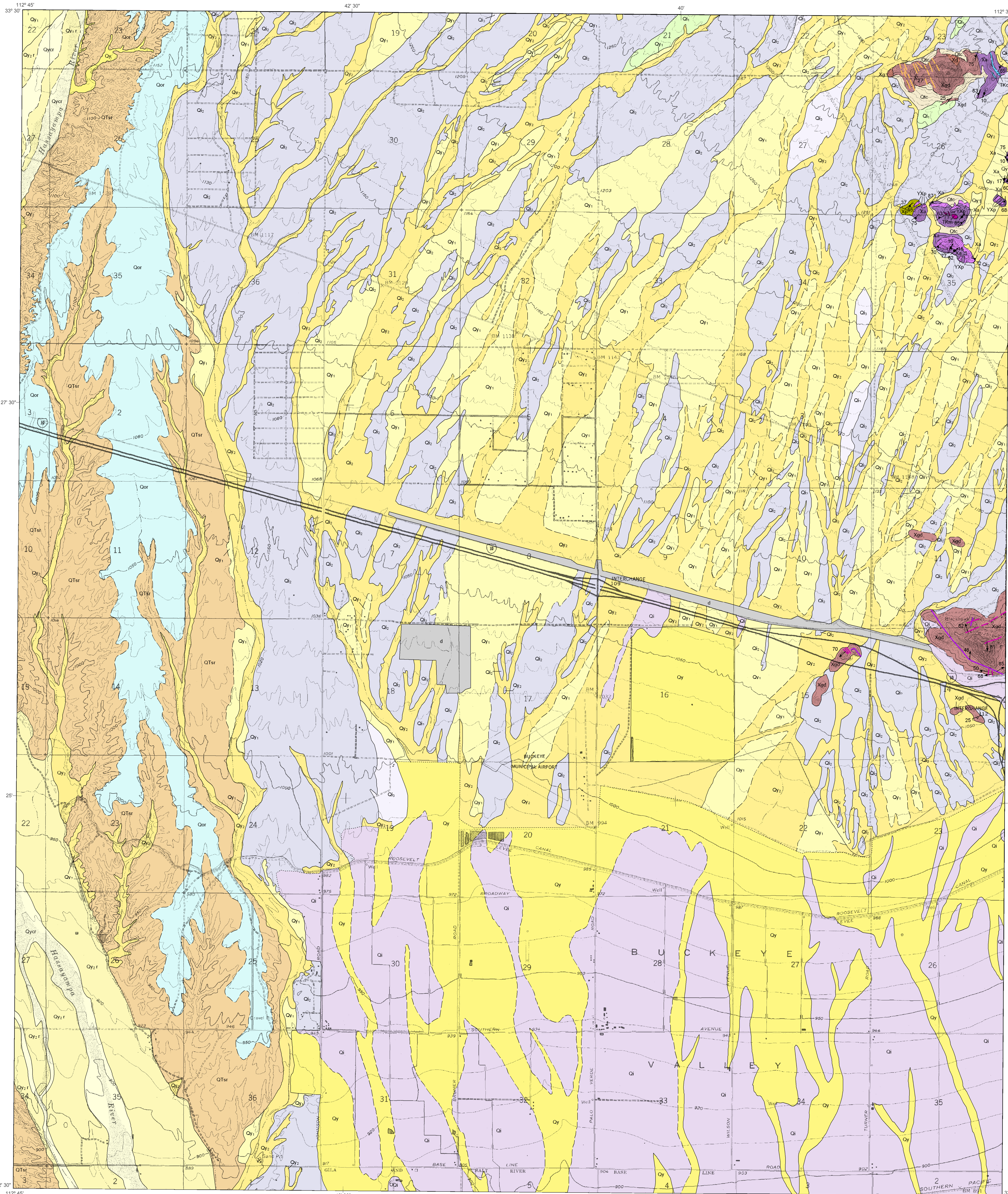
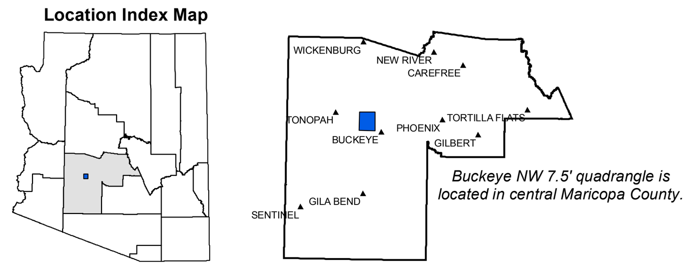


Topographic base from USGS Buckeye NW 7.5' quadrangle, compiled from photogrammetric methods from aerial photos taken 1955 and by planetable surveys 1958. UTM zone 12, NAD 27. Reprojected to NAD 83.
Magnetic declination 13° east of true north.
Contour interval 10 feet.

SCALE 1:24,000

contour interval 10 feet

Location Index Map



Buckeye NW 7.5' quadrangle is located in central Maricopa County.

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Unit Descriptions

Piedmont Alluvium

Qy₂ — **Late Holocene deposits in active stream channels, low terraces, and alluvial fans** – Very young deposits associated with active or recently active fluvial systems. Channel deposits typically consist of sand and pebbles with some cobbles and small boulders in middle and upper piedmont areas, and sand and some pebbles lower on the piedmont. Terrace and fan deposits typically consist of sand and silt with some gravel lenses. Fan and terrace surfaces typically are planar where deposits are fine and gently undulating where deposits are coarser, with gravel bars and finer-grained swales. Desert pavement development is minimal and rock varnish is very light or nonexistent. Soil development is weak. Surface dissection is minimal and is associated with channels that are incised up to 1.5 m below adjacent fans or terraces. Channel patterns are variable, including anastamosing or distributary linked channels and separate small tributary channels feeding into larger channels.

Qy₁ — **Older Holocene deposits on alluvial fans and terraces** – Young deposits associated with recently active alluvial fans and terraces. In middle and upper piedmont areas, deposits are poorly sorted, consisting sand, silt, pebbles, and cobbles; in lower piedmont areas, deposits are typically sand and silt with minor gravel. Surface relief varies with particle size, with relict bar and swale topography where deposits are gravelly and relatively smooth surfaces where sand and silt predominate. Soil development is weak, with some soil structure and minor carbonate accumulation. Surfaces typically are brown to gray, with common gravel litter but minimal desert pavement and light brown rock varnish.

Qy — **Holocene alluvial deposits, undifferentiated, primarily in areas disturbed by agricultural activity**

Qi₃ — **Late Pleistocene alluvial fan and terrace deposits** – Younger intermediate deposits associated with inactive alluvial fans and terraces along washes. Deposits typically are poorly sorted mixtures of silt, sand, pebbles and cobbles. Surfaces are moderately dissected by tributary drainages that head on the surfaces and through-going distributary channels. Local surface topographic varies from about 0.5 to 2 m. Soil development is moderate, with minimal clay accumulation and soil reddening and weak to moderate calcic horizon development. Rock varnish on surface clasts varies from light to dark brown.

Qi₂ — **Middle Pleistocene alluvial fan** deposits – Older intermediate deposits associated with extensive relict alluvial fans. Deposits are poorly sorted, including sand, pebbles and cobbles, with minor silt and clay. Surfaces are moderately to deeply dissected, with local topographic relief varying from about 0.5 to 6 m. Original depositional topography typically is not preserved, and surfaces are quite smooth where not eroded. Qi₁ surfaces are drained by extensive tributary drainage networks. Interfluve areas between drainage vary from quite flat to broadly rounded. Soils have weak to moderate clay accumulation and slight reddening in the upper 30 cm beneath the surface, and calcic horizons show obvious visible carbonate accumulation.

Qi — **Middle and late Pleistocene alluvial fan and terrace deposits, undifferentiated**

Qi₁ — **Middle to early Pleistocene alluvial fan deposits** – Old relict alluvial fans with moderately strong soil development. Deposits are poorly sorted, including sand, pebbles, cobbles, and small boulders with minor silt and clay. Surfaces typically are moderately dissected with up to 6 m of local relief, but interfluve surfaces are quite smooth and have dark, strongly developed pebble-cobble desert pavements. Soils have moderate clay accumulation and obvious reddening and abundant carbonate accumulation resulting in weak cementation.

Hassayampa River Alluvium

Qycr — **Active river channel deposits** – Moderately to poorly sorted sand, gravel and minor silt in recently active channels and lightly vegetated bars of the Hassayampa River. Gravel includes subangular to well-rounded clasts of diverse lithology.

Qy₂ r — **Late Holocene to modern floodplain deposits** – Sand, silt, and gravel deposits associated with slightly higher terraces along the Hassayampa River. Terrace surfaces typically are smooth and are less than 3 m above the active channel. Terrace surfaces typically are covered with fine-grained floodplain deposits, but relict gravel bars and lenses are common.

Qor — **Early Pleistocene river deposits** – Deposits associated with the high terraces along the Hassayampa River that record the maximum aggradation of the river. Terrace surfaces are fairly flat or or broadly rounded, but all terrace surfaces are moderately to deeply dissected by tributary drainages and the river and have been substantially modified by erosion. Exposures are poor, but well-rounded gravel is evident at the surface. Terrace surfaces are also typically covered with litter from underlying petrocalcic soil horizons. Terrace surfaces range from about 15 to 20 m above the active river channel, and rise slightly to the north across the quadrangle.

QTsr — **Pliocene to early Pleistocene river deposits** – A moderately thick sequence of old Hassayampa River deposits that underlies the Qor terrace/fan deposits. These deposits consist of river sand, gravel and silt with a substantial component of tributary sand and gravel. Local zones of substantial carbonate accumulation may represent moderately to strongly developed buried soils.

Other Units

Qtc — **Holocene and Pleistocene colluvium and talus** – Very poorly sorted, weakly stratified, hillslope deposits mantling bedrock slopes.

d — **Disturbed areas** – Much of the quadrangle has been disturbed by human activities, particularly agricultural activities. This unit designation is used only in areas of substantial excavation or anthropogenic deposition, for example, major flood-control levees.

Bedrock map units

TKm — **Mafic dikes (Tertiary – Cretaceous)** – Dark-colored, fine-grained to very fine-grained dioritic dikes with sparse 1-4 mm plagioclase and mafic phenocrysts.

TKq — **Rhyolite porphyry (Cretaceous)** – Quartz-phyric rhyolite porphyry dikes and small intrusions with variable phenocryst content. The rhyolite porphyry is characterized by light gray, commonly flow-foliated aphanitic matrix and contains between 5% and 20% 1-6 mm quartz, potassium feldspar, and plagioclase phenocrysts with sparse biotite, hornblende, and other mafics. In general, grain size and the abundance of accessory mafic minerals increases with phenocryst content. The rhyolite porphyry correlates with the intrusive rocks (unit Ti) of Reynolds et al. (2002).

YXp — **Pegmatite and leucogranite complex (Middle and Early Proterozoic)** – Medium- to coarse-grained pegmatite and heterogenous texture, banded, muscovite leucogranite.

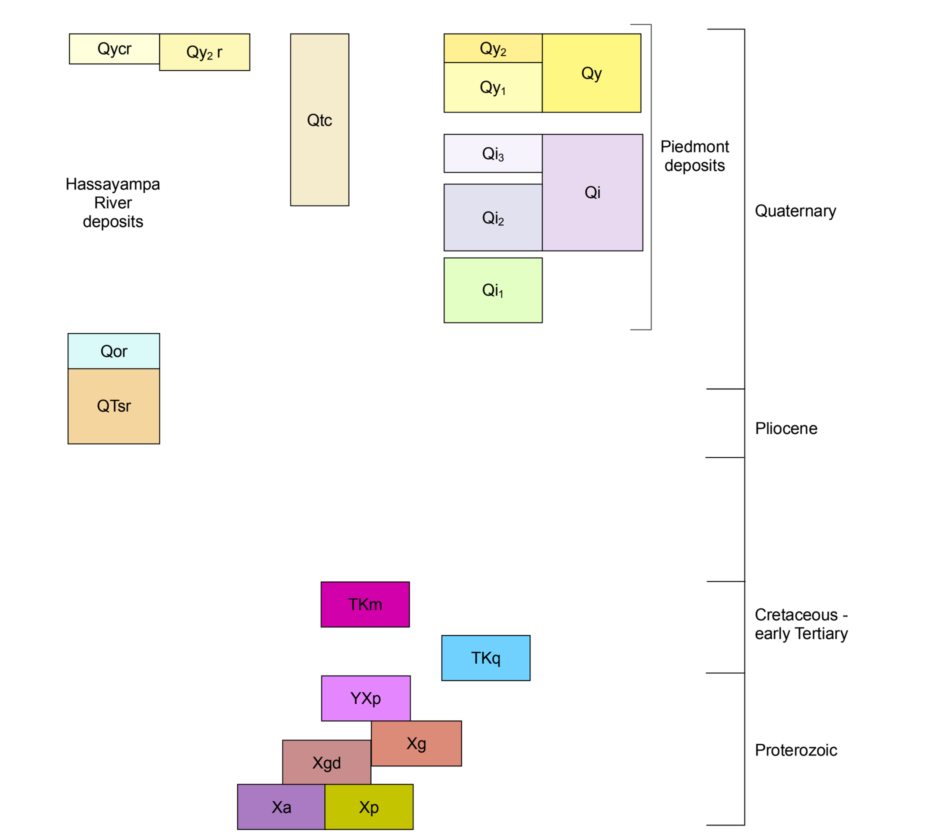
Xg — **Granite (Early Proterozoic)** – Weakly foliated, fine- to medium-grained 10-20% biotite granite or quartz monzonite (Xg) that appears to be younger than the granodiorite (Xgd).

Xgd — **Granodiorite (Early Proterozoic)** – Medium-grained, weakly to strongly foliated granodiorite to quartz monzodiorite containing between 15-40% mafics. The granodiorite correlates with the undifferentiated metamorphic rocks (Xm), granitic rocks and pegmatite (Xgr), and tonalite (Xt) units of Reynolds et al. (2002).

Xa — **Amphibolite schist (Early Proterozoic)** – Fine- to medium-grained amphibolite schist and banded, mafic-rich orthogneiss with lesser amounts of biotite schist, sericite schist and psammitic schist. The amphibolite schist correlates with the undifferentiated metamorphic rocks (Xm), and tonalite (Xt) units of Reynolds et al. (2002).

Xp — **Pinal Schist (Early Proterozoic)** – Fine- to medium-grained, light gray biotite schist, sericite schist, and psammitic schist. The Pinal Schist map unit represents a zone of metamorphic rocks void of amphibolite schist.

Stratigraphic Correlation diagram



GEOLOGIC MAP OF THE BUCKEYE NW 7.5' QUADRANGLE, MARICOPA COUNTY, ARIZONA

by John J. Field, Philip A. Pearthree and Charles A. Ferguson

Arizona Geological Survey Digital Geologic Map 37 (DGM-37), version 1.0

November, 2004

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Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award #03HQAG0114. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. government.

Introduction

The Buckeye NW 7.5' quadrangle is located approximately 35 miles (60 km) west of downtown Phoenix, Arizona. The map area covers the southwestern piedmont of the White Tank Mountains which merges to the south into Buckeye Valley and to the west into Hassayampa Plain. Bedrock was mapped in April, 2004, and Quaternary geology, modified from Field and Pearthree (1991), was supplemented with new mapping and aerial photograph interpretation using high-resolution digital images provided by the Flood Control District of Maricopa County. This map is one of six 1:24,000 scale geologic maps covering much of the Hassayampa Plain area that were produced for this study. Mapping was done as part of a multiyear mapping program directed at producing complete geologic map coverage for the Phoenix-Tucson metropolitan corridor, and was done under the joint State-Federal STATEMAP program, as specified in the National Geologic Mapping Act of 1992.

Surficial Geology

Surficial geology was mapped primarily using aerial photos taken in 1979 for the Bureau of Land Management. Unit boundaries were spot-checked in the field, and mapping was supplemented by field observations during the spring of 2004. 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 and source. This mapping was transferred to a digital orthophotoquad base from 2002 provided by the Flood Control District of Maricopa County. Mapping was compiled in a GIS format and the final linework was generated from the digital data. Surficial deposits of the map area were then correlated with regional deposits to roughly estimate their ages. The mapping of Field and Pearthree (1991) was incorporated into this map with contacts modified extensively in some parts of the map based on reinterpretation of geologic relationships and the higher-quality digital aerial photo base that is currently available.

Characteristics evident on aerial photographs and on the ground were used to differentiate and map various alluvial surfaces. The color of alluvial surfaces depicted on aerial photographs is primarily controlled by soil color, and to a lesser extent, rock varnish. 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 argillic horizons and white calcic horizons. As a result, on color aerial photographs older alluvial surfaces characteristically appear redder or whiter (on more eroded surfaces) than younger surfaces. Older surfaces have a dark brown color where darkly varnished desert pavements are well preserved. Differences in the drainage patterns between surfaces provide clues to surface age and potential flood hazards. Young alluvial surfaces that are subject to flooding commonly display distributary (branching downstream) or braided channel patterns; young surfaces may have very little developed drainage if unconfined shallow flooding predominates. Dendritic tributary drainage patterns are characteristic of older surfaces that are not subject to extensive flooding. Topographic relief between adjacent alluvial surfaces and the depth of entrenchment of channels can be determined using stereo-paired aerial photographs and topographic maps. Young flood-prone surfaces appear nearly flat on aerial photographs and are less than 1 m above channel bottoms. Active channels are typically entrenched 1 to 10 m below older surfaces. Comparisons of calcic horizon development on the White Tank Mountains piedmont with other soil sequences in the western United States provide one of the few methods of estimating the ages of the different alluvial surfaces (Gile et al, 1981; Machette, 1985). Calcic horizon development varies from fine white filaments of calcium carbonate in young soils to soil horizons completely plugged with calcium carbonate (caliche) in very old soils.

Variations in the distribution of surfaces of different ages and sources and concomitant variations in dissection across the quadrangle provide evidence regarding the recent geologic evolution of this area and the distribution of flood hazards. Generally, areas near the Hassayampa River are moderately to deeply dissected, whereas dissection in middle piedmont areas varies substantially across the quadrangle. Very old terraces of the Hassayampa River (unit Qor) record the level of the river bed in the early Quaternary. Qor terraces cap a substantial aggradational sequence that was deposited during the late Tertiary to early Quaternary. At that time the river was not entrenched and probably was depositing sediment across a fairly broad floodplain in the western part of the quadrangle. Since then the Hassayampa River has downcut up to 20 m, with dissection increasing slightly to the north. The effects of this downcutting are expressed by incision of tributary drainages near the western margin of the quadrangle. In the eastern and southern part of the quadrangle, piedmont drainages turn to the southwest and south before eventually joining the Hassayampa or Gila rivers. Incision along these drainages generally is less than a few meters, and most drainages have major expansion reaches with distributary channel networks and extensive, thin young deposits in the middle piedmont. These areas are of particular concern because of the potential for widespread inundation and changes in channel positions during floods (Field and Pearthree, 1992). The southern part of the map area is mantled by relatively fine-grained Pleistocene and Holocene distal fan deposits that merge to the south with floodplain deposits of the Gila River (south of the quadrangle). Surfaces in this southern area have been profoundly modified by agriculture activity, and age estimates and mapping are based on interpretation of an NRCS soil survey (Hartman, 1977).

Bedrock Geology

Bedrock units are dominated by Early Proterozoic granodiorite (Xgd). The granodiorite intrudes amphibolite schist (Xa) and biotite sericite schist (Xp). Collectively, these rocks comprise a widespread metamorphic complex that is present throughout the White Tank Mountains (Reynolds et al., 2002; Ferguson et al., 2004). Other rocks include a small stock of pegmatite (YXp) that probably correlates with a series of Middle Proterozoic pegmatite stocks associated with a coarse-grained, potassium feldspar porphyritic granite found to the north. A series of mostly north-striking mafic (Tb, TKm), intermediate (TKap), and quartz porphyry (TKq) dikes are correlated with similar dikes in the northerly adjacent Wagner Wash Quadrangle (Ferguson et al., 2004). The early to middle Tertiary (TK) and middle Tertiary (T) ages for these rocks are based on cross-cutting relationships the dikes display with respect to a widespread granitic unit (TKg of the northerly adjacent map area) in the northern White Tank Mountains that has been dated at 56.2 ± 14 Ma (U-Pb zircon, Spencer et al., 2003).

Schistosity in Early Proterozoic supracrustal rocks (Xa, Xp) and a weakly developed foliation in the Early Proterozoic granodiorite (Xgd) is generally steeply dipping and northeast striking. These fabrics are cut by the Middle Proterozoic, and middle to early Tertiary stocks and dikes, and are therefore not considered to be related to middle Tertiary extensional deformation. At the southern edge of the bedrock exposures, however, a pervasive, gently southeast-dipping protomylonitic fabric is present in the granodiorite (Xgd). This fabric is similar to pervasive fabrics described in the eastern White Tank Mountains that cut middle Tertiary rocks (Brittinghham, 1985), and is possibly related to middle Tertiary extension.

Acknowledgments

The authors would like to thank Steve Reynolds for introducing us to the bedrock geology of the White Tank Mountains. The Flood Control District of Maricopa County provided support for the initial surficial geologic mapping of this quadrangle (Field and Pearthree, 1991) and provided high-resolution digital orthophotos that were used to accurately locate surficial geologic unit boundaries. Erin M. Moore designed the map layout.

References

Birkeland, Peter W., 1999, Soils and Geomorphology (3rd Ed.), New York: Oxford University Press, 429 p.

Brittingham, P.L., 1985, Structural geology of a portion of the White Tank Mountains, central Arizona: Tempe, Arizona State University, unpublished M.S. thesis, 106 p.

Ferguson, C.A., Spencer J.E., Pearthree, P.A., Youberg, A., and Field, J.J., 2004, Geologic map of the Wagner Wash Well 7½' Quadrangle, Maricopa County, Arizona: Arizona Geological Survey Digital Geologic Map 38, 1 sheet, scale 1:24,000.

Field, J.J., and Pearthree, P.A., 1991, Surficial geology around the White Tank Mountains, central Arizona [Daggs Tank, White Tank Mts. NE, McMicken Dam, Buckeye NW, White Tank Mts. SE, Waddell, Buckeye NW, Valencia, and Perryville 7.5' quadrangles]: Arizona Geological Survey Open-File Report 91-08, 7 p., 9 sheets, scale 1:24,000.

Field, J.J., and Pearthree, P.A., 1992, Geologic mapping of flood hazards in Arizona – An example from the White Tank Mountains area, Maricopa County, Arizona: Arizona Geological Survey Open-File Report 91-10, 16 p., 4 sheets, scale 1:24,000.

Gile, L.H., Hawley, J.W., and Grossman, R.B., 1981, Soils and geomorphology in the basin and range area of southern New Mexico -- guidebook of the Desert Project: New Mexico Bureau of Mines and Mineral Resources Memoir 39, 222 p.

Hartman, G.W., 1977, Soil survey of Maricopa County, central part: Soil Conservation Service, USDA, 117 p., 131 sheets, scale 1:20,000.

Machette, M.N., 1985, Calcic soils of the southwestern United States, *in*, Weide, D.L., ed., Soils and Quaternary Geology of the Southwestern United States: Geological Society of America Special Paper 203, p. 1-21.

Reynolds, S.J., and DeWitt, Ed, 1991, Proterozoic geology of the Phoenix region, central Arizona, *in,* Karlstrom, K.E., ed., Proterozoic geology and ore deposits of Arizona: Arizona Geological Society Digest 19, p. 237-250.

Reynolds, S.J., Woods, S.E., Pearthree, P.A., and Field, J.J., 2002, Geologic map of the White Tank Mountains, central Arizona: Arizona Geological Survey Digital Geologic Map 14, scale 1:24,000.

Spencer, J.E., Isachsen, C.E., Ferguson, C.A., Richard, S.M., Skotnicki, S.J., Wooden, J., and Riggs, N.R., 2003, U-Pb isotope geochronologic data from 23 igneous rock units in central and southeastern Arizona: Arizona Geological Survey Open-File Report 03-08, 40 p.

Map Legend

- Contact, accurate
- Contact, approximate
- Contact, concealed
- Tertiary andesite porphyry dikes
- Tertiary basaltic dikes
- Tertiary - Cretaceous mafic dikes
- 44 Bedding, accurate
- 55 Generic foliation
- 75 Schistosity
- 61 Irregular or contorted inclined foliation
- 25 Lineation in cumulate rocks
- 15 Protomylonite
- 38 Fault attitude