GEOLOGIC MAP OF THE SAINT DAVID 7½' QUADRANGLE, COCHISE COUNTY, ARIZONA

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Arizona Geological Survey Digital Geologic Map 48 (DGM-48), version 2.0

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1:24,000 scale

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(also available in Adobe pdf format on CD-ROM)

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Map Unit Descriptions

Other units

Plowed areas - historically or actively plowed fields, irrigated pastures, and other lightly disturbed ground.

d — **Disturbed ground** - stock tanks and ditches.

San Pedro River alluvium

Qyr — **Active river channel deposits** - Deposits are dominantly unconsolidated, very poorly sorted sandy to cobbly beds exhibiting bar and swale microtopography but can range from fine silty beds to coarse gravelly bars in meandering reaches based on position within the channel. Clasts are typically well-rounded but may be angular to sub-angular. Qycr deposits are typically unvegetated to lightly vegetated and exhibit no soil development. Qycr deposits are entrenched from 30 cm to 5 meters or more below adjacent early historical floodplain deposits depending on location, geomorphic relationship, and local channel conditions. Although much of the San Pedro River was a perennial stream historically, some modern sections are dry or marshy at the surface throughout much of the year. These deposits are the first to become submerged during flow events and can be subject to deep, high velocity flow and lateral bank erosion.

Qyyr — **Historical river terrace deposits** - Terrace deposits that occupy elevations from 1 to 2 meters above Qycr deposits and are inset below the pre-incision historical floodplain. These surfaces are generally planar but exhibit bar and swale microtopography. Although no soil development is present, dense grasses and small mesquite trees abound. Sediments composing these deposits are poorly sorted silt, sand, pebbles and cobbles. Pebbles and cobbles are well-rounded to sub-angular. Trough crossbedding, ripple marks, and stacked channel deposits viewable in cross-section indicate deposition in a low to moderate energy braided stream environment. These deposits are prone to flooding during extreme flow events, and undercutting and rapid erosion of Qy3r surfaces is possible during lower flow events.

Qyyr — **Latest Holocene to historical river terrace deposits** - Deposits associated with the floodplain that existed prior to the early historical entrenchment of the San Pedro River (Hereford, 1993; Huckleberry, 1996; Wood, 1997). Qy2r deposits are associated with broadly planar surfaces that locally retain the shape of historical river meanders. Qy2r surfaces are up to 7 meters above modern Qycr deposits and are the most extensive river terraces in the valley. Qy2r sediments were deposited when the San Pedro River was a widespread, shallowly-flowing river system and are dominated by fine grained floodplain deposits. Dense mesquite bosque and tall grass is typically present on these surfaces except where historic plowing or grazing has taken place. These surfaces appear predominantly fine grained at the surface due in part to the input of organic matter and windblown dust deposition but are composed of interfingering coarse sandy to pebbly braided channel and fine sand to silty river floodplain deposits. Where Qy2r deposits are moderately to deeply incised they are not subject to inundation by river floods, but they may be flood-prone in areas with less channel incision. Qy2r deposits are subject to catastrophic bank failure due to undercutting and lateral erosion during flow events. Distal piedmont fan deposits (Qy2 ,Qyaf, and Qys) onlap onto Qy2r deposits although an interfingering relationship likely exits in the subsurface.

Qyyr — **Late to early Holocene river terrace deposits** - Deposits associated with slightly higher terraces that represent either higher elements of the early historical floodplain or remnants of older Holocene aggradation periods. These fine-grained terrace deposits commonly have been disturbed by plowing or cattle grazing. When undisturbed, Qy1r deposits are densely vegetated by mature mesquite trees (mesquite bosque) and tall grasses. Soil development is moderate and surface color ranges from dark yellowish brown to brown (10 to 7.5 YR 4/4). Due to the dense vegetation input of organic matter at the surface is high and often results in a thin (< 10 cm) organic soil horizon. A light dusting (incipient stage I) calcium carbonate accumulation is evident on the undersides of some buried clasts. Qy1r surfaces stand up to 7 meters above the active channel in highly incised locales and typically are located less than 1.5 m higher than adjacent Qy2r surfaces. These terraces are typically covered with fine-grained floodplain deposits, but relict gravel bars and lenses are common.

Qlyr — **Late Pleistocene river terrace deposits** - River terrace deposits found on ridge ends along the San Pedro River. Ql3r deposits are thin (< 2 m) and composed of rounded to well-rounded gravels, cobbles, and finer-grained sediment. Ql3r soils are moderately developed, with orange to reddish brown clay loam to light clay argillic horizons and stage I-II carbonate accumulation.

Qlyr — **Middle to late Pleistocene river terrace deposits** - River terrace deposits found on scattered hilltops along the San Pedro River. Ql2r surfaces are the highest remnant river terraces in this area, approximately 20 m above the valley floor. Ql2r deposits are composed of rounded to well-rounded boulders, cobbles, and gravels, with finer-grained sediments. Ql2r surfaces are well-preserved and have well-developed soil with reddened (5 YR), clay argillic horizons, with obvious clay skins and sub-angular blocky structure.

Qls — **Pleistocene river deposits, undifferentiated** - a moderately thick sequence of coarse, poorly-sorted San Pedro River deposits and consolidated, moderately to well-sorted, channel conglomerates.

Piedmont alluvium and surficial deposits

Qy$_c$ — **Modern stream channel deposits** - Active channel and gravel bar deposits composed of very poorly-sorted sand, pebbles, and cobbles with some boulders to moderately-sorted sand and pebbles. Channels are generally incised 1 to 4 m below adjacent Holocene terraces and alluvial fans, but may be incised as much as 30 m below adjacent Pleistocene deposits. Channel morphologies generally consist of a single thread high flow channel or multi-threaded low flow channels with gravel bars. Channels are extremely flood prone and are subject to deep, high velocity flows in moderate to large flow events, and severe lateral bank erosion.

Qy$_3$ — **Latest Holocene alluvium** - Low active terraces found only near the San Pedro River along incised portions of major piedmont tributary streams. These low lying terraces were part of unit Qyc prior to the late 19th-early 20th century incision. Unit Qy3 terrace surfaces typically are mantled with pebbles, sand, and finer sediment. Terraces have planar surfaces, but small channels are common. Adjacent channels are extremely flood prone and potential lateral bank erosion is severe. Qy3 terraces may change significantly during high flow events.

Qyaf — **Late Holocene alluvium, active fan deposits** - Qyaf deposits consist of active alluvial fan deposits in the San Pedro valley. These deposits have distributary drainage patterns and are extremely prone to flooding and channel migration. Sediments are unconsolidated and consist of very poorly sorted sand to cobbles. Vegetation includes small mesquite trees, shrubby acacia, prickly pear, and medium creosote.

Qy$_2$ — **Late Holocene alluvium** - Young deposits in low terraces and small channels that are part of the modern drainage system, and alluvial fan surfaces that were active prior to San Pedro River incision. Includes Qyc where not mapped separately. Along larger drainages, Qy2 sediment is generally poorly to very poorly-sorted sand, pebbles, cobbles, and boulders; terrace surfaces typically are mantled with pebbles, sand, and finer sediment. Qy2 alluvial fan deposits consist predominantly of moderately sorted sand and silt, with some pebbles and cobbles bar deposits. Channels on middle and upper piedmont areas generally are incised less than 1 m below adjacent terraces. Channels in the lower piedmont are incised up to 30 m below adjacent Pleistocene fans. Channels and alluvial fans within the San Pedro River valley are incised up to 4m. Channels are flood prone and may be subject to deep, high velocity flows in large flow events. Potential lateral bank erosion is severe. Channel morphologies generally consist of a single-thread high flow channel or multi-threaded low flow channels with gravel bars adjacent to low flow channels. Flood flows may significantly change channel morphology and flow paths. Local relief varies from fairly smooth channel bottoms to undulating bar-and-swale topography that is characteristic of coarser deposits. Terraces have planar surfaces, but small channels are common. Alluvial fans are generally isolated from active flow except for the incised channels not mapped separately. Unit Qy2 has no to weak soil development.

Qy$_1$ — **Older Holocene alluvium** - Older Holocene terraces found at scattered locations along incised drainages throughout the study area, and isolated alluvial fans at the base of the piedmont. Qy1 surfaces are higher and less subject to inundation than adjacent Qy2 surfaces. In areas of deep incision these surfaces are now isolated from flooding. Qy1 terraces are generally planar but local surface relief may be up to 1 m where gravel bars are present. Qy1 surfaces are 2 to 6 m above adjacent active channels. Surfaces typically are sandy but locally have unvarnished open fine gravel lags or pebble and cobble deposits. Terraces along major drainages vary from 2 to 4 m thick Qy1 deposits over basin fill deposits to basin fill strath terraces with less than 1m of Qy1 deposits. Qy1 soils typically are weakly developed, with some soil structure but little clay and no to stage I calcium carbonate accumulation (see Machette, 1985, for description of stages of calcium carbonate accumulation in soils). Yellow brown (10YR Munsell soil color chart) soil color is similar to original fluvial deposits.

Qys — **Fine-grained Holocene alluvium derived from the St. David Formation** - Thin to moderate (< 3m), fine-grained Holocene alluvium derived from, and overlying, basin fill deposits (units Qsf, QTsp, QTsd). It is composed mostly of silts and clays with color reflecting that of the parent material. Qys is typically found in fans at the base of basin fill outcrops along the edges of the peidmont.

Ql$_3$ — **Late Pleistocene alluvial fan and terrace deposits** - Slightly to moderately dissected relict alluvial fans and terraces. Active channels are incised up to about 2 m below Qi3 alluvial fan surfaces on upper and middle piedmont areas; and up to about 8 m below Qi3 terraces along drainages on the lower piedmont. Qi3 fans and terraces are lower in elevation than adjacent older surfaces. Qi3 relict alluvial fans within the Saint David quadrangle are derived mainly from granite and are fairly fine-grained. These Qi3 surfaces are dark brown and smooth with grussy gravel lag. Qi3 terraces consist of pebbles, cobbles, and finer-grained sediment, and are moderately reddened. Qi3 terraces commonly have bar and swale topography, and have moderately preserved, loose to moderately packed pebble and cobble lags. Surface clasts typically exhibit weak to moderate rock varnish. Qi3 terraces along major washes tend to be strath terraces in basin fill deposits with thin (<2 m) Qi3 deposits on top. Qi3 soils are moderately developed, with yellow brown to brown (10 YR to 7.5 YR) clay loam to light clay argillic horizons and stage I to stage II calcium carbonate accumulation.

Ql$_2$ — **Middle to late Pleistocene alluvial fan and terrace deposits** - Moderately to highly dissected relict alluvial fans with strong soil development found throughout the map area. Qi2 surfaces are drained by well-developed, moderately to deeply incised tributary channel networks; channels are typically several meters below adjacent Qi2 surfaces. Well-preserved, planar Qi2 surfaces are smooth with scattered pebble and cobble lags; surface color is reddish brown; surface clasts are moderately to strongly varnished. More eroded, rounded Qi2 surfaces are characterized by strongly varnished, scattered, cobble to cobble and pebble lags with broad ridge-like topography. Soils typically contain reddened (5 to 7.5 YR), modestly clay-rich argillic horizons, with clay skins and subangular blocky structure. Underlying soil carbonate development is typically stage III with abundant carbonate through at least 1 m of the soil profile. This unit loosely correlates to Gray's (1965) granite wash unit.

Ql$_1$ — **Early to middle Pleistocene alluvial fan and terrace deposits** - Deeply dissected relict alluvial fans found on upper piedmonts. Qi1 surfaces form rounded ridges that are higher than adjacent Qi2 surfaces. Qi1 surfaces are drained well-developed, deeply incised (4 to 6 m) tributary channel networks. Underlying basin fill deposits are occasionally exposed along some ridge slopes and along wash banks. Well-preserved Qi1 surfaces have moderately to tightly packed cobble, boulder, and pebble lag. Surface clasts are strongly to very strongly varnished and often have thin carbonate rinds. More eroded, rounded Qi1 surfaces are characterized by coarse pebble, cobble and boulder lags with exposed carbonate horizons. Where well preserved, Qi1 soils are strongly developed with a dark red (5-2.5 YR), heavy clay argillic horizon, subangular blocky to prismatic structure, and stage III-IV carbonate accumulations.

Qo — **Early Pleistocene alluvial fan deposits** - Remnant surfaces of deeply dissected relict alluvial fans found only on the upper piedmonts. Where preserved Qo soils are strongly developed with a distinct dark red (5-2.5 YR), heavy clay argillic horizon and subangular blocky to prismatic structure, and stage III-IV carbonate accumulations. Rounded eroded Qo ridges are white from exposed carbonate layers. Slopes are very coarse with pebble, cobble and boulder lag. In some exposures along Sheep Wash it appears that this Qo deposit grades into basin fill unit Qsf. In other exposures along this wash, unit Qo is clearly courser than the underlying Qsf.

QTa — **Early Pleistocene alluvial fan deposits** - Coarse gravelly to very coarse cobble and boulder deposits that erosionally overlie basin-fill sediments and form the upper parts of high, broad to very rounded ridges of relict alluvial fans. QTa deposits are composed of very poorly-sorted angular to sub-angular sand, pebbles, cobbles, and boulders common in alluvial fan deposits. High standing rounded ridges are composed of carbonate-cemented fanglomerate cap which armors the underlying, less indurated basin-fill sediment. In the northwest corner of the quadrangle.QTa is derived from the granites of Texas Canyon and forms deeply dissected, rounded ridges with a grussy gravel surface mantel, and a few scattered pebble and cobble lags. Exposures of QTa deposits are generally poor, and are commonly the highest standing deposits in the proximal piedmont.

Quaternary to Tertiary Basin Fill alluvium

QTsd — **Pliocene to early Pleistocene St. David Formation** - Unit QTsd is essentially equivalent to the Saint David Formation. The basin fill was mapped with this unit when (1) it was not possible to map individual facies at a scale of 1:24,000, (2) colluvium from overlying units obscured the basin fill, or (3) access was limited. The total thickness of QTsd deposits is not known. Unit QTs is composed of the following five basin fill units.

Qsf — **Pliocene-Pleistocene basin fill alluvial fan deposits** - Piedmont alluvial fan deposits on the middle piedmont consisting of tabular sands and gravels, often stacked. Occasionally paleosols developed on top of one bed before the next was deposited. On the lower piedmont this unit is composed of thinly-bedded distal fan sands and gravels. Excellent exposures of this unit can be seen along Sheep and Dragoon washes. This unit roughly correlates to upper Saint David Formation. Interfingers with units QTsp and QTsc near its base.

QTsp — **Pliocene-Pleistocene floodplain fan deposits** - Piedmont floodplain deposits composed mainly of paleosols, both vadose and hydromorphic paleosols. Includes interbedded tabular sands and gravels (QTsf), marls, pond limestones and interbedded red and green clays (QTsl), and channel conglomerates (QTsc) where not mapped separately. Roughly correlates to middle Saint David Formation. Interfingers with units Qsf in the upper sections.

QTsl — **Pliocene-Pleistocene lacustrine deposits** - Limestones, marls and interbedded red and green clay. Interbedded with, and part of, unit QTsp. Correlative to middle Saint David Formation.

QTsc — **Pliocene-Pleistocene channel conglomerates** - Piedmont channel conglomerates composed of consolidated, matrix supported, moderately to well-sorted, sub-angular to rounded pebble, cobbles and sand. Generally this unit was found within QTsp but at many different elevations. Just east of the town of Saint David this unit is found at the base of QTsp and directly on top of and interfingered with unit Tsp. In other areas it is found within QTsp. And in some places these channel deposits were mapped within Qsf.

Tsp — **Pliocene playa deposits (~3.4 to ~5 Ma)** - Unit Tsp is composed of red (5 to 10 YR) clay and silt with minor interbedded sand and occasional gypsum deposits. This unit correlates to the lower Saint David Formation and represent playa deposits of a closed basin.

Topographic base from USGS 1:24,000 scale quadrangle series.
North American Datum of 1983 (NAD83). Projection and
1,000-meter grid: Universal Transverse Mercator, zone 12.

MN — 10½° — 2006 MAGNETIC NORTH DECLINATION

SCALE 1:24,000

1 0.5 0 1 Miles
1 0.5 0 1 Kilometers
0 1000 2000 3000 4000 5000 Feet
contour interval 20 feet

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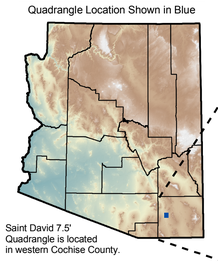
Location Index Map

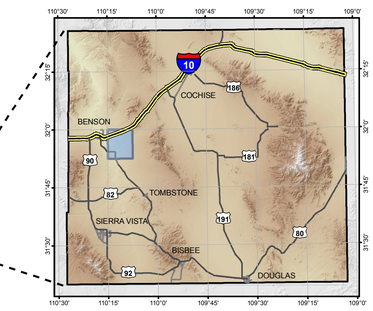
Quadrangle Location Shown in Blue



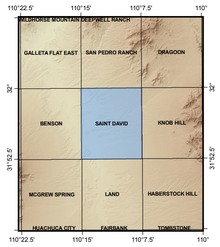
Saint David 7.5' Quadrangle is located in western Cochise County.

Cochise County

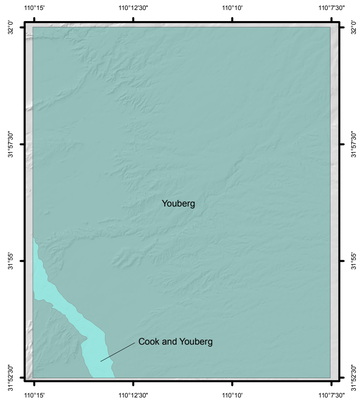
Mapped Area Shown in Blue



Adjoining 7.5' Quadrangles



Mapping Responsibility



Map Symbols

accurate contact
approximate contact
concealed contact

Unit Correlation