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The Saint David 7'½" Quadrangle is located approximately 55 miles (88 km) west of downtown Tucson. The map area encompasses the town of Saint David, a portion of the San Pedro River corridor, and the western piedmonts of the Little Dragoon and Dragoon mountains. The San Pedro River flows north from Mexico to the Gila River. It occupies a broad valley inset below adjacent Pleistocene piedmont alluvial fans. The river is incised several meters below adjacent terraces and recently abandoned floodplains. Entrenchment occurred between 1890 and 1908 as a result of a series of large floods in conjunction with changing land uses and population growth (Hereford, 1993). Once entrenched the channel widened to its current width and eventually stabilized in the mid-1950s (Hereford, 1993).

Four major tributary washes in this quadrangle head in either the Little Dragoon or Dragoon mountains. They include, from north to south, Sheep Wash which flows from the Little Dragoon Mountains, and Dragoon Wash, Stronghold Canyon West and Slavin Wash which head in the Dragoon Mountains. Several large unnamed tributary washes head on the upper portions of the western piedmont of the Dragoon Mountains. These washes have cut deeply into the lower piedmont providing excellent exposures of piedmont and basin fill stratigraphy.

Previous work in the area has mainly focused on basin fill deposits known as the Saint David Formation. These deposits were initially mapped and named by Gray (1965, 1967) who described these sediments as being deposited by a slow-moving, through-flowing river system with ages ranging from late Pliocene to middle Pleistocene based on fossils. Subsequent studies by Johnson and others (1975), Lindsay and others (1990), Slate and others (1996), and Smith (1994, 2000) suggests these deposits record three depositional intervals: (Depositional Interval I) a period of fine-grained deposition in an arid, closed-basin with a seasonally-wetted playa between ca 4.4-3.5 Ma, (Depositional Interval II) integration of the San Pedro drainage basin and a transition to a less arid environment with perennial streams and higher water tables between ca 3.5-1.7 Ma, and (Depositional Interval III) a transition to a strong monsoon pattern with ephemeral flow and tabular sheet-flood deposits between ca 1.7-0.6 Ma. Dates for these intervals are based on fossil assemblages, two isotopically-dated tuffs, and paleomagnetic data. Basin-wide incision began in the middle Pleistocene with downcutting from the San Pedro River (Demsey and Peartree, 1994). Multiple phases of Quaternary alluvial fans and San Pedro river deposits record subsequent periods of aggradation and incision.

**Surficial Geology**

Surficial mapping was conducted using natural-color (scale 1:24,000) stereo-pair aerial photographs from the Bureau of Land Management (BLM) taken in 1988, red-enhanced color photographs (scale 1:48,000) taken in 1979, black and white aerial photographs from 1936 (Fairchild collection), and false color digital orthophotographs (1996). Preliminary unit designations were field checked throughout the map area and mapping was supplemented by observations and descriptions of soils and stratigraphy during the first half of 2005. 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. Mapping was done as part of a multiyear mapping program directed at producing complete geologic map coverage for the San Pedro River valley. This mapping was conducted in conjunction with mapping in Land, Fairbank, and Lewis Springs quadrangles. Previous mapping in the San Pedro River valley was conducted in 2003 and included Benson, McGrew Spring and Huachuca City quadrangles. This mapping was completed under the joint State-Federal STATEMAP program, as specified in the National Geologic Mapping Act of 1992.
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, rock varnish and desert pavement development. 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 slightly 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 5 m below older surfaces, except on the lower piedmont where incision is up to 30 m below adjacent Pleistocene fans. Incision along these tributary drainages on the middle and upper piedmonts is less than a few meters, but there is enough topographic confinement that late Pleistocene and Holocene deposits are inset below the ridges and there are no major distributary channel networks or active alluvial fans on the piedmont. Thus, flood hazards are restricted to broad, nearly flat San Pedro River valley bottom (units Qy4c, Qy2, and locally Qy1). Agricultural activity and recent residential development have modified the landscape to greater or lesser degrees. Areas are mapped as “disturbed” where the surficial deposits are profoundly altered (stock tanks, agricultural fields).

Basin fill deposits were also preliminarily mapped using stereo-pair aerial photography. These deposits are distinguished by their placement in the landscape, erosional and depositional characteristics, and, in some cases, color. For example, limestone beds show up very white on photographs. In some instances, associated red and green clays can also be seen with the limestone beds. The lowest exposed basin fill sediments are red clay and silt playa deposits. These are very distinct at the base of road cuts and cliffs in air photos. Overlying coarser Quaternary deposits tend to have smoother, redder surfaces than the underlying finer-grained, deeply dissected basin fill deposits.

**Quaternary map units**

**Piedmont Alluvium**

Quaternary piedmont deposits from the Little Dragoon and Dragoon mountains to the west of the map area cover most of the Saint David quadrangle. This alluvium was deposited primarily by larger tributary streams that head in the mountains. These deposits have been eroded and reworked by the larger streams heading in the mountains and smaller streams heading in the upper piedmont. Abbreviations are ka, thousands of years before present, and Ma, millions of years before present.

**Qy4c** – **Modern channel deposits (< ~100 yrs).** 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 in moderate to large flow events, and severe lateral bank erosion.

**Qy₃ – Modern alluvium, terraces (< ~1 ka).** 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 Qy₃ 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.

**Qy₂ - Late Holocene alluvium (<~2 ka).** 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 Qy₂ 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.

**Qyaf - Late Holocene alluvium, active fans (<~2 ka).** Young, active alluvial fan deposits in the San Pedro River valley, at the base of piedmont. Qy₂f consists of distributary channel networks with gravel bars and braided channels. These alluvial fans are active and extremely prone to flooding. Flooding may consist of broad sheetflows in lower events to deep, high velocity channel flows in large flow events. Potential lateral bank erosion is severe. 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. Qy₂f have no to weak soil development.

**Qy₁ – Early Holocene alluvium (<~10 ka).** 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 - Holocene alluvium derived from basin fill deposits (<~10 ka) Thin to moderate (< 3m), fine-grain Holocene alluvium derived from, and overlying, basin fill deposits (units Tsf, 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 piedmont.

Qy - Holocene alluvium, undifferentiated (<~10 ka) Includes Qyc, Qy2, and Qy1 deposits. On the upper piedmonts, unit Qy consists of smaller incised drainages where, at this scale, it was not possible to map surfaces separately. At the lower margin of the piedmont, unit Qy consists of young alluvial fans deposited by piedmont tributary streams interfingered with San Pedro River floodplain deposits (unit Qy2r). Where agriculture and urban development have disturbed the area so profoundly it is not possible to distinguish between units the area was generally mapped as Qy.

QI3 - Late Pleistocene alluvium (~10 to 130 ka). 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.

QI2 - Middle Pleistocene alluvium (~130 to 750 ka). Moderately to highly dissected relict alluvial fans with strong soil development found throughout the map area. QI2 surfaces are drained 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.

QI1 - Middle to Early Pleistocene alluvium (~500 ka to 1 Ma) —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 course 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 alluvium (~750 ka to 2 Ma)** - Deeply dissected relict alluvial fans found only on the upper piedmont at the south and north ends of the quadrangle. Southern Qo deposits consists of deeply dissected, rounded ridges with no to weakly preserved surfaces. 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. Northern Qo surfaces are exposed only on eroded hillslopes and ridges. 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.

**Qog - Early Pleistocene alluvium, granite-derived fans (~750 ka to 2 Ma)** – A relict alluvial fan derived from the granites of Texas Canyon found only in the northwest corner of the quadrangle. Qog forms deeply dissected, rounded ridges with little to no soil preservation, a grussy gravel surface mantel, and a few scattered pebble and cobble lags. Where preserved soils are strongly developed with a red (5 YR) heavy clay argillic horizon, subangular blocky to prismatic structure, and stage III-IV carbonate accumulations.

**San Pedro River Alluvium**
Sediment deposited by the San Pedro River covers a northwest-trending strip through the southwestern part of the map area. Deposits are a mix of gravel, cobble, sand and finer material; they exhibit mixed lithologies and a higher degree of clast rounding, reflecting the large drainage area of this watershed. Virtually all of the area covered by river deposits has been altered by intense agricultural and urban develop, so there is greater uncertainty regarding the locations of unit contacts than in piedmont areas.

**Qycr – 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 10 meters or more below adjacent early historical floodplain deposits depending on location, geomorphic relationship, and local channel conditions. Although much of the San Pedro was a perennial stream historically, some sections are dry or marshy at the surface during much of the year. These deposits are the first to become submerged during moderate to extreme flow events and can be subject to deep, high velocity flow and lateral bank erosion.

**Qy3r – Historical river terrace deposits.** Terrace deposits that occupy elevations from 1 to 2 meters above Qycr or Qy4r 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.
Qy2r – Late Holocene to early historical river deposits. Deposits beneath 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 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. Analysis of local exposures and archaeological sites associated with these deposits indicates that some of the surface, and most of the sediment package, is prehistoric. Radiocarbon dates and diagnostic pottery sherds indicate an age of 0.5-3 ka (Onken et al., 2014). 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 and Qy3) onlap onto Qy2r deposits, although interfering relationships exist in the subsurface.

Qy1r – 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 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 are up to 7 meters above the active channel in highly incised locales and typically are less than 1.5 m higher than adjacent Qy2r surfaces.

Qi3r - Late Pleistocene river terrace deposits. Terrace deposits occupy elevations 5 to 20 m higher than and up to 500 m outside the margins of the modern San Pedro channel. These deposits consist of well-rounded pebbles to cobbles exhibiting stage I+ calcium carbonate accumulation with cross-bedded coarse sandy interbeds. Clast composition is varied and includes rock types not found in the mountains from which modern piedmont material is derived from. Qi3r terrace surfaces are planar, often surrounded by distal piedmont alluvium, and are generally lightly vegetated except for small weeds and grasses. Commonly, Qi3r deposits are inset into adjacent piedmont alluvial deposits but can also be inset into older river gravel terraces. Soil development is weak, possibly due to the porous nature of these deposits.

Q3rb Late Pleistocene river terrace deposits (younger member)

Q3ra Late Pleistocene river terrace deposits (older member)
Qi2r - **Middle Pleistocene river terrace deposits.** Terrace deposits are similar to Qi3r deposits but occupy higher positions in the landscape 15 to 35 m above the active San Pedro River channel. Terrace surfaces are slightly to moderately rounded. Clast composition is diverse. Well-rounded pebbles to cobbles with stage I-II calcium carbonate accumulation armor Qi2r surfaces. Vegetation is sparse, consisting of small shrubs and grasses. Soil development is generally weak on Qi2r surfaces but is more evident in finer grained sections. Qi2r surfaces are typically found as high-standing isolated mounds surrounded by distal fan alluvium or as small terraces inset into older fan or basin fill alluvium.

Qi1r **Early to middle Pleistocene river gravel terraces.** Deposits are associated with high-standing, well-rounded river gravel terraces. Qi1r deposits are located 30 to 60 m above the modern San Pedro River channel. Where Qi1r deposits are extensive, remnant planar caps are preserved near the center of the surface. Qi1r deposits are composed of very well rounded to well-rounded pebbles and cobbles from diverse lithologies. Cross-bedded sands with pebbly stringers are interbedded throughout. Near-surface cobbly beds exhibit stage II+ calcium carbonate accumulation. Moderately to strongly calcium carbonate coated clasts or cemented aggregates of clasts mantle the flanks of Qi1r deposits, but clay accumulation is variable, probably due to poor surface preservation. Where surfaces are well-preserved, Qi1r soils are reddened (5-2.5YR), clay argillic horizons, with obvious clay skins and subangular to angular blocky structure. Underlying soil carbonate development is typically stage III-IV, with abundant carbonate through at least 1 m of the soil profile. Sparse small shrubs, weeds, and cacti are present on these surfaces.

QTcr - **Pliocene-Pleistocene San Pedro River channel conglomerates (~1 to 3.5 Ma).** Ancestral San Pedro River channel deposits consisting of consolidated moderately to well-sorted, rounded pebbles and cobbles. Diverse lithology reflects the larger drainage area of the San Pedro River as compared to local tributary streams. These channel conglomerates exhibit trough cross-bedding with a north-south trend. On the west side of the river these deposits are located below Qi2r within unit QTsr. East of the river these units sit directly on the lowest basin fill unit, Tsp.

QTsr - **Pliocene to early Pleistocene river deposits (~1 to 3.5 Ma)** – A moderately thick sequence of old San Pedro River deposits that underlies the Qi2r terrace fan deposits. These deposits consist of river sand, silt, pebbles and cobbles. Hillslopes are generally covered with a course rounded pebble and cobble lag. Limited exposures of the deposit indicate a finer-grained sequence beneath the lag. Clasts within this unit typically have thin carbonate rinds. The soil is violently effervescent. This unit probably interfingers with the basin fill units.

**Quaternary- Tertiary Basin Fill Units**
The Quaternary-Tertiary basin fill units were first mapped by Gray (1965, 1967) who proposed the name Saint David Formation. Subsequent studies by Johnson and others (1975), Lindsay and others (1990), Slate and others (1996), and Smith (1994, 2000) divided these deposits into three depositional intervals: (Depositional Interval I) a period of fine-grained deposition in an arid, closed-basin with a seasonally-wetted playa between ca 4.4-3.5 Ma, (Depositional Interval II) integration of the San Pedro drainage basin and a transition to a less arid environment with perennial streams and higher water tables between ca 3.5-1.7 Ma, and (Depositional Interval III) a transition to a strong monsoon pattern with ephemeral flow and tabular sheet-flood deposits between ca 1.7-0.6 Ma. In this mapping effort the basin fill units were mapped according to facies where possible.
QTsd – St. David Formation, undivided (Pliocene to middle Pleistocene) – Undivided St. David formation. Basin fill deposits were 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 is ~ 200 m (Smith, 1994). Unit QTsd is composed of the following basin fill units.

Qsf - Piedmont alluvial fan deposits of the upper St. David Formation (Early to middle Pleistocene) – Piedmont alluvial fan deposits consisting of 2-6 m thick, stacked, tabular, poorly sorted silty sandy conglomerate separated by thinner (typically < 1 m) beds of finer-grained deposits with reddish paleosols or pebbly sand beds. Toward the basin center, this unit is composed of thinly bedded (< 0.5 m), stacked distal fan deposits of sands and gravels. Qsf fans generally form high rounded, eroded ridges. Excellent exposures of this unit can be seen along incised washes in the eastern portion of the map area. Smith (1994) places this unit in Deposition Interval III (ca 1.7-0.7 Ma); it correlates to the upper St. David Formation of Grey (1967). Generally, Qsf beds conformably overlie beds of the middle St. David Formation.

QTsa – Piedmont alluvial deposits of the Saint David Formation (Pliocene to early Pleistocene) – Unit QTsa is composed of piedmont alluvial fan and channels deposits that grade into floodplain and marsh deposits towards the basin center. QTsa deposits found higher on the piedmont are stacked sandstone and sandy conglomerate interbedded with silty sand and vadose paleosols. QTsa deposits towards the basin center are predominantly hydromorphic paleosols with beds of tuffs, marls, pond and groundwater deposited limestones interbedded with red and green mudstone (unit QTsl), and channel conglomerates (unit QTsc), where not mapped separately. Smith (1994) places this unit in Deposition Interval II (ca 3.5-1.7 Ma); it correlates to the middle St. David Formation of Grey (1967).

QTsl – Limestones and mudstones of the Saint David Formation (Pliocene to early Pleistocene) – Unit QTsl beds are interbedded within, and part of, unit QTsa. QTsl is mapped as a separate unit where deposits of tabular pond and groundwater deposited limestone beds interbedded with red and green mudstone are prominent. Pond limestones are generally < 1 m thick. Groundwater deposited limestones range from structureless chalky micritic calcite to globular calcium carbonate nodules (stage III to IV) within a muddy matrix on the peripheral facies.

QTsc – Piedmont channel conglomerates of the St. David Formation (Pliocene to early Pleistocene) – Unit QTsc beds are piedmont channel conglomerates interbedded within, and part of, unit QTsa. Unit QTsc is composed of consolidated, matrix supported, moderately to well-sorted, sub-angular to rounded pebble, cobbles and sand. Unit QTsc is found at many different elevations. Just east of the town of Saint David, it is found at the base of QTsa and directly on top of and interfingered with unit Tsp.

Tss – Sandflat deposits of the St. David Formation (Pliocene) – Sandflat and mudflat deposits composed of massive to bedded, reddish brown (5YR to 10YR) sandstone, siltstone, and mudstone. Smith (1994) places this unit in Deposition Interval I (ca 4.4 - 3.5 Ma); it correlates to the lower St. David Formation of Grey (1967) and interfingers with units Tsp and QTsa.

Tsp – Pliocene playa deposits of the St. David Formation (Pliocene) – Playa deposits of a closed basin composed of red (5 to 10 YR) clay and silt with minor interbedded sand and occasional gypsum
deposits. Smith (1994) places this unit in Deposition Interval I (ca 4.4 - 3.5 Ma); it correlates to the lower St. David Formation of Gray (1967).

Other Units

D - Disturbed areas – stock tanks and ditches

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