DESCRIPTION OF CAMERON 1:24,000-SCALE MAP UNITS

[The following 14 individual map units are shown only on 1:24,000-scale views; these units are either grouped or renamed on the 1:100,000-scale map. A complete description of map units for both 1:24,000- and 1:100,000-scale is included in the pamphlet that accompanies Scientific Investigations Map SIM 2977.]

SURFICIAL DEPOSITS

Qes **Young eolian sand sheet deposits (Holocene)**—Coconino Plateau and Gray Mountain area: White, gray, fine- to coarse-grained, wind blown sand composed of quartz and chert grains derived from the Harrisburg Member of the Kaibab Formation west and south of Gray Mountain on stream-channel (Qs) or valley alluvial (Qv) deposits. Composed of quartz and small chert fragments derived from Harrisburg Member of the Kaibab Formation in central part of map area.

Moenkopi Plateau and Little Colorado River area: Form extensive deposits northeast and east of Little Colorado River over gently sloping terrain below Adeii Eechii Cliffs. Intertongue with young mixed alluvium and eolian (Qae) deposits. Arbitrary and gradational lateral and vertical contacts that merge between young sand sheet and dune (Qd) deposits and other surficial deposits. Support moderate growth of grass and small high-desert shrubs. Unit is present but not mapped on Moenkopi Plateau because it is often too thin to show except along the Adeii Eechii Cliffs. Thickness, 0.3 to 4.5 m (1 to 15 ft). [Qd on 1:100,000-scale map]

Qdl **Young linear dune deposits (Holocene)**—White, gray, light-red, fine- to medium-grained, well sorted, unconsolidated quartz sand accumulations that are aligned in general northeast direction. Often associated with young eolian sand sheet (Qes) deposits between Little Colorado River and Red Rock Cliffs, on pediment slopes in southeast corner of map area, and along the eroding edge of the Adeii Eechii Cliffs, southwestern edge of Moenkopi Plateau. Linear dunes are generally 12 to 24.5 m (40 to 80 ft) in width and commonly less than 0.8 km (½ mi) in length, but can reach to over 5 km (3 mi) or more in length on Moenkopi Plateau. Old linear dunes (QTdl) on Moenkopi Plateau are often partially re-activated in places due to vegetation loss during dry conditions as shown by Billingsley (1987) that are covered by a young veneer of sand along the Adeii Eechii Cliffs where map contacts are arbitrary. Thickness, 2 to 9 m (6 to 30 ft) [Qd on 1:100,000-scale map]

Qdp **Young parabolic dune deposits (Holocene)**—White, gray, light-red, fine- to coarse-grained, well-sorted, unconsolidated quartz sand arranged into individual parabolic dunes or as complex parabolic dune deposits. Bedrock or older sand accumulations often exposed within interior of isolated parabolic dunes. Contact merges with adjacent dune, sand sheet, alluvial deposits, and bedrock and subject to change on a yearly basis because of changing climatic conditions, high wind storms, and sheet wash erosion associated with severe storms. Includes undivided topographically controlled dunes mapped by Billingsley (1987). Support little or no vegetation between Little Colorado River and Moenkopi Plateau. Thickness, 2 to 15.2 m (6 to 50 ft) [Qd on 1:100,000-scale map]

Qdb **Young barchan dune deposits (Holocene)**—White, gray, light-red, fine- to coarse-grained, well-sorted quartz sand that forms isolated barchan dunes and or barchanoid dune complexes below Red Rock Cliffs on Ward Terrace and along large tributaries to the Little Colorado River; unconsolidated. Arbitrary and gradational contact with other eolian, alluvial, or bedrock deposits and are subject to change on yearly basis due to seasonal storms. Support little or no vegetation. Thickness, 2.4 to 12.2 m (8 to 40 ft) [Qd on 1:100,000-scale map]

Qg1 **Young terrace-gravel deposits (Holocene)**—Little Colorado River area: Light-brown, pale-red, and gray, well-sorted, interbedded mud, silt, sand, gravel, pebbles, cobbles, and some boulders.

Composed mainly of subangular to well-rounded Paleozoic sandstone, limestone, and chert clasts of local origin. Includes well-rounded clasts of quartzite, quartz, and assorted metamorphic crystalline rocks derived from Tertiary sediments in southeast part of map area. Include well-rounded volcanic clasts that originate from San Francisco Volcanic Field in south and southwest part of map area.

Coconino Plateau and Gray Mountain area: Interbedded silt, sand, gravel, and pebbles to boulders locally derived from the Moenkopi, Kaibab, and Toroweap Formations; partly consolidated by matrix of mud and sand cemented by calcium and gypsum. Include volcanic clasts and pyroclastic sand derived from San Francisco Volcanic Field area. Support light to moderate grass, cactus, and high desert shrubs; subject to flash flood erosion.

Northeast and east of Little Colorado River area: Gray, brown, and light-red, mud, silt, sand, chert gravel. Include pebbles and cobbles of chert, sandstone, and limestone clasts derived mainly from the Owl Rock Member of the Chinle Formation and chert beds within the Navajo Sandstone northeast of Little Colorado River. Locally overlaps young alluvial fan (Qa1), floodplain (Qf), and valley alluvial (Qv) deposits. Subject to flash flood and sheet wash erosion. Often covered by overbank floodplain (Qf) deposits and young eolian sand sheet and dune (Qd) deposits. Support light to no vegetation, mainly grass.

Map wide: Contact with adjacent alluvial and eolian deposits is approximate. Forms terraced benches about 1 to 3.6 m (3 to 12 ft) above stream-channel (Qs) deposits on Coconino Plateau and 4 to 6 ft above Little Colorado River channel and floodplain (Qf) deposits. Fills erosion channels cut into bedrock, young alluvial fan (Qa1), and floodplain (Qf) deposits. Thickness, 2 to 6 m (6 to 20 ft) [Qgy on 1:100,000-scale map]

Qa1 **Young alluvial fan deposits (Holocene)**—West and southwest of Little Colorado River: Gray-brown silt, sand, gravel, pebbles, cobbles, and boulders. Pebbles, cobbles, and boulders are subangular to rounded limestone, chert, and sandstone clasts locally derived from Triassic and Permian strata of the Coconino Plateau and Gray Mountain area. Include medium- to small, subrounded to rounded pebbles and cobbles of basalt and andesite clasts and pyroclastic fragments of the San Francisco Volcanic Field in southwest part of map area. Partly consolidated by gypsum and calcite cement. Support light to moderate growth of sagebrush, cactus, and grass.

East and northeast of Little Colorado River: Gray, light-brown, and light-red mud, silt, sand, and cobble and pebble clasts of chert, limestone, and sandstone. Overlapped by ponded sediments (Qps), floodplain deposits (Qf), and young sand sheet and dune (Qd) deposits. Intertongue with upper part of valley alluvium (Qv), young terrace-gravel (Qg1), and young mixed alluvium and eolian (Qae) deposits. Surface subject to extensive sheet-wash erosion, flash flood debris flows, and small arroyo erosion. Thickness, 1 to 6 m (3 to 20 ft) [Qay on 1:100,000-scale map]

Qg2 **Intermediate terrace-gravel deposits (Holocene)**—Gray and brown silt, sand, gravel, and lenses of small conglomerate; unconsolidated. Lithologically similar to young terrace-gravel (Qg1) deposits. Composed mainly of gray and brown siltstone and fine-grained sandstone matrix mixed with subangular to rounded pebbles and boulders of local Permian limestone and sandstone lithologies. Include well-rounded basalt clasts on Coconino Plateau near margins of Sand Francisco Volcanic Field. Form terrace benches about 4.5 to 9 m (15 to 30 ft) above modern streambeds and about 1.5 to 6 m (5 to 20 ft) above young terrace-gravel (Qg1) deposits. Forms terrace benches 3 to 15.2 m (10 to 50 ft) above modern Little Colorado River bed and 1.5 to 6 m (5 to 20 ft) above and next to young terrace-gravel deposits. Important source for road gravel and sand for the Cameron-Flagstaff area. Support growths of cottonwood trees,

camelthorn bush, salt bush, and a variety of high desert shrubs along Little Colorado River. Subject to flash flood and cut bank erosion. Locally intertongue with or inset into young and intermediate alluvial fan (Qa1, Qa2) deposits. Intertongue with or locally overlain by talus and rock fall (Qtr), young alluvial fan (Qa1), valley alluvial (Qv), and landslide (Ql) deposits.

Northeast and east of Little Colorado River: Forms isolated deposits of gray, pebbly, partly consolidated, red silt, white sand, gray chert gravel and subangular fragments and pebbles of multi-colored chert derived from the Navajo Sandstone of the Adeii Eechii Cliffs. Form ridges or terraced benches near modern tributary drainages on Ward Terrace and above Red Rock Cliffs; often 6 to 15.2 m (20 to 50 ft) above modern nearby drainage. Thickness, 2 to 7.6 m (6 to 25 ft) [Qgy on 1:100,000-scale map]

Qa2 **Intermediate alluvial fan deposits (Holocene)**—Lithologically similar to young alluvial fan (Qa1) deposits; partly cemented by calcite and gypsum. Surfaces are gravely and cut by arroyos as much as 3 m (10 ft) deep southwest of Little Colorado River area; surfaces are sandy and often covered by young sand sheet and dune (Qd) deposits northeast and east of Little Colorado River. Commonly overlapped by young alluvial fan (Qa1) deposits and intertongue with or overlap valley alluvial (Qv), talus and rock fall (Qtr), and young and intermediate terrace-gravel (Qg1, Qg2) deposits west of Little Colorado River; commonly overlapped by young alluvial fan (Qa1) deposits east and northeast of Little Colorado River. Include abundant subrounded to subangular basalt clasts in southwest quarter of map area and abundant subangular chert clasts northeast and east of Little Colorado River. Support moderate growth of grass, sagebrush, and cactus southwest of Little Colorado River and little to no vegetation except for some grass northeast of Little Colorado River. Thickness, 2 to 15 m (6 to 50 ft) [Qay on 1:100,000-scale map]

Qdc **Eolian cinder dune deposits (Holocene and Pleistocene)**—Dunes composed of black, gray, and red, coarse-grained fragments of angular to subangular, glassy, basaltic cinders and scoria. Material is derived from nearby pyroclastic volcanic centers where airborne ash and cinders were deposited within a few miles of local volcanic eruptions in the south and southwest part of map area and south and southwest of map edge. Pyroclastic fragments are commonly vesicular and have been transported on the ground by southwesterly winds that allowed the particles to accumulate against or downslope of local topographic obstructions such as basalt flows, steep-walled drainages, rock ledges, and local fault scarps in the Wupatki National Monument area. Deposits are present but too thin to map several miles downwind (northeast) of eruptive centers. Thickness, 1.5 to 12 m (5 to 40 ft) [Qec on 1:100,000-scale map]

Qsc **Eolian cinder sand sheet deposits (Holocene and Pleistocene)**—Sand sheets composed of black, gray, and red, coarse-grained fragments of angular to subangular, glassy, basaltic cinders and scoria. Similar to eolian cinder dune (Qdc) deposits but forms extensive surface over and patches of volcanic particles downwind (northeast) of eruptive centers in south part of map area. Volcanic cinder fragments become smaller and more subrounded further downwind (northeast) the eruptive centers. Forms widespread cinder ground cover over all terrain in south-central part of map area and common within and near Wupatki National Monument area. Northeast of Wupatki National Monument, cinder sand sheet deposits are present as detected on aerial photos, but too thin to show at map scale. Thickness, 0.3 to 1.5 m (1 to 5 ft) [Qec on 100,000-scale map]

Qg3 **Old terrace-gravel deposits (Holocene and Pleistocene)**—West and southwest of Little Colorado River: Gray and light-brown, silt, sand, gravel, cobbles and boulders comprised primarily of local Permian and Triassic clasts, partly consolidated by calcite and gypsum cement; unsorted. Lithologically similar to young and intermediate terrace-gravel (Qg1, Qg2) deposits but includes abundant rounded volcanic clasts and some well-rounded quartzite clasts. Basalt clasts

up to .0.3 m (1 ft) in diameter; smaller basalt cobbles form desert pavement surfaces in southwest quarter of map area. Form terraces about 12 to 40 ft (3.7 to 12 m) above modern streambeds such as Tappan Wash; about 43 m (140 ft) above Little Colorado River, and 3 to 4.5 m (10 to 15 ft) below older terrace-gravel (QTg4) deposits southeast of Cameron.

East and northeast of Little Colorado River: Red and purple mud, silt, sand, and pebbles and cobbles of multicolored chert derived from the Adeii Eechii Cliffs area. Forms stream terraces 7.5 to 17 m (25 to 55 ft) above and often distant from modern drainages. Surfaces of unit often covered by subangular, wind polished dark gray chert and silicified limestone clasts that form a desert varnish. Thickness, 2 to 20 ft [Qgy on 1:100,000-scale map]

Qa3 **Old alluvial fan deposits (Holocene and Pleistocene)**—Gray Mountain area; Gray and light-brown, silt, sand and gravel, lithologically similar to young and intermediate alluvial fan (Qa1, Qa2) deposits; partly consolidated by calcite and gypsum cement. Surface has thin calcrete soil that forms resistant rocky surface north and east of Gray Mountain. Commonly overlapped by or intertongue with talus and rock fall (Qtr) and landslide (Ql) deposits. Support moderate growths of grass, sagebrush, cactus, cliffrose bush and scattered pinyon and juniper trees on lower north slopes of Gray Mountain.

Below Adeii Eechii Cliffs of Moenkopi Plateau: Unsorted mixture of brown and red-purple mud, silt, sand, and angular gray chert pebbles and small boulder debris, consolidated by mud and fine-grained siltstone cement. Forms semi-resistant caprock deposits on isolated ridges of soft purple mudstone and siltstone of Kayenta Formation (Jk), often 24.5 to 46 m (80 to 150 ft) above intermediate alluvial fan (Qa2) deposits. Thickness, 1.5 to 7.6 m (5 to 25 ft) [Qay on 1:100,000-scale map]

QTdl **Old linear dune deposits (Pleistocene and Pliocene(?))**—Light-red to light-brown, very fine- to medium-grained sand and silt. Primarily confined to Moenkopi Plateau area. Often form base or internal core of younger, reactivated linear dune surfaces immediately down wind (northeast) of Adeii Eechii Cliffs and Appaloosa Ridge on Moenkopi Plateau (shown as active linear dunes by Billingsley, 1987). Unit has significantly more clay content on Coal Mine Mesa derived from underlying Mancos Shale (Km). Gradational and arbitrary contacts with adjacent surficial deposits. Linear dune traces are often longer than 3 km (2 mi) and as much as 10 km (6 mi). Some linear dunes merge with other linear dunes and form a linear complex of parabolic or barchanoid dune trains within a short length of linear dune (not shown). Dunes are stabilized by grassy vegetation and Mormon tea brush. Thickness, 2 to 12 m (6 to 40 ft) (QTd on 1:100,000-scale map]

QTdp **Old parabolic dune deposits (Pleistocene and Pliocene(?))**—Light-red to light-brown, very fine- to medium-grained sand and silt. Chiefly confined to Moenkopi Plateau area. Often form complex linking set of parabolic dunes along edge of Appaloosa Ridge and edge of Adeii Eechii Cliffs. Several individual dunes on Moenkopi Plateau may have recently formed downwind of ponded sediments and may not be as old as adjacent old eolian sand sheet and dune (QTes) deposits, and old linear dune (QTdl) deposits. Bedrock or ponded sediment (Qps) are often formed within interior edge of old parabolic (QTdp) dunes. Dunes are stabilized by grassy vegetation and Mormon tea brush. Thickness, 2 to 6 m (6 to 20 ft) [QTd on 1:100,000-scale map]