

MAP UNIT DESCRIPTIONS

Surficial deposits

af Disturbed land and artificial fill (modern)–Compacted clay, silt, and sand associated with roads, buildings, and earthen dams.

Qe Eolian deposits (Holocene) – Loose sand capping ridges or blanketing the lee side of slopes. Sand is pale brown (10YR 6-7/3) or light-yellowish brown to lightbrown to reddish yellow (7.5-10YR 6/4 and 7.5YR 6/6), fine- to medium-grained, subangular to rounded, well sorted, and composed of quartz, 1-15% feldspar, and 3-15% lithic + mafic grains (lithic grains include chert and volcanic grains). Loose and 1-3 m thick.

Qca Colluvium and alluvium, undivided (upper Pleistocene to Holocene)-Colluvium, talus, and alluvial slopewash along the eastern and northern flanks of Cerro Colorado. Up to ~30 m thick.

Stream-valley alluvium

Qaa Active channel and fan (modern)-Active channels of ephemeral drainages that grade to Rio Puerco. Sediment typically consists of gravelly, fine- to very coarse-grained sand that is in laminated to very-thin beds that are horizontal-planar to cross-stratified. Probably less than 2 m thick.

Qay Younger alluvium associated with tributaries of Rio Puerco (Holocene-uppermost Pleistocene)–Brown to very-pale brown (10YR 5-7/3) sand and pebbly sand inset into Qam and graded to the level of younger Rio Puerco alluvium (Qary). Sand is mostly fine- to coarse-grained, subrounded, moderately-sorted, and composed of quartz, minor (5-20%) feldspar, and minor (5-20%) mafic + lithic grains (including chert, volcanic grains, and quartzite). Pebbles are rounded to subrounded and moderately-to poorly-sorted, and mainly derived from erosion of the Ceja and Cerro Conejo Formations. 1-3 m exposed thickness.

Qam Medium-aged alluvium (middle Pleistocene)-Sand and pebbly-cobbly sand whose eroded, upper surface lies above that of Qay. Gravel is subrounded to rounded, moderately- to poorly- sorted, and composed largely of chert and granite with subordinate andesite to basaltic andesite (~10%), rhyolite, sandstone, basalt, and quartz + quartzite (trace gneiss and petrified wood). Sand is pale-brown to very pale brown to light brown (10YR 6-7/3 and 7.5YR 6/4), fine-to very-coarse-grained, subrounded to subangular, moderately-to poorly-sorted, and composed of quartz, minor (~10% or less) feldspar, and 7-15% mafic + lithic grains. Remnants of strongly developed calcic paleosols are irregularly preserved on hilltops. Loose and up to 18 m

Qam(s) Surficial sand and clayey-silty sand sheet overlying medium-aged aluvium deposited east of Rio Puerco (Holocene to middle Pleistocene)-Very fine- to very-coarse-grained sand and slightly-clayey-silty sand with colors of pale-brown to light-yellowish-brown (10YR 5-6/3-4) to reddish-brown (7.5YR 6/4-6), with local streaks of strong brown (7.5YR 5/6). Sand is subrounded, well-sorted, and composed of quartz, 10-15% feldspar, and 7-10% mafic + lithic grains. Soil development includes up to Stage I calcium carbonate horizon development, none-to weak-clay illuviation, and weak cambic horizons. 0.3-2.0 m thick.

Alluvium of the Rio Puerco

thick

Qara Active channel of the Rio Puerco (modern)-Light-yellowish-brown to lightgray (2.5Y 6/3-7/2), very-fine- to medium-grained sand that is subangular, well-sorted, and composed of quartz, 5-7% feldspar, and 5-7% mafic and lithic grains. Weakly-to moderately-consolidated and non-cemented. Thickness is probably thin (<2 m).



CORRELATION DIAGRAM



Qary Younger alluvium of Rio Puerco (Holocene to uppermost Pleistocene)-Interbedded sand and fine-grained floodplain deposits that underlie the flat floor of the Rio Puerco valley. Sand is fine- to medium-grained, subrounded to subangular, well-sorted, and composed of quartz, 5-7% feldspar, and 5-12% lithic + mafic grains (lithic grains include volcanic fragments and minor chert), in non-cemented and moderately-consolidated, well-laminated beds. Colors range from light-gray to palebrown to light-yellowish-brown (2.5Y 6-7/2-3). Floodplain deposits are very-thin to medium-tabular beds of light-brownish-gray (2.5Y 6/2) clay, silt, and very-fine- to fine-grained sand. No notable soil development.

Qarm Medium-aged alluvium of the Rio Puerco (middle Pleistocene)-Relativelythick terrace fills preserved along the west side of the Rio Puerco, consisting of pebbly sand and sand interbedded with minor-fine-grained floodplain deposits. Gravel consists of very-fine to very-coarse pebbles with up to 20% cobbles, that are subrounded to rounded, moderately-to poorly-sorted, and of 25-50% chert, 20-30% light-gray to gray andesite-basaltic andesite, 1-12% basalt, 5-25% yellow Mesozoic sandstone, 1-10% quartzite, 5-15% red granite, trace-5% FeO concretions, variable calcium carbonate-indurated sandstone clasts, and trace Pedernal Chert. Sand is fineto very-coarse-grained, subrounded to subangular, moderately to poorly sorted, and composed of quartz, 1-10% feldspar, and 7-15% mafic + lithic grains (including volcanic lithic fragments and lesser chert). Colors of brown to light-gray, to lightyellowish-brown (10YR 5/3, 2.5Y-10YR 6-7/2-3). Floodplain deposits of light-yellowish-brown (2.5Y 6/3) silt and very-fine-grained sand. Locally cemented by calcite, where overlying less permeable units. Up to 18 m thick.

Qaru Undifferentiated alluvium of the Rio Puerco (Middle Pleistocene)-Various terrace deposits of sand and gravel occupying a geomorphic position between Qarm and Qaro. Gravel consists of pebbles with ~5% cobbles and 0.5% boulders that are subrounded, poorly sorted, and composed of chert, 15% gray andesite-basalt, ~15% Mesozoic sandstone-siltstone, ~15% granite, ~5% felsic volcanic rocks, and 15-20% eroded-out FeO concretions. Sand is light-yellowish-brown to pale-brown (2.5Y 6-7/3), subrounded to subangular, poorly-sorted, and composed of quartz, <15% feldspar, and 5-10% lithic + mafic grains.

Qaro Older alluvium of the Rio Puerco (middle Pleistocene)–Sandy pebbles, pebbly sand, sand, and silt-clay associated with an ancestral Rio Puerco. Gravel consists of pebbles with 1-10% cobbles and 0-1% boulders that are subrounded to rounded, poorly-sorted, and composed of 10-25% gray andesite-basaltic andesite, 10-20% Mesozoic sandstone, 1-10% basalt, 15-50% chert, 1-10% red-orange granite, 5-15% FeO concretions, 1-5% rhyolite, 5-10% quartzite, 0-5% intraformational sandstone rip-ups, and 1-5% vein quartz. Channel-fill sand is yellowish-brown to light-yellowish-brown (10YR 5-6/4) to pale-brown to very-pale-brown (10YR 6-7/3), fine- to very coarse-grained, subangular to rounded, poorly-to-well sorted, and composed of quartz, 5-10% feldspar, and 5-15% lithic and mafic grains (lithic are mostly volcanic fragments, with minor chert). Minor floodplain deposits of light-gray to white to palebrown (2.5-5Y 7-8/1-2) clayey-silty very-fine- to fine-grained sand and light-yellowish- brown to light-brown (7.5-10YR 6/4) clay-silt. Contains a lens of white volcanic ash that was geochemically correlated to the 0.64 Ma Lava Creek B (LCB) tephra from Yellowstone National Park (Izett and Wilcox, 1982; age from Lanphere et al., 2002). Up to 25 m thick.

Qao(s)Surficial silty-clayey sand and sand sheet overlying older alluvium of the Rio Puerco (Holocene to middle Pleistocene)–Surficial unit is light-yellowish-brown to pale-brown (10YR 6/3-4), internally-massive, and composed of fine- to medium-grained, eolian sand to clayey-silty very-fine-to fine-grained sand. Sand is subrounded to subangular, well-sorted, and composed of quartz, 1-10% feldspar, and 3% lithic + mafic grains. Soil development includes Stage II to IV calcic horizon development. 0.2-3 m thick.

Ceja Formation

Tcrp Rio Puerco Member of the Ceja Formation (Plio-Pleistocene)–Very-pale brown, amalgamated channel-fills of sand and pebbly to cobbly sand. Gravel are rounded to subrounded, poorly-sorted, and composed of chert (including Pedernal chert) with 20-30% quartzite, ~10% gray, intermediate-to mafic-volcanic clasts, ~10% sandstone clasts, and 3-10% granite. Unit contains scattered cobbles and boulders up to 1 m in maximum diameter. Sand is mostly medium- to very coarse-grained, subrounded to subangular, poorly-to moderately-sorted and composed of quartz, 15-25% lithic + mafic grains, and 5-10% est feldspar. Gradational to interfingering basal contact. Weakly consolidated and non-cemented. 35-45 m thick.

Tca Atrisco Member of the Ceja Formation (Pliocene)–Yellowish-brown to verypale-brown, very fine-to fine-grained sandstone and reddish-brown mudstone. Sand is very-fine- to coarse-grained, subrounded to subangular, poorly-to well-sorted, and composed of quartz with 5-15% volcanic-rich lithic grains, and 1-15% feldspar. Sparse very-fine to fine-pebbles of chert (including Pedernal Chert), quartzite, granite, and light-gray volcanics are scattered about sands and occur as thin channel-fills. Colors of pale-brown to pink to reddish-yellow (10YR 7/3 to 7.5YR 6/6 and 6-7/4). Minor-tabular mudstones, siltstones, and very-fine-grained sandstones of pale-brownto reddish-brown colors (7.5YR 7/3-4, 10YR 7/4, 5YR 5/4). Weakly consolidated and non-cemented. Lower interval may be correlative to Loma Barbon Member of the Arroyo Ojito Formation (late Miocene; Connell et al., 1999; Connell, 2008). 130 m thick.

Arroyo Ojito Formation

Ton Navajo Draw Member (upper Miocene)–Pale-brown to pale-yellow (10YR 6/3 to 2.5Y 7/3) and light-yellowish-brown to very-pale-brown (10YR 6/4 and 10YR 7/3-4), channel-fill sandstone interbedded with minor to subequal mudstone. Unit recognized by its pale-brown to yellowish colors, moderately-to well-sorted sand texture, and lack of gravel. Sand is mostly very-fine- to coarse-grained, subrounded to subangular, moderately-to well-sorted, and composed of quartz, 1-10% feldspar, and 3-15% lithic + mafic grains dominated by volcanic detritus. 10-20% silt-clay floodplain deposits whose beds are tabular and <60 cm thick. Pebbles are verysparse and consist of chert (including Pedernal chert), light-gray volcanic rocks, and intraformational clasts of caclium carbonate, siltstone, and sandstone. Unit is weakly to well consolidated and variably cemented by calcium carbonate. Thickness not well constrained, but estimated to be 150-200 m.

Tonr Red sandstone–Reddish-brown, eolianite sandstone (2.5YR 4/4-5/4) exposed along flanks of Cerro Colorado and as pods of reddish-colored (stained?) sandstone in Ton south of Cerro Colorado.

Tonc White tufa – White calcium carbonate-cemented sandstone and conglomerate (lithoid tufa) within unit Ton; may be an ancient spring deposits in the Arroyo Ojito Formation. Corresponds to unit Qc (caliche) in Kelley (1977).

Towp Western piedmont facies of Arroyo Ojito Formation (upper Miocene)–Fine- to coarse-grained sandstone interbedded with subordinate (5-10%) pebbly channel-fills and minor (~1-3%) mudstone and muddy-sand beds. Sand colors are generally lightyellowish-brown to very-pale-brown (10YR 6/4 to 7/3-4), or light-brown to reddishyellow (7.5YR 6/4-6) to pink (7.5YR 7/3-4); with some 10YR 5-6/6 and 7.5YR 5/4. Sands are very-fine- to very-coarse-grained, subrounded to subangular, moderately-to wellsorted, and of quartz, 1-15% feldspar, and 5-15% lithic grains (light gray volcanic grains and chert). Mudstone colors of reddish-brown (2.5YR 4/4) to light-brown (7.5YR 6/4) to light-vellowish-brown (10YR 5-6/4) to brown (10YR 4-5/3). Scattered very-fine to coarse pebbles of chert, 1-10% quartzite, 3-10% quartz, trace-10% gray volcanics, 1-10% felsic tuffs, 1-25% calcium carbonate-cemented sandstone, trace extra-formational sandstone, trace to 1% petrified wood, 0-1% granites, trace basalt. Weakly-to moderately-consolidated, variably cemented. 240-250 m thick



LA MESITA NEGRA CROSS SECTION Scale of 1:24000 No vertical exaggeration

Cerro Conejo Formation

Tcc Cerro Conejo Formation (middle Miocene)-Tan to orange sandstone interbedded with minor conglomerate and mudstone intervals; only mapped west of the Rio Puerco. Correlation to the Cerro Conejo Formation is based on the unit's stratigraphic. Sandstones are very-fine- to very-coarse-grained with subangular to rounded, moderately-to well-sorted grains of quartz, 1-13% feldspar, 5-15% lithic grains (including volcanic fragments and lesser chert). Rare gravels are very-fine to fine pebbles, subrounded, and composed of chert, 10-20% quartz and quartzite, 5% light-gray volcanics, and 1-5% FeO concretions. Colors of light-brown to pink to reddishyellow to pinkish-white (10YR 6-7/4, 7.5YR 6-7/4, 5-7.5YR 6/6, or 7.5YR 8/2). Variably cemented, weakly to well consolidated.

Tccu Upper Cerro Conejo Formation–Sandstone interpreted to reflect a mix of fluvial and eolian depositional processes, interbedded with minor light-reddish brown mudstone. Eolian strata are recognized by thick cross-stratification, lenticular grain-flow beds, paucity of conglomerate, lack of mudstone, and presence of rhizoliths. Sand is very-pale-brown (10YR 7/4), fine- to verycoarse-grained, subrounded to subangular, poorly-to well-sorted, and composed of quartz, minor feldspar (<5%), and 5-15% lithic grains (silicified volcanic grains and chert) + minor mafics. Locally, paleosols are present that exhibit evidence of clay illuviation and calcium carbonate accumulation. Weakly-to well-consolidated; non- to weakly-cemented by calcium carbonate. 70-80 m thick.

Tccl Lower Cerro Conejo Formation–Very-pale-brown to pink (7.5-10YR 7/3-4), with lesser light-yellowish-brown (10YR 6/4) to light-brown (7.5YR 6/4), sandstone and pebbly sandstone interbedded with minor conglomerate beds and minor lightreddish-brown (5YR 5-6/4) claystone-mudstone. Gravel consist of rounded to subrounded, poorly-sorted, very-fine to very-coarse pebbles and 1-3% cobbles composed largely of light-gray to gray dacites, rhyolites, rare basalt, and chert, with lesser quartzite and trace petrified wood. Sand is fine- to very-coarse-grained, subangular to rounded, moderately-to well-sorted, and composed of quartz, 3-5%(?) feldspar, and 10-20% lithic grains (chert and felsic volcanic grains) + minor mafics. Mudstone is generally in very-thin to thick, tabular beds. Variably cemented by calcium carbonate. Base of unit not observed. At least 250 m thick.

Tzc Zia Formation, Chamisa Mesa Member (lower Miocene)–Very-pale-brown (10YR 7/3-4) to pink (7.5YR 7/4) sandstone interbedded with 0-1% mudstone and 1% sandy limestone. Lesser light-gray (10YR 6-7/2) or pale-yellow (2.5Y 7/2) sandstone colors. Mudstone is in very-thin to tabular, tabular beds. Sandy limestone is chalky-white and in thin to thick, internally laminated tabular beds. Sandstones are very-fine- to very-coarse-grained, subangular to rounded, moderately-to well-sorted, and composed of quartz, 5-25% lithic + mafic grains, and 1-5% feldspar. Lithic grains mostly consist of chert and silicified(?) volcanic grains. Trace pebbly beds whose clasts are subrounded, moderately-sorted, and composed of silicified felsic volcanic rocks, chert, and minor quartzite. Weakly-to moderately-consolidated and variably cemented by calcium carbonate. At least 100 m thick.

Tzp Zia Formation, Piedra Parada Member (lower Miocene)–Light gray (10YR 7/1-2), medium- to coarse-grained sandstone that is extensively cross-laminated. Unit lacks gravel and mudstone beds. Sand is rounded to subangular, well-sorted, and composed of guartz, 15-25% lithic grains (volcanic and chert grains) + very minor mafics. About 20-35% of unit is strongly cemented by calcium carbonate. 20-25 m thick.

Td Dacite vent at Cerro Colorado (upper Miocene)-Reddish-brown to reddish-yellow to medium-gray dacitic lava associated with vent at Cerro Colorado. Consists of variably porphytic flows and flow breccias. Phenocrysts of 5-15% plagioclase (up to 4 mm across, subhedral, clear and vitreous to white and chalky), 3-7% amphibole (thin black needles up to 1 mm long), and <1-1% biotite (platy and up to 2 mm across, black to dark reddish brown). 40Ar/39Ar of 7.16 ± 0.47 Ma (Connell et al., in press).

Tb Basaltic lava at La Mesita Negra (upper Miocene)–Light gray to gray, tholeitic basalt flows. Contain 10-15% vesicules up to 2 cm long, as well as 7-10% variably altered pyroxene phenocrysts (0.5-4.0 mm long). 40Ar/39Ar age of 8.16 ± 0.05 Ma (Maldonado et al., 2006).

Tis Unit of Isleta #2 (upper Eocene to Oligocene)–Cross-section only.

Tg Galisteo Formation (Eocene)–Cross-section only.

Cretaceous

Kmf Menefee Formation (Upper Cretaceous)–Light-to dark-gray to brownish -gray to pale-brown mudstones interbedded with minor, light-gray to yellow to white sandstone and silty fine sandstone. Mudstones are typically well-laminated and very-fine-grained, with colors of 2.5Y 5-8/1-5/2, 10YR 7/2-8/2, and 2.5Y 7/3. Sandstone exhibits fresh colors of 2.5Y 7-8/1-2 to 7/3 and weathered colors of 7.5YR 6-7/6 to 7/8 or 10YR 6/4. Sandstones are very-fine- to medium-grained, subangular to subrounded, well-sorted, and composed of quartz, 5-15% feldspar, and 5-15% mafic and lithic grains (that include light-gray volcanic fragments and chert). Sandstone is cemented by calcium carbonate and locally by iron oxides. Both lithologies commonly bear stains of reddish, orangish, yellowish, dark-brownish, and black colors from iron and manganese oxides. 610-620 m thick.

Kpl Point Lookout Sandstone (Upper Cretaceous)–Cross-section only.

Kcc Crevasse Canyon Formation (Upper Cretaceous)–Light-gray, light-reddishbrown, light-yellowish-brown, and brown, fine sandstones and mudstones. Measured colors of 2.5YR 4/5, 10YR 7/1, 2.5Y 6/4, and 2.5Y 7/3. Sands are very-fineto fine-grained, locally-silty, subangular to subrounded, well-sorted, and composed dominantly of quartz with minor cherty lithic grains + mafic grains (up to 15%) and sparse feldspars (up to 5%). Mudstones are typically massive, occurring in tabular, medium to thick beds. Typically poorly-indurated, but cementation increases down-section. 150-160 m thick.

Kg Gallup Sandstone (upper Cretaceous)–Cross-section only.

- Kmu Upper Mancos Shale (upper Cretaceous)–Cross-section only.
- Kth Tres Hermanos Formation (upper Cretaceous)–Cross-section only.

Kml Lower Mancos Shale (upper Cretaceous)–Cross-section only.

Kd Dakota Sandstone (upper Cretaceous)–Cross-section only.

Jurassic

Jmbs Morrison Formation, Bluff Sandstone, and Summerville Formation, undivided (middle to upper Jurassic) - Cross-section only.

- Todilto Formation (middle Jurassic)–Cross-section only.
- Je Entrada Sandstone (middle Jurassic)–Cross-section only.

Triassic

Ru Triassic strata, undivided (middle and upper Triassic)–Cross-section only.

Pzu Upper Paleozoic strata, undivided (Permian) – Cross-section only.