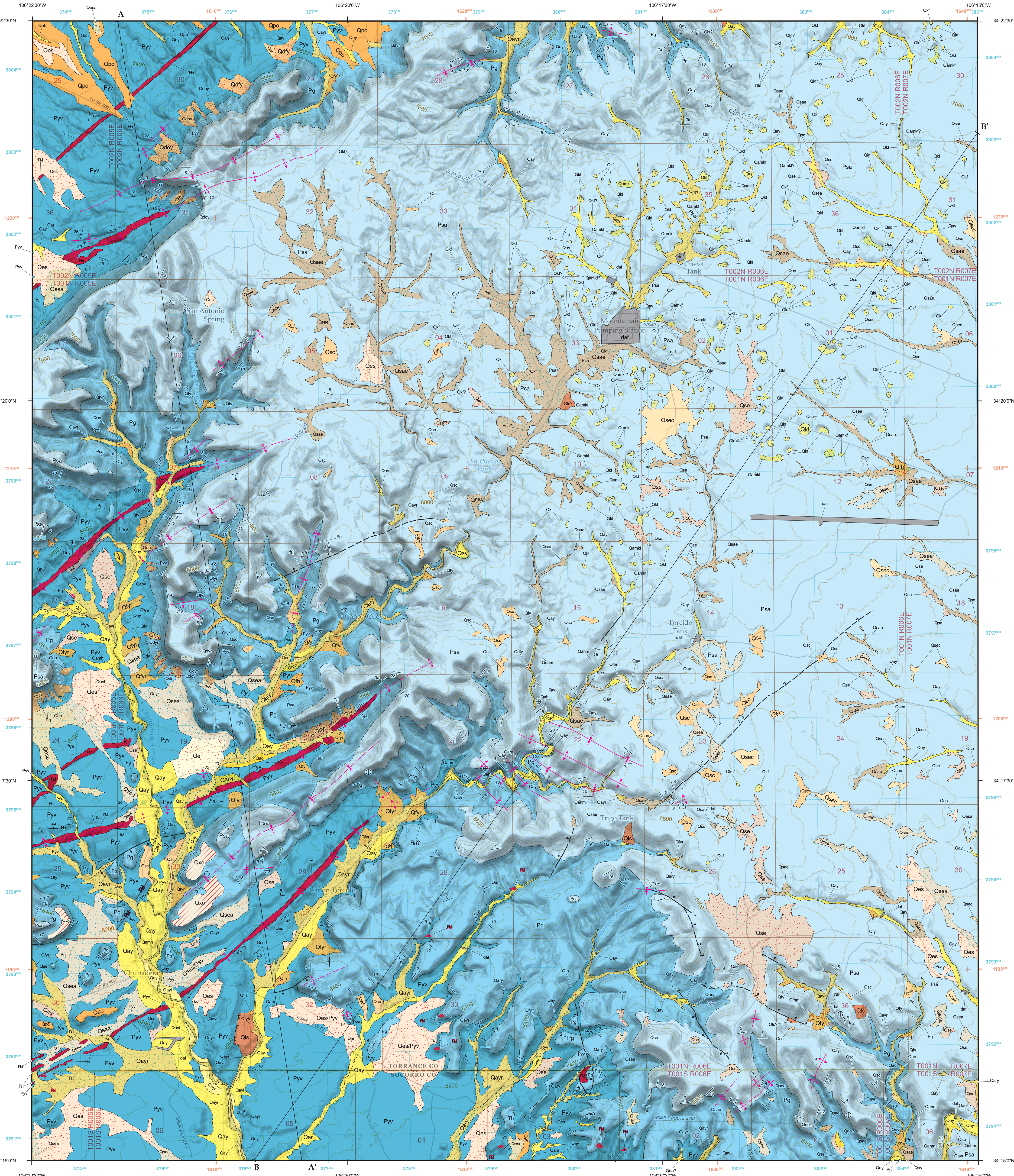
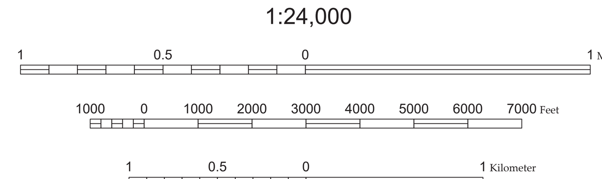
NMBGMR Open-File Geologic Map 306
Last Modified: August 2024



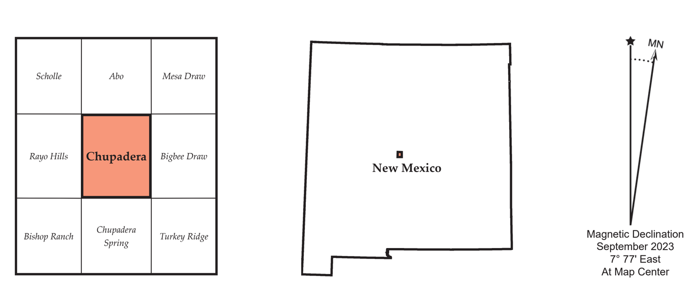
Base map from U.S. Geological Survey 2023
North American Datum of 1983 (NAD83)
Projection and 1,000-meter grid: Universal Transverse Mercator, Zone 13S, shown in blue.
10,000-foot ticks: New Mexico Coordinate System of 1983 (Central Zone), shown in red.
Roads....U.S. Census Bureau, 2015–2016
Names....GNIS, 2016
Hydrography....National Hydrography Dataset, 2014
Contours....IFSAR 4.5 m Digital Terrain Model, 2008
Wetlands....FWS National Wetlands Inventory 1977–2014
Public Land Survey System....BLM, 2019

1:24,000



Contour Interval 40 Feet

North American Vertical Datum of 1988



Quadrangle Location

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
801 Leroy Place
Socorro, New Mexico
87801-4796
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This and other STATEMAP quadrangles are available for free download in both PDF and ArcGIS formats at:

https://geoinfo.nmt.edu

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Digital layout and cartography by the NMBGMR Map Production Group:
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New Mexico Bureau of Geology and Mineral Resources
Open-File Geologic Map 306

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Geologic Map of the Chupadera 7.5-Minute Quadrangle, Socorro and Torrance Counties, New Mexico

September 2024

by

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Comments to Map Users

A geologic map displays information on the distribution, nature, orientation, and age relationships of rock and deposits and the occurrence of structural features. Geologic and fault contacts are irregular surfaces that form boundaries between different types or ages of units. Data depicted on this geologic quadrangle map may be based on any of the following: reconnaissance field geologic mapping, a compilation of published and unpublished work, and photogeologic interpretation. Locations of contacts are not surveyed but are plotted by interpretation of the position of a given contact onto a topographic base map; therefore, the accuracy of contact locations depends on the scale of mapping and the interpretation of the geologist(s). Any enlargement of this map could cause misunderstanding in the detail of mapping and may result in erroneous interpretations. Site-specific conditions should be verified by detailed surface mapping or subsurface exploration. Topographic and cultural changes may not be shown due to recent development.

Cross sections are constructed based upon the interpretations of the author made from geologic mapping and available geophysical and subsurface (drill hole) data. Cross sections should be used as an aid to understanding the general geologic framework of the map area and not be the sole source of information for use in locating or designing wells, buildings, roads, or other human-made structures.

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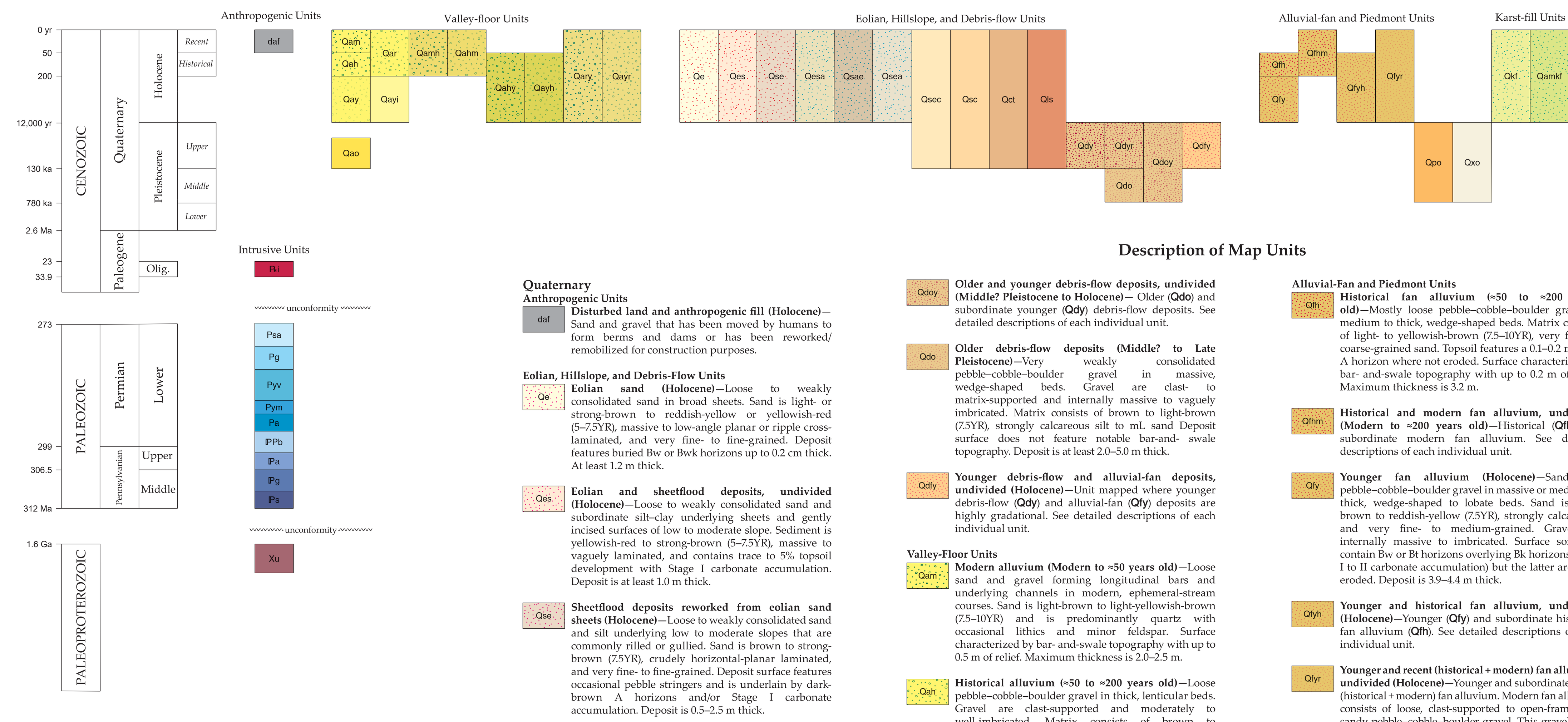
Correlation of Map Units



Explanation of Map Symbols

Contact—The identity and existence are certain and questionable where queried. The location is accurate where solid and approximate where dashed.

Gradational contact—The identity and existence are certain. The location is accurate where solid and approximate where dashed.

Fault (generic; vertical, subvertical, or high- angle; or unknown or unspecified orientation or sense of slip)—The identity and existence are certain and questionable where queried. The location is accurate where solid, approximate where dashed,, and concealed where dotted.

Normal fault—The identity and existence are certain and questionable where queried. The location is accurate where solid, approximate where dashed, and concealed where dotted. Bar and ball on downthrown block.

Anticline—The identity and existence are certain. The location is accurate where solid, approximate where dashed, and concealed where dotted.

Syncline—The identity and existence are certain. The location is accurate where solid, approximate where dashed, and concealed where dotted.

Monocline, anticlinal bend—The identity and existence are certain. The location is accurate where solid.

Head or main scarp of landslide—Inactive, subdued, indistinct, and (or) location is approximate. Hachures point down scarp.

Dike—The identity and existence are certain. See description of map unit Pei in the Description of Map Units.

Pei outcrops too small to illustrate at 1:24,000 scale.

Horizontal bedding.

Inclined bedding—Showing the strike and dip.

Vertical bedding—Showing the strike.

Overturned bedding—Showing the strike and dip.

Cross-section line and label.

Erosional surface on the Glorieta Sandstone.

Description of Map Units

Quaternary

Anthropogenic Units

daf — **Disturbed land and anthropogenic fill (Holocene)**—Sand and gravel that has been moved by humans to form berms and dams or has been reworked/remobilized for construction purposes.

Eolian, Hillslope, and Debris-Flow Units

Qe — **Eolian sand (Holocene)**—Loose to weakly consolidated sand in broad sheets. Sand is light- or strong-brown to reddish-yellow or yellowish-red (5–7.5YR), massive to low-angle planar or ripple cross-laminated, and very fine- to fine-grained. Deposit features buried Bw or Bwk horizons up to 0.2 cm thick. At least 1.2 m thick.

Qes — **Eolian and sheetflood deposits, undivided (Holocene)**—Loose to weakly consolidated sand and subordinate silt-clay underlying sheets and gently incised surfaces of low to moderate slope. Sediment is yellowish-red to strong-brown (5–7.5YR), massive to vaguely laminated, and contains trace to 5% topsoil development with Stage I carbonate accumulation. Deposit is at least 1.0 m thick.

Qse — **Sheetflood deposits reworked from eolian sand sheets (Holocene)**—Loose to weakly consolidated sand and silt underlying low to moderate slopes that are commonly rilled or gullied. Sand is brown to strong-brown (7.5YR), crudely horizontal-planar laminated, and very fine- to fine-grained. Deposit surface features occasional pebble stringers and is underlain by dark-brown A horizons and/or Stage I carbonate accumulation. Deposit is 0.5–2.5 m thick.

Qesa — **Eolian and subordinate sheetflood and alluvial deposits (Holocene)**—Loose eolian silt to fine-grained sand that has been reworked by alluvial processes in places. See unit descriptions for Qe, Qes, Qea, and Qse.

Qsae — **Sheetflood alluvial, and subordinate eolian deposits, undivided (Holocene)**—Loose, silty to coarse-grained sand on low- to moderate-grade slopes that are more commonly incised than those underlain by unit Qesa and coarser than unit Qesa. Nearly all eolian sand has been reworked by alluvial processes. Some gravel may be present. See unit descriptions for Qe, Qes, Qsea, and Qse.

Qsea — **Sheetflood and subordinate eolian and alluvial deposits, undivided (Holocene)**—Loose, silty sand on low- to moderate-grade slopes that are more commonly incised than those underlain by unit Qesa. Nearly all eolian sand has been reworked by alluvial processes. See unit descriptions for Qe, Qes, Qsae, and Qse.

Qsc — **Sheetflood and colluvial deposits, undivided (Holocene)**—Loose to weakly consolidated, silty sand and pebble (rare cobble) gravel underlying moderate-grade slopes at the base of bedrock uplands. See unit descriptions for Qse and Qct.

Qsec — **Sheetflood deposits reworked from eolian sand sheets and colluvial deposits, undivided (Holocene)**—Loose to weakly consolidated sand, silty sand-and-pebble (rare cobble) gravel underlying moderate-grade slopes at the base of bedrock uplands. See unit descriptions for Qse, Qsc, and Qct.

Qct — **Colluvium and talus, undivided (Holocene)**—Loose, poorly sorted, angular to subrounded cobble-boulder gravel forming aprons or mantles at the foot slopes of bedrock uplands. Deposit is <5 m thick.

Qls — **Landslide deposits (Holocene)**—Pebble–cobble–boulder gravel in massive to thick or very thick, wedge-shaped beds. Gravel is matrix-supported and internally massive or chaotically bedded in slope- parallel sheets. Matrix sand is brownish-yellow to yellow (10YR) and very fine- to medium-grained. Locally features a surface soil with stage II carbonate accumulation in the upper 1.0–1.5 m of the deposit. Deposit is at least 4.0 m thick.

Qdy — **Younger debris-flow deposits (Holocene)**—Loose to weakly consolidated, reverse-graded, silty to pebbly sand and pebble–cobble gravel in massive or thick, tabular to broadly lenticular beds. Sand is strong-brown to reddish-yellow (7.5YR) and very fine- to medium-grained. Stage II carbonate accumulation is observed in the upper 0.6 m of the deposit. Maximum thickness of the deposit is 8.5 m.

Qdyr — **Younger and recent debris-flow deposits, undivided (Holocene)**—Younger (Qdy) and subordinate recent (modern + historical) debris-flow deposits. Recent deposits are not mapped separately and consist of pebble–cobble–boulder gravel in massive or medium to thick, lobate to snout- or fan-shaped beds. Gravel are open-framework to matrix-supported and internally massive to weakly imbricated. Often capped by open-framework boulder trains. Deposit is at least 1.4–2.0 m thick.

Qdoy — **Older and younger debris-flow deposits, undivided (Middle? Pleistocene to Holocene)**— Older (Qdo) and subordinate younger (Qdy) debris-flow deposits. See detailed descriptions of each individual unit.

Qdo — **Older debris-flow deposits (Middle? to Late Pleistocene)**—Very weakly consolidated pebble–cobble–boulder gravel in massive, wedge-shaped beds. Gravel are clast- to matrix-supported and internally massive to vaguely imbricated. Matrix consists of brown to light-brown (7.5YR), strongly calcareous silt to mL sand. Deposit surface does not feature notable bar-and- swale topography. Deposit is at least 2.0–5.0 m thick.

Qdfy — **Younger debris-flow and alluvial-fan deposits, undivided (Holocene)**—Unit mapped where younger debris-flow (Qdy) and alluvial-fan (Qfy) deposits are highly gradational. See detailed descriptions of each individual unit.

Valley-Floor Units

Qam — **Modern alluvium (Modern to ≈50 years old)**—Loose sand and gravel forming longitudinal bars and underlying channels in modern, ephemeral-stream courses. Sand is light-brown to light-yellowish-brown (7.5–10YR) and is predominantly quartz with occasional lithics and minor feldspar. Surface characterized by bar- and-swale topography with up to 0.5 m of relief. Maximum thickness is 2.0–2.5 m.

Qah — **Historical alluvium (≈50 to ≈200 years old)**—Loose pebble–cobble–boulder gravel in thick, lenticular beds. Gravel are clast-supported and moderately to well-imbricated. Matrix consists of brown to light-brown (7.5YR), very fine- to medium-grained sand. Gravel may underlie low-angle to horizontal-planar laminated sand (Qe or Qes). Surface characterized by bar-and-swale topography with up to 0.35 m of relief. Deposit is at least 0.8–1.6 m thick.

Qar — **Recent (historical + modern) alluvium (Modern to ≈200 years old)**—Historical (Qah) and modern alluvium (Qam) in approximately equal proportions. See detailed descriptions of each individual unit.

Qamh — **Modern and historical alluvium, undivided (Modern to ≈200 years old)**—Modern (Qam) and subordinate historical (Qah) alluvium. See detailed descriptions of each individual unit.

Qahm — **Historical and modern alluvium, undivided (Modern to ≈200 years old)**—Historical (Qah) and subordinate modern (Qam) alluvium. See detailed descriptions of each individual unit.

Qay — **Younger alluvium (Holocene)**—Sand and minor gravel underlying broad surfaces that are deeply incised in places. Sand is brown or reddish-yellow to dark-yellowish-brown (7.5–10YR) and interfingers with imbricated lenses of pebble–cobble gravel. Deposit features buried Bw or Bt horizons and stage I to II calcic soils in its upper part. Deposit is 3.5–10.0 m thick.

Qayi — **Younger alluvium, inset subunit (Holocene)**—Sediment similar to but underlying a cut-fill terrace inset 4.0–5.0 m into younger alluvium (Qay). Deposit is up to 6.0 m thick.

Qahy — **Historical and younger alluvium, undivided (Holocene)**—Historical (Qah) and subordinate younger alluvium (Qay). See detailed descriptions of each individual unit.

Qayh — **Younger and historical alluvium, undivided (Holocene)**—Younger (Qay) and subordinate historical alluvium (Qah). See detailed descriptions of each individual unit.

Qary — **Recent (historical + modern) and younger alluvium, undivided (Holocene)**—Recent (Qah + Qam) and subordinate younger alluvium (Qay). See detailed descriptions of each individual unit.

Qayr — **Younger and recent (historical + modern) alluvium, undivided (Holocene)**—Younger (Qay) and subordinate recent alluvium (Qah + Qam). See detailed descriptions of each individual unit.

Qao — **Older alluvium (Middle to Late Pleistocene)**—Pebble–cobble gravel or conglomerate in massive or medium to thick, lobate to tabular beds. Matrix consists of strong-brown (7.5YR), very fine- to medium-grained sand. Conglomerate is calcite- cemented, matrix-supported, and consists of pebbles of Glorieta Sandstone, carbonate, and monzonite. Deposit features a 0.4-m-thick, Stage IV calcic soil at its surface. Total thickness is at least 4.0–5.0 m.

Alluvial-Fan and Piedmont Units

Qfh — **Historical fan alluvium (≈50 to ≈200 years old)**—Mostly loose pebble–cobble–boulder gravel in medium to thick, wedge-shaped beds. Matrix consists of light- to yellowish-brown (7.5–10YR), very fine- to coarse-grained sand. Topsoil features a 0.1–0.2 m thick A horizon where not eroded. Surface characterized by bar- and-swale topography with up to 0.2 m of relief. Maximum thickness is 3.2 m.

Qfhm — **Historical and modern fan alluvium, undivided (Modern to ≈200 years old)**—Historical (Qfh) and subordinate modern fan alluvium. See detailed descriptions of each individual unit.

Qfy — **Younger fan alluvium (Holocene)**—Sand and pebble–cobble–boulder gravel in massive or medium to thick, wedge-shaped to lobate beds. Sand is light-brown to reddish-yellow (7.5YR), strongly calcareous, and very fine- to medium-grained. Gravel are internally massive to imbricated. Surface soil may contain Bw or Bt horizons overlying Bk horizons (stage I to II carbonate accumulation) but the latter are often eroded. Deposit is 3.9–4.4 m thick.

Qfyh — **Younger and historical fan alluvium, undivided (Holocene)**—Younger (Qfy) and subordinate historical fan alluvium (Qfh). See detailed descriptions of each individual unit.

Qfyr — **Younger and recent (historical + modern) fan alluvium, undivided (Holocene)**—Younger and subordinate recent (historical + modern) fan alluvium. Modern fan alluvium consists of loose, clast-supported to open-framework, sandy pebble–cobble–boulder gravel. This gravel forms bars, lobes and underlying braided channels. See detailed descriptions of Qfh and Qfy.

Qpo — **Older piedmont alluvium (Middle? to Late Pleistocene)**—Thin pebble–cobble and pebble–cobble–boulder gravel occurring as small remnants or capping low-gradient ridges. Clasts are 40–60% pebbles, 20–45% cobbles, and 10–20% boulders of Glorieta Sandstone and carbonate. Surface soils are commonly eroded. Deposit is <2.4–3.0 m thick.

Qxo — **Older pediment gravels (Middle? to Late Pleistocene)**—Pebble–cobble and pebble–cobble-boulder lag gravels overlying erosional surfaces formed on the Glorieta Sandstone in the southwest part of the quadrangle. Clasts are angular to subangular and commonly feature strong varnish. Pediment surfaces are 50–70 m above modern grade. Deposits are 0.8–2.0 m thick.

Karst-Fill Units

Qkf — **Karst-fill deposits (Holocene)**—Silt–clay, sand, and minor gravel-filling karst-related collapse features (dolines) in the central and eastern parts of the quadrangle. Deposit is likely similar to units Qesa, Qsae, and Qsea but better stratified and lacking flow-related sedimentary structures.sedimentary structures. Deposit is up to 6.0–8.0 m thick.

Qamkf — **Karst-fill deposits modified by alluvial and/or mass movement processes (Holocene)**—Similar to unit Qkf but exhibiting evidence of alluvial or mass-movement reworking such as flow or slump structures. Deposit may be similar to units Qah, Qay, Qesa, Qsae, and/or Qsea. Deposit is up to 6–8 m thick.

Paleogene

Intrusive Units

Pei — **Intrusive monzonite (Early Oligocene)**— Medium- to whitish- or very light-gray, non-vesicular, massive monzonite. Phenocrysts in phaneritic outcrops include 20–30% hornblende, 10–15% plagioclase, trace to 1% biotite, and trace quartz. Hornblende and biotite phenocrysts are typically altered. Forms dikes and sills intruding the Los Vallos Formation (Pyv) or Glorieta Sandstone (Pg). Dikes are commonly 45–75 m wide.

Paleozoic

Psa — **San Andres Formation (Early Permian)**— Gray to brownish-gray limestone and dolostone interbedded with whitish gypsum, purplish to reddish mudstone, and buff-colored sandstone in the lower part. Carbonate intervals are massive to horizontal-planar or ripple-laminated and are intermittently fossiliferous, bioturbated, oncoidal, and/or cherty in the upper 10 m of exposure. Gypsum is massive to nodular or laminated. Unit is 45–50 m thick.

Pg — **Glorieta Sandstone (Lower Permian)**—White to yellowish-white or very pale-pinkish, poorly to moderately indurated, strongly calcareous, massive or thin- to thick-bedded, tabular to lenticular, internally massive to horizontal-planar laminated to low-angle planar or tangential cross-stratified, moderately to well-sorted, subangular to rounded, quartzose, vfl–fU sandstone. Up to 5–10% feldspar and lithics (dark mafics and/or iron-oxide flakes) may be present in some sandstone bodies. Iron-oxide stains and concretions up to 20 cm in diameter are occasionally observed in the upper 37 m of the unit. Rare siltstones are gray to dark-greenish gray, slightly calcareous, lenticular, and massive. Sandstones are interbedded with thin siltstones and dark-purplish gray, non-calcareous, massive to ripple-laminated mudstones in the lower 2 m of the unit, suggesting a gradational contact with the underlying Joyita Member of the Los Vallos Formation. Forms prominent cliffs and ledges below slopes of the lower San Andres Formation (Psa). Wilpolt and others (1946) observed that strata in the middle part of the Glorieta are less resistant to erosion in places, giving the unit a double-ledged character. Landscape degradation during the Pleistocene apparently took advantage of these weaker beds with paleo-drainages beveling pediment surfaces on the Glorieta and depositing associated lag gravels (Qxo) in the southwest part of the quadrangle. The Glorieta Sandstone is up to 70 m thick.

Pyv — **Los Vallos Formation of the Yeso Group (Early Permian)**—Interstratified limestone, dolostone, gypsum, mudstone, siltstone, and sandstone. Gypsum is massive to nodular or laminated. Mudstone and siltstone is reddish, massive, and gypsiferous. Sandstone is yellow to red-brown, massive to low-angle planar cross-stratified, and very fine- to fine-grained. Carbonates are massive to laminated or brecciated, fossil-poor, and vuggy. Unit is up to 235 m thick.

UNITS SHOWN ONLY ON CROSS SECTIONS

Permian

Pym — **Meseta Blanca Formation of the Yeso Group (Early Permian)**—Whitish-gray to buff or pinkish-tan to occasionally mottled green, variably indurated to friable, thin- to medium-bedded, tabular, internally massive to low-angle planar or trough cross-stratified, moderately well- to well-sorted, subangular to rounded, vfL–mL sandstone. Unit is approximately 97 m thick.

Pa — **Abo Formation (Late Permian)**—Interbedded darkreddish-brown to pale-red or dark- purplish-brown to maroon siltstone and very fine- to medium-grained sandstone. Unit is approximately 235 m thick.

Pennsylvanian

PPb — **Bursum Formation (Late Pennsylvanian to Early Permian)**—Light-brown sandstone, gray fossiliferous limestone, and minor intraformational (limestone-clast) conglomerate beds. Approximately 76 m thick.

Pa — **Atrasado Formation (Late Pennsylvanian)**—Gray, thin- to thick-bedded, fossiliferous limestone and intervening intervals dominated by greenish-gray to reddish-brown siliciclastic mudstone, siltstone, and calcareous shale. Unit is 180–240 m thick.

Pg — **Gray Mesa Formation (Middle Pennsylvanian)**—Medium- to thick-bedded, fossiliferous, cherty limestone and siliciclastic deposits consisting of mudstone, shale, and sandstone. Unit is approximately 120 m thick (Allen et al., 2014).

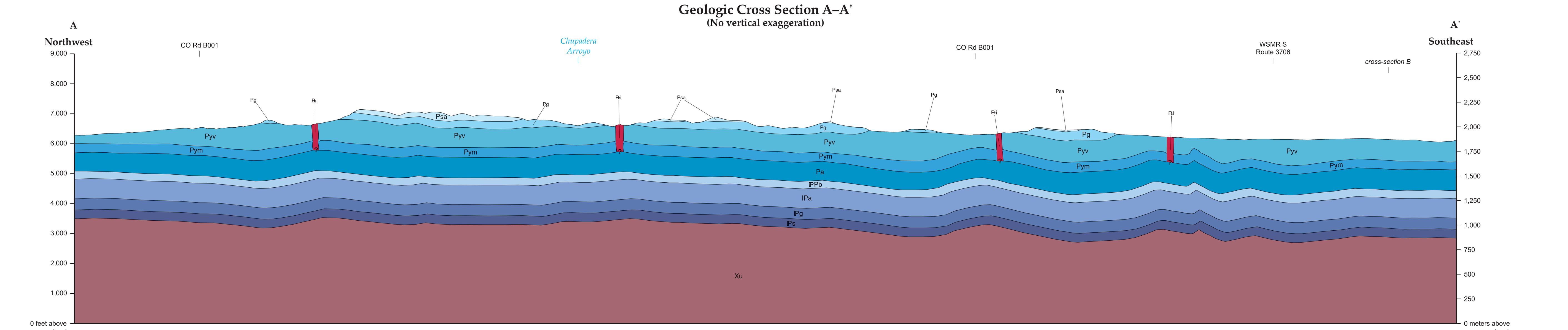
Ps — **Sandia Formation (Middle Pennsylvanian)**—Greenish-gray, reddish-brown, and yellowish mudstone to silty or sandy shale and calcareous shale; yellowish- and reddish-brown, gray, and greenish-gray planar-laminated and cross-stratified sandstone to pebble conglomerate; and gray to brownish-gray fossiliferous limestone and sandy limestone. Unit is approximately 70 m to more than 100 m thick (Allen et al., 2014).

Paleoproterozoic

Xu — **Paleoproterozoic rocks, undivided (Paleoproterozoic)**—Chiefly the lower member of the Sevilleta Metarhyolite, described by Allen et al. (2014) as medium-gray to black, dense, finely banded metarhyolite with minor white mica, oxides, epidote, and biotite. Speckled with 1.0–2.5 mm white feldspar crystals that have been sericitized.

Geologic Cross Section A–A'

(No vertical exaggeration)



Geologic Cross Section B–B'

(No vertical exaggeration)