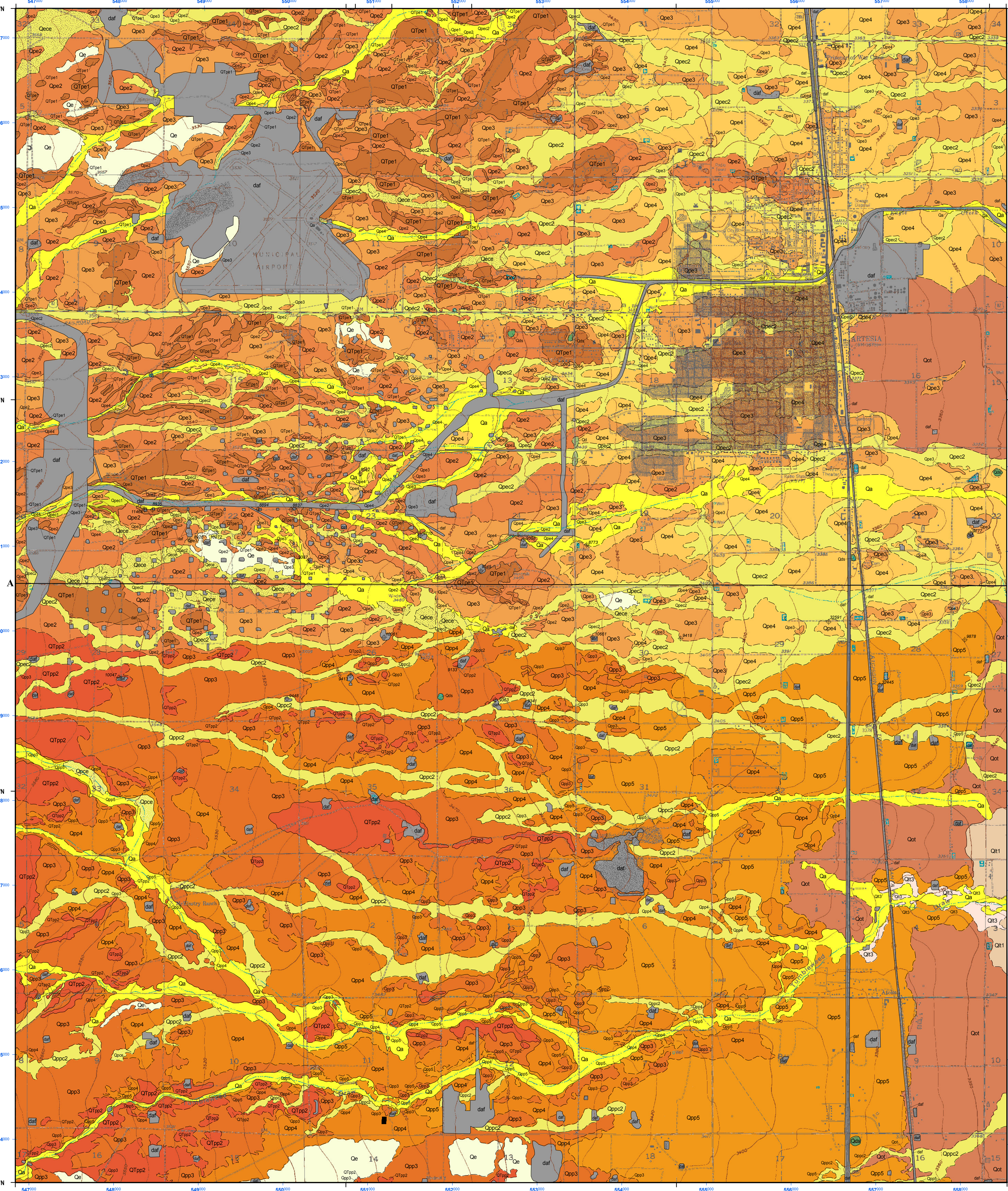

Base map from U.S. Geological Survey 1955, from photographs taken 1946, Topography by planetable surveys 1955.
Polyconic projection, 1927 North American datum, reprojected to UTM projection -- zone 13N
1000-meter Universal Transverse Mercator grid, zone 13, shown in red

QUADRANGLE LOCATION

Magnetic Declination
May, 2009
8° 16' East
At Map Center

1:24,000

1 MILE — 1000 7000 FEET — 1 KILOMETER

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Mapping of this quadrangle was funded by a matching-funds grant from the STATEMAP program of the National Cooperative Geologic Mapping Act, administered by the U. S. Geological Survey, and by the New Mexico Bureau of Geology and Mineral Resources, (Dr. Peter A. Scholle, *Director and State Geologist*, Dr. J. Michael Timmons, *Geologic Mapping Program Manager*).

New Mexico Bureau of Geology and Mineral Resources
Open-file Geologic Map 169

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This and other STATEMAP quadrangles are available for free download in both PDF and ArcGIS formats at:

http://geoinfo.nmt.edu

Geologic map of the Artesia quadrangle, Eddy County, New Mexico.

May 2011

by
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EXPLANATION OF MAP SYMBOLS

A—A' Location of geologic cross section.

Geologic contact. Solid where exposed or known, dashed where approximately known, dotted where concealed or inferred.

Arrows showing mean direction of paleoflow, based upon pebble imbrication, n ≥ 20 each arrow.

Soil pit.

10047 Oil & gas exploration well used in cross section construction.

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map may be based on any of the following: reconnaissance field geologic mapping, compilation of published and unpublished work, and photogeologic interpretation.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 associated with recent development may not be shown.

Cross sections are constructed based upon the interpretations of the author made from geologic mapping, and available geophysical, and subsurface (drillhole) 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 man-made structures.

DESCRIPTION OF MAP UNITS

CENOZOIC

NEOGENE

Alluvium, lacustrine, and anthropogenic deposits

daf **Disturbed land and/or artificial fill (Historic) —** Dumped fill and areas affected by human disturbances, mapped where deposits or extractions are areally extensive. Especially notable are the numerous constructed oil and gas well pads. Also includes the U.S. Bureau of Reclamation's Kaiser Channel of the Pecos River, as well as other straightened reaches.

Qa **Quaternary alluvium, undifferentiated (Historic to uppermost Pleistocene) —** Brown (7.5YR4/2) to light brown (7.5YR6/3), unconsolidated, moderately sorted, pebbly sand, silt, and clay. Contains primarily carbonate gravels and pebbles. Varies considerably in thickness from <1 to 3 m in tributaries and up to 10-12 m in the floodplain.

Pecos Valley alluvial terrace complex

Alluvial terraces of the Pecos River and its tributaries were first described in the classic study of Fiedler and Nye (1933). They recognized 3 terraces: (from lowest to highest) the Lakewood, the Orchard Park, and the Blackdom. On the Artesia quad, much of the higher Eagle Creek and Rio Peñasco piedmont alluvial complex is erroneously mapped by Fiedler and Nye (1933) as Blackdom terrace. These materials, however, are all derived from these western tributaries, not the Pecos River.

Lakewood terrace alluvial deposits (upper to middle Pleistocene) — Following McCraw, *et al.* (2007) and McCraw and Land (2008), three distinct, low-lying (upper to uppermost middle(?) Pleistocene) "Lakewood terraces" are recognized. Fiedler and Nye's original Lakewood terrace, equivalent here to Qlt_1, has an elevation of 6 to 9 m above the floodplain and is located on the eastern edge of the quad. The lowest and youngest, Qlt_3, is <1-2 m above the floodplain and extends up Tumbleweed Draw. These are comprised of occasional gravels and pebbles, brown (10YR5/3) to dark yellowish brown (10YR3/4), unconsolidated, moderately sorted, coarse- to fine- grained sand, silty sand, silt and sandy clay. Pedogenic carbonate increases from stage I to stage II+ (occasionally III) from Qlt_3 to Qlt_1. Mostly non-gypsiferous.

Qlt3 **Youngest Lakewood terrace alluvial deposits (upper Pleistocene)** — Thickness <1 to 1 m.

Qlt1 **Older Lakewood terrace alluvial deposits (upper to middle Pleistocene)** —Thickness ~2 to 9 m.

Qot **Orchard Park terrace alluvial deposits (upper Pliocene (?) to upper Pleistocene)** — According to Fiedler and Nye (1933), the Orchard Park terrace rises 1.5-3 m above the Lakewood terrace and 10.5-20 m above the Pecos floodplain. It is comprised of gravels and pebbles of dolomite, limestone, sandstone, chert, and quartzite in a very pale brown (10YR7/4) to reddish brown (5YR4/4), unconsolidated, moderately sorted, coarse- to fine- grained sand, silty sand, silt, and sandy clay. Pedogenic carbonate is a strong stage III. Thickness ranges from 3 to 15 m.

Rio Peñasco alluvial piedmont complex

Rio Peñasco alluvial piedmont deposits (Upper Pleistocene to Late Miocene(?)) — The headwaters of the Rio Peñasco are located high in the Sacramento Mountains in predominantly carbonate rocks of the San Andres formation (*Psa*) and clastic sediments of the Yeso formation (*Pye*). Where it leaves the Permian highlands, it has built a large piedmont alluvial complex, which coalesces with Eagle Creek to the north and the Seven Rivers to the south. These piedmont deposits grade to and onto the Pecos Valley alluvial terraces on the easternmost edge in the Artesia area. Oldest, highest remnant surfaces (Tpp_1 and $QTpp_2$) are Pliocene or older, and likely graded to a river system which forms Gatuña formation deposits today. Middle to upper Pleistocene piedmont deposits (Qpp_{3-4}) are inset into these and grade to *Qot*. The youngest, Qpp_5, grades to Qlt_3. Several channels (*e.g.,* Tumbleweed Draw) on this piedmont surface were likely former Rio Peñasco channels.

Lithologically, the Rio Peñasco piedmont deposits are distinctly different from those of Eagle Creek to the north and Seven Rivers to the south. While gravels are dominated by limestone clasts, dolomite, chert, yellow-brown sandstone, conglomerate, and quartzite are common. The matrix consists of dark yellowish brown (10YR3/4) to light brown (7.5YR6/3), unconsolidated, moderately sorted, coarse- to fine-grained sand, silty sand, silt, and sandy clay. Stage V-VI pedogenic carbonate can be found in the oldest deposits, while middle to upper Pleistocene deposits range from stage IV to III. Degree of pedogenic carbonate development can be the main distinguishing characteristic between the youngest deposits.

Qpp5 **Youngest Quaternary piedmont alluvium (Holocene to upper Pleistocene)** — Thickness 1 to 3 m.

Qpp4 **Younger Quaternary piedmont alluvium (Upper Pleistocene)** — Thickness 2 to 4 m.

Qpp3 **Old Quaternary piedmont alluvium (Upper to middle Pleistocene)** — Most extensive deposit. Thickness 2 to 4 m.

QTpp2 **Older piedmont alluvium (Middle Pleistocene to late Pliocene)** — Thickness 2 to 6 m.

Contact beneath conglomeratic boulder between $QTpp_2$ and a $Qppc_2$ channel, incised into the old Rio Peñasco piedmont alluvium. The boulder is not *in situ* and its' matrix is actually stage V pedogenic carbonate.

Rio Peñasco piedmont channel deposits (Historic to upper Pleistocene) — Numerous, thin alluvial channels, swales, and occasional coalescing depression fill deposits drain the piedmont alluvial complex. They usually consist of light brown (7.5YR6/4) to pinkish gray (7.5YR6/2), unconsolidated, poorly sorted, fine-grained sand, silt, and clay sediments. They were often mapped primarily by soil moisture increases in lower areas relative to adjacent piedmont deposits noted on photography. Eolian input often mantles the "v-shaped" contours associated with stream channels and in some areas sand sheets and dunes can fill these channels (*Qpce*). On the Rio Peñasco, on the Dayton quad immediately to the south, older channels ($Qppc_1$) are mapped on Qpp_4 surfaces, similar and stratigraphically equivalent to those on Eagle Creek Qpe_3 deposits.

Qppc2 **Young Quaternary piedmont channels (Holocene to upper Pleistocene)** — Thickness <1 to 2 m.

Qpce **Young Quaternary piedmont channels filled with eolian sands, occasionally forming dunes (Holocene to upper Pleistocene)** — Thickness ≤ 1 m.

Eagle Creek alluvial piedmont complex

Eagle Creek alluvial piedmont deposits (Upper to middle Pleistocene) — Eagle Creek (or Eagle Draw further west) heads on the easternmost flank of the southern Sacramento Mountains in San Andres Formation (*Psa*) rocks and flows east to the Pecos River. Where it leaves the Permian highlands, it has built a large piedmont alluvial complex, which coalesces with the Rio Felix to the north and the Rio Peñasco to the south. This piedmont complex grades to and onto the Pecos Valley alluvial terraces. Oldest, highest remnant surfaces are correlative to Quaternary – Tertiary piedmont deposits of the Rio Peñasco ($QTpp_2$). Collectively, these are comprised of gravels that are almost exclusively limestone derived from *Psa*, supported in a matrix of light brown (7.5YR6/3), unconsolidated, moderately sorted, coarse- to fine-grained sand, silty sand, silt (largely calcareous), and sandy clay. Topographic expression between the youngest deposits are often to subtle to practically non-existent. Distinction is often based upon a stronger developed pedogenic carbonate (Qpe_3 = stage III – II+; Qpe_4 = stage II). Qpe_4 grades to Qlt_3.

Qpe4 **Youngest Quaternary piedmont alluvium (Holocene to upper Pleistocene)** — Thickness 1 to 3 m.

Qpe3 **Younger Quaternary piedmont alluvium (Upper Pleistocene)** — Thickness 2 to 4 m.

Qpe2 **Older Quaternary piedmont alluvium (Upper to middle Pleistocene)** — Most extensive deposit. Thickness 2 to 4 m.

QTpe1 **Oldest piedmont alluvium (Middle Pleistocene to late Pliocene)** — Thickness 2 to 6 m.

Eagle Creek piedmont channel deposits (Historic to upper Pleistocene) — Up until the mid 20th Century, prior to channelization through town, Eagle Creek flowed primarily south of the town of Artesia. These abandoned channels (2-3 m thick) are now similar to the numerous, thin alluvial channels, swales, and occasional coalescing depression fill deposits that only drain the local piedmont alluvial complex. These channels usually consist of light brown (7.5YR6/4) to pinkish gray (7.5YR6/2), unconsolidated, poorly sorted, fine-grained sand, silt, and clay sediments. They were often mapped primarily by soil moisture increases in lower areas relative to adjacent piedmont deposits noted on photography. Eolian input often mantles the "v-shaped" contours associated with stream channels and in some areas sand sheets and dunes can fill these channels (*Qece*). Older channels ($Qpec_1$) are mapped on Qpe_3 surfaces above modern Eagle Creek in the vicinity of the Eagle Creek retaining dam on the northwestern edge of the quad.

Qpec2 **Young Quaternary piedmont channels (Holocene to upper Pleistocene)** — Thickness <1 to 2 m.

Qpec1 **Older Quaternary piedmont channels (Upper Pleistocene)** — Thickness <1 to 2 m.

Qece **Young Quaternary piedmont channels filled with eolian sands, occasionally forming dunes (Holocene to upper Pleistocene)** — Thickness ≤ 1 m.

Quaternary depression fill and sinkhole deposits

Qd **Quaternary depression fill, undifferentiated (Holocene to middle Pleistocene)** — Unconsolidated, well-sorted, fine-grained (fine sands to clay) complexes of alluvial, colluvial, eolian, and occasional lacustrine deposits within closed depressions. Colors variable. Depressions are created by either gradual subsidence or sudden collapse followed by gradual subsidence of underlying gypsiferous carbonate terrane. These complexes are often significantly modified by stream erosion and deposition, playa deposition, deflation, and mass wasting. Depression fills have been active since the middle Pleistocene and are usually 1-3 m thick but can reach thicknesses in excess of 30 m.

Qds **Quaternary sinkhole deposits, primarily caused by collapse (Historic to middle Pleistocene)** — Complexes of unconsolidated, well- to poorly-sorted, coarse- to fine-grained sands to clay, alluvial, colluvial, eolian, and occasional lacustrine deposits within closed depressions. Colors variable. Thickness <1 to 3 m.

PALEOZOIC

Permian Artesia Group

Pqg **Queen and Grayburg formations, undifferentiated** (Guadelupian) — Cross section only.

Lower Permian Formations

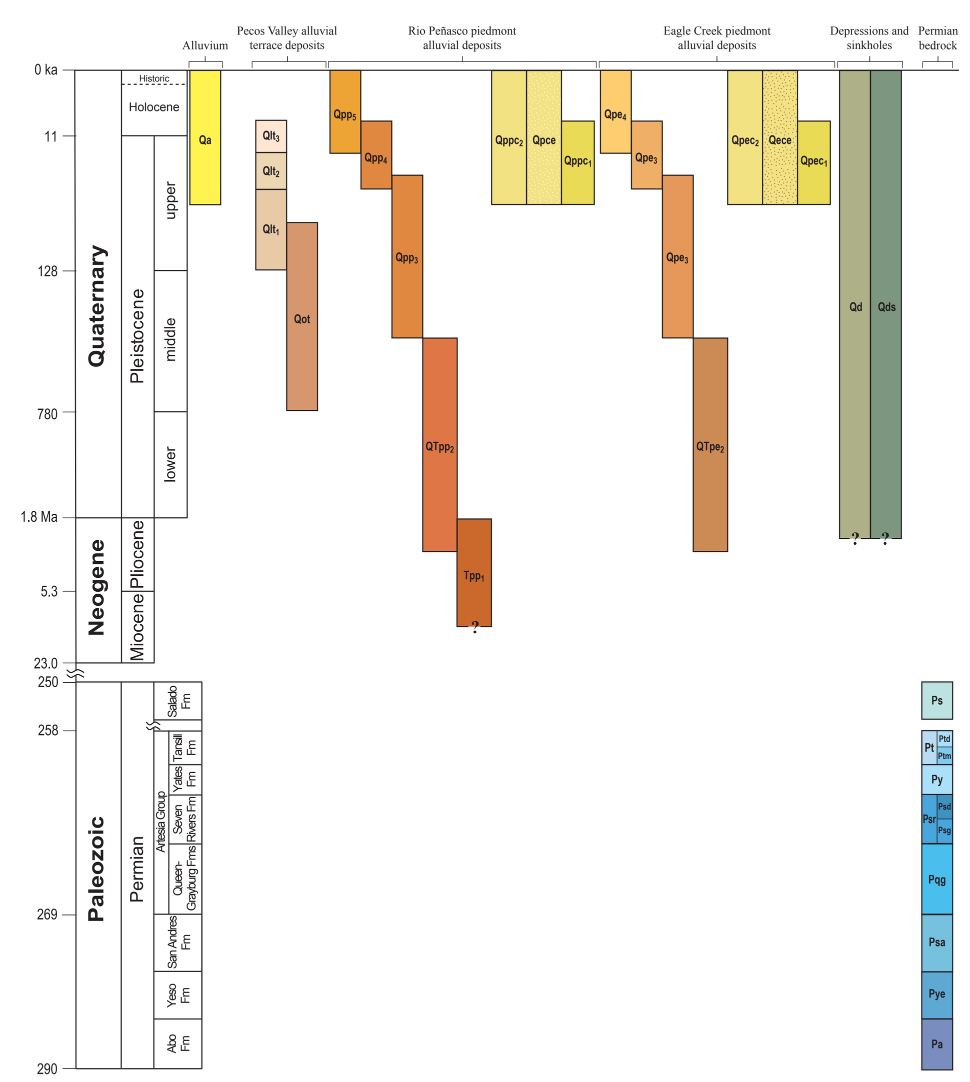
Psa **San Andres formation** — Cross section only.

Pg **Glorieta sandstone tongue** — Cross section only.

Pye **Yeso formation, undifferentiated** — Cross section only.

Pa **Abo formation, undifferentiated** — Cross section only.

CORRELATION OF MAP UNITS



View looking north-northwest with Tumbleweed Draw in the foreground (*Qa*). Younger Rio Peñasco piedmont deposits (Qpp_4) below the storage tank are inset into old piedmont deposits (Qpp_3). The hill on the distant skyline is $QTpp_2$.

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GEOLOGIC CROSS SECTION