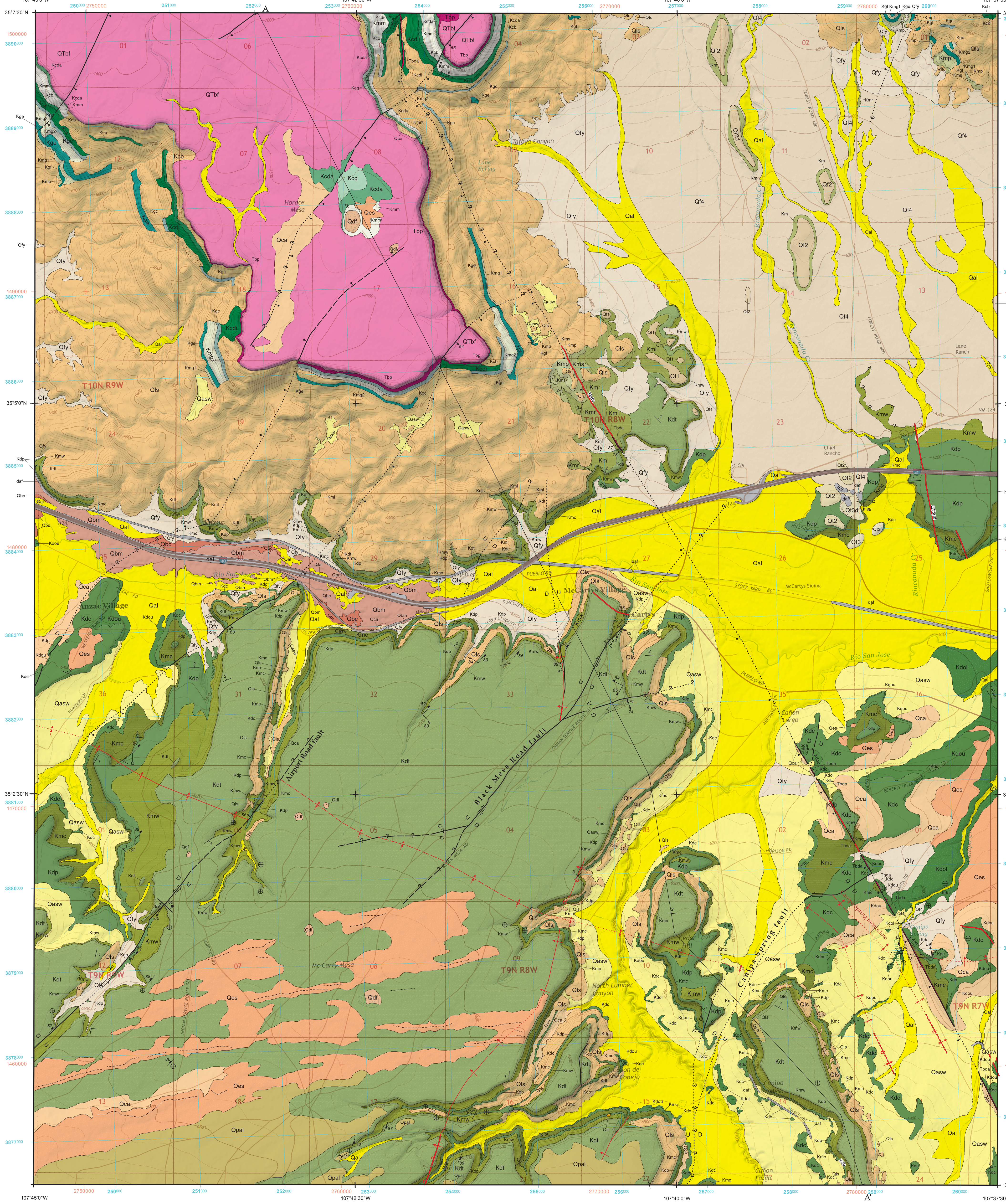


1:24,000

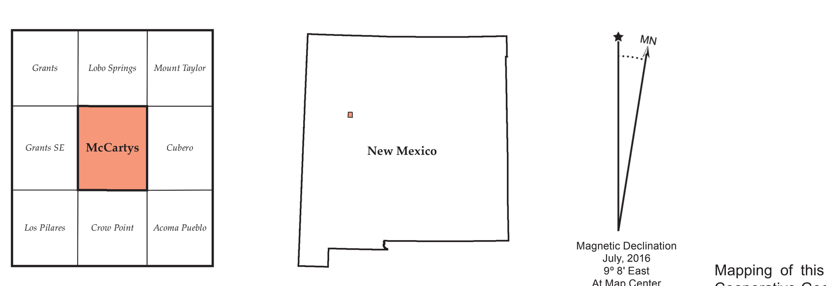
Base map from U.S. Geological Survey 2013.
North American Datum of 1983 (NAD83) World Geodetic System of 1984 (WGS84).
Projection and 1000-meter grid: Universal Transverse Mercator, Zone 13S, shown in blue.
10,000-foot ticks: New Mexico Coordinate System of 1983(west zone), shown in red.

Roads .... ©2006-2010 Tele Atlas
Names .... GNIS, 2008
Hydrography .... National Hydrography Dataset, 2005
Contours .... National Elevation Dataset, 2000

1 0.5 0 1 Mile
1000 0 1000 2000 3000 4000 5000 6000 7000 Feet
1 0.5 0 1 Kilometer

Contour Interval 20 Feet
North American Vertical Datum of 1988

Magnetic Declination
July, 2016
9° 8' East
At Map Center



Quadrangle Location

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
801 Leroy Place
Socorro, New Mexico
87801-4796

[575] 835-5490

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

http://geoinfo.nmt.edu

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 265

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Geologic Map of the McCartys 7.5-Minute Quadrangle, Cibola County, New Mexico

June, 2017

by
Colin T. Cikoski[1], Paul G. Drakos[2], and James Riesterer[2]

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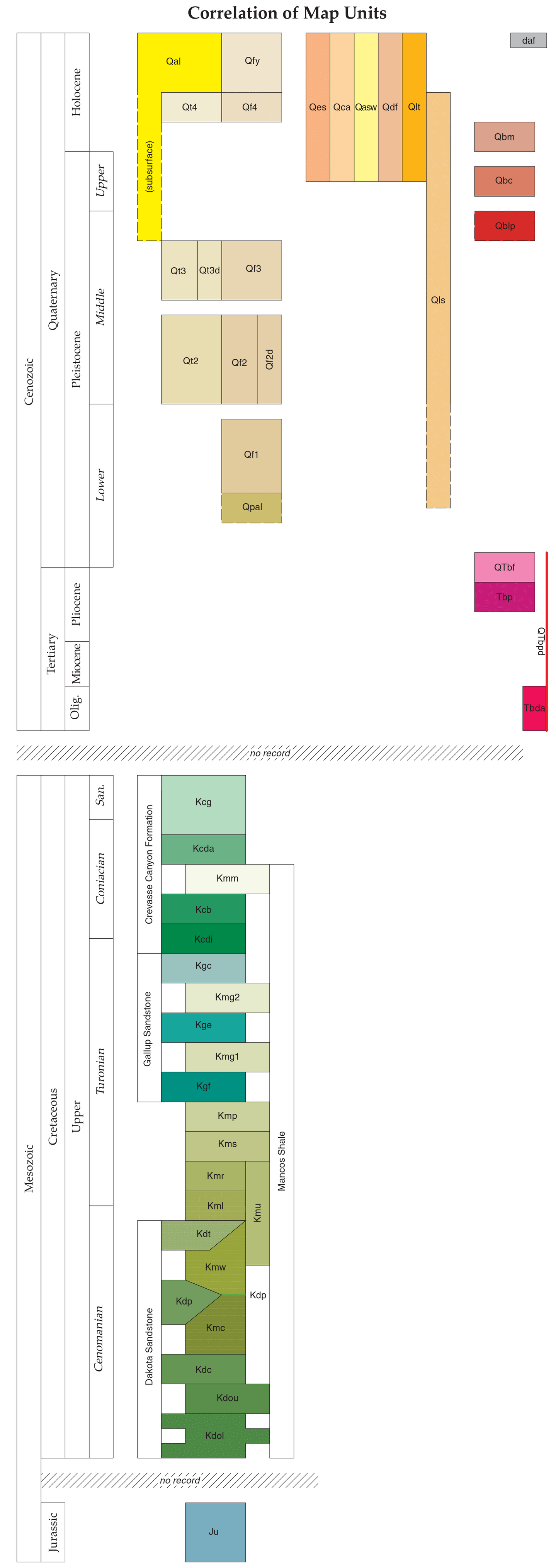
Comments to Map Users

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map may be based on any of the following: reconnaissance field geologic mapping, compilation of published and unpublished work, and photogeologic interpretation.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 (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.

The New Mexico Bureau of Geology and Mineral Resources created the Open-file Geologic Map Series to expedite dissemination of these geologic maps and map data to the public as rapidly as possible while allowing for map revision as geologists continued to work in map areas. Each map sheet carries the original date of publication below the map as well as the latest revision date in the upper right corner. In most cases, the original date of publication coincides with the date of the map product delivered to the National Cooperative Geologic Mapping Program (NCGMP) as part of New Mexico's STATEMAP agreement. While maps are produced, maintained, and updated in an ArcGIS geodatabase, at the time of the STATEMAP deliverable, each map goes through cartographic production and internal review prior to uploading to the Internet. Even if additional updates are carried out on the ArcGIS map data files, citations to these maps should reflect this original publication date and the original authors listed. The views and conclusions contained in these map documents are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the State of New Mexico, or the U.S. Government.

Correlation of Map Units



Explanation of Map Symbols

Contact—Identity and existence are certain; questionable where queried. Location is accurate were solid, approximate where dashed, and concealed where dotted.

Contact used where Kdp is too thin to map as a polygon

Buttress unconformity-Identity certain; location is accurate were solid and approximate where dashed.

Generic fault-Identity and existence are certain; questionable where queried. Location is accurate were solid, approximate where dashed, and concealed where dotted.

Normal fault-Identity and existence are certain; questionable where queried. Location is accurate were solid, approximate where dashed, and concealed where dotted.

Listric normal fault-This symbol used here to denote the landslide detachment plane.

Strike and dip of a depositional contact

Dip-slip sense of offset across a fault; "D" on downthrown block; "U" on upthrown block.

Dextral strike-slip sense of offset across a fault

Sinistral strike-slip sense of offset across a fault

Strike and dip of a fault plane

Trend and plunge of fault striations

Strike and dip of a minor normal fault plane

Monocline-Identity and existence are certain; questionable where queried. Location is accurate were solid, approximate where dashed, and concealed where dotted.

Anticlinal bend of a monocline-Identity and existence are certain; questionable where queried. Location is accurate were solid, approximate where dashed, and concealed where dotted.

Synclinal bend of a monocline-Identity and existence are certain; questionable where queried. Location is accurate were solid and concealed where dotted.

Crest of eolian dune

Dikes-Unit label when present denotes specific composition dikes.

Cross section line

Horizontal bedding

Strike and dip of bedding

Inclined joint that is continuous across outcrops-Showing strike and dip.

Inclined joints (dip direction to the right) for multiple observations at one locality that are continuous across outcrops-Showing strike and dip.

Inclined joints (dip direction to the left) for multiple observations at one locality that are continuous across outcrops-Showing strike and dip.

Inclined joint that is discontinuous across outcrops-Showing strike and dip.

Inclined joints (dip direction to the right) for multiple observations at one locality that are discontinuous across outcrops-Showing strike and dip.

Inclined joints (dip direction to the left) for multiple observations at one locality that are discontinuous across outcrops-Showing strie and dip.

Vertical or near-vertical joint that is discontinuous across outcrops-Showing strike and dip.

Description of Map Units

Anthropogenic Deposits

daf **Disturbed ground and artificial fill**—Gravel, sand, and mud associated with anthropogenic activities. Included in the unit are compacted fill beneath roads, railroads, and dams and uncompacted spoil piles from gravel pit operations. Mapped on quadrangle only where deposit obscures underlying geology or is thick enough to show in topography. 0 to perhaps 10 m thick.

Eolian and Colluvial Deposits

Qca **Talus and colluvium**—Poorly sorted gravels, sands, and muds transported by unconfined alluvial and mass wasting processes. Map unit includes fine-grained eolian sand locally blanketing colluvial deposits. Only mapped where extensive or concealing geologic relations. Thickness is 0 to perhaps 10 m.

Qls **Landslide terrain**—Variably coherent slide blocks and associated poorly sorted gravels, sands, and muds. Blocks usually show evidence of both translational and rotational transport. Map unit includes associated alluvium, colluvium, and eolian material. Thickness is 0 to as much as 60 m.

Qes **Eolian material**—Very fine- to fine-grained eolian sands. Well-sorted, rounded- to subrounded-grains of dominantly quartz. Weak to no soil development. Includes lesser associated slope wash deposits reworked from the eolian sands. Deposit thickness likely no more than 2 m.

Qdf **Depression fill**—Very fine- to fine-grained sands and muds accumulating in closed depressions. The unit occurs mainly atop Horace Mesa. Poorly sorted deposits transported by slopewash and eolian processes, consisting dominantly of siliceous grains. Deposit thicknesses are likely no more than 1 m.

Alluvial Deposits

Qasw **Slopewash alluvium**—Colluvial, eolian, and alluvial deposits of fine sand and silt with scattered gravel lenses. Deposits are found mantling slopes below mesas, accumulated behind large landslide blocks, and on hillslopes. Unconsolidated to locally carbonate cemented. Deposit thicknesses are as much as 6 m.

Qal **Alluvium**—Deposits of sand, silt, and gravel in valley bottoms. Upper 5 to 10 m of Qal deposits are Middle to Late Holocene in age; older buried alluvial deposits in Rio San Jose valley are Pleistocene in age. Alluvium is typically fine-grained, silt and sand with pebble- and cobble-gravel lenses and interbedded colluvium in tributary drainages. Deposits are characterized by weakly developed soils with 10YR-7.5YR color (reflecting varying parent material), none to Stage I carbonate morphology and a lack of Bt horizon development. Thickness is approximately 10 m in tributary drainages, and 30 to 50 m along the Rio San Jose valley (thickness includes intercalated basalt flows). Map unit includes local outcrops of the **Qbm** and **Qbc** basalt flows at the surface.

Terrace Deposits

Qt4 **Deposits underlying Qt4 terrace surfaces**—Thin deposits of silty fine to very fine sand overlying weathered Cretaceous bedrock. Deposits exhibit minimal soil development, with 7.5 YR 4/4 color, and overlies a bedrock strath 7 to 9 m above Canipa Spring Creek. Underlying bedrock is extensively weathered Cretaceous sandstone that is difficult to distinguish from the terrace deposit. The unit only occurs immediately downstream of Canipa Spring; upstream, the creek bed rises sharply to about the elevation of the terrace. Deposits are <1 m thick.

Qt3 **Deposits underlying Qt3 terrace surfaces**—Deposits of sandy pebble- to boulder-size gravel composed of rounded to subrounded basalt, sandstone, rhyolite, minor chert and quartzite clasts underlying small eroded remnants of terrace surfaces located approximately 15 to 20 m above the Rio San Jose valley floor or local base level. The boulder-size fraction of deposits are primarily basalt in composition. Carbonate-coated clasts observed weathering out of deposit approximately 1 to 2 m below the terrace tread. Deposits are about 8 m thick. Suffix "d" indicates a deposit disturbed by gravel pit operations.

Qt2 **Deposits underlying Qt2 terrace surfaces**—Deposits of sandy pebble- to boulder-size gravel underlying strath terrace surfaces located approximately 40 to 50 m above the Rio San Jose valley floor or local base level. Clast composition is predominantly basalt with lesser intermediate and felsic volcanics and scattered sandstone, quartzite, chert, and rare limestone clasts. Surface soils are typically eroded; however, soils with Stage IV carbonate and overlying Bt horizons with 5YR 4/4 color are locally preserved. Deposit thickness is approximately 6.5 m thick, with local channel-fill deposits being 10 m or more.

Fan Deposits

Qfy **Younger alluvial fans**—Typically fan-shaped deposits of sand, silt, clay, and gravel up to boulder size emanating from tributary drainages. Deposits are characterized by weakly developed soils with 10YR-7.5YR color (reflecting varying parent material), none to Stage I carbonate morphology and a lack of Bt horizon development. Deposits thicknesses are <5 m to 10 m or more. Grades into alluvial deposits of major drainages down-gradient.

Qf4 **Deposits underlying Qf4 fan surfaces**—Part of a fan complex at the mouths of Rinconada, Water, Timber, and Castillo Canyons; **Qf4** surfaces form part of the modern piedmont. Deposits are typically interbedded fine to medium sand and imbricated cobble- to boulder-size gravel, with individual gravel beds 0.25 to 3 m thick. **Qf4** deposits typically include buried soils. **Qf4** soils are characterized by cambic (Bw) or weakly-developed carbonate (Bk) horizons, with maximum Stage I+ carbonate morphology, locally including buried Bw or Bk horizons. **Qf4** surfaces are generally 3 to 6 m above the incised Rinconada Creek. The base of deposit is poorly exposed; total thickness is 2 to 10 m or more. Correlative to map unit **Qafy** along Rinconada Creek on the Lobo Springs quadrangle to the north.

Qf3 **Deposits underlying Qf3 fan surfaces**—Part of a fan complex at the mouths of Rinconada, Water, Timber, Castillo, Seco, and San Jose Canyons; **Qf3** surfaces form part of the modern piedmont. Deposits of sandy pebble to boulder gravel of mixed volcanic lithologies and subordinate sandstone clasts. The map unit is limited to a small **Qf3** surface west of Rinconada Creek, with a tread 1.5 m above adjacent **Qf4** surfaces, or about 5 m above local base level. Based on observations from the adjacent Cubero quadrangle, soils are partially eroded, but exhibit carbonate horizons with Stage II to III morphology and Bt horizons with 5YR to 7.5YR color. The base of deposits poorly exposed; thicknesses are greater than 3 m.

Qf2 **Deposits underlying Qf2 fan surfaces**—Deposits of rounded to subangular, sandy pebble to boulder gravel with silty medium sand interbeds, underlying remnant **Qf2** fan surfaces along upper Rinconada Creek. Surfaces are 12 to 15 m above local base level, with soils that are partially stripped; however, preserved surface soils have carbonate horizons with Stage I+ morphology. Truncated discontinuously preserved buried soil approximately 2.4 m below the fan surface exhibits 5YR 5/3 color. Deposits are 7 to 10 m thick. Suffix "d" indicates a deposit disturbed by gravel pit operations.

Qf1 **Deposits underlying Qf1 fan surfaces**—Deposits of predominantly angular to subangular, poorly sorted, pebble-boulder (mostly pebble-cobble) gravel underlying remnant **Qf1** fan surfaces west of Rinconada Creek. Surfaces are 30 to 35 m above local base level, with stripped surface soils; however, clasts eroding from the deposit exhibit continuous carbonate coatings on one or more sides. Clasts are >90% basalt, both vesicular and aphanitic, with minor andesite and rare sandstone. Deposits are approximately 13 m thick.

Qpal **Undivided high-level alluvium**—Pebbly-cobbly sands on McCartys mesa and isolated sandy-gravel deposits on Canipa Mesa. Sands are commonly quartz and lithics, gravel composition is variable: on Canipa Mesa, gravel is dominantly (80%) sandstone with subordinate basalt and minor limestone; on McCarty Mesa, gravel consists mainly of basalts, but with a clast suite of chert, quartzite, granite, and sandstone pebbles and cobbles (plus rare petrified wood) at the base; upsection transition between these clast suites is gradational. Surface soils are unexposed; however, clasts weathering out of deposits commonly exhibit continuous carbonate coatings. Colors of 10YR 5/4 measured. Deposit bases are poorly exposed, but thicknesses are likely 4 to 8 m.

Spring Deposits

Qlt **Conejo Spring Calcareous Tufa**—Porous limestone and carbonate-cemented sand with casts of roots, grasses, reeds, and other plant matter, with thin (<0.5 cm thick) flowstone layers. Weathered surfaces are pale yellow (2.5Y 7/4) to light-yellowish brown; fresh surfaces are light-brownish-gray (2.5Y 6/2). Exposed in the immediate vicinity of Conejo Spring, cropping out roughly 10 m NW of the spring and extending for approximately 30 m to the west. Thickness is less than 2 m.

Zuni-Bandera Volcanic Field

Qbm **McCartys flow**—Dark-gray, variably porphyritic basalt. Phenocrysts are fine (<1 mm across), subhedral, vary from trace to minor (<1 to 20% of faces), and consist principally of olivine and pyroxene with rare plagioclase. Basalt surface is largely unvegetated and exposed, with primary flow features preserved. Age estimates range from 2.4 to 3.9 ka (Laughlin et al., 1994; Dunbar and Phillips, 2004). Thickness is about 0 to 6 m.

Qbc **El Calderon flow**—Dark-gray to black, principally fine-grained basalt. Phenocrysts are rare (up to 5% of faces) and consist mainly of subhedral pyroxene and lesser anhedral olivine, both <0.5 mm across in size. Basalt surface is largely concealed by the vegetated eolian material. Age estimates range from 34 to 130 ka (Laughlin and Wolde-Gabriel, 1997; Cascadden et al., 1997; Dunbar and Phillips, 2004). Thickness is about 0 to 7 m.

Qblp **Laguna Pueblo flow**—Cross section only. Buried basalt is noted in numerous wells along the Rio San Jose valley (e.g., Risser and Lyford, 1983, 1984; Channer et al., 2015). Within the quadrangle, this basalt is inferred to be the Laguna Pueblo flow, based on 40Ar/39Ar age dating of basalts by Channer et al., that suggest this flow is continuous in the subsurface from the Zuni-Bandera field to the west through to the town of Laguna to the east. Channer et al., reported ages of 322 ± 11 ka and 325 ± 43 ka for this flow. Thickness is about 7 to 15 m.

Mount Taylor Volcanic Field

QTbf **Fine-grained basalt**—Medium-gray, weathering brownish-gray and black, generally fine-grained basalt. Trace phenocrysts consist of medium to coarse (mainly 1-5 mm across, max 1.5cm across), anhedral plagioclase and pyroxene. Basalt is moderately well flow foliated. Thickness is about 15 to 30 m.

Tbp **Older porphyritic basalts**—Medium-gray, weathering brownish-gray and black, plagioclase-pyroxene porphyry basalt. Phenocrysts are 20 to 25% of faces and consist of nearly subequal medium to coarse (mostly <3 mm long lathes, max 1 cm long), subhedral plagioclase and coarse (mostly <6 mm across, max 1.5 cm across), anhedral pyroxene. Flow is weakly flow foliated to massive. Map unit usually consists of a single ledge-forming flow, but locally consists of two flows separated by a rubble-covered slope. Basalt flows locally overlie a 30 to 40 cm thick pink (7.5YR 7/3-7/4 measured) basaltic pyroclastic sequence. Age estimates range from 3.2 to 2.7 Ma (Laughlin et al., 1993; Channer et al., 2015). The unit is 0 to 40 m thick.

Intrusive Rocks

QTbpd **Porphyritic basaltic dikes**—Medium gray, weathering to brownish-gray, porphyritic basaltic dikes. Phenocrysts are a minor constituent (up to 15% of faces) and consist of subhedral to euhedral plagioclase and anhedral pyroxene with trace olivine. Widths up to 1.5 m.

Tbda **Acomita dike of Laughlin et al. (1983)**—Dark-gray, weathering to dark-grayish-brown, principally fine-grained, basaltic dike. Rare phenocrysts consist of subhedral plagioclase and lesser anhedral to subhedral pyroxene. Trace outsized phenocrysts (xenocrysts?) of anhedral, rounded plagioclase up to 1 cm across are also present. Where thin, a subvertical foliation parallel to the dike walls is common; where thick, columnar jointing perpendicular to dike walls is common. Dike locally extends as thin sills into surrounding shale units. K-Ar age estimate of 30.7 ± 1.4 Ma (Aldrich et al., 1986). Width is commonly 0 to 6 m, locally as much as 10 m wide.

Mancos Shale

Kmm **Mulatto Shale Tongue**—Dark-gray to tan, thinly laminated, very poorly exposed, muddy sandstones and shales. Sandstones consist of very fine-grains of dominantly quartz with minor clayey mud grains and rare lithics in thin, tabular beds. Thickness is poorly constrained due to poor exposure; approximately 60 to 70 m thick.

Kmg2 **Upper Gallup-intercalated tongue**—Dark-gray to grayish-brown, gypsiferous, thinly laminated, very poorly exposed shales, sandy shales, and muddy sandstones between the "E" and "C" tongues of the Gallup Sandstone. Sand grains are very fine to locally fine and dominantly of quartz with trace feldspars and lithics. Sharp basal contact. Thickness is approximately 30 to 40 m.

Kmg1 **Lower Gallup-intercalated tongue**—Dark-gray to grayish-brown, gypsiferous, thinly laminated, very poorly exposed shales and rare sandy shales between the "F" and "E" tongues of the Gallup Sandstone. Sand grains are very fine and consist dominantly of quartz. Sharp basal contact. Thickness is approximately 25 to 35 m.

Kmp **Pescado Tongue**—Gypsiferous shales and rare sandy shales above the Semilla Sandstone Member and below the "F" tongue of the Gallup Sandstone. Dominantly wavy laminated, fissile shales. Includes sparse discontinuous sparry gypsum beds up to 10 cm thick. The thickness of the interval is approximately 20 to 30 m.

Kms **Semilla Sandstone Member**—Interbedded, light-gray to pale-brown concretionary shales and muddy, very fine sandstones. Sandstones are thinly lenticular or non-planar tabular bedded, and commonly cross-laminated. The color of 2.5Y 7/2 is measured. Bed thicknesses and lateral extents increase upsection. Interbedded shales are marked by light-brown calcitic concretions up to 70 cm in diameter. Interval is 25 to 30 m thick.

Kmu **Mancos Shale along Rinconada Creek, undivided**—Dark-gray to tan, thinly laminated, gypsiferous, very poorly exposed shales, and lesser sandstones. Includes equivalents of the Whitewater Arroyo, Bridge Creek Limestone, and Rio Salado Members of the Mancos Shale, and potentially thin equivalents of the Twowells Tongue of the Dakota Sandstone. Thickness is as much as 95 m.

Kmr **Rio Salado Tongue**—Gypsiferous shales and rare sandy shales above the Bridge Creek Limestone beds and below the Semilla Sandstone Member. Dominantly wavy laminated, fissile shales. Includes sparse discontinuous sparry gypsum beds up to 10 cm thick. The thickness of interval is approximately 40 to 50 m.

Kml **Bridge Creek Limestone beds**—Interbedded dark- to medium-gray (weathering to a distinctive pale-yellowish-brown) shales, limy shales, and fine-grained, carbonate grainstones and packstones. Fresh color of 10YR 4/1 measured, weathered colors of 2.5Y 7/1 and 8/2-8/3 measured. Shales are thinly wavy laminated and poorly exposed. Limy shales and carbonates are thin to medium bedded, massive to internally laminated, contain local carbonate nodules, and form ledges in outcrop and flaggy plates on residuum slopes. Limestone grains are up to about 0.25 mm in diameter. Sharp basal contact. Thickness is approximately 10 to 17 m.

Kmw **Whitewater Arroyo Shale Tongue**—Dark-gray, well-laminated, very poorly exposed shales and lesser siltstones. Sharp basal contact. Thickness is approximately 20 to 33 m.

Kmc **Clay Mesa Shale Tongue**—Dark- to medium-gray, well-laminated, very poorly exposed shales. Sharp basal contact. Thickness is approximately 15 to 20 m.

Crevasse Canyon Formation

Kcg **Gibson Member**—Interbedded siltstones, shales, sandstones, and local coal seams. Siltstones and shales are brown to gray to black and poorly exposed. Sandstones are pale brown to greenish gray and consist of fine- to medium-grains of dominantly quartz with rare lithics and trace clay in commonly cross-stratified thin beds. Coal beds are <0.5 m thick. Top not preserved on quadrangle; preserved thickness of about 5 to 10 m.

Kcda **Dalton Sandstone**—White to pale-brown sandstones. Sandstones are variably silty and consist of fine- to medium-grains of dominantly quartz with rare lithics and feldspars and trace clay in commonly cross-stratified thin to thick beds. Thickness is about 15 to 20 m.

Kcb **Borrego Pass Lentil**—White to very pale-brown sandstones and minor pebbly sandstones. Sandstones consist mainly of moderately to poorly sorted, very fine- to medium-grains of dominantly quartz with minor feldspars, rare siliceous lithics, and trace, black ferromagnesian lithics in commonly cross-stratified, medium-thickness, planar-tabular and lenticular beds. The colors of 2.5Y-10YR 8/3 are measured. Pebbly sandstones consist of poorly sorted, fine sands to pebbles; very coarse sands to pebbles are dominantly subrounded-rounded quartzites, lesser milky-white to pink cherts, and trace quartz sandstones; fine to coarse sands are like those in finer beds. Pebbly sandstones are in cross-stratified thin to medium lenticular beds. Thickness is approximately 20 to 25 m.

Kcdi **Dilco Member**—Interbedded siltstones, shales, sandstones, and local coal seams. Siltstones and shales are gray to light brown, or dark gray to black where carbonaceous, thinly planar laminated, and poorly exposed. Sandstones are pale brown to pale gray and consist of moderately to poorly sorted very fine- to fine-grains of dominantly quartz with rare feldspars, siliceous lithics, and black ferromagnesian lithics in thin to medium, planar and non-planar tabular beds that are variably massive or cross-stratified. Sandstone intervals are 1 to 1.5 m thick. Maxwell (1977) reports coal seams and carbonaceous shale intervals are as much as 1.5 m thick. Sharp basal contact. Unit thickness is about 35 to 45 m.

Gallup Sandstone

Kgc **"C" tongue**—White to pale-brown sandstones. Sandstones consist of moderately-well-sorted, very fine- to medium-grains of dominantly quartz with minor siliceous lithics and trace feldspars and black ferromagnesian lithics in medium to thick, planar and non-planar tabular beds that are variably cross-bedded and massive. Colors of 10YR8/1-8/2 and 2.5Y 8/2 measured. Local lenticular beds and muds in the uppermost 2 m, locally muddy in the lowermost beds. Maxwell (1977) reports ironstone concretions and shale partings in top 1 m. Gradational lower contact. Thickness is approximately 18 to 22 m.

Kge **"E" tongue**—White to pale-brown to locally brown sandstones in two coarsening-upwards intervals. Each sandstone interval coarsens upsection from very fine- to medium-grained, generally moderately well sorted throughout, and consist dominantly of quartz with minor to trace siliceous lithics and trace feldspars, black ferromagnesian lithics, clays, and muscovite, in thin to medium, planar and non-planar, to wavy-tabular beds. Colors of 2.5Y 9.5/1, 8/2-8/3, and 7/3-7/4 and 10YR 7/3-7/4 measured. In each coarsening upwards sequence, beds grade upsection from commonly massive with indistinct bedding and trace burrow structures to well-expressed bedding with common cross-stratification. Local well-indurated, (with calcitic cement) weathering to brown (7.5YR 4/3 and 5/4 measured), lenticular cross-stratified beds occurring at the top of each sequence. Minor silts and clays in lowest beds of each sequence. The lower sequence about 7 to 14 m thick, the upper sequence about 10 to 16 m thick.

Kgf **"F" tongue**—Pale-brown to locally white and pinkish-gray sandstones. Sandstones coarsen upsection from very fine- to fine-grained, generally all are moderately-well-sorted and consist dominantly of quartz with rare siliceous lithics, rare to absent clays, and trace feldspars and black ferromagnesian lithics in thin to medium, planar and non-planar tabular beds that are typically massive at the base and cross-stratified at the top. Gradational lower contact. Thickness is about 10 to 20 m.

Dakota Sandstone

Kdt **Twowells Sandstone Tongue**—Pale-yellowish or brownish-gray sandstones. Sandstones coarsen upsection from poorly sorted, muddy, and very fine-grained to moderately sorted, mud-poor, and fine- to locally medium-grained, and consist dominantly of quartz with minor siliceous lithics and trace feldspars and black ferromagnesian lithics in planar and non-planar tabular, massive or cross-stratified medium beds. Uppermost 2 m are generally thinly bedded with prominent cross-stratification. Bedding-parallel burrow structures are locally abundant. Gradational lower contact. May pinch out beneath the Rinconada Creek-area piedmont. Thickness is <5 to 25 m.

Kdp **Paguate Sandstone Tongue**—Pale-gray to light-brown sandstones and siltstones. Siltstones grade upsection into Sandstones; sandstones consist of moderately sorted, very fine- to fine-grains of dominantly quartz with rare to trace siliceous lithics, feldspars, and ferromagnesian lithics in thin to medium, tabular, planar-, wavy-, or wedge-shaped beds with local internal planar or cross-stratification. The colors of 10YR 8/1 and 2.5Y 7/3 are measured. Local vertical burrow structures, local medium-grained lenses. Unit thins to a single bed in the southeast of the quadrangle. Gradational lower contact. Thickness is approximately <1 to 14 m.

Kdc **Cubero Sandstone Tongue**—Pale-gray to very pale-brown to yellow sandstones. Sandstones coarsen upsection from poorly sorted, muddy, and very fine-grained to moderately sorted, mud-poor, and fine-grained, and consist dominantly of quartz with rare siliceous lithics and trace feldspars and black ferromagnesian lithics. Beds vary from thin, massive, and tabular with local burrow structures to thin to medium, tabular, and planar- to wavy- to wedge-shaped with internal planar or cross-laminae. Colors 10YR 7/4 to 7/6 measured. Locally fossiliferous, with fossils concentrated in brown-weathering calcitic concretions. Gradational lower contact. Up to 8 m thick.

Kdou **Upper Oak Canyon Member**—Gray, thinly laminated, poorly exposed shales and lesser light-gray, thinly bedded, fossiliferous limestone lenses. Sharp basal contact. Thickness is approximately 10 to 12m.

Kdol **Lower Oak Canyon Member**—Interbedded white to very pale-brown sandstones and lesser gray shales and siltstones. Sandstones consist dominantly of very fine- to medium-grains of quartz with rare siliceous lithics and trace feldspars and black ferromagnesian lithics in thin to medium, planar and non-planar tabular and locally lenticular beds with common cross-stratification. Colors of 10YR 8/1-8.5/1 and 7.5YR 8/2 measured. Shales are thinly laminated gray to pale-yellowish-brown and typically grade upsection into sandstones. Thickness is approximately 15 to 20 m.

Jurassic System

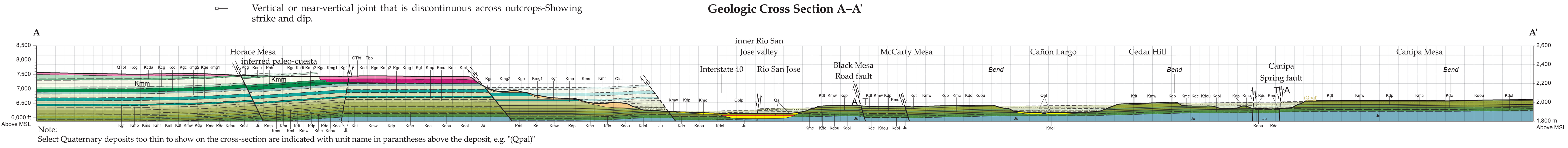
Ju **Jurassic rocks, undivided**—Cross-section only. Dominantly sandstones with subordinate mudstones, with trace pebbly sandstones and limestones. Includes, in descending order: Morrison Formation (0 to 30+ m thick), Bluff and Zuni Sandstones (85 to 100 m), Summerville Formation (20 to 75 m), Todilto Formation (0 to 10 m), and Entrada Sandstone (45 to 110 m; nomenclature after Lucas and Heckert, 2003). Unit thicknesses obtained from mapping on quadrangles to the east and southeast (Maxwell, 1976; Cikoski et al., 2016).

TABLE 1—Summary of geochronologic data for the McCartys 7.5' quadrangle

Unit	Age[1] (Ma)	±2σ[2]	Type[3]	Ref.[4]	Latitude	Longitude	Comments
Qbc	1.57	0.26*	K-Ar	L79			Too old (Laughlin et al., 1993); taken from ~3 miles east of Grants along I-40. *Unclear if published error is 1σ or 2σ
	0.128	0.033	K-Ar	CL88			
	0.054	0.1	K-Ar	L93	**	**	**Published lat/long are inconsistent with described location; location described as ~3 miles east of Grants along I-40.
	0.0347	0.003	36Cl	DP04	35.07°N	107.75°W	Weighted mean of 0 mm/kyr and 5 mm/kyr erosion rate assumptions
	0.115-0.120	--	PM	C97			Suggested to have erupted during the Blake geomagnetic polarity event
Tbp	3.238	0.17	K-Ar	L93	35.09°N	107.71°W	
	2.72	0.011	Ar/Ar	C15			
Tbda	30.7	1.4	K-Ar	A86	35.03°N	107.62°W	Sampled basalt reported to overlie ancestral Rio San Jose gravels
	Age[1] (ka)						
Qbm	2.97	0.12	14C	L94	34°56.01'N	107°50.33'W	
	3.01	0.14	14C	L94	34°56.01'N	107°50.33'W	
	2.5	1.1	3He	L94	35°05.16'N	107°46.52'W	
	2.4	0.6	3He	L94	35°05.16'N	107°46.52'W	
	3.9	1.2	36Cl	DP04	34°55.97'N	107°50.45'W	Weighted mean of 0 mm/kyr and 5 mm/kyr erosion rate assumptions

Notes
1: Age as published. No attempt made to normalize values. C-14 ages are not calibrated calendar ages.
2: Uncertainty as published, scaled to ±2σ where appropriate.
3: PM – age range suggested by comparison of radiometric ages and basalt flow paleomagnetic data to the paleomagnetic record; 14C ages date material from buried soils immediately underlying the flows; 3He and 36Cl are cosmogenic surface exposure ages; 40Ar/39Ar and K-Ar are crystallization ages.
4: A86 - Aldrich et al., 1986; C97 – Cascadden et al., 1997; C15 - Channer et al., 2015; CL88 – Champion and Lanphere, 1988; DP04 – Dunbar and Phillips, 2004; L79 - Laughlin et al., 1979; L93 – Laughlin et al., 1993; L94 – Laughlin et al., 1994.

Geologic Cross Section A–A'



Note:
Select Quaternary deposits too thin to show on the cross-section are indicated with unit name in parentheses above the deposit, e.g. "(Qpal)"