NEW MEXICO BUREAU OF GEOLOGY AND MINERAL RESOURCES A RESEARCH DIVISION OF NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY

Open-File Report 619
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This and other STATEMAP quadrangles are available for free download in both PDF and ArcGIS formats at:

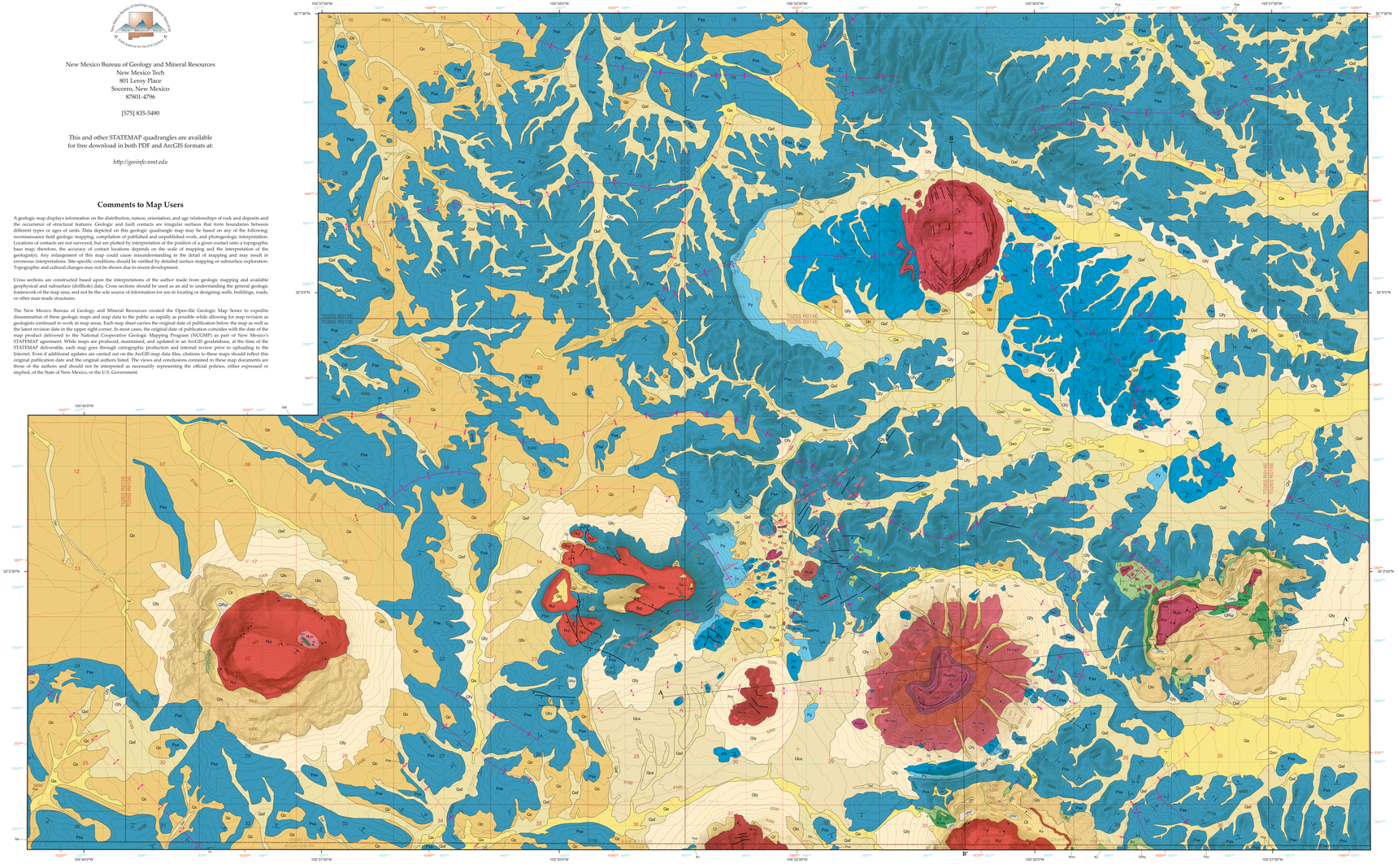
http://geoinfo.nmt.edu

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map may be based on any of the following: reconnaissance field geologic mapping, compilation of published and unpublished work, and photogeologic interpretation.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



Base map from U.S. Geological Survey 2020.
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.....
Boundaries.....U.S. Census Bureau, 2016
Hydrography.....National Hydrography Dataset, 2003–2018
Contours.....IFSAR 4.5 m Digital Terrain Model, 2008
Public Lands Survey System.....BLM, 2019
Wetlands.....FWS National Wetlands Inventory 1977–2014

1:24,000

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

New Mexico Bureau of Geology and Mineral Resources

Geology and Mineral Deposits of the Cornudas Mountains, Otero County, New Mexico

Open-File Report 619

2022

by

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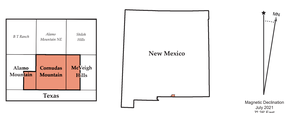
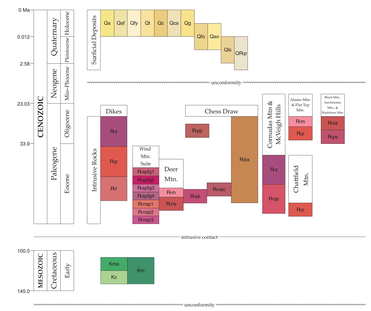
Quadrangle Location



Correlation of Map Units



Explanation of Map Symbols

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

Internal contact—Identity and existence are certain. Location is accurate where long dashed and approximate where short dashed.

Dike—Identity and existence are certain. Location is accurate where solid and approximate where dashed.

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

Normal fault—Identity and existence are certain, and questionable where queried. Location is accurate where solid, approximate where dashed, and concealed where dotted. Ball and bar on downthrown block.

Anticline—Identity and existence are certain. Location is accurate where solid, approximate where dashed, and concealed where dotted.

Syncline—Identity and existence are certain. Location is accurate where solid, approximate where dashed, and concealed where dotted.

Fault showing local normal offset—U indicating upthrown block and D indicating downthrown block.

Inclined bedding—Showing strike and dip.

Massive igneous rock

Inclined metamorphic or tectonic foliation—Showing strike and dip.

Cross section line and label

Description of Map Units

SURFICIAL DEPOSITS (QUATERNARY)

Qa **Stream floodplain alluvium (Holocene)**—Stream floodplain alluvium consisting of sand, silt, and clay. Maximum exposed thickness approximately 20 ft (6 m).

Qal **Alluvial and fluvial deposits (Holocene)**—Alluvial and fluvial deposits consisting of sand, silt, clay, and pebble to cobble gravel deposited in narrow stream channels and on broad alluvial slopes at base of low hills and the mountain fronts. Generally, less than 15 ft (4.5 m) thick.

Qfy **Young alluvial fan deposits (Holocene)**—Young alluvial fan deposits consisting of poorly sorted silty sand and gravel deposited in small alluvial fans along valley margins and around hills and mountains. Locally includes minor colluvium (**Qc**) where exposures are too small to differentiate on map. Maximum thickness unknown.

Qt **Talus (Holocene)**—Talus deposits consisting of unsorted, unstratified angular pebbles to boulders with maximum diameters of 30 ft (9 m). Covers flanks of steep slopes of hills and mountains underlain by resistant bedrock. Maximum thickness unknown.

Qc **Colluvium (Holocene)**—Colluvium consisting of weakly to strongly cemented caliche soil developed in residual deposits of sand, silt, clay, and angular pebbles and cobbles. Commonly covers the San Andres Formation (**Psa**) in northwestern part of map area, which is drained by tributaries of Shiloh Draw to the north. Thickness generally less than 1-2 ft (0.3-0.6 m).

Qcoa **Colluvial and alluvial deposits, undivided (Holocene)**—Colluvial and alluvial deposits, undivided consisting of colluvium (**Qc**) that is partly reworked and dissected by intermittent streams infilled with young alluvium (**Qa**). Restricted to the south-central part of the map area, which is drained by tributaries of University Draw to the south. Maximum thickness unknown.

Qg **Colluvial and alluvial gravel (Holocene?)**— Colluvial and alluvial gravel consisting of colluvial and alluvial gravel consisting of angular to subrounded pebbles and cobbles of fine grained calcareous rocks. Unit is mapped locally covering benches on Flat Top and underlain by phonolite (**Tp**), where it is interpreted as the erosional remnants of metamorphosed calc-silicate rocks (**Krm**). Less than 2 ft (0.6 m) thick.

Qfo **Old alluvial fan deposits (Holocene—Pleistocene)**—Old alluvial fan deposits consisting of poorly sorted silty sand and gravel deposited in dissected, abandoned alluvial fans that no longer receive sediment. Maximum thickness unknown.

Qao **Old alluvium (Holocene—Pleistocene)**—Old alluvium consisting of dissected terraces underlain by sand, silt, clay, and pebble to cobble gravel. Preserved as small, isolated hills 3-10 ft (0.9-3.0 m) above active stream valley floors. Maximum thickness unknown.

Qls **Landslide deposits (Pleistocene)**—Landslide deposits consisting of angular fragments of bedrock mixed with soil, or a heterogeneous mixture of boulders and finer-grained material derived from adjacent hillslopes. Characterized by irregular-shaped, hummocky topography and numerous closed depressions. Landslides mainly confined to areas underlain by Cretaceous sedimentary rocks found adjacent to Eocene—Oligocene igneous intrusions.

QPfp **Pediment alluvium (Pleistocene—Pliocene?)**—Pediment alluvium consisting of angular boulder to cobble gravel set in finer-grained matrix and deposited on gently sloping surfaces. Preserved as isolated, flat-topped deposits on flanks of Alamo, Black, and Chatfield Mountains and Flat Top at elevations near 4,900 ft (1,470 m).

PALEOGENE INTRUSIVE ROCKS

Rxtx **Porphyritic nepheline syenite (Oligocene?)**—Porphyritic nepheline syenite is dark-gray to gray-green, fine- to medium-grained. Phenocrysts consist of euhedral anorthoclase phenocrysts up to 1 inch (0.025 m) long in groundmass of anorthoclase, clinopyroxene, biotite, nepheline, and analcime, with trace amounts of eudialyte locally. Well-foliated rocks characterize exposures on Black Mountain (26.95±0.04 Ma).

Rxnz **Nepheline syenite (Eocene)**—Nepheline syenite (Eocene) is medium- to light-gray, coarse- to fine-grained, equigranular to slightly porphyritic. Consists of alkali feldspar, nepheline, amphibole, and biotite. Found on San Antonio Mountain (27.00±0.18 Ma) and Washburn Mountain (31.32±0.44 Ma as sills, small sill or plug found in southern Chess Draw (29.33±0.23). Includes older intrusion exposed at Deer Mountain (36.71±0.05 Ma).

Rbx **Breccia dikes (Eocene—Oligocene)**—Breccia dikes (Eocene—Oligocene) in Chess Draw. These dikes are mostly altered where exposed at the surface and contain feldspar phenocrysts and rock fragments altered to clay. In drill core they are black to gray matrix (feldspar, amphiboles with small fragments (less than 3 cm) of phonolite, trachyte, nepheline syenite, syenite, sandstone, and limestone. Matrix locally has a trachytic texture. No age determination, but is younger than the phonolite and trachyte dikes (from cross cutting relationships in drill core).

Rxt **Trachyte dikes (Eocene—Oligocene?)**—Trachyte dikes (Eocene—Oligocene) are fine-grained, porphyritic dikes with phenocrysts of feldspar forming a trachytic texture. Feldspars in dikes exposed at the surface are generally altered to white clay. Groundmass consists of feldspar, amphiboles, and quartz, and is typically altered to iron oxides and clay where exposed at the surface. Generally grey-green in color in drill core and orange to buff at the surface. Found in Chess Draw (south of Mesquite Hills) and less altered dikes are found in drill core from the Chess Draw area. No age determination, but is older than the breccia, and younger than the nepheline syenite and syenite dikes (from cross cutting relationships in drill core).

Rxp **Phonolite sills and dikes (Oligocene)**—Phonolite sills and dikes consisting of aphanitic rock composed predominantly of alkali feldspar, nepheline, clinopyroxene, and riebeckite. Varies in color from black to grey-black to green-black. Locally porphyritic with senocrysts of olivine, clinopyroxene, and biotite. Phonolite of Chatfield Mountain (26.80±0.04 Ma), Flat Top (28.49±0.35), and Alamo Mountain (31.07±0.16) shows well-developed magmatic foliation. On western and southern Alamo Mountain (**Rqp**), phonolite is platy with foliation dipping at a low angle to underlying sedimentary bedding. Large plug in northeast Chess Draw (30.59±0.04 Ma, **Rqpp**). Phonolite (**Rq**) surrounds the **Rsas** at the small hill in northern Chess Draw (**Tas** of Potter, 1996). Dikes and plugs are variable in width (meters) and length (as much as 1 mi long), and range in age from 35.82±0.06 to 30.16±0.09 Ma.

Rqpp **Phonolite plugs (Oligocene)**—Phonolite plugs consisting of aphanitic rock composed predominantly of alkali feldspar, nepheline, clinopyroxene, and riebeckite. Varies in color from black to grey-black to green-black. Locally porphyritic with senocrysts of olivine, clinopyroxene, and biotite. Phonolite of Chatfield Mountain (26.80±0.04 Ma), Flat Top (28.49±0.35), and Alamo Mountain (31.07±0.16) shows well-developed magmatic foliation. On western and southern Alamo Mountain (**Rqp**), phonolite is platy with foliation dipping at a low angle to underlying sedimentary bedding. Large plug in northeast Chess Draw (30.59±0.04 Ma, **Rqpp**). Phonolite (**Rq**) surrounds the **Rsas** at the small hill in northern Chess Draw (**Tas** of Potter, 1996). Dikes and plugs are variable in width (meters) and length (as much as 1 mi long), and range in age from 35.82±0.06 to 30.16±0.09 Ma.

Rsm **Marginal facies (Eocene—Oligocene)**—Marginal facies of Deer and Alamo Mountains intrusions, near external contacts of intrusions and around blocks of sedimentary wallrock. Gray-green, aphanitic to very fine grained, equigranular to slightly porphyritic mafic syenite. Generally, consists of phenocrysts of feldspar and amphibole, up to 0.5 inches (15 cm) long in groundmass.

Rsnsc **Nepheline syenite (Eocene)**—Nepheline syenite (35.90±0.06 Ma) in southern Chess Draw forms a small sill (or stock?) that is exposed along five ridges. The nepheline syenite is coarse- to medium-grained and consists of feldspars, amphiboles, biotite, nepheline and accessory minerals.

Rsss **Nepheline–bearing augite syenite stock (Eocene)**—Nepheline-bearing augite syenite stock in northern Chess Draw consisting of gray, medium-grained, equigranular nepheline-bearing augite syenite (**Tas** of Potter, 1996). Consists of anorthoclase, plagioclase mantled by anorthoclase, augite, biotite, and interstitial nepheline and analcite. Small body surrounded by mafic nepheline syenite.

Rsqs **Rsqs is quartz–bearing syenite (Eocene—Oligocene)**
Rss is syenite (Eocene—Oligocene)
Syenite consisting of medium-gray, weakly foliated, granoblastic to porphyritic syenite composed of tabular, euhdral anorthoclase, subhedral clinopyroxene, biotite, and interstitial quartz. Exposed at Cornudas Mountain (35.27±0.07 Ma) and McVeigh Hills (34.96±0.07 Ma). Sill west of Cornudas Mountain is 36.4±0.04 Ma. Includes numerous altered dikes in Chess Draw and McVeigh Hills.

Exposures on Wind Mountain range from weakly to strongly foliated, and contains anorthoclase, nepheline, clinopyroxene, anedral fayalite mantled by red hornblende, and minor to trace amounts of biotite, aparitte, zircons, and muscovite. Units forming the Wind Mountain lacolith are subdivided after McLemore et al. (1996) into:

Rsqfg1 **Syenite (Eocene—Oligocene)**—Syenite porphyry is fine-grained, and contains minor analcite, aegrite, Na amphibole, biotite and magnetite in a plagioclase rich groundmass. Forms the top of the Wind Mountain laccolith.

Rsqfg2 **Syenite (Eocene—Oligocene)**—Syenite porphyry is fine-grained, and contains predominantly plagioclase, aegrite, Na amphibole, biotite.

Rsqfg3 **Syenite (Eocene—Oligocene)**—Syenite porphyry is fine-grained, and contains predominantly plagioclase, aegrite, Na amphibole, biotite but is more mafic than **Rsqfg2**.

Rsqfg4 **Syenite (Eocene—Oligocene)**—Syenite porphyry is fine-grained, and contains analcite, aegrite, Na amphibole, biotite and magnetite in a plagioclase rich groundmass.

Rnsp1 **Nepheline syenite porphyry (Eocene—Oligocene)**—Nepheline syenite porphyry is coarse-grained, and contains K-feldspar phenocrysts in a matrix of plagioclase, nepheline, analcite, with accessory aegerite, Na amphibole, minor magnetite.

Rnsp2 **Nepheline syenite porphyry (Eocene—Oligocene)**—Nepheline syenite porphyry (37.34±0.65 Ma) is medium-grained, and contains K-feldspar phenocrysts in a matrix of plagioclase, nepheline, minor analcite, with accessory aegerite, Na amphibole, minor magnetite. Includes local zones of red to brown REE-bearing eudialyte. Forms the lower portion of the laccolith.

Rnsp3 **Nepheline syenite porphyry (Eocene—Oligocene)**—Nepheline syenite porphyry exposed at Little Windy (36.98±0.03 Ma) is medium-grained, and contains blocky, vertical K-feldspar phenocrysts in a matrix of plagioclase, nepheline, with accessory arfedsonite-aegerite, minor magnetite. Located southwest of Wind Mountain.

SEDIMENTARY ROCKS

Kmc **Mulero and Mesilla Valley Formations, undivided (Cretaceous)**—Mulero and Mesilla Valley Formations, undivided consisting of yellow-tan to light-gray, nodular, fossiliferous limestone and minor shale and siltstone (Mulero) overlain by poorly exposed brown-tan to orange-tan sandstone and siltstone (Mesilla Valley). Maximum exposed thickness about 100 ft (30.5 m).

Kc **Campagrande Formation and Cox Sandstone, undivided (Cretaceous)**—Campagrande Formation and Cox Sandstone, undivided consisting of yellow-orange siltstone and minor cream-white, fine-grained limestone. The interbedded siltstone and limestone are approximately 15 ft (4.5 m) thick and are exposed on the northwest side of Chatfield Mountain (Kues and Lucas, 1993). The Cox Sandstone overlies the Campagrande Formation at Chatfield Mountain, and elsewhere rests unconformably on the Permian San Andres Formation (**Psa**). The Cox Sandstone consists of a basal, rounded to angular chert-pebble conglomerate overlain by interbedded silty to sandy, light-gray, thin-bedded limestone and orange-tan to red-brown to cream-white, calcareous, quartz-rich, crossbedded sandstone. Locally channel-fill deposits of lithic pebble conglomerate are interlayered with sandstone. Maximum thickness of the Cox Sandstone is approximately 100 ft (30.5 m).

Km **Metamorphosed calc-silicate rocks (Cretaceous)**—Metamorphosed calc-silicate rocks consisting of yellow-white to pale-green, fine-grained metamorphosed calcareous rock that rests directly on Flat Top sill and may represent a stoped block within the Alamo Mountain intrusion. Less than 5 ft (1.5 m) thick.

Psa **San Andres Formation (Permian)**—San Andres Formation consisting of medium-gray to light-olive-gray dolomite and dolomitic limestone overlain by dark-gray limestone. Lower dolomitic rocks are fine- to medium-grained. Shale lenses are most abundant in the middle part of the dolomitic section. Basal dolomitic limestone is locally pisolitic and vuggy and contains layers of coquina and intraformational conglomerate. Dark-gray, massive, conspicuously fossiliferous limestone is restricted to the uppermost exposures of this formation in the map area. Forms erosion-resistant ledges and has a maximum exposed thickness of approximately 300 ft (350 m).

Py **Yeso Formation (Permian)**—Yeso Formation consisting of interlayered gypsum-rich, laminated claystone (locally enclosing dark-gray gypsum nodules); yellow-white, sugary-textured limestone; coarse-grained gypsum; red to green shale and claystone; and orange-tan to red and red-brown, medium-grained quartz sandstone. Most exposures are restricted to the top of the unit where red to green shale directly underlie the San Andres Formation (**Psa**). Maximum exposed thickness is approximately 100 ft (30.5 m).

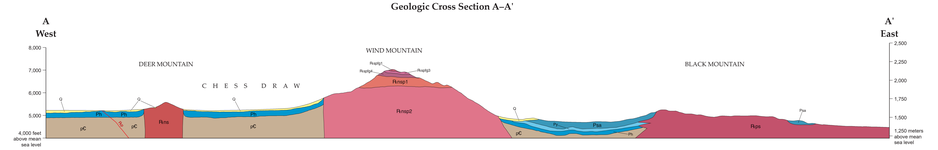
Ph **Hueco Formation (Permian)**—Hueco Formation consisting of dark-gray, fine-grained, thin- to medium-bedded, fossiliferous limestone containing conspicuous dark-gray to black chert nodules and stringers. Maximum exposed thickness is less than 100 ft (30.5 m).

CROSS SECTION ONLY (QUATERNARY TO PRECAMBRIAN)

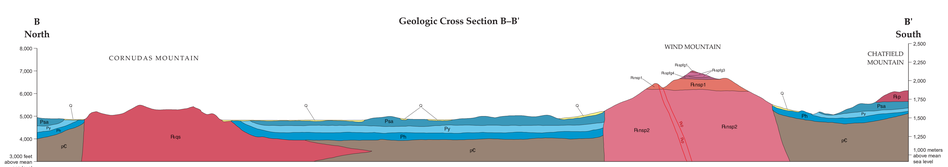
Q **Quartenary deposits, undivided (Quaternary)**—Cross section only. Combined Quaternary units on surface of cross section.

pC **Precambrian (Precambrian)**—Cross section only. Precambrian units in cross section.

Geologic Cross Section A–A'



Geologic Cross Section B–B'



Geologic Cross Section C–C'