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Geologic Map of the Guadalupe Mountains National Park, Culberson and Hudspeth Counties, Texas

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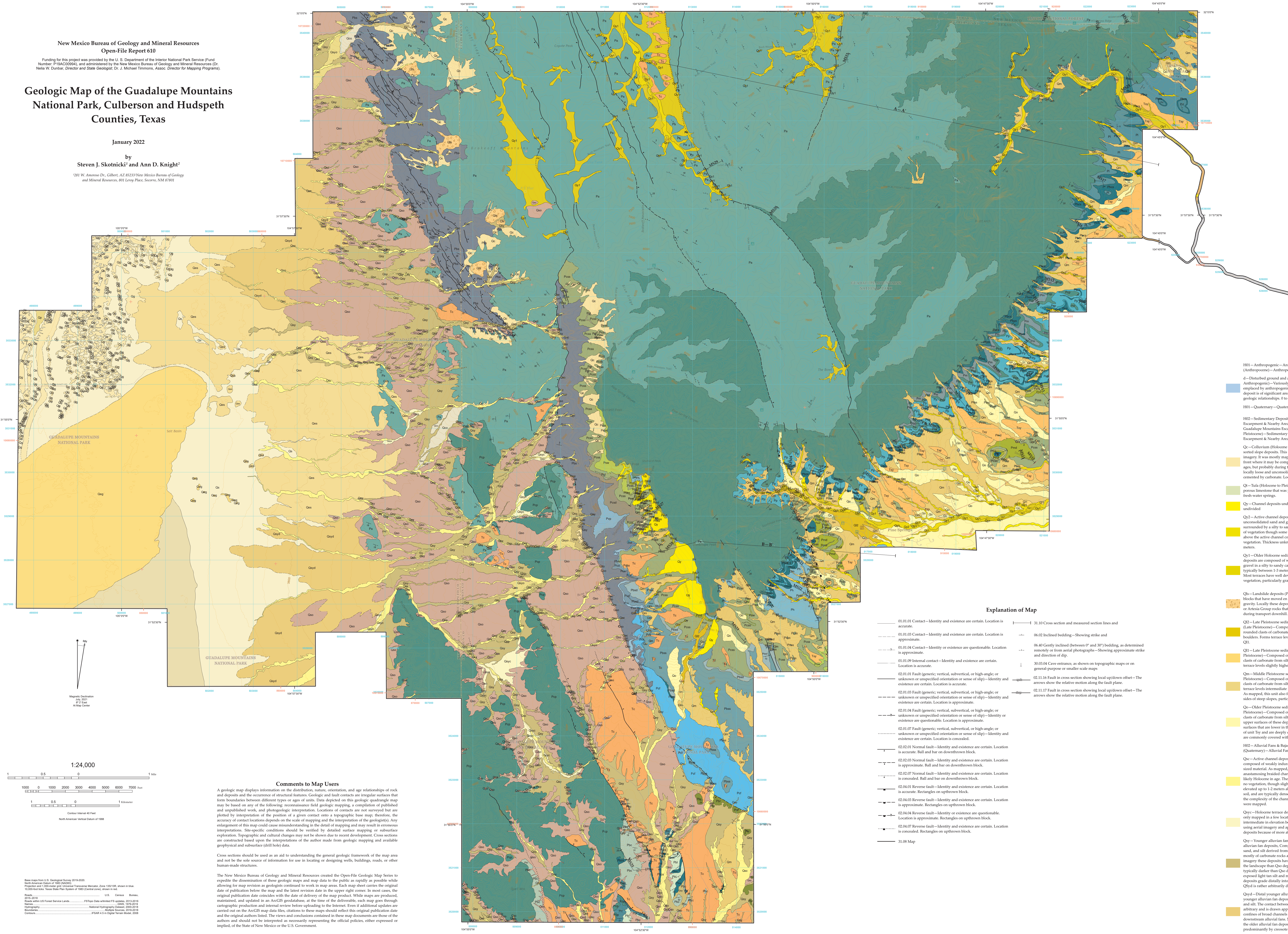
by
Steven J. Skotnicki[1] and Ann D. Knight[2]

[1]281 W. Amoroso Dr., Gilbert, AZ 85233 [2]New Mexico Bureau of Geology and Mineral Resources, 801 Leroy Place, Socorro, NM 87801



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map may be based on any of the following: reconnaissance field geologic mapping, a compilation of published and unpublished work, and photogeologic interpretation.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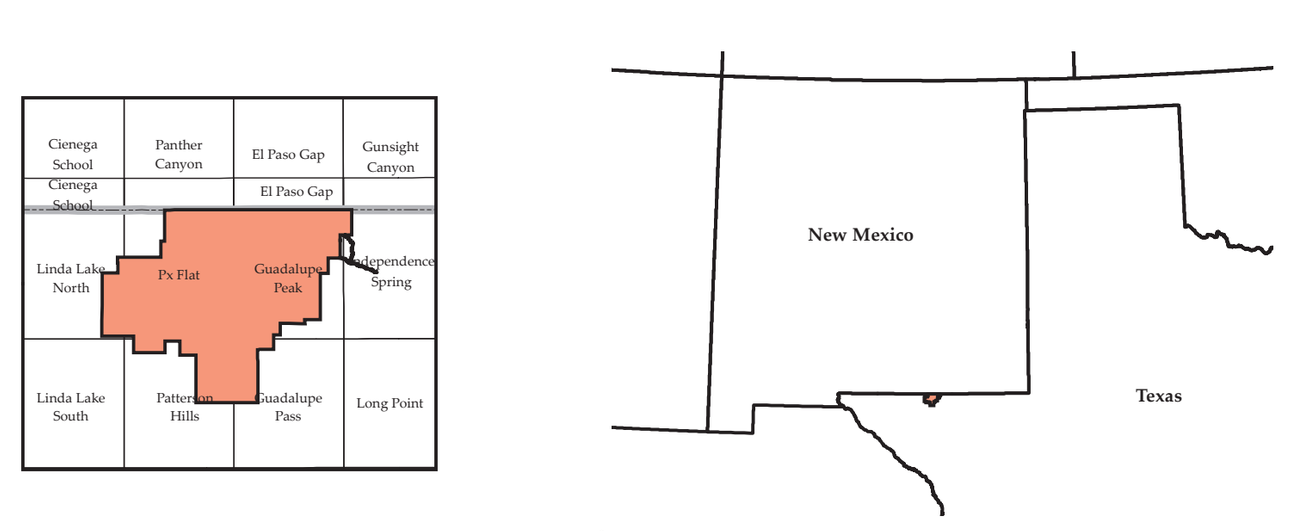

Map Location

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

[575] 835-5490

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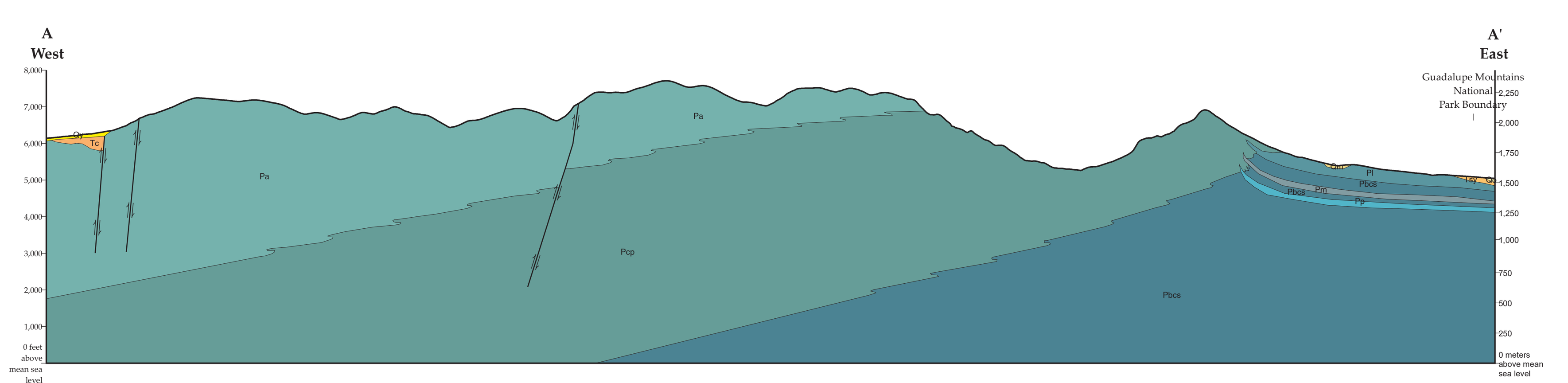
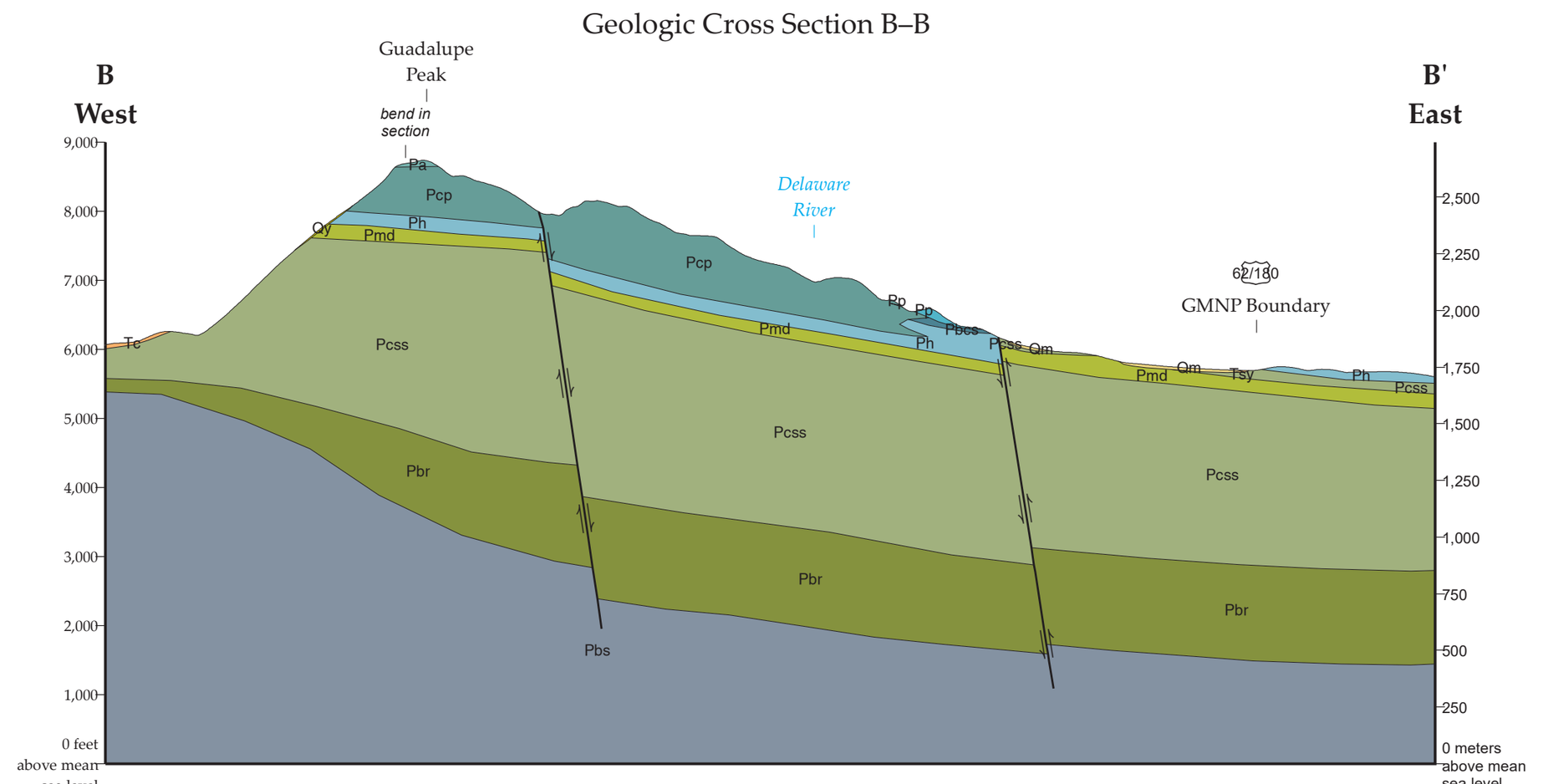
Phil L. Miller, Amy L. Dunn, Ann D. Knight, and Justine L. Nicolette

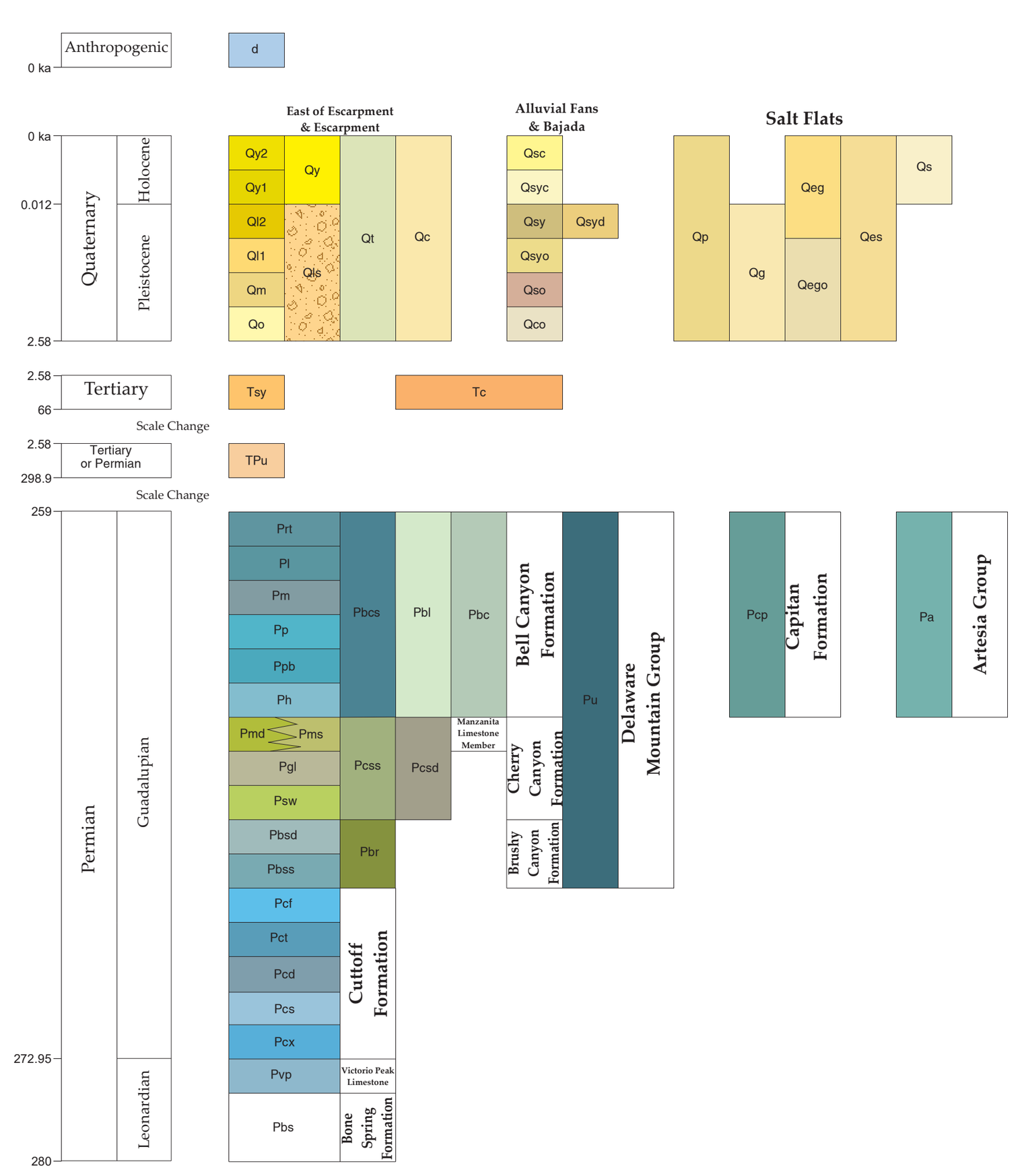
Geologic Cross Section A–A'



Geologic Cross Section B–B'



Correlation of Map Units



Explanation of Map

01.01.01 Contact—Identity and existence are certain. Location is accurate.

01.01.03 Contact—Identity and existence are certain. Location is approximate.

01.01.04 Contact—Identity or existence are questionable. Location is approximate.

01.01.09 Internal contact—Identity and existence are certain. Location is accurate.

02.01.01 Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip)—Identity and existence are certain. Location is accurate.

02.01.03 Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip)—Identity and existence are certain. Location is approximate.

02.01.04 Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip)—Identity or existence are questionable. Location is approximate.

02.01.07 Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip)—Identity and existence are certain. Location is concealed.

02.02.01 Normal fault—Identity and existence are certain. Location is accurate. Ball and bar on downthrown block.

02.02.03 Normal fault—Identity and existence are certain. Location is approximate. Ball and bar on downthrown block.

02.02.07 Normal fault—Identity and existence are certain. Location is concealed. Ball and bar on downthrown block.

02.04.01 Reverse fault—Identity and existence are certain. Location is accurate. Rectangles on upthrown block.

02.04.03 Reverse fault—Identity and existence are certain. Location is approximate. Rectangles on upthrown block.

02.04.04 Reverse fault—Identity or existence are questionable. Location is approximate. Rectangles on upthrown block.

02.04.07 Reverse fault—Identity and existence are certain. Location is concealed. Rectangles on upthrown block.

31.08 Map

31.10 Cross section and measured section lines and

06.02 Inclined bedding—Showing strike and dip

06.40 Gently inclined (between 0° and 30°) bedding, as determined remotely or from aerial photographs—Showing approximate strike and direction of dip.

30.03.04 Cave entrance, as shown on topographic maps or on general-purpose or smaller scale maps

02.11.16 Fault in cross section showing local up/down offset—The arrows show the relative motion along the fault plane.

02.11.17 Fault in cross section showing local up/down offset—The arrows show the relative motion along the fault plane.

Description of Map Units

H01—Anthropogenic—Anthropogenic (Anthropocene)—Anthropogenic

d—Disturbed ground and artificial fill (Historic - Anthropogenic)—Variously compacted sands, gravels, and muds emplaced by anthropogenic means. Only mapped where the deposit is of significant areal extent, thickness, or masks underlying geologic relationships. 0 to perhaps 10 m thick.

H01—Quaternary—Quaternary (Quaternary)—Quaternary

H02—Sedimentary Deposits of the Guadalupe Mountains Escarpment & Nearby Areas—Sedimentary Deposits of the Guadalupe Mountains Escarpment & Nearby Areas (Holocene to Pleistocene)—Sedimentary Deposits of the Guadalupe Mountains Escarpment & Nearby Areas

Qc—Colluvium (Holocene to Pleistocene)—Locally derived poorly sorted slope deposits. This unit was mapped mostly from aerial imagery. It was mostly mapped on steep slopes along the mountain front where it may be composed of material deposited in different ages, but probably during the Quaternary. Material on slopes is locally loose and unconsolidated, while in other areas it is strongly cemented by carbonate. Locally disected by narrow gullies.

Qt—Tufa (Holocene to Pleistocene)—Composed of light gray porous limestone that was probably deposited via precipitation at fresh-water springs.

Qy—Channel deposits undivided (Holocene)—Channel deposits undivided

Qy2—Active channel deposits (Holocene)—Predominantly unconsolidated sand and gravel dominated by clasts of carbonate surrounded by a silty to sandy carbonaceous matrix. Mostly devoid of vegetation though some low terraces typically less than 1 m above the active channel contain weak soil horizons and thicker vegetation. Thickness unknown but probably less than several meters.

Qy1—Older Holocene sedimentary deposits (Holocene)—These deposits are composed of weakly to strongly indurated sand and gravel in a silty to sandy carbonaceous matrix. They form terraces typically between 1-3 meters above the active channel deposits. Most terraces have well developed silty soil that supports abundant vegetation, particularly grasses. Estimated thickness up to 5 meters.

Qls—Landslide deposits (Pleistocene)—Large relatively intact blocks that have moved en masse downhill due to the action of gravity. Locally these deposits contain blocks of Capitan Formation or Artesia Group rocks that have been partly to completely rotated during transport downhill.

Ql2—Late Pleistocene sedimentary deposits, younger member (Late Pleistocene)—Composed of poorly sorted, subrounded to rounded clasts of carbonate from silt and sand size to large boulders. Forms terrace levels slightly lower in the landscape than Ql1.

Ql1—Late Pleistocene sedimentary deposits, older member (Late Pleistocene)—Composed of poorly sorted, subrounded to rounded clasts of carbonate from silt and sand size to large boulders. Forms terrace levels slightly higher in the landscape than Ql2.

Qm—Middle Pleistocene sedimentary deposits (Middle Pleistocene)—Composed of poorly sorted, subrounded to rounded clasts of carbonate from silt and sand size to large boulders. Forms terrace levels intermediate in the landscape between Ql and Qm. As mapped, this unit also forms remnants of talus deposits on the sides of steep slopes, particularly along McKittrick Canyon.

Qo—Older Pleistocene sedimentary deposits (Early Pleistocene)—Composed of poorly sorted, subrounded to rounded clasts of carbonate from silt and sand size to large boulders. The upper surfaces of these deposits exhibit relatively flat construction surfaces that are lower in the landscape than the tops of the ridges of unit Tsy and are deeply dissected by drainages. Upper surfaces are commonly covered with soil and grasses.

H02—Alluvial Fans & Bajadas—Alluvial Fans & Bajadas (Quaternary)—Alluvial Fans & Bajadas

Qsc—Active channel deposits (Holocene)—These deposits are composed of weakly indurated boulders, cobbles, sand, and silt-sized material. As mapped, this unit contains multiple anastamosing braided channels of multiple ages, though all are likely Holocene in age. The active channels typically contain almost no vegetation, though slightly older depoisits form terraces that are elevated up to 1-2 meters above the active channel, contain more soil, and are typically densely vegetated with catclaw. Because of the complexity of the channels only the larger more obvious ones were mapped.

Qsyc—Holocene terrace deposits (Holocene)—These deposits were only mapped in a few locations and form elevated terraces that are intermediate in elevation between Qsc and Qsy. They were mapped using aerial imagery and appear slightly darker than most Qsc deposits because of more abundant vegetation.

Qsy—Younger alluvian fan deposits (Pleistocene)—Younger alluvian fan deposits, Composed of boulders, cobbles, pebbles, sand, and silt derived from the mountains to east, comrpised mostly of carbonate rocks and less abundant sandstone. On aerial imagery these deposits have incised Qso deposits and are lower in the landscape than Qso deposits. In aerial images the unit is typically darker than Qso deposits because of less abundant exposed light tan silt and more abundant vegetation. These deposits grade distally into Qsyd deposits, where the contact with QSyd is rather arbitrarily drawn.

Qsyd—Distal younger alluvian fan deposits (Pleistocene)—Distal younger alluvian fan deposits composed mostly of pebbles, sand, and silt. The contact between the upstream Qsy deposits is rather arbitrary and is drawn approximately where the fans leave the confines of broad channels in older deposits and spread into downstream alluvial fans. Much of the materail that is distal from the older alluvial fan deposits is composed of silt and is covered predominantly by creosote bushes.

Qsyo—Intermediate terrace between Older and Younger alluvian fan deposits (Pleistocene)—These deposits form an intermediate terrace between Qso and Qsy. These were mapped only locally using aerial imagery.

Qso—Older alluvian fan deposits (Pleistocene)—These deposits were mostly mapped using aerial imagery. The deposits are higher in the landscape than Qsy deposits, are lighter in color than Qsy deposits because of less vegetation and more light tan silt on the surface, are slightly higher in the landscape, and are more deeply disected by gullies.

Qco—Oldest alluvian fan remnants (Pleistocene)—Erosional remnants of alluvial fans, high in the landscape and adjacent to the mountain front. Composed of poorly sorted boulders, cobbles, pebbles, sand, and silt. This unit forms isolated erosional remnants of previously more extensive and older alluvial fan deposits that once filled the valley along the montain front to an elevation approximately 20 meters higher than the present active channels.

H02—Salt Flats—Salt Flats deposits (Quaternary)—Evaporite, Playa, and Eolian deposits

Qp—Playa deposits (Holocene to Pleistocene)—These deposits form closed basins that used to contain small lakes. The deposits contain either quartz silt or gypsum, or both, that has been remobilized by eolian activity. Subtle shorlines are visible along the margins of some features. The interior of the closed basins is typically very flat, though locally contains small dunes. Only the largest of these features was mapped as playas. Many more smaller closed basins are included within unit Qs.

Qeg—Gypsum sand dunes (Holocene to Pleistocene)—This unit forms the prominent, high-standing gypsum sand dunes on the far western side of the Park. Many dunes are active, though most are stabilized by small shrubs. Sand grains are medium- to coarse-grained, and partially rounded to platy, and are frosted. Interdune areas characteristically form small bowl-shaped depressions that are very abundant. The elongated shape of the dune field indicates that the sand has been carried from the southwest to the northeast.

Qes—Quartz sand dunes (Holocene to Pleistocene)—These sand dunes are composed mostly of fine-grained to medium-grained quartz sand grains. Grain size can vary considerably on different portions of the same dune. The grains are subangular to well rounded and partially frosted. This unit forms an extensive dune field on the west-central portion of the western alluvial slope. Similar to the nearby gypsun dunes, the quartz dunes characteristically contain large bowl-shaped internally drained depressions. The unit appears to be older than the gypsum dunes but is still undergoing transport and modification by eolian activity. Several large intermittent streams that drain off of the mountain front to the east have cut through the dune field and exposed moderately cemented dune deposits in the canyon walls.

Qs—Silt deposits (Holocene)—The gypsum deposits (Qg) contain a great abundance of shallow closed depressions of all sizes and shapes, from irregularly shaped to long sinuous forms, and from a few meters across to hundreds of meters across. The vast majority of these depressions are partially filled with quartz silt, interpreted to be wind-blown material. Where extensive enough, the silt is mapped as its own deposit (Qs).Upon close examination, small dunes are visible on the floors of many of the depressions.

Qg—Gypsum deposits (Pleistocene)—As mostly mapped in aerial imagery, this unit consists of light gray gypsum of uncertain origin. Many exposures examined have undergone extensive diagenesis and remobilization by pedogenic and eolian processes. Many outcrops are covered with small mounds composed of both gypsum and silt approximately 1 m across and 0.5 meters tall. It is not clear if these deposits were primarily deposited as precipitates within a shallow lake or they have been subsequently remobilized by wind or wave activity.

Qego—Older gypsum sand dunes (Pleistocene)—This unit forms older gypsum sand dunes that are buried by the younger Qeg dunes. In aerial imagery, this unit is darker because of more abundant vegetation.

H01—Tertiary—Tertiary (Tertiary)—Tertiary

Tsy—Tertiary sedimentary deposits (Tertiary)—Composed of poorly sorted, subrounded to rounded clasts of carbonate from silt and sand size to small boulders. Forms rounded ridges and hills with no preserved flat constructional surfaces. Exposures are poor except where exposed in stream cuts. Stream-cut exposures are strongly cemented by carbonate. Slopes are mantled with regolith. Where visible, bedding is defined by interbedded sandy and pebbly layers which locally display cut-and-fill channel structures. The near-horizontal nature of these deposits suggests that they were not affected by tectonism.

Tc—Tertiary sedimentary deposits (Tertiary)—Composed of poorly sorted, subrounded to rounded clasts of carbonate from silt and sand size to large boulders, strongly cemented by carbonate. This unit was mapped west of Guadalupe Pass where forms rounded hills and ridges that are locally cut by faults. Other outcrops form isolated erosional remnants high in the landscape that represent a much older base level. These deposits are similar to Tsy but are interpreted to be synchronous with and/or pre-date faulting and deformation.

TPu—Tertiary or Permian bedrock, undivided (Tertiary or Permian)—Tertiary or Permian bedrock, undivided

H01—Permian—Permian (Permian)—Permian

H02—Capitan Formation—Capitan Formation (Permian, Guadalupian)—Capitan Formation

Pcp—Capitan Formation (Permian, Guadalupian)—Capitan Limestone

H02—Artesia Group—Artesia Group (Permian, Guadalupian)—Artesia Group

Pa—Artesia Group (Permian, Guadalupian)—Artesia Group

H02—Delaware Mountain Group—Delaware Mountain Group (Permian, Guadalupian)—Delaware Mountain Group

Pu—Delaware Mountain Group, undivided (Permian, Guadalupian)—Delaware Mountain Group, undivided

H03—Bell Canyon Formation—Bell Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Bell Canyon Formation

Pbc—Bell Canyon Formation, undivided, of the Delaware Mountain Group (Permian, Guadalupian)—Bell Canyon Formation, undivided

Pbl—Limestone of the Bell Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—This unit was mostly mapped from a distance and from aerial imagery. It appears to contain abundant layers and ledges of limestone, think- to thick-bedded, but also probably contains minor amounts of bedded siltstone/sandstone.

Pbcs—Fine-grained sandstone/siltstone member of the Bell Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Thin-bedded to laminated planar beds of siltstone and fine-grained sandstone. Typically erodes into smooth slopes. Fresh surfaces are commonly light mustard yellow in color.

Prt—Reef Trail Member of the Bell Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Typically dark tan to light brown on weathered surfaces and is dark brown on fresh surfaces with a strong petroliferous odor. It contains no chert and exhibits thin platy beds that stand out on weathered surfaces like the edges of thin plates. It commonly shows weak laminae and sparse fossil fragments are typically darker colored compared to the lighter colored fossil fragments in most of the other limestone units.

Pl—Lamar Limestone Member of the Bell Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Thin- to thick-bedded limestone. Beds are mostly massive and composed of micrite or contain abundant mostly sand-sized fossil skeletal debris. Sparse light gray bedded chert is visible locally within the lower half of the unit. Unlike the other limestone members of the Bell Canyon Formation, this unit contains no visible siltstone layers. Good exposures are accessible on both the north and south sides of McKittrick Canyon.

Pm—McCombs Limestone Member of the Bell Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Mostly thin- to medium-bedded limestone. Contains abundant sand-sized fossil skeletal debris and locally abundant small limestone intraclasts. Bedded chert is visible only north of Rader Ridge. Limestone beds are interbedded with abundant beds of chaotic limestone breccia tongues of the Capitan Formation. This is the least accessible of the limestone members of the Bell Canyon Formation, exposed mostly at the base of the escarpment between Rader Ridge and Lamar Canyon where it contains up to about 25% siltstone beds.

Pp—Pinery Limestone Member of the Bell Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Thin- to thick-bedded mostly massive limestone. Many beds contain abundant sand-sized fossil skeletal debris partly replaced by calcite spar. Darker filled burrows are visible on some bedding planes. Some outcrops contain abundant light to dark gray bedded chert. Large fusulinids (Polydiexodina) are locally very abundant and best seen on bedding planes where they form thick intergrown masses. Particularly good exposures are denoted in the measured cross-sections. Well exposed with and northeast of Pine Spring Canyon.

Ppb—Basal beds of the Pinery Limestone Member of the Bell Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Dark gray thinly bedded micrite. Forms a few ledgy layers interbedded with sandstone/siltstone.

Ph—Hegler Limestone Member of the Bell Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Interbedded thin-, medium-, and thick-bedded micrite. Beds are mostly massive to weakly laminated. Beds exhibiting well-defined laminae are minor. Many beds contain abundant fossil skeletal debris partly replaced by calcite spar and to a lesser extent incompletely by orange-weathering chert. Gray bedded and nodular chert is sparse. Contains very minor interbedded yellow siltstone layers. This unit is exposed entirely southwest of Pine Spring Canyon and is interpreted to be the formation that forms the base of the cliffs below El Capitan.

H03—Cherry Canyon Formation—Cherry Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Cherry Canyon Formation

H04—Manzanita Limestone Member—Manzanita Limestone Member of the Cherry Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Dolomite and sandstone

Pmd—Dolomite unit of the Manzanita Limestone Member of the Cherry Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Dolomite. Light yellowish tan to light brown and sandy. Contains abundant fine to coarse quartz sand grains in a dolomitic matrix. East of Guadalupe Pass, beds are typically thick and massive and form small resistant ledges. West of Guadalupe Pass, along the base of El Capitan and the western escarpment, the unit typically contains a thick sections of thin- to medium-bedded dolomite that, from a distance, resembles the neighboring sandstone/siltstone, but is typically more resistant and forms small ledgy cliffs. Commonly contains one or more very thin blue-green siliceous layers up to 10 cm thick that may be altered volcanic ash.

Pms—Sandstone member of the Manzanita Limestone Member of the Cherry Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Sandstone. This sandstone is distinct from the other fine-grained sandstones and siltstones within the Cherry Canyon Formation because it is typically slightly coarser (fine-grained to marginally coarse-grained), is rather thick-bedded, and contains tabular and trough cross-bedding. This unit characteristically forms a light gray to light bluish gray unit that, as a layer, is easily distinguishable from the neighboring thinly bedded very fine-grained sandstone/siltstone layers. This unit also typically erodes into a smooth slope, except below the western escarpment, where it forms the lowermost portion of the cliff. Visible and accessible exposures can be found at Nipple Hill and along the south side of Rader Ridge.

Pcsd—Medium-grained sandstone member of the Cherry Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Thin to thick-bedded to massive ledge-forming medium-grained sandstone. Light tan on fresh surfaces. Dark rusty tan on weathered surfaces. Forms thick channel-fills that pinch out laterally.

Pcss—Fine-grained sandstone/siltstone member of the Cherry Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Thin-bedded to laminated planar beds of siltstone and fine-grained sandstone. Typically erodes into smooth slopes. Fresh surfaces are commonly light mustard yellow in color.

Pgl—Getaway Limestone Member of the Cherry Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Mostly thin-bedded limestone containing bedded chert. Minor thick, massive beds. Upper part is interbedded with yellow siltstone. Exposed only on slopes of the western escarpment in the southwest corner of the map.

Psw—South Wells Limestone Member of the Cherry Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Thick-bedded massive limestone. Contains sparse chert nodules. Locally thinly bedded and weakly laminated and resembles siltstone from a distance. Exposed only on slopes of the western escarpment in the southwest corner of the map.

H03—Brushy Canyon Formation—Brushy Canyon Formation of Delaware Mountain Group (Permian, Guadalupian)—Brushy Canyon Formation

Pbr—Brushy Canyon Formation, undivided (Permian, Guadalupian)—Brushy Canyon Formation, undivided

Pbsd—Medium-grained sandstone member of the Brushy Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Thin to thick-bedded to massive ledge-forming medium-grained sandstone. Light tan on fresh surfaces. Dark rusty tan on weathered surfaces. Forms thick channel-fills that pinch out laterally.

Pbss—Fine-grained sandstone/siltstone member of the Brushy Canyon Formation of the Delaware Mountain Group (Permian, Guadalupian)—Thin-bedded to laminated planar beds of siltstone and fine-grained sandstone. Typically erodes into smooth slopes. Fresh surfaces are commonly light mustard yellow in color.

H02—Cutoff Formation—Cutoff Formation (Permian, Guadalupian)—Cutoff Formation

Pcf—Fetid member of the Cutoff Formation (Permian, Guadalupian)—Thin- to medium-bedded micrite. Beds are massive to finely laminated and commonly very dark-gray on fresh surfaces and medium-bluish-gray on weathered surfaces. Freshly broken surfaces produce a fetid to strong petroliferous odor. Bedding planes commonly exhibit small-scale undulations defined by dark and light regions several centemeters across that superficially resemble horizontal burrows. This member thickens southward where it contains abundant intraformational folds.

Pct—Thick-bedded member of the Cutoff Formation (Permian, Guadalupian)—Light-tan. No fossils visible. Appears to be composed dominantly of micrite and microspar. Locally contains 5–10% medium-gray bedded nodular chert that weathers rusty-red. Forms small cliff above thin-bedded member. Upper portion appears to contain thin quartz sandstone layers. Weathers into irregularly shaped masses with deeper solution channels up to several tens of centimeters deep that is difficult to walk across. Exposed between Shumard Canyon and Bone Spring Canyon where it forms the prominent small cliff at the top of the ridge.

Pcd—Thin-bedded member of the Cutoff Formation (Permian, Guadalupian)—Composed of rather regularly thin-bedded micrite up to ~10 cm thick. Where well exposed in Shumard Canyon it fills at least one deep channel cut into the top of the Bone Spring Formation. South of Shumard Canyon the unit mostly forms a slope where thin-bedded limestone is intercalated with siltstone and fine-grained sandstone.

Pcs—Sandstone and shale member of the Cutoff Formation (Permian, Guadalupian)—Interbedded platy fine-grained sandstone and shale and possibly some thin limestone beds. Forms a mostly regolith-covered slope.

Pcx—Breccia member of the Cutoff Formation (Permian, Guadalupian)—Contains poorly sorted angular clasts of limestone surrounded by a limy and sandy matrix. Lower contact locally cuts across underlying bedded and the breccia fills narrow to broad channels. The unit pinches out locally and forms lens-like outcrops. Mostly exposed as one layer with chaotic internal structure except in Bone Spring Canyon where it forms two or more discreet breccia layers separated by what appears to be (from a distance) coherent limestone.

H02—Victorio Peak Limestone—Victorio Peak Limestone (Permian, Leonardian)—Victorio Peak Limestone

Pvp—Victorio Peak Limestone (Permian, Leonardian)—Massive, light-tan limestone. Bedding is very weakly defined to nonexistent. Outcrops are light-tan to light-gray. Forms the steep cliffs and high resistant mesa north of Shumard Canyon, making access very difficult. As mapped, the lower contact is gradational with the underlying upper, thick-bedded member of the Bone Spring Formation. The entire Victorio Peak Limestone is truncated by the Cutoff Formation south of Shumard Canyon.

H02—Bone Spring Formation—Bone Spring Formation (Permian, Leonardian)—Bone Spring Formation

Pbs—Bone Spring Limestone (Permian, Leonardian)—Cross section only. King (1948) and Hayes (1964) suggest the unit consists dominantly of brownish gray to black, thinly bedded, rarely cherty limestone with lesser black to dark brown shale and dark brown shaly limestone. Well logs report a unit thickness of about 1,005 to 1,224 m here.