

# **Geologic Map of the Carlsbad East Quadrangle, Eddy County, New Mexico**

By

**Dehler, C. M.; Pederson, J. L.**

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*Open-file Digital Geologic Map OF-GM 060***

**Scale 1:24,000**

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

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### **Description of map units—Carlsbad East Quadrangle**

Sediment color was estimated by comparing dry sediment/rock to Munsell Color Chart (Munsell Color, 1994).

**Hd-disturbed areas (Holocene)**— Disturbance areas are quarries, dump, or flooded areas that obscure the local geology.

**Qal-alluvium (Holocene)** Brown (7.5 YR 6/4), silt to sand, well sorted, subangular to subrounded, dominantly quartz with rare lithics, occupies draws and river channels and associated active floodplains. Little to no vegetation. Overlies or inset into older units. Thickness (0-2m)

**Qaes (Pleistocene (?) to Holocene)**-Brown (7.5 YR 6/4), silty clay to silt to sand, sticky, plastic, local lithic pebbles, well sorted, subangular to subrounded, grains composed of 70% quartz and 30% carbonate and chert. Weak soil development in upper 1.25 m shows massive silty clay to clayey silt, brown (7.5 YR 5/4), slightly plastic, bioturbated, effervesces strongly, local organic film with granular soil structure in upper 15 cm, gypsiferous and calcareous concretions decreasing downward to 40 cm, prismatic structure down to 1.25 m. Locally weathers into badlands and exhibits piping. Sparsely to moderately vegetated. Common veneer on nearly all Quaternary deposits in the map area.. Up to 10-m thick.

**Qasm1-alluvial sand mainstem (Holocene)**- Light brown (7.5 YR 6/4), silt to fine-lower sand, subrounded to subangular, well sorted, massive, quartzose and lithic grains, scattered pebbles, rare cobbles, dispersed within matrix, few fine calcic nodules, surface locally reworked into coppice dunes, few thin laminated drapes of dark red mud. Top of this deposit forms a terrace (T1) 5 m above modern Pecos River and deposit is equivalent to flume sand in Carlsbad, can overlie or be inset into Qagm2. (up to 10m thick).

**Qagm2-alluvial gravel mainstem (Pleistocene)** Pecos River gravel and sand, medium upper to coarse upper with lesser granules and pebbles (3-6 cm in dia, ave.), moderately sorted, well rounded, moderately to well cemented by calcite. Sand fraction is mostly quartz and chert. Pebbles are composed of red, tan, and gray quartzite, variegated cherts, gray limestone, yellow limestone, yellow siltstone, lt grey and yellow dolomite, petrified wood, light tan and gray volcanic porphyry, bull quartz, schist; dominated by locally derived carbonates and siliciclastics. Large-scale trough crossbeds (m-scale widths and thicknesses). Capped by calcrete (1.5 to 2 m thick), autobrecciated, laminar at top. Inset into TQg. Forms low mesas and knobs along Pecos valley; often forms valley walls. Caps dominantly TQg in this map area and is locally deformed into domes. Fine-grained Holocene fill (Qasm1) lies between this deposit and the Pecos River (Qal) (potential fill-cut bench). (Thickness >15 m, likely similar to Qagdc2 thickness).

**Qagdc2-alluvial gravels of Dark Canyon (Pleistocene)**- Pink (7.5 YR 8/3) (matrix) and commonly medium gray (N 5) (clasts), fine sand to boulder gravel, sub-angular to rounded, locally-derived clasts of dolomite, limestone, siltstone, and sandstone, tabular to lenticular beds, crossbedded and imbricated, paleocurrent data indicate northeasterly flow. Calcrete cap (1-2 m thick). Correlates to Qagm2. Thickness >15 m, likely similar to other Qagm2 thickness.

**TQg Gatuna Formation (late Tertiary to early Pleistocene?)** Moderate orange pink (5 YR 8/4) to reddish orange (10 R 6/6) to red (2.5 YR 5/6), well sorted, subrounded to well rounded siltstone to sandstone (silt to fine upper sand), calcite cemented, bluish hue in places, locally gypsiferous, local well rounded granules and pebbles of chert, interbedded with non-calcareous mudstone (weathers blocky). Sandstone and siltstone beds are medium to thick and show horizontal planar laminations, low-angle crossbeds, and cut-and-fill structures. Mudstones in lenticular to tabular thin beds and also in m-scale-thick intervals. Slope former with badland weathering. Capped by mudstone- and gravel-bearing calcrete: plug is 0.5-1.0 m thick, pillar structures penetrate down into bedrock about 2 m. Varying bedding orientations in area show that TQg is warped (salt tectonics). Overlies local Permian bedrock units. Highly variable thickness 0->~100 m.

**Prc-Permian Rustler Formation, Culebra Dolomite Member (Ochoan)**- Cream to light gray (2.5 Y 7/1, 8/1, 8/2 and 7.5 Y2 8/1), finely crystalline, sugary dolomite and local limestone, prominently fractured, thin to medium bedded, autobrecciated locally, locally exposed and forms core of dome in northeastern map area. (<~12 m thick)

**Ptms---Tansill Formation—mixed silty facies (Guadalupean)**

Mixed dolomite, sandy siltstone to claystone, and gypsum. Forms slopes. Dolomite: Cream color weathered, blue-gray fresh. Thin to medium bedded. Claystone to siltstone to local very-fine-lower sandstone: dominantly olive green, with gray to orange, claystone to mudstone with thin interbeds of siltstone and very fine sandstone. Sandstone is a quartz arenite, subangular to subrounded grains, well sorted, and carbonate, silica and hematite cemented. Contorted beds with very thin gypsum interbeds. Poorly exposed. Likely equivalent to Ocotillo Member of DeFord and Riggs (1941). Lateral facies of Ptm. Thickness >10 feet (3 m).

**Ptm--- Tansill Formation—mixed facies (Guadalupean)**

Mixed dolomite, siltstone, and gypsum. Significantly less silty and gypsiferous than Ptms. Forms ledges. Sandy to silty, sugary dolomite to dolomitic limestone, weathers white to light tan to light grey to yellow, fresh color is light tan to light-medium grey to green. Conchoidally fractures. Interbedded with calcareous grey-green shale and pink siltstone. Alternating intervals of nonvesicular and vesicular dolomite define bedding, as do recessed intervals where shale has weathered out. Intraclastic breccia, peloids, mudcracks, fine laminations, local coated grains and ripplemarks, and teepee structures present. Rare gastropods and ostracods. Horizontal burrows present east of Avalon Hills. Thin to medium beds of dolomite interbedded with gypsum: dolomite shows evapomoldic porosity. Evapomoldic porosity can be mm-3 cm in diameter, pores often coalesced to define bedding. Voids can be lined with calcite and siderite, and are often at the base of individual beds. Terra rosa locally. Mesoscale plunging folds common in this facies: gypsum deposits or caves are associated with anticlinal hinges. Secondary calcite veins locally. Unit forms red to yellow to tan soils. Contact with overlying Ptms facies is gradational and grades laterally into Ptmp and Ptms. Thickness >40 feet (12 m).

**Ptmp---Tansill Formation---pisolite facies (Guadalupean)**

Interbedded laminated, massive, and pisolitic-oolitic dolomites. Pisolites-oolites are yellowish-tan to reddish-tan to creamy white weathered, grey-tan fresh, and grains are mms to >6 cms. in diameter. Thinly to thickly bedded. Beds are tabular to lenticular and weather blocky. Small

(cms thick)- and large (meters-thick)-scale teepee structures present. Laminated and massive dolomites are yellow to grey weathered, light grey fresh, finely crystalline, silty to sandy, and can weather into vesicular and nonvesicular intervals, with vesicles defining bedding. Local intraclasts and coated grains. Cryptalgal laminations and evapomoldic porosity common. Low-angle crossbeds within thick beds present. Gastropods (replaced by silica) and bioturbation present locally. This facies present near central western edge of field area, south of the Avalon Hills. Forms alternating cliffs and ledges. Grades laterally into Ptd facies and Ptm facies. Thickness: up to ~150 feet (46 m).

### **Ptd—Tansill Formation---Dolomite facies (Guadalupian)**

Ledgy to cliffy dolomite at the base of the Tansill formation. Sugary dolomite to dolomitic limestone, tan to gray to light tan fresh, light gray to tan to creamy white weathered. Local pisoids and ooids. Planar to crinkly-laminated to massive. Possible mudcracks. Thin to medium tabular beds with undulose to planar bedding contacts. Bedding tabular and blocky. Evapomoldic porosity and “vesicular” weathering. Local solution breccia. Contact with overlying Ptm facies is gradational. Thickness: 0-40 feet (0-12 m).

### **Map symbols:**

**Pleistocene bar-and-swale paleocurrent indicators**--from air photo interpretation, only

**Bedding contact**-dashed where approximately located or where interpreted from air photo

**Bedding orientation**—dip and strike (azimuth) of bedding

**Anticline**-arrows on axis denote plunge direction, dashed where approximate, dotted where concealed

**Hatchures**- indicate depression made by salt removal/collapse and (or) wind deflation

**Oil/gas well location** (used in this study)

**Water well location** (used in this study)

### **Depositional environments of Permian facies**

Permian outcrops (in the Carlsbad East quadrangle) are confined to a few places along the western edge and the northeastern part of the quadrangle. Sedimentary structures and macrofossils are rare. The sedimentary characteristics of the Tansill formation facies and Culebra Dolomite suggest a restricted shallow shelf environment (back reef).

### **Structural geology**

Mapping reflects gentle folding of Permian through Quaternary units. The random orientation of much of the bedding, and the presence of domes and basins, in combination with many

dissolution depressions, suggest that salt mobility is dominantly responsible for local deformation of units.

### **Geomorphology and landscape evolution of the Pecos River**

The Gatuna Formation likely represents the earliest Pecos River deposits and may be older than middle Pleistocene, but is likely post Ogallala Fm. The Gatuna Fm. represents a north- to south-directed river system that underwent a significant valley-filling episode. This unit is not fully within the present landscape position in that it is not confined to the modern Pecos Valley, but parallels it in a broader region between uplands to the west and east.

Two hypotheses address the landscape position of the Quaternary deposits in this quadrangle. The preferred hypothesis is that the deposits underlying the hills in the quadrangle (Qamg2) are the same deposit as that in the topographically lower surrounding landscape (Qaes/Qagp2). Another hypothesis is that these deposits at higher elevations are an older deposit and that the hills represent eroded terraces preserved in the landscape. This latter hypothesis is not favored due to: insignificant differences in calcrete development; same composition of clasts (provenance); calcrete surfaces follow land surface; and no terrace risers observed. In keeping with the first hypothesis, Qamg2 and related deposits are the oldest known Quaternary deposits in the field area. They are post-Ogallala Fm (and post Gatuna Fm—TQg) and pre-modern Pecos River, and likely represents the ancestral (Pleistocene) Pecos River in a setting analogous to the modern Pecos River. Although most of the alluvial gravels in the quadrangle may be approximately the same age, they may be polygenetic.

Aeolian deposits (Qaes) in the area are dominantly confined to the eastern side of the Pecos River (downwind side), within a mile-wide belt east of the Pecos River. The main sand source for these dunes is from the paleo- and modern Pecos River deposits.

### **References**

DeFord, R.K., and Riggs, G.D., 1941. The Tansill Formation, West Texas and southeastern New Mexico: Am. Assoc. Petroleum Geol., Bull., v. 25, no. 9, pp. 1713-1728.