

Preliminary Geologic Map of the Sierra de la Cruz Quadrangle, Socorro County, New Mexico (Year 1 of 1-Year)

By

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*Open-file Digital Geologic Map OF-GM 227***

Scale 1:24,000

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ABSTRACT

The Sierra de la Cruz quadrangle exposes Pennsylvanian through Holocene strata in possibly the most structurally complex area in central New Mexico. A variety of faults and folds of both Laramide and rift affinity are present. Most faults strike northeast, north, or northwest; most are high-angle. Normal, reverse, and strike-slip faults are present. The Montosa fault, a regional, dextral-oblique reverse fault of Laramide origin (see Cather, 2009a, and references therein) terminates in the southern part of the quadrangle (Brown, 1987). It was reactivated as a west-down normal fault (probably during the Miocene) before being buried by the Black Mesa basalt (undated, but probably Pliocene or early Pleistocene).

Low-angle normal faulting (younger over older) within the Permian section is particularly well developed in the Sierra de la Cruz quadrangle (Colpitts, 1986; Linden, 1990). Low-angle normal faults in the La Cebolla area of the southeastern part of the quadrangle represent the detachment fault into which the listric Bustos fault (exposed to the south) soles (Cather and Osburn, 2007; S. Flores, 2011, unpublished geologic map; Axen et al., 2012; see cross section). Low-angle normal faults are mostly top-east, as shown by truncation geometry of hanging-wall bedding by the fault (Cather, 2009b; 2009c).

Field relations previously interpreted as thrust faults (older over younger) by Linden (1990) and Colpitts (1986) in the northwestern part of the quadrangle can also be explained using high angle faults. Although the structural interpretation of some areas is unclear because of inadequate exposure, local field relationships previously ascribed to thrust faulting clearly do not involve low-angle structures (e.g., near 339900E, 3786900N and 341500E, 3789500N). Based on this, I have used high-angle faults to explain field relationships that were previously interpreted using thrust faults elsewhere on the map. This was done to provide an alternative to the earlier interpretations, although in some cases the structural style is ambiguous.

DESCRIPTION OF UNITS

CENOZOIC ERATHEM

Middle(?) Pleistocene-Holocene

Qal Alluvium (Holocene)-- Sand, gravel, and mud in, and adjacent to, modern arroyo channels. Alluvium is typically at or near the grade of modern channels. 0-10 m thick.

Qc Colluvium and talus (upper Pleistocene-Holocene)—Gravelly deposits of poorly sorted colluvium and talus blocks on, or adjacent to, steep slopes.

Qae Eolian deposits (upper Pleistocene-Holocene)-- Eolian sand and loessic silt locally reworked by alluvial processes. Deposits are stabilized by vegetation in most areas. Includes thin, discontinuous eolian veneers on stable upland surfaces. 0-5 m thick.

Qvy Younger piedmont alluvium (upper Pleistocene)-- Gravel, sand, and minor mud deposited at low elevations (less than about 10 m) above modern stream grade. Alluvium is representative of deposition in a variety of piedmont environments, including alluvial fans, paleovalley and arroyo fills, strath terraces, fill terraces, and pediment surfaces. 0-15 m thick.

Qvo Older piedmont alluvium (middle(?) Pleistocene)--Gravel, sand, and mud deposited at higher elevations (more than about 10 m) above modern stream. Range of depositional environments is similar to Qvy. 0-15 m thick.

Upper Eocene-lower Miocene

Ti, Tid, Tis Andesite to basaltic andesite intrusions (**Ti**), dikes (**Tid**), and sills (**Tis**)-- Mafic to intermediate-composition, aphanitic to sparsely porphyritic, medium to dark gray intrusive rocks that commonly exhibit greenish alteration. The age of the intermediate-composition sill in SE/4 sec. 6, T2S, R3E is 20.98 ± 0.12 Ma (integrated Ar40/Ar39 age); the dike in NW/4 sec. 8, T2S, R3E is 34.70 ± 0.11 Ma (integrated Ar40/Ar39 age on biotite) (Mark Green, written commun., 2012).

MESOZOIC ERATHEM

Upper Cretaceous

Kth Tres Hermanos Formation (middle Turonian)--Sandstone and shale unit that forms a regressive-transgressive wedge of nearshore marine and non-marine deposits. About 80 m thick regionally. Top of unit is not exposed in quadrangle. Consists of three unmapped members, in ascending order: the Atarque Sandstone Member (regressive coastal barrier sandstone), the Carthage Member (marine, marginal marine, and non-marine sandstone and shale), and the Fite Ranch Sandstone Member (coastal barrier sandstone).

Kml Lower part of the Mancos Shale (middle Cenomanian-lower Turonian)-- Calcareous and noncalcareous, gray marine shale with minor, thin sandstone beds. About 135 m thick regionally. Base is not exposed in quadrangle.

TRc Chinle Group (Upper Triassic)--Red, gray and maroon fluvial mudstone with subordinate sandstone, limestone-pebble conglomerate, and limestone. Forms slopes and valleys. About 200 m thick.

TRm Moenkopi Formation (Middle and Lower Triassic)--Red-brown, brown, and buff continental mudstone, sandstone and minor conglomerate. About 20-30 m thick.

PALEOZOIC ERATHEM

Permian

Psa San Andres Formation (Permian, Leonardian)--Interbedded limestone, dolostone, gypsum. Limestone is brownish-black, pale yellowish-brown and medium gray, and range from wackestone to grainstone. Dolostone is brownish-gray to olive-gray, and locally gypsiferous. Bedded gypsum is abundant in upper San Andres in the northwestern part of the quadrangle. Gypsum is white to light gray, laminated to massively bedded. Thickness is ~60-200 m.

Pg Glorieta Sandstone (Permian, Leonardian)--White to very pale orange, fine- to medium-grained, friable to well-indurated, crossbedded quartzarenite. Has scattered coarse, well-rounded, frosted quartz grains, especially in the lower half of the unit. Thickness is ~70 meters.

Py Yeso Formation (Permian, Leonardian)--Interbedded sandstone, siltstone, dolomitic limestone and shale. Divided into four members (in ascending order): the Meseta Blanca, Torres, Cañas Gypsum, and Joyita Members (the upper two members are locally cut out by low-angle normal faults). The Meseta Blanca Member constitutes the lower Yeso Formation (**Pyl**; ~90 m thick), and the Torres, Cañas Gypsum and Joyita Members constitute the upper Yeso Formation (**Pyu**; ~200 m thick). Meseta Blanca Member--interbedded very pale orange, pinkish-gray and moderate reddish-brown, very fine- to coarse-grained quartzose sandstone, are very light gray to dark reddish-brown siltstone and are dark reddish-brown to grayish-red, slope forming mudstones and shales. Thickness is ~90 meters. Torres Member--interbedded pale to moderate reddish-brown, grayish-pink or grayish-red, fine- to medium-grained quartzose sandstone, white to light gray gypsum thin layers and lenses of dolomitized oolitic limestone, and pale yellowish-brown to olive black limestone that ranges from carbonate mudstone to peloidal or oolitic packstone and grainstone and are locally fossiliferous, dolomitic, and argillaceous. As many as 12 limestone beds present within the section. Thickness is ~160 meters. Cañas Gypsum Member--interbedded very light gray to white laminated to chicken-wire gypsum and minor, thin very fine-grained silty sandstone and a thin, medial, fetid, gypsiferous carbonate mudstone. Thickness is 0-24 meters. Joyita Member--pale reddish-brown to moderate reddish-orange, friable and calcareous, fine- to very fine-grained quartzose sandstone with scattered displacive halite casts and clay flakes on bedding surfaces. The upper beds display low-angle cross beds and ripple cross-laminations. Thickness is 0-30 meters.

Pa Abo Formation (Permian, Leonardian)--Interbedded dark reddish brown mudstone and shale, and grayish red to dark reddish brown siltstone, sandstone and, locally, thin conglomerate and rare limestone. Thickness is ~200 meters.

Pb Bursum Formation (Permian, Wolfcampian)--Interbedded medium dark gray to grayish red mudstone, medium gray to brownish black, peloidal, fossiliferous, and locally dolomitic limestone, and grayish orange pink to grayish orange, fine to very coarse-grained, lenticular and trough cross-bedded sandstone. About 60 m thick.

Pennsylvanian

IPma Atrasado Formation of Madera Group (Desmoinesian, Missourian, and Virgilian)--Marine and paralic interbedded brownish-gray arkosic sandstone, greenish-gray to gray mudstone, and light gray limestone. Approximately 250 m thick.

IPmg Gray Mesa Formation of Madera Group (Desmoinesian)--Medium-gray, fossiliferous, commonly cherty, marine limestone, greenish-gray mudstone, and minor sandstone. Cross section only; ~50 m thick regionally.

EXPLANATION OF MAP SYMBOLS

Contact between geologic units. Dashed where approximately located; dotted where concealed.

Fault showing direction (arrow) and amount of dip of fault plane. Dashed where approximately located; dotted where concealed. Bar and ball on downthrown block of steep faults. Square teeth on upper plate of moderate- to low-angle normal faults that cut out section (younger over older); triangular teeth on upper plate of low-angle thrust faults that repeat section (older over younger).

Anticline showing trace of axial plane and plunge direction. Dashed where approximately located, dotted where concealed.

Syncline showing trace of axial plane and plunge direction. Dashed where approximately located, dotted where concealed.

Strike and dip of bedding.

Vertical bedding.

Horizontal bedding.

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