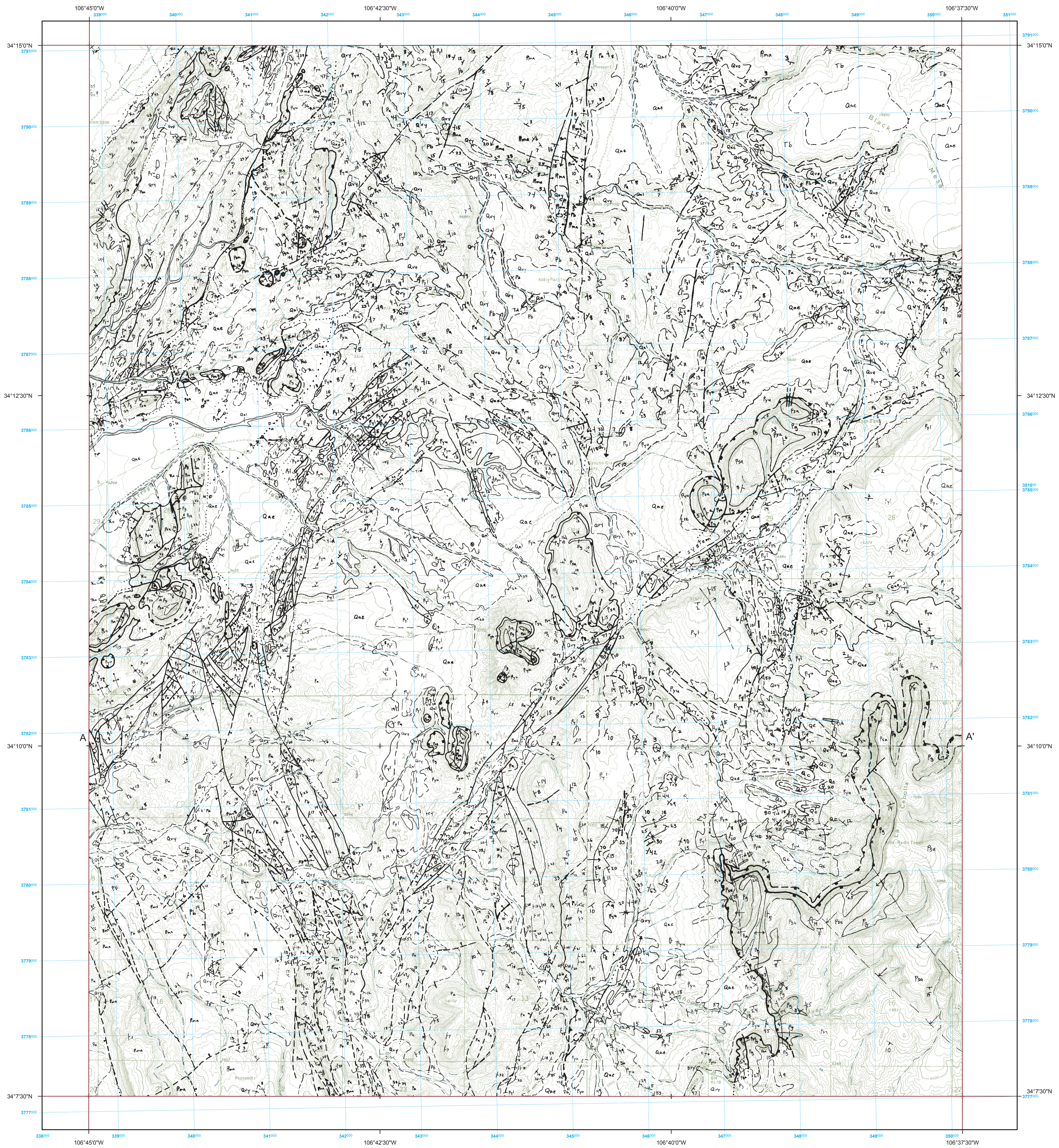
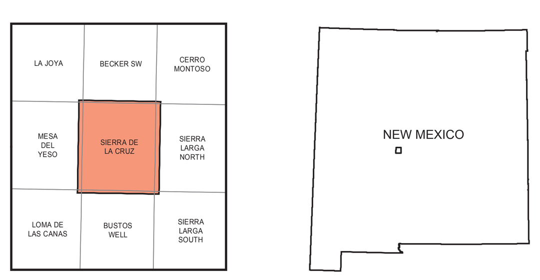
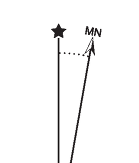


Base map from U.S. Geological Survey 1972, from photographs taken 1971, field checked in 1972.
1927 North American datum, UTM projection -- zone 13N
1000-meter Universal Transverse Mercator grid, zone 13, shown in red

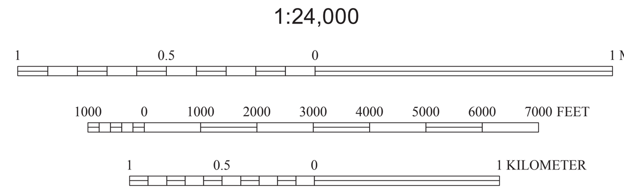


QUADRANGLE LOCATION



Magnetic Declination
March, 2005
9° 52' East
At Map Center

1:24,000



CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

New Mexico Bureau of Geology and Mineral Resources
Open-File Geologic Map 227

Mapping of this quadrangle was funded by a matching-funds grant from the STATEMAP program of the National Cooperative Geologic Mapping Act, administered by the U. S. Geological Survey, and by the New Mexico Bureau of Geology and Mineral Resources, (L. Greer Price, *Director and State Geologist*, Dr. J. Michael Timmons, *Geologic Mapping Program Manager*).

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

Geologic map of the Sierra De La Cruz quadrangle, Socorro County, New Mexico

June, 2012

by
Steven J. Cather[1] and Robert Colpits Jr. [2]

[1] NMBGMR, 801 Leroy Pl. Socorro, NM, 87801
[2] 7000 I20 West #20, Aledo, TX, 76008

This draft geologic map is preliminary and will undergo revision. It was produced from either scans of hand-drafted originals or from digitally drafted original maps and figures using a wide variety of software, and is currently in cartographic production. It is being distributed in this draft form as part of the bureau's Open-file map series (OFGM), due to high demand for current geologic map data in these areas where STATEMAP quadrangles are located, and it is the bureau's policy to disseminate geologic data to the public as soon as possible.

After this map has undergone scientific peer review, editing, and final cartographic production adhering to bureau map standards, it will be released in our Geologic Map (GM) series. This final version will receive a new GM number and will supercede this preliminary open-file geologic map.

DRAFT

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 associated with recent development may not be shown.

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 map has not been reviewed according to New Mexico Bureau of Geology and Mineral Resources standards. The contents of the report and map should not be considered final and complete until reviewed and published by the New Mexico Bureau of Geology and Mineral Resources. The views and conclusions contained in this document 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.

MAP UNIT DESCRIPTIONS

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.

Ꝁc 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.

Ꝁm 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.

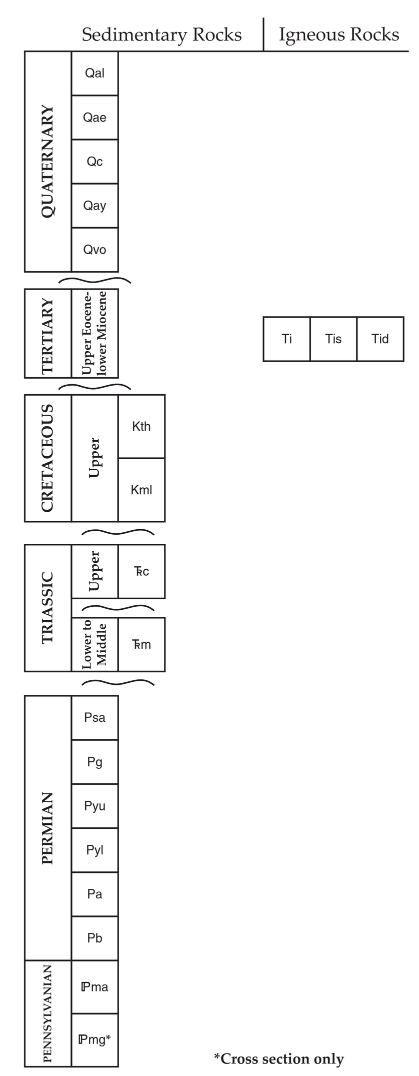
Pb Bursum Formation (Permian, Wolfcampian)--Interbedded medium dark gray to grayish red mudstone, medium gray to brownish black, peloidal, fossiliferous, and locally dolomitic limestone, and grayish orange pink to grayish orange, fine to very coarse-grained, lenticular and trough cross-bedded sandstone.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

CORRELATION DIAGRAM



*Cross section only

MAP EXPLANATION

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.

REFERENCES

Axen, G., Flores, S., Cather, S.M., and Green, M., 2012, Neogene decollment-style faulting in Permian Yeso formation, Sierra Larga, Socorro County, New Mexico: Geological Society of America, Abstracts with Programs, v. 44, p. 28.

Brown, K.B., 1987, Geology of the southern Cañoncita de la Uva area, Socorro County, New Mexico [M.S. thesis]: Socorro, New Mexico Institute of Mining and Technology, 89 p.

Cather, S.M., 2009a, The Montosa fault: New Mexico Geological Society, 60th field conference guidebook, p.73-74.

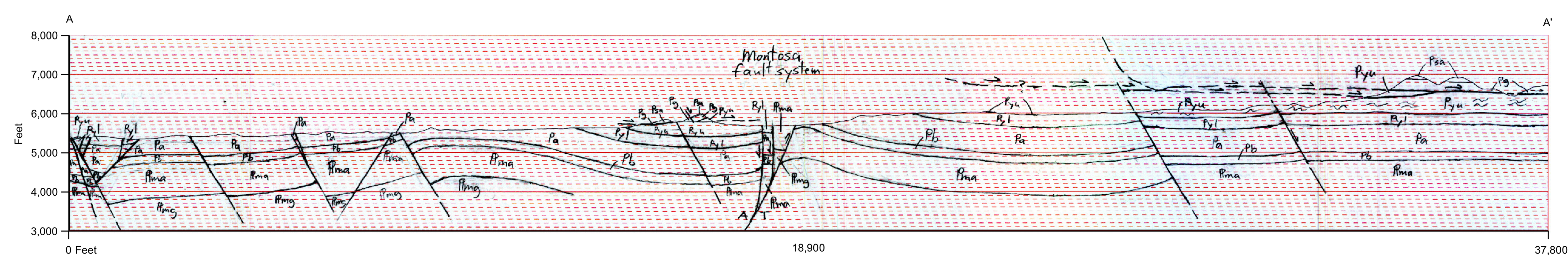
Cather, S.M., 2009b, Tectonics of the Chupadera Mesa region, central New Mexico: New Mexico Geological Society, 60th field conference guidebook, p.127-137.

Cather, S.M., 2009c, Stratigraphy and structure of the Laramide Carthage-La Joya basin, central New Mexico: New Mexico Geological Society, 60th field conference guidebook, p.227-234.

Cather , S.M., and Osburn, G.R., 2007, Preliminary geologic map of the Cañon Agua Buena quadrangle, Socorro County, New Mexico: New Mexico Bureau of Geology and Mineral Resources, OF-GM 146, scale 1:24,000.

Colpitts, R.M., Jr., 1986, Geology of the Sierra de la Cruz area, Socorro County, New Mexico [M.S. thesis]: Socorro, New Mexico Institute of Mining and Technology, 141 p.

Linden, R.M., 1990, Allochthonous Permian rocks in the Socorro region, central New Mexico: A structural analysis of emplacement and deformation [Ph.D. thesis]: Socorro, New Mexico Institute of Mining and Technology, 104 p.



1:24,000