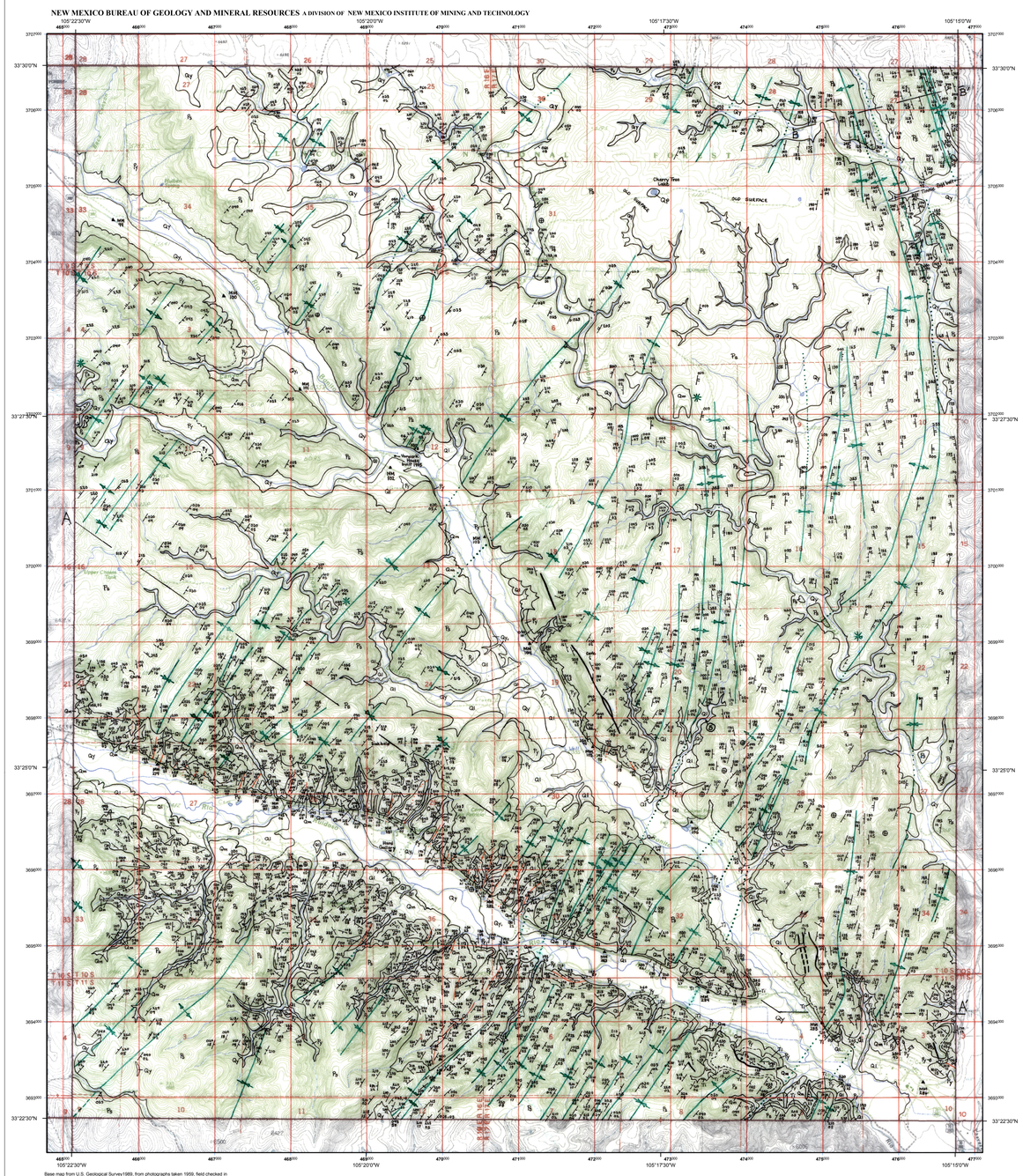

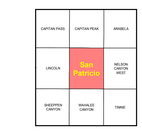

QUADRANGLE LOCATION

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
NATIONAL GEODETIC VERTICAL DATUM OF 1929

New Mexico Bureau of Geology and Mineral Resources
Open-file Map Series
OFGM 189

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, (Dr. Peter A. Scholle, *Director and State Geologist*, Dr. J. Michael Timmons, *Geologic Mapping Program Manager*).

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This and other STATEMAP quadrangles are (or soon will be) available for free download in both PDF and ArcGIS formats at:

http://geoinfo.nmt.edu/publications/maps/geologic/ofgm/home.html

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

Geologic map of the San Patricio quadrangle, Lincoln County, New Mexico

May 2009

by
Steven J. Skotnicki

Lawrence Geoservices, 2321 Elizabeth St NE, Albuquerque, NM, 87112

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.

UNIT DESCRIPTIONS

Quaternary Deposits

Qy Holocene alluvial deposits. These deposits were mapped separately from the remainder of the Quaternary surficial deposits because they are relatively easy to identify and are important because these are areas that may be prone to flooding. They are composed of weakly consolidated interbedded gravel, silt, and clay. They commonly form relatively flat deposits at the bottom of the wider drainages. They characteristically contain abundant dark, organic- and clay-rich soils at the surface. The deposits are commonly incised up to about 2-3 meters by the modern drainages, where vertical faces locally show older soil horizons. As mapped, this unit locally contains at least two and possibly more terrace levels that might be mappable with larger-scale aerial photos.

Typical exposure of Qy deposits forming flat valley floors and dissected by modern stream channels. Sloping fans emanating from small canyons are also Qy. View is to the west in Devil's Canyon about 1 mile upstream from highway 70.

Qy1 Holocene alluvial deposits, older member. This subdivision of **Qy** was mapped separately only in areas along the major rivers where it was obvious that it formed an older deposit higher in the landscape. The Hurd Gallery in San Patricio rests close to the edge of one such terrace where it sits elevated from the lower **Qy** terrace by about 2-3 meters. Where exposed in road-cuts, these deposits are composed of interbedded silt and gravel. The top surface is mostly covered with fine silt.

Qp Playa deposits. Mostly weakly consolidated silt and clay. This unit is fills two natural depressions in the southeast corner of the Lincoln quadrangle and one in the northeast corner of the San Patricio quadrangle. The depression in the San Patricio quadrangle has the name 'Cherry Tree Lake', according to James McDaniels who lives about two miles to the northwest of the lake.

Ql Late Pleistocene alluvial deposits. Interbedded silt, fine sand, and gravel. Exposed in some road and stream-cuts not far from the confluence of Rio Ruidoso and Rio Bonito. These deposits contain interbedded silt and locally derived gravel, but are less cemented than the **Qm** deposits and typically contain weakly developed pedogenic carbonate horizons. A good exposure is on the north side of Hondo. These deposits form flat constructional surfaces that reside about 20 feet above the Holocene deposits (**Qy**).

Stream-cut exposure of Ql deposits. Note the absence of extensive calcium carbonate compared to Qm deposits and the presence of a darker soil zone at the top.

Qm Middle Pleistocene alluvial deposits. Interbedded silt, fine sand, and gravel. Good exposures are found in the Highway 70 road-cuts which show abundant tan silt interbedded with coarse subangular to subrounded gravel and small boulders. The lower portions near the large rivers commonly contain rounded river deposits up to about 1-2 meters thick, overlain by silt and carbonate-clast alluvial deposits. Some exposures show multiple soil zones, some of which are moderately cemented by pedogenic carbonate. These deposits form flat constructional surfaces that reside about 40 feet above the Late Pleistocene deposits **(Ql)**.

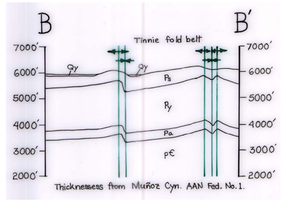
Left: Great exposure of Qm at the mouth of the canyon south of mile marker 278. Thin beds of rounded river gravels are overlain by silty overbank deposits containing soil horizons, overlain by alluvial fan deposits composed of poorly sorted carbonate clasts.
Right: At least three soil horizons are exposed in Qm deposits about 1/2 mile northwest of mile marker 280. Note old gravel-filled channel on the right side.

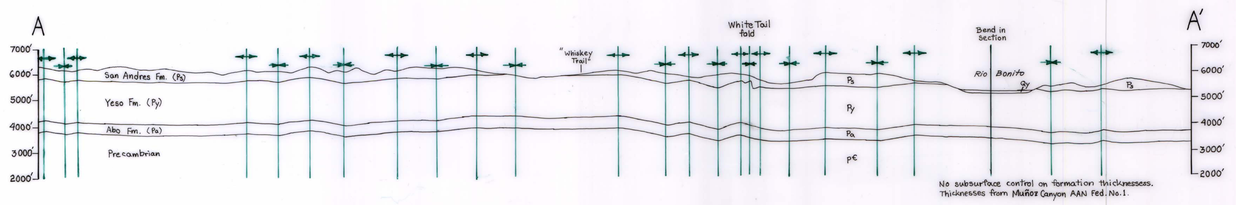
Qo Early Pleistocene alluvial deposits. Coarse conglomerate containing clasts up to large boulders 1-2 meters across. Forms a few small rounded dissected remnants in the Lincoln quadrangle. No soil zones remain. Poorly exposed, and typically strongly cemented by calcium carbonate.

Tertiary Intrusive Rocks

Ti Intrusive rock (Tertiary?). The textures of all sills in the area are all very similarly fine- to medium-grained. All contain plagioclase, biotite, opaques, and dark stubby minerals that appear to be pyroxene. MacKenzie and others (1992, p.133) described this type of rock as a kersantite, a variety of Lamprophyre (see also Cather et al., 1991). Nearly all of them intrude at or very close to the base of the San Andres Formation and are mostly concordant to bedding. These rocks typically weather into small spheroidal boulders and fine sand. The thickness of these sills is typically from several feet up to about 60 feet, though locally exceeds 150 feet.

Sills intruding the lower part of the San Andres Formation between mile markers 271 and 272 intrude both concordant and discordant to bedding.





Paleozoic Rocks

Ps San Andres Formation (Permian). Medium- to thick-bedded dolomite and limestone. Dolomite beds are typically light gray-colored, whereas limestone beds are commonly darker gray. Many beds contain sand-sized broken fossil debris surrounded by a matrix composed of micrite and more commonly microspar. Some beds contain faint, parallel laminae parallel to bedding. Other beds are massive and appear bioturbated. Orange-weathering chert is minor but widespread and is composed of granular microcrystalline quartz. The chert commonly forms irregularly shaped masses up to several tens of centimeters across that is both discordant and concordant to bedding. Common larger fossils include coiled gastropods up to about 5 cm across and less abundant nautiloids up to about 10 cm. Smaller recognizable fossils include crinoid stem segments, disarticulated brachiopods (commonly up to 2 cm and replaced by chert), and sparse fussilinids. The carbonate beds are interbedded with well sorted, fine- to medium-grained quartz sandstone from 1-10 meters thick, which probably represent intertonguing Glorietta Sandstone. The sandstone beds occur throughout the interval of the San Andres Formation, but are most common and thicker in within a few hundred feet of the base. Sandstone beds typically weather light orange to brown and in most outcrops contain abundant calcite-cemented BB-size concretions up to 2-3 mm across. Maximum thickness in cross-section is about 800 feet.

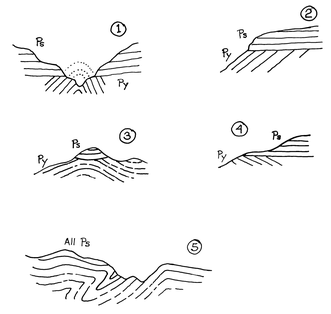
Left: Exposure showing bedding in the San Andres Formation on the north side of Devils Canyon, on the west side of section 16. The layer 2/3rd of the way down the slope with the vertical jointing is a sill.
Right: Pink-weathering nodular chert in the San Andres Formation.

Left: Some beds within the San Andres Formation contain abundant coiled fossils that resemble aminoids, but lack obvious chamber walls. These may be gastropods.
Right: A typical exposure of the Glorieta Sandstone in the lower part of the San Andres Formation.

Py Yeso Formation (Permian). Interbedded fine-grained quartz sandstone, siltstone, dolomite, and bedded gypsum. Siltstone is commonly rusty red and pale yellow. Dolomite beds are locally fossiliferous and contain silicified brachiopod and crinoid fragments, abundant coiled gastropods, aminods, and possibly cephalopods. Dolomite beds locally contain moldic porosity with some pores still filled with gypsum. Gypsum beds are typically sub-horizontally banded and are locally thicker than 10 meters. Exposures are poor and typically mantled by regolith. The thickness obtained from the log of the Muñoz Canyon AAN Fed. No.1 well is 1,685 feet.

Left: A good exposure of the Yeso Formation in a stream-cut showing red and yellow siltstones overlain by thin– to medium-bedded dolomite. Looking southwest in canyon south of mile marker 278.
Right: Both gastropods (left) and aminoids/nautiloids (right) are common in both the Yeso Formation and San Andres Formation.

Pa Abo Formation (Permian). Shown only in the cross-sections. The thickness obtained from the log of the Muñoz Canyon AAN Fed. No.1 well is 370 feet.



1. Diagrammatic drawing showing the angular unconformity between the Yeso Formation and the overlying San Andres Formation at Locality 1. Looking north.
2. Diagrammatic drawing showing the angular unconformity between the Yeso Formation and the overlying San Andres Formation at Locality 2. Looking north.
3. Diagrammatic drawing showing the angular unconformity between the Yeso Formation and the overlying San Andres Formation at Locality 3. Looking north.
4. Diagrammatic drawing showing the angular unconformity between the Yeso Formation and the overlying San Andres Formation at Locality 4. Looking north.
5. Diagrammatic drawing showing a large kink-fold within the San Andres Formation at Locality 5. Looking north.

Quaternary deposits

Qy | Qy1 | Qp

Ql

Qm

Qo

Tertiary rocks

Ti

Paleozoic rocks

Ps

Py

Pa