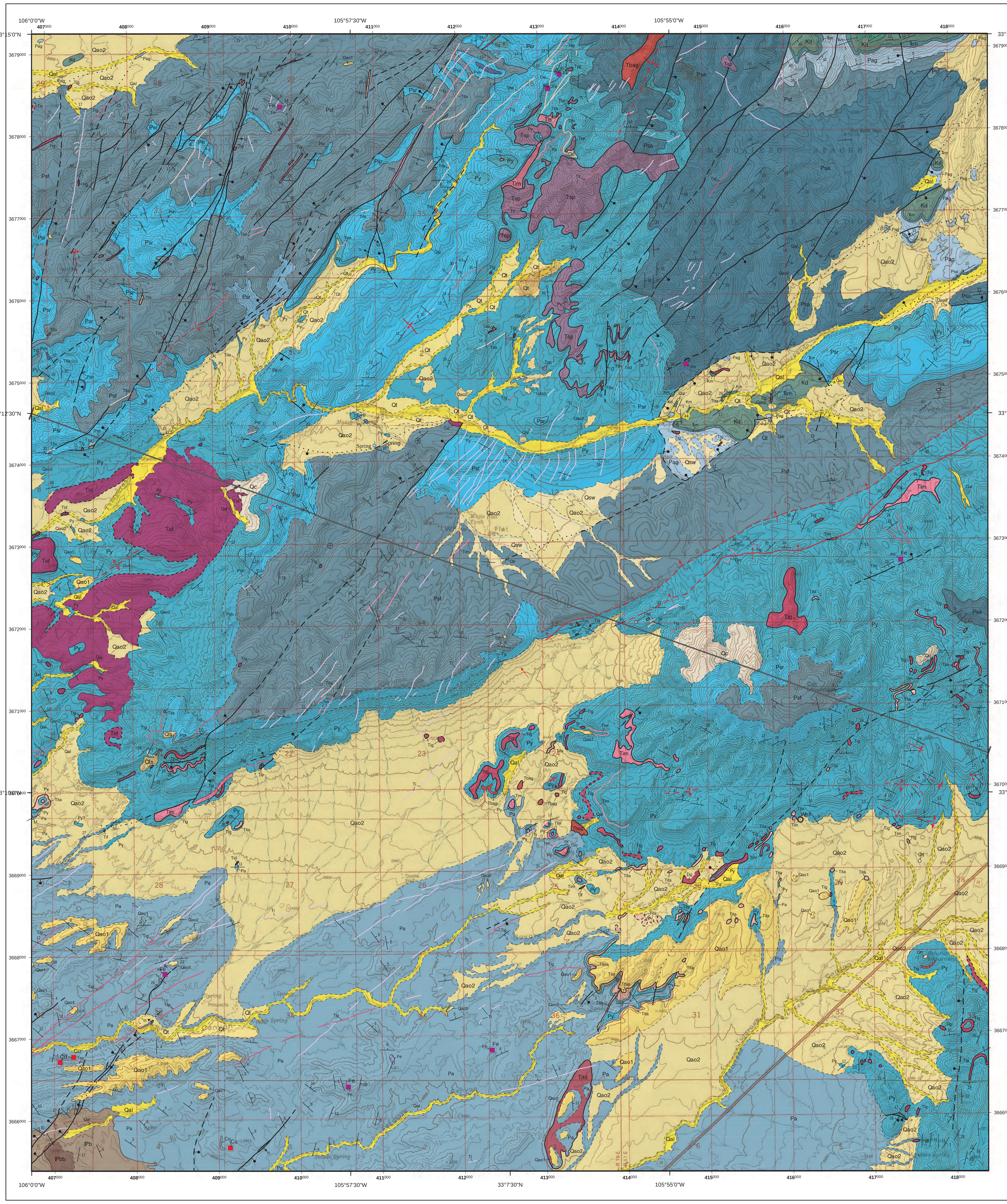
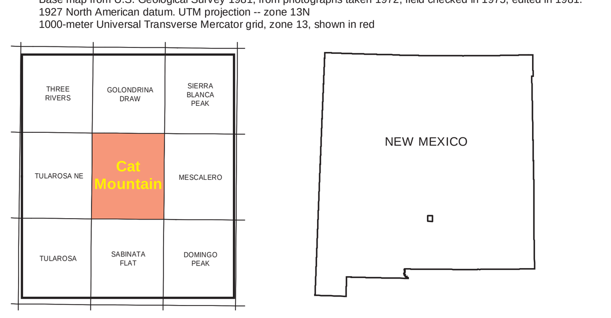
NMBGMR Open-file Geologic Map 183
Last Modified 16 December 2010



Base map from U.S. Geological Survey 1981, from photographs taken 1972, field checked in 1975, edited in 1981.
1927 North American datum. UTM projection -- zone 13N
1000-meter Universal Transverse Mercator grid, zone 13, shown in red



QUADRANGLE LOCATION

Magnetic Declination
April, 2007
9º 11' East
At Map Center

1:24,000

1 MILE · 7000 FEET · 1 KILOMETER

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

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

New Mexico Bureau of Geology and Mineral Resources
Open-file Map Series
OFGM 183

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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

Geologic map of the Cat Mountain quadrangle, Otero County, New Mexico

May 2008

by
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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, 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.

INTRODUCTION

The Cat Mountain 7.5-minute quadrangle is located northeast of the village of Tularosa on the eastern margin of the Tularosa Basin in south-central New Mexico. Main access is via U.S. Highway 70 through the southeastern corner of the area and by a maintained dirt road through Coyote Canyon in the central part of the quadrangle. Southwest-flowing Tularosa Creek and Temporal Creek are the most significant drainages. A mix of private, Bureau of Land Management and State stakeholders own or manage the land. A portion of the western edge of the Mescalero Apache Reservation occupies the northeast corner of the quadrangle.

Moore et al. (1988) mapped the northwestern part of the Mescalero Apache Reservation, including the northeastern corner of the Cat Mountain quadrangle at a 1:24,000 scale. We did not have permission to work on the reservation, so we used a slightly modified version of the Moore et al. (1988) map on the reservation land. Moore et al. (1988) originally lumped the Triassic Moenkopi Formation and and the Permian Grayburg Formation into a unit described as Triassic Santa Rosa Formation. We modified their "Triassic" contacts using Google Earth images and air photos. Otte (1959) mapped the southern quarter of the quadrangle at a scale of 4 inches to 1 mile (1:15,840). Otte (1959) focused his excellent and thorough work on the Pennsylvanian to Permian Labrocita Formation, which we correlate to the Bursum Formation in this report. Otte (1959) mapped the Labrocita Formation and the lower part of the overlying Abo Formation on a bed-by-bed basis using a plane table, creating a map of unprecedented detail. Kelley (1971) measured a complete section of the Yeso Formation in this area.

The quadrangle is in the transition between the east-dipping Sacramento Mountains and the Sierra Blanca volcanic field. In addition, this area is located on the southwestern margin of the Sierra Blanca basin, a north-northeast trending Laramide basin that contains sedimentary rocks as young as Eocene in age. The volcanic and plutonic rocks of the Sierra Blanca complex and Lincoln County porphyry belt were erupted onto and intruded into the Sierra Blanca basin ~26 to 38 million years ago. Countless dikes and sills associated with Sierra Blanca volcanism criss-cross the Cat Mountain region; the dikes follow a pronounced NE-trend. Rio Grande rift extensional faulting has since disrupted the Sierra Blanca basin and the volcanic centers. Rock exposures are generally quite good due to the sparse Chihuahuan desert vegetation and the moderate topography.

DESCRIPTION OF MAP UNITS

QUATERNARY

Qal — **Quaternary alluvium (Holocene):** Unconsolidated gravel, sand, clay, and silt, deposited in major modern drainage and tributary channels and associated floodplains. Locally contains small amounts of alluvial fan, colluvium and other Quaternary units. up to 5 m thick.

Qc — **Undivided colluvium (Holocene)**: Hillslope colluvial deposits composed of pebble to boulder size clasts from a variety of lithologies, mainly limestone. Common on north-facing slopes. Varies in thickness from ~ 5 – 50 m.

Qt — **Terrace deposits (Holocene):** Unconsolidated gravel, sand, and silt deposits along major present-day drainages inset into older alluvial deposits _ m above modern grade. 1-2 m thick.

Qsw — **Slopewash deposits (Holocene):** Unconsolidated tan silt with lenses of gravel and sand that consists primarily of eolian material reworked by sheetflow. These deposits cover the floors of broad valleys in the central part of the quadrangle. These deposits commonly sit on well-consolidated older alluvium. 1- 5 m thick.

Qls — **Landslide deposit (middle Pleistocene to Holocene):** Undivided landslide deposits composed of locally derived, cohesive blocks of Yeso Formation. Generally associated with a head scarp in their source area. Varies in thickness from ~ 5 – 50 m.

Qtr — **Travertine deposit (Pleistocene to Holocene):** Gray, porous limestone (tufa) cementing alluvium on the south side of the collapse structure at the confluence of Dry Canyon and Rinconada Canyon. Thickness < 2m.

Qao2 — **Old alluvium (Pleistocene):** Well-consolidated gravel, sand, and silt deposited by alluvial fans sourced from Black Mountain, located northeast of the quadrangle, and the northern foothills of the Sacramento Mountains. Gravel includes sedimentary (mainly limestone) and volcanic clasts. Red soil with carbonate stringers is well-developed at the top of the unit and gypsiferous silt is usually present in the uppermost part of the alluvium. Qao2 is usually covered by a thin veneer of young alluvium or slopewash and is best observed in deeply incised arroyos. Surfaces developed on this deposit are near modern grade. Younger thin cut and fill deposits along Salinas Draw on the northern edge of the quadrangle are lumped with Qao2. Up to 15 m thick.

Qao1 — **Older alluvium (Pleistocene):** Well-consolidated gravel, sand, and silt deposited by alluvial fans sourced in the northern foothills of the Sacramento Mountains on a high level strath cut on Permian Abo Formation in south-central part of the map area. Strath surfaces beneath this deposit are 50 to 70 m above modern grade. The gravels are typically clast-supported, imbricated, subrounded to subangular, poorly sorted, and consist of pebbles and cobbles. Gravel includes sedimentary (mainly limestone) and volcanic clasts.Up to 25 m thick.

NEOGENE

Ti — **Undifferentiated dikes and sills mapped from air photos.**

Tif — **Fine-grained trachyte (Eocene?):** Black to dark green, fine-grained dikes with barely discernable needles of plagioclase and pyroxene. Dikes 1 to 2 m wide.

Tit — **Trachyte (Eocene)**: Dikes of light gray to dark-gray porphyry with 15 to 25% plagioclase laths 10 to 20 mm long set in an equigranular to fine-grained matrix of dark green pyroxene and feldspar. The plagioclase laths are often distinctly aligned parallel to the margins of the dike. Dikes 1 to 4 m wide.

Tita — **Porphyritic trachyandesite (Eocene):** dikes and sills of light-gray porphyry with 5 to 15% phenocrysts of plagioclase feldspar, dark green pyroxene, and potassium feldspar that are 1-10 mm across. These intrusive bodies may grade into more equigranular textures (Tig). Syenitic and sedimentary xenoliths are locally present.

Titas — **Trachyandesite sill (Eocene):** Aerially extensive sill north of Highway 70 on the southwestern side of Cat Mountain. Porphyritic with phenocrysts of plagioclase, pyroxenes, and biotite. Sill is 10 m thick.

Titd — **Porphyritic trachydacite (Eocene)**: dikes and sills of light-gray porphyry with 5 to 15% phenocrysts of plagioclase feldspar, biotite ± hornblende, and dark green pyroxene that are 1-10 mm across.

Tig — **Alkali gabbro-syenogabbro (Eocene)**: equigranular, fine- to medium-grained, salt-and-pepper textured dikes and sills with plagioclase feldspar and pyroxene phenocrysts. These intrusive bodies may grade into more porphyritic textures (Tita). These intrusions often contain xenoliths of syenite (Figure 2). Dikes of this composition cut sills of megacrystic trachyte porphyry south of Coyote Peak and on the Tularosa NE quadrangle to the west. Alkali gabbro may contain amphibole and biotite (Moore et al., 1988). Thick sills of this composition in the northeastern parts of the map area have cumulate pyroxene at the base.

Tbag — **Coarse-grained alkali gabbro (Eocene):** Black to dark green medium to coarse-grained sill with subequal amounts of black pyroxene and plagioclase with sparse apple green pyroxene located on the southwest side of Cat Mountain. The coarse gabbro grades upward into a fine- to medium grained equigranular gabbro.

Tim — **Megacrystic trachyte porphyry (Eocene):** greenish gray porphyritic sills and dikes with megacrysts of embayed tschermakitic hornblende or green pyroxene that are up to 2 to 4 cm across. Often contains hornblende ± biotite. These intrusives can contain xenoliths of pink coarse-grained syenite with phenocrysts of orthoclase feldspar and hornblende.

Tip — **Amphibole-rich trachydacite (Eocene):** Black to dark green, medium-grained sills composed of ~30% dark green elongate amphibole needles, and subequal amounts of plagioclase and potassium feldspar. Sills 1 to 5 m thick.

Tis — **Syenite (middle Eocene)**: pink, medium-grained equigranular sill composed of potassium feldspar, plagioclase feldspar, pyroxene, and biotite.

Tid — **Alkali gabbro of Granite Well (Eocene)**: Greenish gray, equigranular, fine- to medium-grained, salt-and-pepper textured sill with plagioclase feldspar, pyroxene and biotite phenocrysts exposed south of Granite Well along Temporal Creek near the mountain front. This sill has a pryoxene-rich cumulate phase near the base. Sill is about 30 to 35 m thick.

Tsp — **Syenite of Temporal Creek (middle Eocene):** Tan to pink, equigranular to porphyritic stock exposed in the northeast corner of the quadrangle (Moore et al., 1988) north of Temporal Creek straddling the western boundary of the Mescalero Apache Indian Reservation. The most common phenocrysts are clinopyroxene, plagioclase feldspar, and potassium feldspar. Some phases of this stock have amphibole (Moore et al., 1988), while others have sparse phenocrysts of quartz. Trachyte dikes with large plagioclase phenocrysts cut this stock.

Tg — **Gravel (Pliocene?):** Unconsolidated gravel resting on San Andres Limestone in a saddle on Coyote Ridge at an elevation of ~5980 feet (1822m). The gravel includes sandstone, and pebbles of volcanic rocks from Sierra Blanca, as well as rounded limestone pebbles. < 1 m thick.

Mesozoic

Km — **Mancos Shale (Upper Cretaceous):** Black, finely-laminated, fossiliferous shale with thin beds of limestone and intercalated bentonite beds near the base. Brown to tan, cross-bedded to tabular-bedded sandstone and sandstone containing abundant oyster fossils occur higher in the exposed section. These marine deposits are in the lower part of the Rio Salado Tongue of the Mancos Shale (Moore et al., 1988).

Kd — **Dakota Sandstone (Upper Cretaceous):** Medium to thick-bedded to thinly laminated, medium- to coarse-grained, cross bedded white sandstone with lenses of dark gray shale. Chert and quartzite pebble conglomerate commonly occurs at or near the base of the unit. Distinctive, cylindrical *Ophiomorpha nodosa* burrows are abundant at the top of the Dakota Sandstone.

₮m — **Moenkopi Formation (Upper Triassic):** Red-brown, fine-grained, thin bedded, trough cross-bedded to ripple laminated sandstone. The sand grains are subround to round and include muscovite and lithic fragments. Conglomeratic sandstones with pebbles of chert and quartz are present in a few localities. The upper and lower contacts are disconformable. The fluvial Moenkopi Formation scoured channels into the underlying Grayburg Formation of the Artesia Group. The unit thickens toward the east. Thickness up to 10 m.

PALEOZOIC

Pag — **Grayburg Formation, Artesia Group (Permian):** Red siltstone with green reduction spots, red mudstone, and massive gypsum. Siltstone is massive to occasionally cross-laminated. Base with underlying Fourmile Draw Member of the San Andres Limestone is sharp and has a lag gravel. Gypsum occurs in the upper 10 m of the unit. The top is eroded and scoured by the Moenkopi Formation.

Psa — **San Andres Formation (Permian):** Kelley (1971) recognized three members in south central New Mexico. The lower part of the deposit, the Rio Bonito Member, is composed of medium- to thick-bedded dark gray, fossiliferous limestone, golden tan dolomite, and thin beds of yellow siltstone and gypsum. The middle part of the unit, the Bonney Canyon Member, is fossiliferous, gray thin-thick bedded dark gray limestone. The intercalated limestone gypsum unit in the upper part of the San Andres Formation belongs to the Fourmile Draw Member of Kelley (1971). In this area, only the Rio Bonito Member and the Fourmile Draw Member are present.

Psr — **Rio Bonito Member:** Dark gray, thin to thick bedded, fossiliferous limestone with thin to medium-bedded gypsum near the top of the unit. Fossils include productid brachiopods, crinoids, echinoderm spines, and bryozoa fragments. The contact with the underlying Yeso Group is generally quite sharp; however thin (<0.5 m) gypsum beds can persist a few meters above the contact. The Rio BonitoMember is 60 to 75 m thick.

Psh — **Hondo Sandstone:** This unit was described by Harbour (1971). The sandstone is present within the Rio Bonito Member approximately 30 m above the base of the limestone. The Hondo Sandstone is a gold-brown to tan, well-sorted, medium to fine-grained quartz arenite with well-rounded sand grains. Bedding is commonly tabular, cross-bedding is rare. The sandstone is discontinuous and ranges from 0 to 10 m thick. The sandstone, where present, is only 0.7 m thick on Cat Mountain (13 S 415916 3670526 NAD27) and is 5 to 10 m thick on the west end of Coyote Ridge.

Psf — **Fourmile Draw Member:** The Fourmile Draw Member is composed of interbedded light gray dolomite, dark gray limestone, and laminated gypsum. The carbonates contain fossils, but fossils are not as common as they are in the Rio Bonito Member. The relative percentage of gypsum to carbonate increases upsection through the member. The thickness of this unit is uncertain because the top is not exposed on the quadrangle and this unit is quite deformed. Estimated thickness is on the order of 300 m.

The contact between the Rio Bonito and Fourmile Draw members is very gradational and is here defined to be at the base of a distinctive limestone bed present across the map area. The marker limestone is dark gray, fossiliferous, and has a gypsum bed that is about 6 m thick below it. The carbonates above the marker limestone become progressively more dolomitic up section. The marker limestone is generally the thickest succession of limestone above cliffs of the Rio Bonito Member, but the marker does vary in thickness (20 to 80 feet; average is 40). The marker limestone forms an easily tracable unit on poorly exposed, gypsum-mantled hills.

The 6 m thick gypsum bed is continuous across the area, but thin, discontinuous gypsum and intercalated limestone beds often occur in the uppermost Rio Bonito Member as much as 25 m below the mappable marker limestone. Similarly, thin sequences of dark gray, fossiliferous limestone that grade up into dolomite and thick beds of gypsum are present above the marker limestone.

Py — **Yeso Formation (Permian):** Red and yellow siltstone and thin beds of gray limestone and laminated to thin bedded gypsum dominate the basal part of the section. A 30 m thick medium-bedded limestone forms a prominent bed in the middle portion of the unit. The upper part of the Yeso on Cat Mountain is gypsum with yellow and red siltstone and thin-bedded limestone. Red siltstone often occurs near the top of the unit. In contrast, the upper Yeso Formation to the north is primarily gypsum and limestone. The limestones are sparsely fossiliferous, containing brachiopods. A solitary nautiloid 15 cm across was found in limestone near the base of the unit. Sea star fossils are at the Yeso/San Andres contact in the northeastern part of the map area. Oncolites are preserved in the limestone at 13 S 416913 3670824 (NAD 27). The Yeso Formation has a gradational contact with the underlying Abo Formation that is particularly well exposed south and southwest of Cat Mountain. The red arkosic sandstone and red and green mudstone of the Abo Formation grade upward into thin beds of black and green shale, fine-grained green and yellow, sandstone, and thin beds of gypsum and limestone. The upper contact is gradational with the San Andres Formation . Kelley (1971) measured a complete section of Yeso Formation on the Cat Mountain quadrangle in the vicinity of Coyote Peak in T13S, R10E, sec. 21 and 22. Maximum thickness 372 m (1220 ft).

Pa — **Abo Formation (Permian):** Brick red sandstone, mudstone, siltstone, and conglomerate. The Abo Fomation is dominated by mudstone (50%) and arkosic sandstone and conglomerate (40%). Fossiliferous limestone and pedogenic carbonate, which are primarily found in the basal 150 m, make up the rest of the unit (Otte, 1959). Sandstones are cross-bedded to tabular, coarse to medium-grained, and poorly to moderately sorted. Angular to subround quartz, orthoclase feldspar, and muscovite are common sand grains. Conglomerates contain well-rounded clasts of Proterozoic quartzite, Proterozoic rhyolite porphyry, chert of uncertain age, and sandstone. Thin fossiliferous limestone beds that are 0.2 to 0.7 m thick locally occur near the transitional base of the unit, particularly in the southeast corner of the quadrangle. Thin (4 to 20 cm) chert beds are locally found just above the contact with the Labrocita Formation and above a thin (0.2 m) limestone bed at 13 S 408507 3666281 (NAD 27). Petrified wood is preserved in the Abo Formation at 13 S 408658 3664679 (NAD27). Malachite and hematite mineralization is associated with the Abo Formation. 427 m to 550 m thick (Otte, 1959; Speer, 1983).

IPb / IPbb — **Bursum Formation (Late Pennsylvanian to Early Permian):** Maroon and green sandstone interbedded with fossiliferous limestone and black shale. Biohermal mounds (**IPbb**) are dominantly composed of algae but have abundant crinoid stems preserved at the top. Bryozoans and brachipods are other common fossils on the mountds. This unit is equivalent to the Labrocita Formation of Otte (1959). We followed Otte (1959) by using a continuous limestone bed (Otte's bed 55) to mark the gradational contact between the Bursum and the Abo formations. Base not exposed. Maximum thickness in the northern Sacramento Mountains is 330 m (Raatz, 2002) and estimated thickness northeast of Tularosa is 305 m (Otte, 1959).

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