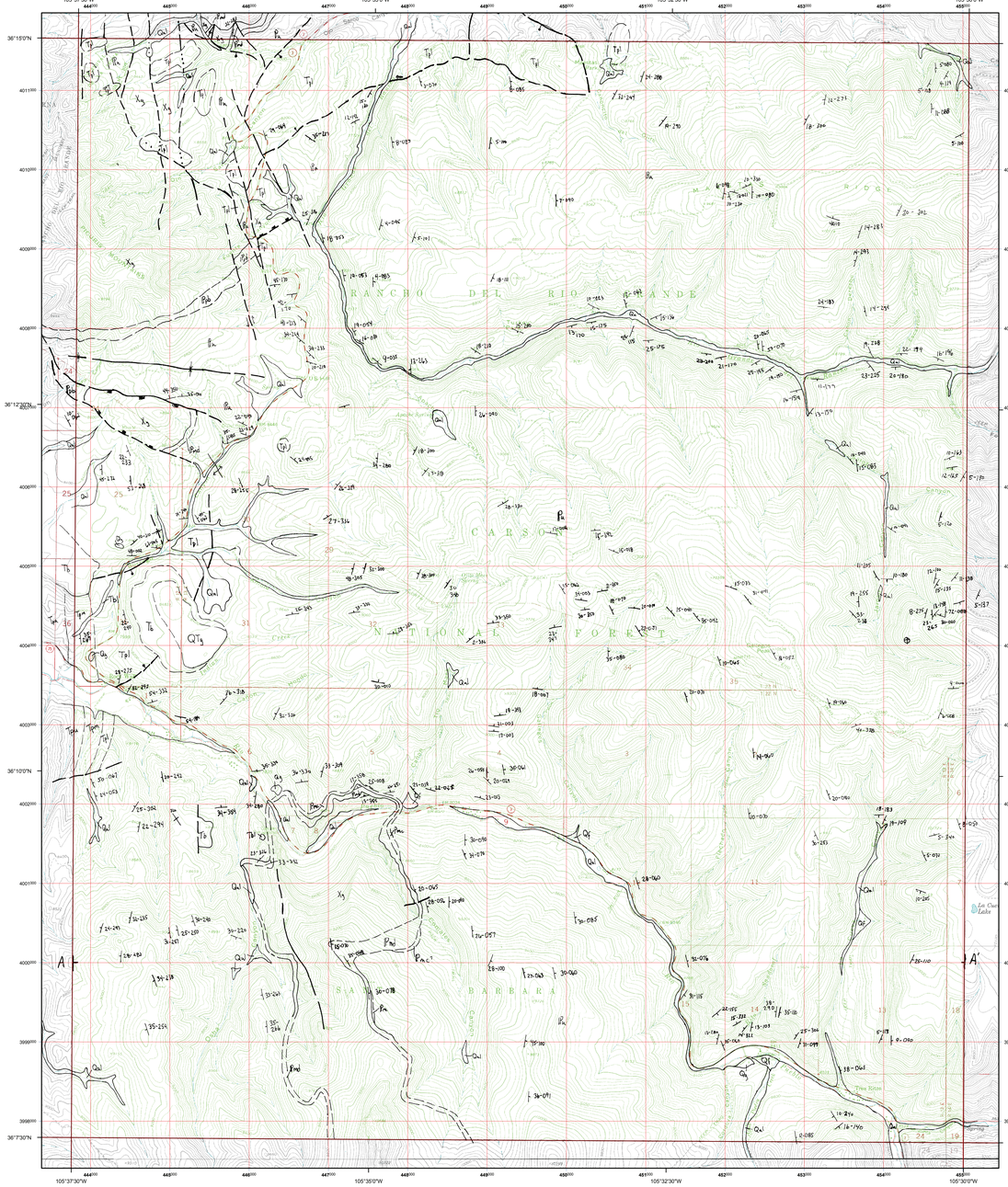
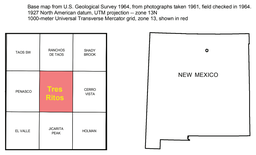


Base map from U.S. Geological Survey 1964, from photographs taken 1961, field checked in 1964.
1927 North American datum, UTM projection – zone 13N
1000-meter Universal Transverse Mercator grid, zone 13, shown in red



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 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 Geologic Map **145**

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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 Tres Ritos quadrangle, Taos County, New Mexico

May 2007

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.

Description of Units

Quaternary Rocks
Qal/Qf

Stream channel and valley-floor alluvium, and active floodplains (Holocene?)-Light-to-medium brown; loose, poorly to well-sorted; rounded-to-subangular, thin-to-thick bedded or massive; sand, pebbles, and boulders. Light-brownish sand, gravelly sand, and sandy gravel with minor mud and silt underlies modern ephemeral channels. Gravel is generally poorly sorted, subangular to subrounded pebbles. Sand is generally coarse- to very coarse-grained, poorly to moderately sorted, and subrounded to subangular. Estimated thickness of deposits associated with ephemeral channels is 1-5+ m. Thickness of alluvium under the Rio Pueblo is unknown.

Qc
Quaternary Colluvium

Colluvial deposits have not been mapped on this Quadrangle but most of the map area is covered by ~1-5 meters of brown-to-nearly black; loose; very poorly sorted; rounded-to-angular; massive-to-very crudely bedded; sandy-silty conglomerate and pebbly silty sand.

Qlb

Quaternary landslide deposits with intact blocks of Tertiary basalt flow(s) (late Pleistocene to Holocene?) Quaternary landslide deposits with intact blocks of Tertiary basalt flow(s) and abundant, subangular-to-angular basalt blocks. Found on slopes below the Vadito basalt.

Qg
Undifferentiated Quaternary gravel deposits. Commonly buff-to-brownish, rounded-to-well rounded, crudely bedded, uncemented, quartzite-rich conglomerate and sandy conglomerate. These deposits are rarely preserved on a mappable scale on this quadrangle, although small accumulations of rounded stream cobbles are occasionally found on hillslopes along the valley of the Rio Pueblo.

QTg
Quaternary and late Pliocene(?)

Poorly sorted sand and gravel deposits, typically with layers containing large rounded boulders of Proterozoic quartzite. Found on high erosional pediment surfaces, and commonly forms colluvial veneer on underlying units. Maximum thickness of 10 m. Broadly similar deposits cover large areas on the nearby Penasco (Bauer et al., 2003), El Valle (Aby et al., 2005), Trampas (Bauer et al., 2005), and Truchas (Smith et al., 2004) quadrangles and are discussed further in those reports. No rigorous, regional correlation of QTg deposits has been conducted and no direct age control is available. These deposits are therefore grouped together solely on their geomorphic position. On this Quadrangel QTg deposits are confined to one small area overlying Tb near the western edge of the map area. These gravels are composed of Proterozoic quartzite (~90%) and Paleozoic sandstone (~10%) with minor amounts of other Paleozoic rock types.

Tertiary Rocks
Tb
Tertiary 'Vadito' basalt

The basalt flows in the southwest part of the quadrangle are gray where weathered and black on fresh surfaces, strong, vesicular, **olivine tholeiite basalt**. These flows are up to approximately 10 m thick. No exposure of the lower contact of these flows has been found, but pebble-to-boulder gravel is often found on slopes immediately below the basalt. These 'deposits' have not been mapped due to their poor exposure and location below steep basalt cliffs.

Picuris Formation
Tpu
upper volcaniclastic member

Red to purple; very friable to nonfriable; very poorly to moderately well sorted; poorly rounded to rounded, thickly to thinly bedded; carbonate-cemented, **pebble and gravel conglomerate.** In the small area of exposure on this quadrangle, pebble-sized clasts are Tertiary volcanic (95%) and rounded Precambrian quartzite(5%), based on a single clast count. Most contacts between beds are abrupt and basal contact of coarser beds commonly scoured. Upper and lower contact are not exposed.

TpmTpmc
Cemented part of middle tuffaceous member

The upper part of the middle tuffaceous member is commonly strongly cemented with silica in the southern Picuris Mountains (Aby et al., 2004). This upper part of the middle member also commonly contains abundant clasts of Proterozoic rocks, as opposed to the rest of the middle member which contains only sparse lenses of such clasts. Only one small exposure of this unit is found on this quadrangle just northwest of the Rock Wall. Readers are referred to Aby et al. (2004) and Bauer et al. (2003) for a complete description of this unit

Middle tuffaceous member

The middle tuffaceous member is a yellowish-white; friable; moderately-to-well sorted; subangular to subrounded; massive or thinly-to-very thickly bedded; mostly weakly carbonate cemented; silty, vfl-cl, tuffaceous sandstone. Recent dating of a primary ash fall in the lower part of this unit on the Penasco Quadrangle immediately west of the Tres Ritos Quad) indicates deposition was occurring at ~25 Ma (Bauer et al., 2003, Peters, 2005). This date is equivalent to the age of the Amalia Tuff of the Latir Volcanic Field (Smith et al., 2002) and is assumed to represent ash-fall from that caldera-forming eruption. Clasts from the middle member range in age from ~23-28 Ma (Aby et al, 2004).

Tpl
Lower conglomerate member

The lower conglomerate member is whitetish, yellowish, yellowish-green, greenish, tan, and/or reddish; very friable; poorly-to-very poorly sorted (sometimes bimodal); rounded-to-subangular; thinly-to-very thickly bedded and sometimes massive(?); uncemented-to-moderately cemented, **sandy-to-silty boulder-to-pebble conglomerate with minor sandstone and pebbly sandstone**. The well-to-moderately-well rounded clasts in the lower member are commonly fractured and in float have a distinctive appearance due to the resulting combination of angular and rounded faces. Contacts are commonly mapped in float. The lower contact is placed at the first accumulations of diverse Proterozoic clasts (Quartzite, Pilar slate, +/- schist). The lower member is very poorly exposed on most of the Quadrangle except in road-cuts along NM 514 west of the "Rock Wall". In the southern Picuris mountains the lower member is approximately 200 m thick and may be up to 300-400 m thick in the western Picuris mountains (Aby et al., 2004).

Pebbles in the conglomerate are composed mostly of Proterozoic quartzite and smaller amounts of Pilar Slate (Table 1). The conglomerate displays a general fining-upward trend with very large (up to 2 m+) boulders at the base and poorly-to-moderately sorted, sandy, pebble-to-cobble conglomerate near the top. Some large boulders near the base of the section are granitic, in contrast to the predominance of quartzite clasts in most pebble counts (Table 1). Some individual beds within the lower conglomerate member along NM 518 also contain Tertiary volcanic clasts. These volcanic clasts are both under and overlain by Proterozoic clast dominated beds and seem to form a relatively thin interval (or intervals). **Several of these clasts have been submitted for geochemical and geochronologic analysis.**

Paleozoic Rocks
Pennsylvanian

Ppu
Undivided Pennsylvanian
(Sandia Formation or Flechado and Alamitos Formations)

Poorly exposed; greenish, reddish, yellowish, buff, tan, black, and brown; very friable-to-firm; sandy-to-clayey; thinly-to-thickly bedded; poorley-to-moderately well cemented (?) **sandy-to-clayey siltstone, mudstone, and shale** interbedded with mostly greenish and brownish, firm-to-very strong, poorly-to-moderately well sorted, poorly-to-moderately well rounded; thin-to-very thickly bedded; moderately-to-very well cemented; quartzose, feldspathic, and arkosic **silty-to-pebbly-sandstone and sandy conglomerate** and minor, thin-to-thick bedded; greyish and blackish **limestone**. Limestones contain a rich assortment of fossils (see below) and sandstones often have leaf fragments that have been altered to limonite. Contacts between beds are generally sharp, rarely with minor scour (less than ~20 cm). Lower contact is sharp, planar (?), and disconformable(?) where overlying Mississippian rocks and unconformable where overlying Proterozoic rocks. Lower contact is mapped at the top of the Del Padre Sandstone or highest Mississippian carbonate, or at the base of the lowest sedimentary bed where Mississippian rocks are absent. Contact with younger rocks is commonly a fault, but in some cases is depositional. In some places, an originally depositional contact seems to have been faulted, and low angle(?) faulting of depositional contacts with substantial (10's of meters(?) relief has produced complex map patterns (see Picuris Formation discussion). Lichen cover generally obscures sedimentary structures in available outcrops. Pebbles in conglomeratic beds are usually granitic and/or quartzite(?). White quartzite pebbles derived from the Ortega Quartzite are difficult to distinguish from vein quartz derived from Proterozoic granites and pegmatites. Conglomeratic parts in the lower part of the unit sometimes contain rare, sometimes banded pebbles of chert that are derived from the limestones of the Espiritu Santo Formation of the APG. Miller et al. (1963; Rio Pueblo section) measured an incomplete section 1756 m (5761.5 feet) thick along the Rio Pueblo at and east of the Commales Campground; they indicate an aggregate thickness of Pennsylvanian strata in this area of ~6000+ feet (1830+m).

Ppb
Basal sandstone

Mostly white with some yellowish, brownish, and/or reddish/red streaks and staining; very hard; moderately well sorted; angular-to-moderately well rounded; medium-to-thick bedded (?); well-to-very well, silica-cemented quartz **sandstone, pebbly sandstone, and minor breccia(?)**. This unit can be difficult to distinguish from the underlying Ortega Quartzite of the Hondo Group as induration is complete and both rock types break across grains (Aby et al., 2004). This unit can also be confused with the Mississippian Del Padre Sandstone as they occupy a similar stratigraphic position and are virtually identical in some hand samples. The basal Pennsylvanian sandstone has slightly more matrix; sparse, altered feldspar grains; generally poorer rounding of grains; and a less diverse range of (diagenetic?) colors than the Del Padre. Lower contact is mapped at the top of Proterozoic rocks. Upper contact is mapped at the top of the highest well-cemented sandstone. Partial removal of Mississippian carbonates regionally makes it likely that the basal Pennsylvanian sandstone directly overlies the Del Padre Sandstone in at least some areas. In such cases the two units would be effectively indistinguishable and the Del Padre sandstone would be included within the basal Pennsylvanian sandstone as mapped.

Mississippian
Espiritu Santo carbonates and Terrero Formation (combined)
Pmc
Mississippian Carbonates

Espiritu Santo and Terrero Formation carbonates are light grey on weathered surfaces and dark grey on fresh surfaces; fine grained (mostly recrystalized); well-to-moderately well sorted; thinly-to-very thickly bedded(?); massive; carbonate cemented **dolomite, dedolomite, and recrystalized limestone** (Armstrong et al., 1993). In the map area dolomite is rare. Large (~.5 to 70 cm), generally dark (black, grey, whiteish and rarely brownish), banded chert nodules and irregularly shaped layers are distinctive. Weathered surfaces show numerous-to-rare shell fragments while fossil fragments are rarely visible on fresh surfaces. This member lies disconformably on the Del Padre Sandstone. The lower contact is mapped at the lowest limestone (non-sandstone) bed. The upper contact of the Mississippian carbonates (Espiritu Santo Carbonates + Terero Fm.) is not exposed in the map area. We have mapped the approximate upper contact above the highest limestone (or float thereof) and/or at the base of the lowest presumed Pennsylvanian sandstone bed (see below). In some cases the upper contact has been inferred from the apparent local thickness of the combined Mississippian carbonates.

Espiritu Santo Formation

Pmd
Del Padre Sandstone Member (late Tournaisian)

The Del Padre Sandstone Member of the Espiritu Santo Formation is a white, tan, yellowish, green, red, and/or mottled; fine upper-to-very coarse upper; strong-to-very strong; moderately-to-very well sorted; well rounded-to-subangular, thinly-to-very thickly bedded; (mostly) horizontally laminated-to-low angle crossbedded, quartz-overgrowth cemented **sandstone, pebbly sandstone, sandy conglomerate, and minor breccia(?)**. Contacts between beds are generally sharp and parallel although minor (<20 cm) scour is seen locally. Jointing is prominent in much of this member. In the Rio Pueblo section this member is either ~19.5 m (Miller et al., 1963), ~17 m (Armstrong and Mamet, 1979) or ~8 m (Baltz and Meyers, 1999) thick. We did not measure our own section of the Del Padre, but our mapping suggests that the higher estimates are closer to the observed thickness. Exposure quality is good relative to other Paleozoic rocks (due to induration) but is variable in general. Even where exposure is relatively good, lichen cover commonly obscures sedimentary features and/or bedding in all ages of rocks. We map the basal contact of the Del Padre at the lowest identifiable clastic beds. This designation can be subjective where the Del Padre overlies the Ortega Quartzite as this Proterozoic unit sometimes retains a granular texture and bedding in the Del Padre is apparently parallel to fl foliation (bedding?) in the Ortega in at least some places. The upper contact is mapped at the top of the highest strongly cemented sandstone bed. We have relied heavily on the presence or absence of the Espiritu Santo carbonates in distinguishing the Del Padre Sandstone from the basal Pennsylvanian sandstone.

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Stratigraphic Correlation chart for Tres Ritos Quadrangle