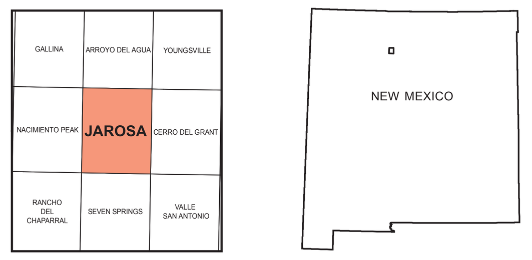
Base map from U.S. Geological Survey 1953, from photographs taken1951, field checked in1953, edited in 1977.
1927 North American datum, UTM projection -- zone 13N
1000-meter Universal Transverse Mercator grid, zone 13, shown in blue



QUADRANGLE LOCATION

Magnetic Declination
June, 2005
10° 4' East
At Map Center

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

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 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

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

OFGM 128

Geologic map of the Jarosa quadrangle, Rio Arriba County, New Mexico.

May 2006

by
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Map Symbols

Gelogic contact– solid where exposed or known, dashed where approximately known.

Normal fault–bar-and-ball on downthrown side. Solid where exposed, dashed were approximately known, dotted where concealed.

Syncline fold–dashed where approximately known.

Monocline fold–dashed where approximately known.

50 Strike and dip of bedding.

Mine.

A A' Location of geologic cross section.

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map may be based on any of the following: reconnaissance field geologic mapping, compilation of published and unpublished work, and photogeologic interpretation.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.

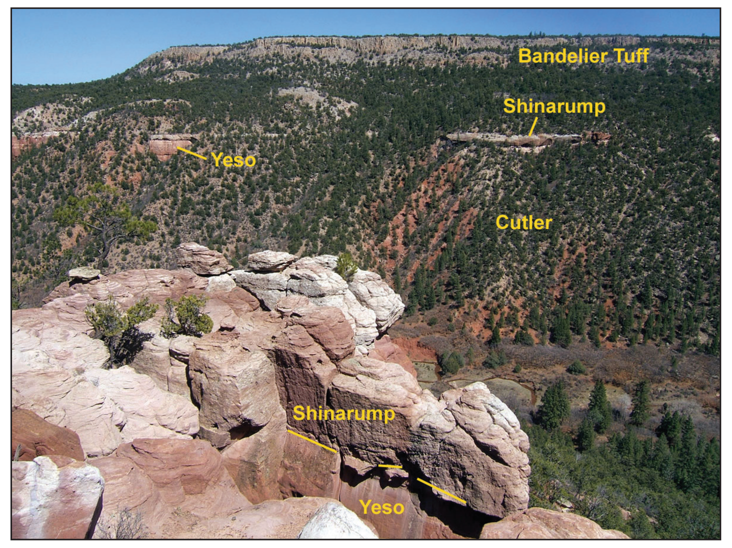
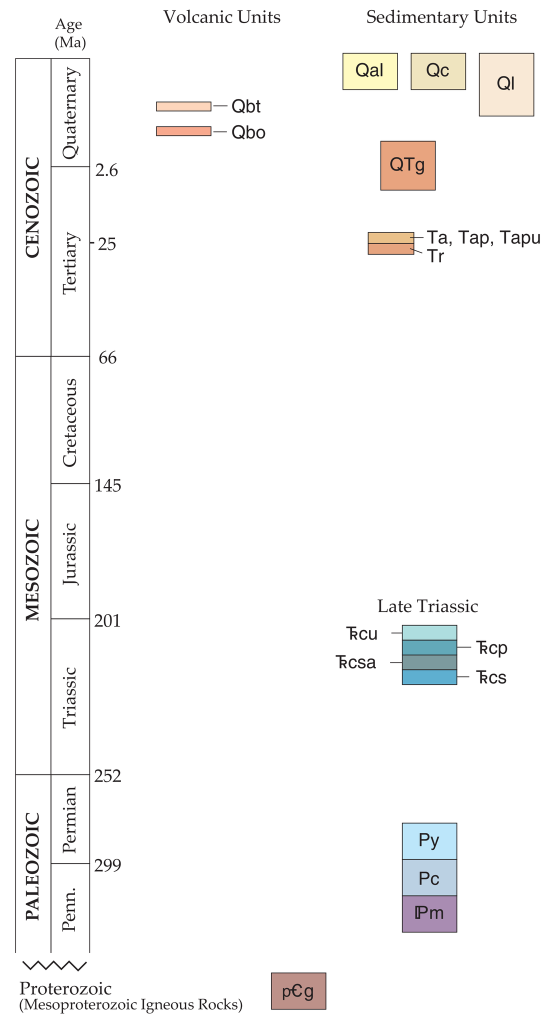


Figure 1—View looking eastward across Puerco Canyon in the northern part of the quadrangle. The Shinarump conglomerate (Ꞧcs) forms a fairly continuous bench on both sides of the canyon, resting unconformably above Permian Yeso Group (**Py**).

Correlation Diagram



Map Unit Descriptions

Quaternary Units

Qal — **Alluvium—**Late Pleistocene to Holocene. Alluvial deposits in modern drainage bottoms and elevated basins. Deposits include conglomerates, sands, and silts. Holocene terrace deposits less than 2 meters above drainage bottoms are included.

Qc — **Colluvium—**Late Pleistocene to Holocene. Poorly–sorted talus, debris, and other rock fragments derived from local volcanic and sedimentary rocks. Often occurs as wedge–shaped hillslope deposits. Although pervasive throughout the quadrangle, colluvium was seldom mapped. Maximum thickness is approximately 5 meters.

Ql — **Landslides—**Pleistocene to Holocene. Unsorted, chaotic debris emplaced during a single detachment event from a steep slope or cliff, generally containing a sediment matrix. Also, slump or block slides, especially along the flanks of steep hillslopes such as Coyote Creek canyon. Fan-shaped deposits occur where debris spread out on valley floor. Thickness can exceed 20 meters.

Qbt — **Upper Bandelier Tuff, Tshirege Member—**Quaternary. White to orange non–welded to welded ash–flow tuff containing abundant phenocrysts of quartz and sanidine, with rare microphenocrysts of clinopyroxene and hypersthene. Ash–flow tuff beds consist of multiple flow units in a compound cooling unit with thin surge beds (less than 0.5 meters thick) locally exposed. Erupted at approximately 1.25 Ma during the formation of the Valles Caldera (Goff et al., 2011; Spell et al., 1996). In rare exposures, the Tsankawi tephra deposit was found underlying the Tshirege tuff (up to 2.2 meters thick—photo of Dick Buffler and Tsankawi tephra, see report). Exposures of **Qbt** along tributary systems of Coyote Creek canyon often appear auto brecciated, possibly due to remobilization after tuff solidification. Maximum thickness is approximately 80 meters. Two photos (Figure 3a and 3b in report) show **Qbt** autobreccias typical in tributaries of Coyote Creek and Jaquez Canyons. Many exposures in these canyons are younger landslide deposits. However, several exposures display clasts of tuff in a tuff matrix (autobrecciated) that appears to be indurated more than landslide deposits—possibly representing tuff remobilized during the solidification process.

Qbo — **Lower Bandelier Tuff, Otowi Member—**Quaternary. White to medium gray non-welded to welded ash-flow tuff containing abundant phenocrysts of quartz and sanidine with rare mafic phenocrysts. Multiple cooling units typically with abundant lithic fragments, although lithic –poor horizons do occur, especially in more densely welded cooling units. No deposits of Guaje tephra were found at the base of the unit. A gray welded unit in the lower part of the Otowi Member dips 5 to 10° south in the southeastern corner of the quadrangle, lapping onto the south side of paleohighs underlain by Abiquiu Formation. $^{40}Ar/^{39}Ar$ ages 1.61± 0.01 to 1.62±0.04 Ma (Izett and Obradovich, 1994; Spell et al., 1996). Maximum thickness is approximately 100 meters.

Tertiary Units

QTg — **Alluvial gravels—**Late Pliocene to Early Pleistocene. Unconsolidated alluvial deposits including conglomerates, sands and silts. Generally occur as poorly exposed alluvial and colluvial deposits beneath exposures of Bandelier Tuff (**Qbt** and/or **Qbo**). Clasts of Proterozoic granite and quartzite, recycled Ritito Conglomerate (**Tr**) are common. These gravels may correlate with the Cerro Toledo interval and Puye Formation of the Pajarito Plateau area. Approximately 1 to 5 meters thick.

Ta — **Fine-grained sandstones, shale and tuffaceous and arkosic limestone, Abiquiu Formation—**Late Oligocene to Early Miocene. Poorly–exposed calcareous and tuffaceous mudstone, limestone, and fine–grained sandstone that has a gradational contact with the underlying Ritito Conglomerate (**Tr**). Some tuffaceous layers appear to be primary, or slightly reworked tepra (Figure 4 in report). The unit fines upwards with increasing volcaniclastic material. The most pervasive Pedernal Chert horizons occur at the boundary between the upper and lower members, but is also common capping the Abiquiu Formation. Lenticular, chert horizons occur sporadically within the formation and the underlying Ritito Conglomerate. Maximum thickness is approximately 70 meters.

Tpcu — **Pedernal chert—**Uncertain age. Chert horizons occur primarily at the boundary of the Abiquiu Formation and Ritito Conglomerate, and capping the Abiquiu Formation. In general, the chert is white to translucent with bands of black, yellow and orange coloration. Generally, the pervasive chert horizon at the boundary was too thin to map, but where thicker is mapped as **Tpc**. An extremely thick section occurs on the NE flank of Cerro Jarosito (approximately 25 meters thick). Locally, chert capping the Abiquiu Formation was mapped, forming benches on the highest peaks in the study area. Where broad and continuous, chert layers typically form relatively flat-lying benches, highly resistant to erosion. Discontinuous lenses of chert also occur within both the Abiquiu Formation and the Ritito Conglomerate. Pedernal Chert is a common component of younger alluvial and colluvial deposits throughout the quadrangle, often preserved as a lag component on mesas and hillslopes. Maximum thickness of approximately 25 meters.

Tr — **Alluvial conglomerate and sandstone, Ritito Conglomerate—**Late Oligocene. Beige to gray fluvial deposits, commonly conglomeratic and arkosic. Typically poorly–consolidated. Weathered, finer grained sandstone intervals produce an orangy–colored soil. Clasts in the conglomerate are typically subrounded to rounded (up to 28 cm across), consisting of Proterozoic granite, metarhyolite and quartzite, as well as Paleozoic limestone, shale, and chert (Figure 5 in report). In general, granite and metarhyolite clasts are twice as abundant as sedimentary clasts and four times more abundant than quartzite in the conglomerate. The unit is typically expressed as colluvium on hillslopes. Maximum thickness exceeds 60 meters.

Triassic

Ꞧcu — **Petrified Forest Formation—**Poorly–exposed, thinly–bedded red mud, siltstone, and sandstone occurs in sporadic exposures at the top of the Triassic sequence in the NE quadrant of the Jarosa quadrangle. These deposits most likely represent thin remnants of the Painted Desert Member and Mesa Montosa Member of the Petrified Forest Formation. The deposits are exposed primarily above the Poleo Formation (**Trcp**) and beneath the Bandelier Tuff (**Qbt** and **Qbo**). Maximum thickness is approximately 15 meters.

Ꞧcp — **Poleo Formation—**Yellow–brown, yellow–gray, white and red, medium–to fine–grained, micaceous, cross–bedded, quartzose sandstone, conglomeratic sandstone and conglomerate. Planar and trough cross–stratification common. Layers containing abundant petrified wood fragments are common (Figure 6 in report). The conglomerate in the Poleo Formation is often black and contains both intrabasinal siltstone and nodular calcrete clasts and extrabasinal siliceous (chert and quartzite) clasts. This unit forms prominent white cliffs. The base of the unit is sharp (corresponds to the Tr-4 unconformity of Lucas (1993)) and the upper contact is gradational into the overlying Painted Desert Member of the Petrified Forest Formation. Maximum thickness is approximately 100 meters in Jarosa Canyon along the SW flank of Mesa Pinabetosa.

Ꞧcsa — **Salitral Formation—**The Salitral Formation is a slope-forming unit that consists of an upper reddish-brown to orange shale with thin beds of tan limestone (Youngsville member) and a lower unit of mottled shale with lenses of gray–to reddish–brown, medium–to coarse–grained sandstone (Piedra Lumbre) member. Exposures are generally poor, thickness varies significantly, and blocks of overlying Poleo sandstone frequently occur as slide blocks on hillslope exposures. Maximum thickness is approximately 30 meters.

Ꞧcs — **Shinarump Formation—**The Shinarump Formation (previously called the Agua Zarca Formation) consists of white, coarse–grained to medium–grained pebbly sandstone with conglomeratic lenses (Figures 7–9 in report). Low to medium scale channel crossbeds are common. Extrabasinal conglomerate includes clasts of quartz, chert, and quartzite. Where well exposed, the base of the unit typically overlies Permian Yeso Formation in a striking disconformity. Local mineralization (copper, uranium) produces colors that range from black to yellow to green. Trough crossbeds are the dominant bedform, indicating a southwesterly paleocurrent direction. Petrified wood is rare. Maximum thickness is approximately 18 meters.

Pennsylvanian - Permian

Py — **Yeso Group—**Early Permian. Eolian and alluvial sandstones. Typically, deposits in the study area include orange–red sandstone with large–scale eolian crossbeds. Laminated sand sheet bedding is also common, gradational with fluvial, arkosic, and cross-bedded deposits near the base. A purple–red shale is common above the eolian cross–bedded sequence. The unit is typically capped by a paleo–weathering horizon. These strata (Figure 10 in report) most likely belong to the De Chelly Sandstone of the Yeso Group (equivalent to the Meseta Blanca Member of the Yeso Formation) and are unconformably overlain by basal strata of the Triassic Chinle Group. Maximum thickness is approximately 30 meters.

Pc — **Cutler Group—**Late Pennsylvanian to Early Permian. Siliciclastic redbed alluvium. The Cutler group has recently been subdivided into the El Cobre Canyon and Arroyo del Agua Formations by Lucas and Krainer (2005). However, these formations were not subdivided during mapping of the quadrangle. In general, the underlying El Cobre Canyon Formation is exposed south of the Mesa Pinabetal fault while the Arroyo del Agua Formation is exposed north of the fault. The contact with the underlying Madera limestone (Guadalupe Box Formation) is gradational and consists of intercalated, thin-bedded and nodular fossiliferous limestone, red shale and reddish–brown sandstone. The El Cobre Canyon Formation consists of brown and reddish–brown sandstone, shale and lesser amounts of limestone–pebble conglomerate. Lenticular, multilateral sand bodies are common. A gray to green, coarse–grained arkosic conglomerate with limestone pebbles (up to 1 meter thick) is a characteristic unit throughout the study area. The Arroyo del Agua Formation consists of reddish–brown medium–grained sandstone with shale interbeds. Sandstones are arkosic and contain subrounded, iron–oxide stained quartz.

Pm — **Madera Group, Guadalupe Box Formation—**Late Pennsylvanian. Arkosic limestone. Recent work by Krainer et al. (2005) defines the upper arkosic limestone member of the Madera Group as the Guadalupe Box Formation. In general, deposits consist of gray, intercalated, thin–bedded limestone, arkosic limestone and shale. Many beds are fossiliferous with spherical ovoids and subrounded quartz grains with calcite-filled fractures and anhedral calcite crystals. A basal calcareous sandstone and thinly–bedded limestone rests nonconformably above muscovite–biotite granite of Precambrian age in exposures along the Rio Puerco in the northwest corner of the quadrangle (Figure 11 in report). The contact with the overlying Cutler group is gradational and placed at the top of the highest, laterally continuous limestone bed.

Precambrian

p€g — **Precambrian Muscovite-Biotite Granite—**Mesoproterozoic. Pink, medium-grained granite with microcline, quartz, muscovite, and biotite phenocrysts. Three separate exposures occur in the northwest corner of the Jarosa quadrangle—the beveled, realtively unaltered and nonconformable surface of the granite is well exposed along the Rito Resumido and Rio Puerco (Figure 12 in report) and is overlain by arkosic limestone of the Madera Group (**IPm**). There is a distinctive horizontal foliation to the granite, parallel to erosional surface. Woodward and Timmer (1979) document a series of NW-trending high–angle faults (parallel to the Mesa Pinabetal fault) along the contact of the Precambrian and Madera limestone, downdropping the section to the northeast. Displacement along these faults may be related to closely-spaced, steeply-dipping shear fractures.

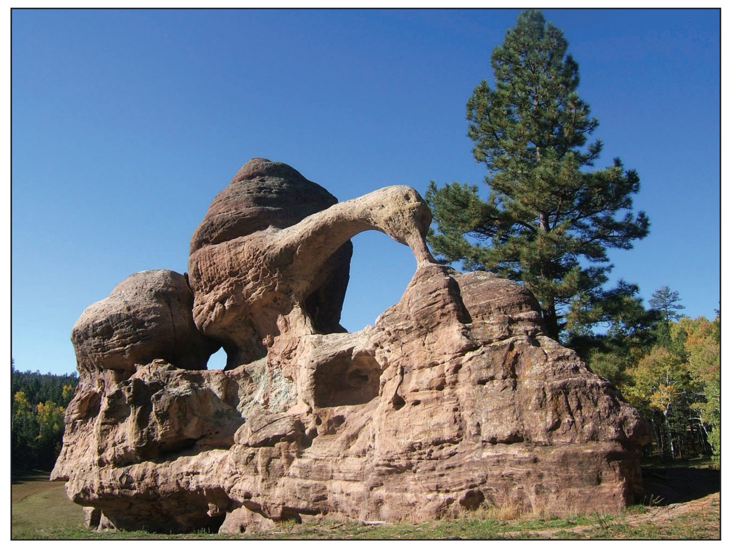


Figure 2—Teakettle Rock. El Cobre Formation, Cutler Group (**Pc**).

Figure 3—Variegated eolian sandstone of the Yeso De Chelly sandstone. These strata most likely belong to the De Chelly Sandstone of the Yeso Group (=Meseta Blanca Member of the Yeso Formation) and are unconformably overlain by basal strata of the Triassic Chinle Group. Maximum thickness is approximately 30 meters.

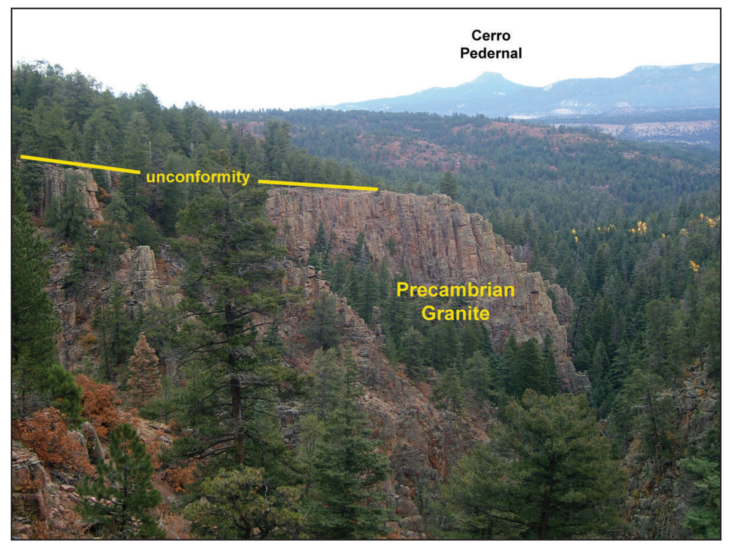


Figure 4—Nonconformity on the Proterozoic, capped by Guadalupe Box Formation.