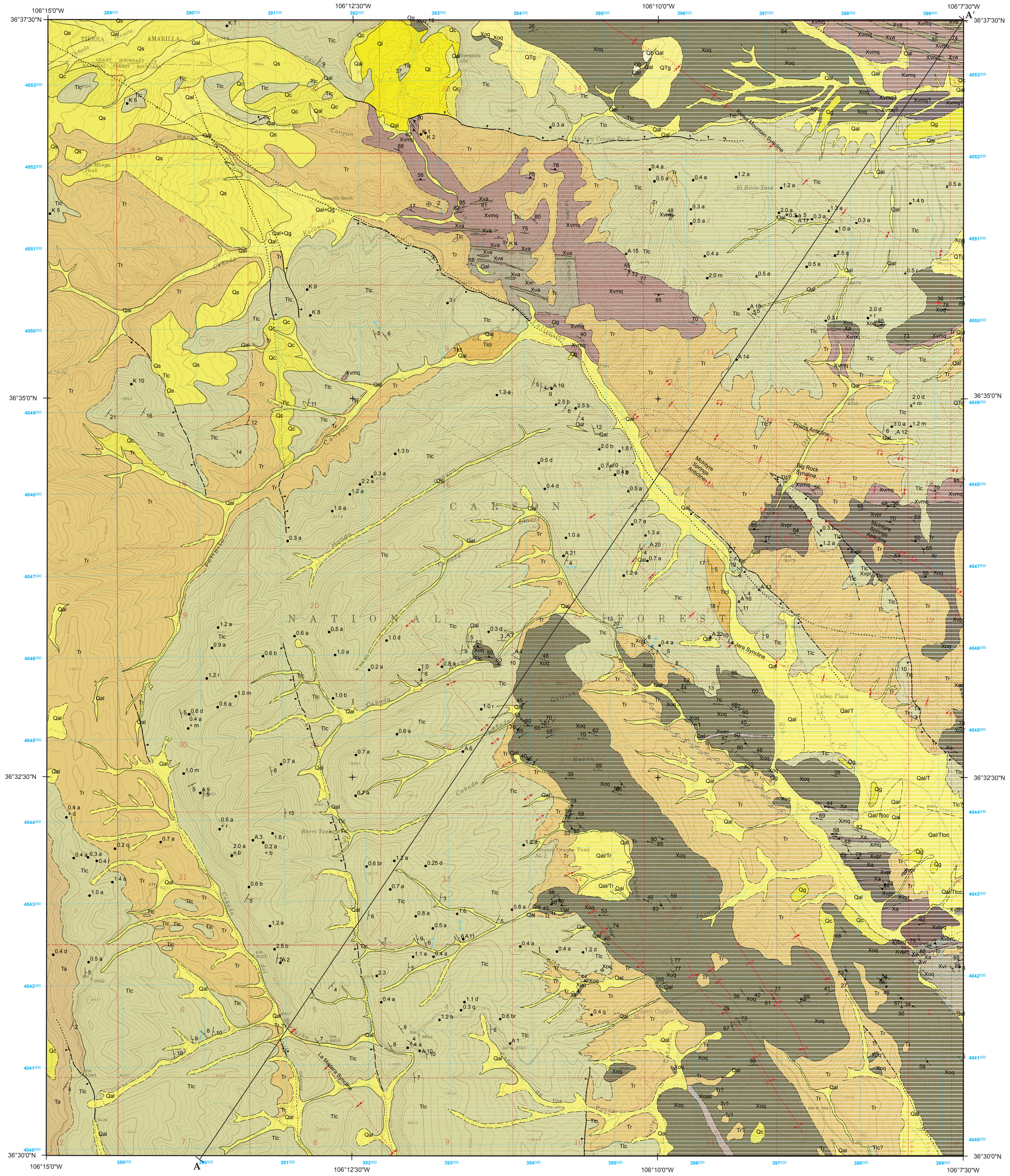
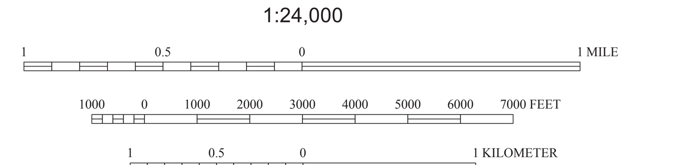


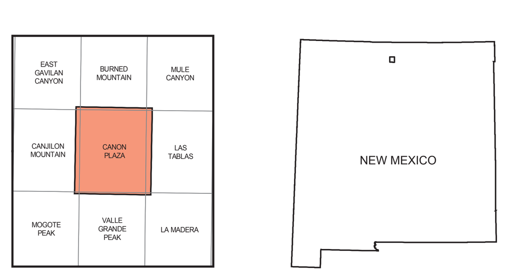
Base map from U.S. Geological Survey 1963, from photographs taken 1962, field checked in 1963.
Polyconic projection. 1927 North American datum. Reprojected to UTM projection -- zone 13N.
1000-meter Universal Transverse Mercator grid, zone 13, shown in red

1:24,000

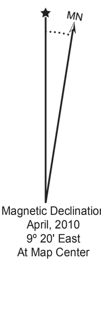


CONTOUR INTERVAL 40 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929



QUADRANGLE LOCATION



Magnetic Declination
April, 2010
9º 20' East
At Map Center

New Mexico Bureau of Geology and Mineral Resources
Open-file Geologic Map 221

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*).

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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 Cañon Plaza quadrangle, Rio Arriba County, New Mexico

June, 2012

by
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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.

MAP UNIT DESCRIPTIONS

Quaternary Rocks

Qal Quaternary Alluvium. Stream channel and valley-floor alluvium, active floodplains, low stream terraces, and tributary mouth 'fans' (Holocene and latest Pleistocene?)-Poorly exposed; light gray-to-pale brown; loose; poorly-to-well-sorted; rounded-to-subangular; thin-to-thick bedded, massive and/or lensoidal; silty sand-to-sandy gravel with rare cobbles/boulders and/or gravelley channel deposits. Light-brownish silty sand, gravelly sand, and sandy gravel with minor gravel, mud and silt underlies modern ephemeral channels. Gravel is generally poorly-to-moderately 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 but is possibly thicker. Thickness in alluvial reaches of the Rio Vallecitos is unknown. To the extent possible Qal contacts have been mapped in the field and mapped deposits are restricted to stream-laid sediments (as opposed to hillslope material deposited by unchannelized flow). The contact with bedrock units is drawn at the "feather edge" of Qal deposits where they often merge with (mostly unmapped) Quaternary colluvium. At 1:12000 scale the practical limit of a mappable unit's width is about 10 meters, so alluvial deposits <10 m wide are not shown. Where the Qal contact is mapped as a solid line it is well defined and was "walked out". Where this contact is mapped as a dashed line it was either not well defined geomorphically or was mapped from a distance or from air photos and topography. Some alluvium in tributary reached is not mapped where it was not directly observed and air photos were inconclusive.

Qc Quaternary Colluvium. Colluvium is common throughout the quadrangle but is only mapped where it completely obscures relations among older units or where it is relatively thick, extensive, and forms discrete bodies. Poorly exposed, light brown, loose-to-friable, poorly sorted, sub-rounded-to-angular, massive and chaotic gravelly sand and sandy gravel(?). Composition is determined by units underlying individual colluvial bodies.

Qg Undifferentiated Quaternary gravel deposits. Poorly exposed; variably colored; loose; moderately sorted; subangular-to-well rounded; sandy cobble-to-boulder conglomerate and pebbly sand. This unit consists mostly of terrace gravel of the Rio Vallecitos and other streams. Clast composition dominated by Proterozoic rock types with subordinate Tertiary volcanic clasts locally. Estimated 1-7 m thick.

Qal and Qg Mixed unit of Quaternary Alluvium and Quaternary stream gravel

Ql Quaternary landslide Landslide deposits defined by presence of small ponds, hummocky topography, and/or 'backtilted' bedding.

CORRELATION DIAGRAM

Age	Units					
Pleistocene and/or Holocene	Qal	Qs	Ql	Qc	Tlcl	
Pleistocene	Qg					
Pliocene and /or Pleistocene	QTg					
	Unconformity					
Miocene and late Oligocene	Tlc	Cordito Member of Los Pinos Formation				
Early Miocene(?) and Oligocene	Tr	Ritito Conglomerate				
	Unconformity					
Proterozoic						
Hondo Group	Xoq / Xaos	Ortega Quartzite				
Vadito Group	Xvmq	Micaceous quartzite of Vadito Group				
	Xvbrq	Big Rock Quartzite (micaceous)				
	Xvbrc	Big Rock Conglomerate				
	Xva	Amphibolite of Vadito Group				
	Xvpr	Pelitic schist of Vadito Group				
	Xvr	Metarhyolite of Vadito Group				
	Xm	Mopin Group Undivided (seen only in cross section)				

Qb Quaternary blockfield Two small blockfields on the slopes of Quartzite Mountain (Burned Mountain Quadrangle) composed of sub angular to rounded 0.1-5m clasts of Ortega Quartzite. Deposit has a somewhat hummocky surface that grades to small Qal deposits (see map).

Qal\Ttoc Quaternary alluvium overlying unit Ttoc (gradational unit between Ojo Caliente Sandstone and Chama-El Rito Member of the Tesuque Formation). Unit Ttoc is not exposed on this quadrangle but is exposed to the east (Aby et al., 2010) on the Las Tablas Quadrangle.

Qal/Tlc Quaternary alluvium overlying the Cordito Member of the Los Pinos Formation

Qal/T Quaternary alluvium overlying uncertain Tertiary unit(s)

Qal/Tr Quaternary alluvium overlying Ritito Conglomerate

QTg Quaternary and/or Tertiary gravel

Tlcl Landslide block composed entirely of Cordito Member sediments Landslide deposits defined by presence of small ponds, hummocky topography, and/or 'backtilted' bedding.

Tertiary Sedimentary Rocks

Tlc Cordito Member, Los Pinos Formation (uppermost Oligocene-late miocene) Southern Type: Table 1 shows that two types of Cordito Member are exposed on this quadrangle. The following description is for the Cordito Member south of Philipito Canyon. The Cordito Member was named by Butler (1946) for Canon de Tio Cordito (uncle fatty's canyon) south of Tres Piedras on the Petaca Peak Quadrangle.

Very poorly-to-moderately well exposed; light tan-to-whitish; loose-to-moderately strong; moderately well-to-moderately poorly sorted; subrounded-to-subangular; thin-to-thick tabular-to-lensoidally bedded; weakly-to-strongly cemented; sandy conglomerate, gravelly sandstone and silty sandstone dominated by felsic gravel clasts with subordinate intermediate composition clasts and relatively rare mafic and proterozoic clasts. Natural exposures are dominated by well cemented cobble and boulder conglomerate, but the majority of road cut exposures are coarse-to-fine silty pebbly sandstone and sandy pebble conglomerate.

The Cordito is clearly derived from the Latir Volcanic Field based on the presence of abundant silicic volcanic detritus including Amalia Tuff. However, no plutonic rocks from the Latir field are found in the Cordito, although they are abundantly exposed in the Latir Field at present (Lipman and Reed, 1989). The largest clasts in the Cordito are often fine-to-medium grained 'dacite' that may indicate more proximal contributions of this type of material.

The lower contact of the Cordito Member where it overlies the Ritito Conglomerate is not usually exposed due to abundant detritus derived from the Cordito, however, the transition from volcanic-clast dominated to Proterozoic clast dominated float is usually abrupt where it is exposed. An exception to this abrupt transition is in the area west of Jaques Canyon Tank # 1 in the southeastern part of the Quadrangle. Here we have mapped an interbedded and/or gradational contact as rare exposures show that individual beds of Ritito Conglomerate are below Cordito Member beds in this area. We generally place the contact between Cordito Member and Ritito Conglomerate at ~15% volcanic clasts, however, near the contact between these units individual beds containing >15% volcanic clasts may be included in the mapped Ritito Conglomerate (e.g. in the Western part of section 5 T26N:R7E) where including them would cause unnecessary(?) abrupt perturbations to the map pattern. The abundant debris shed by the Cordito Member often makes precise location of the lower contact impossible and some "outlying" polygons of Cordito Member (e.g. in the NE 1/4 of Section 14 T27N:R7E) may be composed of such debris. The lower contact should be considered approximately located in most cases and particularly above ~8500 feet elevation where thick duff commonly covers theusrface and even float is often rare.

Tlc Cordito Member, Los Pinos Formation (uppermost Oligocene-late miocene) Northern type: North of Felipito Canyon the Cordito Member is notably different in clast composition from the southern type described above, although other characteristics are similar. Some of the lowest slopes on the south side of Felipito Canyon have float similar to the northern type of Cordito Member but Hondo Canyon (the next canyon south) does not seem to contain any of the clasts unique to the northern type of Cordito Member and this float may be derived from the underlying Ritito Conglomerate. Table 1 shows that the northern type of Cordito member contains more dacite and Proterozoic rocks than the southern type. Some of the dacite in the northen type is similar to distinctive dacite of the Esquivel member of the Los Pinos Formation (Aby, 2011), and some of the Proterozoic clasts in the northern type may be Tres Piedras Granite. We believe this unit is a gradational part of the Cordito representing mixing of Esquivel Member sediments, Latir-field debris, and Proterozoic clasts from near Tres Peidras(?). Although a new member could be defined based on these differences we believe it is best at present to include all rocks containing Amalia Tuff in the Cordito Member. Roadcut exposures along FR 42 (count A13 Table 1) contain abundant dacite clasts and relatively common Proterozoic clasts and may be an 'outlying' part of this northern type.

Ta Tertiary Abiquiu Formation (Oligocen-Miocene(?)) Very poorly exposed; friable(?); light-tan-to-whitish; moderately well sorted; subrounded-to-subangular; moderately cemented sandy/silty pebble conglomerate and pebbly sandstone(?). Definition of a boundary between the Cordito Member and Abiquiu Formation on this quadrangle is arbitrary because of poor exposure. Float along the lower part of the steep slopes on the western edge of the quadrangle has relatively more pumice and seems to be more fine grained. The Abiquiu/Cordito contact is better defined to the south (Kempter et al, 2008) and our contact is partially projected from there. Relatively pumice-rich beds are found in the Cordito Member in the southwestern part of section 13 T27N:R7E on the hanging wall of the fault found there. These beds could be considered part of the Abiquiu Formation.

Tr Ritito Conglomerate (lower(?)Oligocene through lower Miocene). We use the terminology of Barker (1958) for mapping gravel adjacent to and/or derived from Proterozoic paleo-topographic highs. The Ritito Conglomerate was defined by Barker on the Cañon Plaza quadrangle for gravel containing Proterozoic-derived detritus consisting of rounded-to- subangular pebbles to small boulders of quartzite, amphibolite, and metarhyolite. He describes the unit as weakly cemented with a medium-gray color. Maldonado and Kelley (2009) have recently expanded the use of the term Ritito to include rocks previously included in the Abiquiu Formation. As presently used, this term simply implies sediment in north-central New Mexico derived from Proterozoic sources that is not demonstrably equivalent to the Eocene El Rito Formation or of Pliocene or younger age.

Very poorly exposed; loose-to friable(?); moderately well sorted(?); rounded-to-subrounded; weakly cemented sandy-to-pebbly(?) conglomerate. Sediment consists of pebbles and cobbles, with minor boulders, in a sand matrix(?). Maximum clast sizes is usually 50 cm but locally is several meters(?). Dominated by Proterozoic detritus (quartzite, porphyritic metarhyolite, schist, schistose metarhyolite, amphibolite, granite and vein quartz (Table 1). Although the Ritito Conglomerate seems to be 'locally derived' float is usually a mixture of at least two Proterozoic clast types even when nearby basement is monolithologic indicating some mixing/transport of Ritito sediments pior to deposition. This interpretation is supported by the common rounding of clasts in the unit. Near the contact with the Cordito Member in rare good exposures (notably in the southwestern quarter of section 23 T27N:R7E) individual beds of Proterozoic clasts and volcanic clasts are interbedded over about 20-30 m of section but are not extensively mixed.

PALEOPROTEROZOIC ROCKS

Hondo Group (Includes Ortega Quartzite and associated units)

Xoq Ortega Quartzite – Coarse-grained, gray to white vitreous cross-bedded quartzite consisting mostly of quartz with minor amounts of muscovite, kyanite, and layers of hematite. Viridine-bearing quartzites occur in the lower Ortega Quartzite on Kiowa Mountain and is a regionally continuous marker horizon.

Xoas Aluminous schist – Interlayers within Ortega Quartzite, locally contains kyanite, andalusite, and sillimanite. This unit was previously mapped as qka in the La Madera quadrangle (Bingler, 1965)

Vadito Group (Includes associated metasedimentary and metavolcanic rocks)

Xvmq Vadito micaceous quartzite – Tan, grayish white to greenish white micaceous and feldspathic quartzite. This unit is schistose, ranges from fine-to-medium grained with mica content varying between 10-30%. Consists of quartz, muscovite, K-spar, biotite, hematite, and epidote. Locally contains trough crossbeds. This unit is correlated to Xmq in the Ojo Caliente Quadrangle (Koning and others, 2005) and Xmqu in the La Madera Quadrangle (Koning et al., 2007). It is interpreted to be a meta-arkose to meta-litharenite of dominantly fluvial origin (because of the trough cross bedding and immature composition) that represents a gradational transition from the micaceous quartzites of the Vadito Group (Xvmq) to the quartzarenites of the Hondo Group.

Xva Vadito Amphibolite – Foliated to massive amphibolite that occurs as pods, dikes, and continuous layers that are interbedded with micaceous quartzites (Xvmq) in the Kiowa Mountain syncline. Consists of hornblende, plagioclase feldspar, as well as chlorite and actinolite; grades into areas rich in tourmaline. Foliation defined by inter-layered amphibole and plagioclase feldspar-rich layers. Primary textures are rare but include amygdaloidal textures. Unit is interpreted to include both metabasaltic flows and hypabyssal intrusive sills and dikes.

Xvpr Vadito Posos Metarhyolite- Yellowish orange to orangish tan to pinkish gray in color. Weathers to an orange-reddish orange color. Fine grained foliated metarhyolite containing fine-grained quartz, plagioclase, K-feldspar, muscovite, and iron oxides, with rare biotite, epidote, and garnet. Has distinctive embayed quartz and microcline mm-scale phenocrysts and ribbons. Dark and orange patches on foliation surfaces may represent deformed pumice clasts. Ash flow layering locally preserved and mapped as primary layering (bedding symbol). This unit is correlative to the Cerro Colorado metarhyolite and the Arroyo Rancho metarhyolite (Bishop, 1997), as well as to the Burned Mountain metarhyolite (Barker, 1958). The Cerro Colorado metarhyolite has been dated at ~1.70 Ga based on zircons (Lanzirotti personal communication 1996 to Bishop, 1997); Burned Mountain metarhyolite also has a ~ 1.70 Ga age (Silver, unpublished). This unit has been interpreted by several workers to have originally been ash flow tuffs (Just, 1937; Jahns, 1946; Treiman, 1977). The unit is texturally heterogeneous with interlayers of schistose layers. Unit grades into micaceous quartzites (Xvmq and Xvbrq), schistose metarhyolites (Xvsr), and foliated parts of the Tres Piedres granite (Xtpg) making unique identification in many areas difficult.

Xvbrc and Xvbrq Vadito Big Rock Conglomerate and Quartzite – Stretched and folded pebble metaconglomerate(Xvbrc) interbedded with micaceous quartzite and aluminous schists (Xvbrq), conglometate varies from clast-supported to matrix-supported and occurs in lenses within quartzite. Clasts include bluish-grayish quartzite and vein quartz (egg shaped, up to 10 cm), highly stretched felsic volcanic clasts (up to 15 cm long), and chert (modeately ellipsoidal shapes). Clasts are typically flattened and elongated in the main foliation plane (S1). The matrix of the conglomerate varies from quartzite, to quartz-muscovite schist, to metarhyolite. The quartzites contain trough cross bedding. This unit likely correlates with to the conglomerate exposed near Big Rock and in the Ojo Caliente and La Madera Quadrangles. The gradational relationship and the location of trough cross bedded micaceous quartzites both above and below lead to the interpretation that the conglomerate forms channels in a fluvial deposit. Gradation of quartzites to rhyolite and rare occurance of rhyolite as matrix to pebbles suggests the fluvial channel conglomerate was deposited adjacent to rhyolitic calderas.

Xvr Vadito Group undivided (mainly metarhyolite)– Similar to Posos rhyolite and Petaca schist but stratigraphically underlying the Big Rock conglomerate and quartzite. Fine-grained foliated rhyolite containing quartz, plagioclase, K-feldspar, muscovite, and iron oxides, with rare biotite, epidote, and garnet. Locally has distinctive embayed quartz and microcline mm-scale phenocrysts and ribbons. Dark and orange patches on foliation surfaces may represent deformed pumice clasts. Ash flow layering locally preserved and mapped as primary layering (bedding symbol). This unit is texturally heterogeneous with interlayers of schistose layers. Unit grades into micaceous quartzites and aluminous schists (Xvbrc, Xvbrq, Xvps, Xvas, Xvpet) making unique identification in many areas difficult.

Xm Mopin Group undivided (seen only in cross section)

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MAP EXPLANATION

Strike and dip of bedding (Dip-dip azimuth).

Contact-solid where well located, dashed where approximately located or partially concealed, dotted where inferred or covered by alluvium, queried where uncertain.

Interbedded and/or Gradational Contact

Normal Fault-solid where exposed and/or well located, dashed where approximately located, dotted where inferred or buried, queried where uncertain. Ball-and-bar on downthrown block. Number indicated magnitude of dip

Bidirectional paleocurrent indicator-paleoflow direction inferred from azimuth of channel margins. Arrow indicates inferred direction of flow based on interpretation of source area; number indicates azimuth of channel margin or average of several channel margins.

Unidirectional paleocurrent indicator (Imbrication) number indicates azimuth of inferred paleoflow

Maximum clast size -visually estimated size in meters of largest boulder in area. r=crystal poor rhyolite b=distinctive blueish crystal-poor rhyolite m=mafic (Jarita basalt) a=Amalia Tuff

Landslide

Location of clast count (see Table 1)