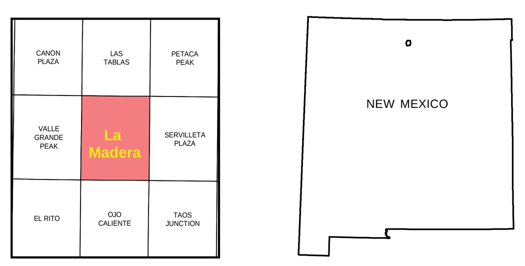
Base map from U.S. Geological Survey 1953, from photographs taken 1947, field checked in 1953. 1927 North American datum, UTM projection -- zone 13N. 1000-meter Universal Transverse Mercator grid, zone 13, shown in red



QUADRANGLE LOCATION

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

Magnetic Declination November, 2005 9° 47' 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

New Mexico Bureau of Geology and Mineral Resources
Open-file Geologic Map **141**

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

Geologic map of the La Madera quadrangle, Rio Arriba 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 MAP UNITS

QUATERNARY EOLIAN AND SLOPEWASH DEPOSITS

Qes **Eolian and slopewash deposits (late Pleistocene and Holocene)** – Pale brown to light yellowish brown (10YR 6/3-4) and brown to yellowish brown (10YR 5/3-4), silty very fine- to fine-grained sand that mantles flat surfaces and broad topographic depressions. [illegible]

Qes/Tstvm **Eolian and slopewash deposits overlying mixed volcaniclastic sediment of the Tesuque Formation (upper Pleistocene-Holocene and lower-middle Miocene, respectively)**

QUATERNARY ALLUVIUM

Qay **Younger alluvium filling valley bottoms (Holocene)** – [illegible]

Qao **Older alluvium (upper Pleistocene)** – [illegible]

Qao/Tstc **Older alluvium overlying the Chama-El Rito Member of the Tesuque Formation (upper Pleistocene and middle Miocene, respectively)**

Qao/Tstco **Older alluvium overlying interbedded Chama-El Rito Member-Ojo Caliente Members of the Tesuque Formation (upper Pleistocene-Holocene and middle Miocene, respectively)**

Qaoc **Older alluvium intercalated with colluvium at the base of steep slopes (middle to upper Pleistocene)** – [illegible]

Qafo **Older alluvial fan deposits on south flank of Ortega Mountains (lower to upper Pleistocene and Holocene)** – [illegible]

QTgq **High-level, quartzite gravel deposits (Pliocene to lower(?) Pleistocene)** – [illegible]

TERRACE DEPOSITS OF RIO VALLECITOS, RIO TUSAS, AND RIO OJO CALIENTE

[illegible]

Qtvu **Undivided terrace deposits of the Rio Vallecitos** – [illegible]

Qtv1 **Lowest terrace deposit of the Rio Vallecitos (Uppermost Pleistocene)** – [illegible]

Qtt1 **Lowest terrace deposit of the Rio Tusas (Upper Pleistocene)** – [illegible]

Qtv2 **Lower-middle terrace deposit of the Rio Vallecitos (Upper Pleistocene)** – [illegible]

Qtt2 **Lower terrace deposit of the Rio Tusas (Upper Pleistocene)** – [illegible]

Qtc3, Qtv3u, Qtv3m, Qtv3l **Middle terrace deposit of the Rio Vallecitos (Upper to middle Pleistocene)** – [illegible]

Qtt3 **Upper-middle terrace deposit of the Rio Tusas (Middle Pleistocene)** – [illegible]

Qtv4 **Upper-middle terrace deposit of the Rio Vallecitos (Middle Pleistocene)** – [illegible]

Qtv5 **Upper terrace deposit of the Rio Vallecitos (Lower-middle Pleistocene)** – [illegible]

Qtg **Uncorrelated, gravelly terrace deposit alongside of streams (such as the Rio Tusas in the northeast part of the quadrangle)** – [illegible]

Qtp **Terrace deposits of piedmont sediment** – [illegible]

MIOCENE SEDIMENTARY ROCKS

TESUQUE FORMATION OF SANTA FE GROUP

[illegible]

Tsto **Ojo Caliente Sandstone Member of the Tesuque Formation (middle to upper(?) Miocene)** – [illegible]

Tstoc **Interbedded Ojo Caliente Sandstone Member (dominantly) and the Chama-El Rito Member, Tesuque Formation (middle Miocene)** – [illegible]

Tstco **Interbedded Chama-El Rito Member (dominantly) and Ojo Caliente Sandstone Member, Tesuque Formation (middle Miocene)** – [illegible]

Tstc **Upper Chama-El Rito Member, Tesuque Formation (middle Miocene)** – [illegible]

Tstvm **Mixed, coarse volcaniclastic sediment of Tesuque Formation (middle Miocene)** – [illegible]

Tstvm-Tstsp [illegible]

Tstp **Plaza lithosome of Tesuque Formation (middle Miocene)** – [illegible]

Tstpt **Plaza-Tusas lithosome of Tesuque Formation (middle Miocene)** – [illegible]

Tstdf **Tuffaceous debris-flow deposits (lower Miocene)** – [illegible]

Tsgqw **Quartzite-rich gravel in basal Santa Fe Group deposits derived from western and central parts of the quadrangle (lower Miocene)** – [illegible]

Tsgqe **Quartzite-rich gravel in basal Santa Fe Group deposits derived from the east of the quadrangle (lower Miocene)** – [illegible]

Tlpce **Cordito Member of Los Pinos Formation in eastern stream system (Oligocene to lower Miocene)** – [illegible]

Tlpcw **Cordito Member of Los Pinos Formation in western stream system (Oligocene to lower Miocene)** – Light gray sandy conglomerate to gravelly sandstone. Beds are very thin to thick and broadly lenticular; subordinate trough cross-stratification and tangential cross-stratification. Gravel consists of pebbles and cobbles that are clast-supported, poorly sorted, and subrounded. Clasts include felsic volcanic rocks (i.e., rhyolite and ryholitic tuffs that include the Amalia Tuff), dacite-rhyodacite, and hypabyssal intrusive rocks in varying proportions. Clasts are poorly sorted and subrounded. Sand is fine- to very coarse-grained, poorly sorted, subrounded, and lithic-rich. Locally as much as 10-15% tuffaceous matrix. Unit differentiated from Tlpce by the presence of gray banded rhyolite. Well-cemented and tilted more steeply than Miocene volcaniclastic units. Unconformably overlain by unit **Tdrd**; the latter appears to have filled valleys eroded into **Tlpcw**. Possibly as much as 100 m-thick west of the Rio Vallecitos; unit is thinner east of the Rio Vallecitos (commonly 6-30 m-thick).

Tlpcw-Tgq **Interbedded Cordito Member of Los Pinos Formation (western stream system) with quartzite-rich Tertiary gravel** – Unit found west of Rio Vallecitos and generally not well-exposed. Interbedding and general composition is inferred by observing variations in clast compositions of surficial (colluvial) gravel.

Teo **Older eolian and slopewash deposits (Oligocene)** – Light yellowish brown (10YR 6/4) to very pale brown (10YR 7/3) very fine- to fine-grained sand. Generally found between the basalt flows and the Cordito Member of the Los Pinos Formation, but too thin to map there. We only map this unit where it overlies basalt northeast of the confluence of Rio Vallecitos and Cañon de los Alamos, where it is perhaps 6-8 m-thick. There, this sand is silty (estimate 3-10% silt) and contains 1-10%, scattered, medium to very coarse sand of Proterozoic or basaltic detritus. In general, the sand is gesubrounded to subangular, well sorted, and is probably of quartz with 10% possible Kspar and 7-10% mafic grains). Weakly consolidated to loose and non-cemented. Mostly 2-3 m-thick between the basalt flows and Cordito Member (Tbf and Tplcw). .

Tr **Ritito Conglomerate (Oligocene)** – Sandy conglomerate composed exclusively of locally derived Proterozoic clasts. Found only in Cañada de los Tanques east of South Petaca. Gravel are subangular to subrounded, poorly sorted, and consists of well-graded pebbles, cobbles, and boulders. Conglomerate is indurated by silica cement. Clast imbrications indicate a southeast-directed paleoflow. Unit is overlain by a few meters of very pale brown to light gray (10YR 7/2-3), silty very fine- to medium-grained sand. This sand is in turn overlain by the thick basalt flows of unit **Tbf**. This conglomerate is in a similar stratigraphic position as the Ritito Conglomerate in the Las Tablas quadrangle to the north (Barker, 1958). Unit **Tr** is less than 15 m-thick.

LOWER MIOCENE AND OLIGOCENE VOLCANIC ROCKS

Trq **Quartz-bearing, porphyritic rhyolite bodies within dacite-rhyodacite flows (lower Miocene)** – Distinctive, white to brownish or grayish white, porphyritic rhyolite with 10-25% quartz phenocrysts (brownish gray color and 0.2-2.0 mm-long). The rest of the rock is aphanetic groundmass with trace to 1% lithic fragments of silicic volcanic rocks (rhyolite?), rhyodacite-dacite, and quartzite up to 2 cm-long. Occurs as pods or small intrusions within unit **Tdrd** or, more rarely, alongside of unit **Tdrd**. We preliminarily interpret that these bodies reflect mixing of two somewhat immiscible magmas (this rhyolite and the dacitic-rhyodacitic magma of Tdrd proper), which were both extruded, but more work is needed to test that interpretation.

Tdrd **Dacite and rhyodacite flows (lower Miocene)** –Reddish brown to gray to pinkish gray volcanic flows and and flow breccia consisting of a distinctive porphyritic dacite with greater than 10% coarse feldspar phenocrysts (up to 10 mm-long). There are also minor quartz (in the rhyodacite, where it is up to 3 mm), 3-5% hornblende plus biotite phenocrysts (< 2 mm). Generally this unit is indurated. Eroded detritus of this unit is interpreted to comprise, in part, the Plaza lithosome, clasts of which have been dated at 21-23 Ma by the K-Ar method (Ekas et al., 1984). Unit includes minor beds of unit **Tstp**. Individual flows are generally 1-3 m-thick. Exposed cumulative thickness is 1-25, perhaps as much as 60 m-thick in the subsurface.

Tdrdu **Undivided dacite and rhyodacite flows together with the quartz-rich porphyritc rhyolite bodies ((lower Miocene)** – As described in unit **Tdrd**, but inclusions of Trq were not differentiated.

Tat **Amalia(?) Tuff (upper Oligocene)** – Reddish welded tuff with flattened pumice, less than 1% mafic grains, and containing minor crystals of blue, irredescent sanidine crystals. Near-vertical and overlain by gently east-dipping rhyodacite and dacite flows of unit Trdd. $^{40}Ar/^{39}Ar$ dating of the Amalia Tuff in the Latir volcanic field has returned an age of 25 Ma (Zimmerer et al., 2007), and $^{40}Ar/^{39}Ar$ dating of the Amalia Tuff in the Tusas Mountains also returned an age of 25 Ma (Smith et al., 2002). Greater than 30 m-thick.

Tbf **Basalt flow (Oligocene)** – Gray to dark gray to black, olivine-bearing basalt that generally weathers reddish brown or brown; olivine phenocrysts are up to 1 mm long and occupy trace to 10% of the rock; basalt is commonly vesicular. Individual flows are generally 1-5 m-thick. Cumulative thickness of 100-150 m. Probably correlates to the Hinsdale basalt (5-28 Ma age range according to Lipman and Mehnert (1975 and 1979); Baldridge et al. (1980); probably 24-27 Ma on this quadrangle.

PROTEROZOIC IGNEOUS AND METAMORPHIC ROCKS

MESOPROTEROZOIC ROCKS

Yp **Pegmatite** – Potassium feldspar + quartz + plagioclase+muscovite+ biotite pegmatite. Large books of muscovite up to 5-cm in diameter. Occurs as dikes, sills, and pods cutting metasedimentary and metavolcanic rocks. Not strongly foliated, but dikes and sills are variably boudinaged and folded. U-Pb zircon dating places age of crystallization at ~1400 Ma (Lanzirotti, personal comm. to Lombardi, 1997).

PALEOPROTEROZOIC ROCKS

Xtp **Tres Piedras granite** – Granitic gneiss consisting principally of quartz, feldspar, biotite, and muscovite. Orangish on weathered surface and has a granular texture. Locally contains garnet up to 1 mm diameter in the matrix and up to 5 mm in muscovite-rich lenses. This unit intrudes rocks of the Vadito Group. Contact with neighboring schist units is difficult to discern. U-Pb zircon dating places age of crystallization at 1650 Ma (Maxon, 1976).

Hondo Group (Includes Ortega Quartzite and associated units)

Xqs **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),

Xq **Ortega Quartzite** – Coarse-grained, gray vitreous cross-bedded quartzite consisting mostly of quartz with minor amounts of muscovite, kyanite, and layers of hematite. A viridine-bearing member recognized as unit Xqv in the Ojo Caliente quadrangle constitutes the base of this quartzite and is aregionally continuous marker horizon.

Vadito Group (Includes associated metasedimentary and metavolcanic rocks)

Xmqu **Micaceous quartzite** – Grayish white to greenish white thinly laminated micaceous quartzite. This unit is schistose, ranges from fine-to-medium grained with mica content varying between 10-60%. Consists of quartz, muscovite, biotite, hematite, and epidote. Locally contains trough crossbeds. This unit is most likely correlative to Xmq in the Ojo Caliente Quadrangle (Coning and others, 2005). Represents a gradational transition from Vadito to Hondo groups

Xr **Metarhyolite** – Brick red to light pink schistose to massive metarhyolite, consisting principally of fine-grained quartz, feldspar, muscovite, and opaques. Has distinctive quartz "eyes" and ribbons. This unit is likely correlative to the Cerro Colorado metarhyolite and the Arroyo Rancho metarhyolite (Bishop, 1997) found in the Ojo Caliente quadrangle, as well as to the Burned Mountain metarhyolite (Barker, 1958), and unit fs of Bingler (1965). The Cerro Colorado metarhyolite has been dated at ~1.70 Ga based on zircons (Lanzirotti personal communication 1996 to Bishop, 1997). Interpreted by several workers to have originally been ash flow tuffs (Just, 1937; Jahns, 1946; Treiman, 1977)

Xa **Amphibolite** – Foliated to massive amphibolite that occurs as pods, dikes, and continuous layers within metavolcanic and metasedimentary rocks. 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 absent, but may include both metabasaltic flows and hypabyssal intrusive sills and dikes. These layers are also widespread in the Ojo Caliente and Las Tablas Quadrangles (Coning and others, 2005; Williams, 1987).

. **Xc** **Big Rock Conglomerate** – Stretched and folded pebble metaconglomerate layer interbedded with the aluminous schists, varies from weathering-resistant clast-supported lenses to long, matrix-supported lenses. Clasts include bluish-grayish quartzite, vein quartz, black shaley pebbles, volcaniclasts (up to 10 cm diameter), and chert (ellipsoidal shapes). Clasts are typically flattened and elongated in the main foliation plane. The matrix of the conglomerate varies from quartzite, to quartz-muscovite schist, to metarhyolite. This unit likely correlates with to the conglomerate exposed Big Rock and Ojo Caliente Quadrangles.

Xas **Aluminous schists** – Grayish brown to greenish brown fine-grained schists of varying compositions and bearing various aluminous phases including garnet, staurolite, kyanite, sillimanite, andalusite, and cordierite. Principle minerals include quartz, plagioclase, biotite, and muscovite. Accessory minerals include ilmenite, epidote, magnetite, tourmaline, apatite, monazite, and chlorite. Locally this unit is in gradational contact with the lower micaceous quartzite. The aluminous schists are interpreted to be an alternating sequence of rhyolites, tuffs, and reworked volcanic rocks. Individual layers of schist vary in thickness from tens of centimeters to meters wide. This unit has members that are likely correlative to qmps, qb, qp, and qbk of Trieman, 1977). The aluminous schists are mapped as separate units Xk, Xst, Xcd, and Xs in the Ojo Caliente Quadrangle (Coning and others, 2005).

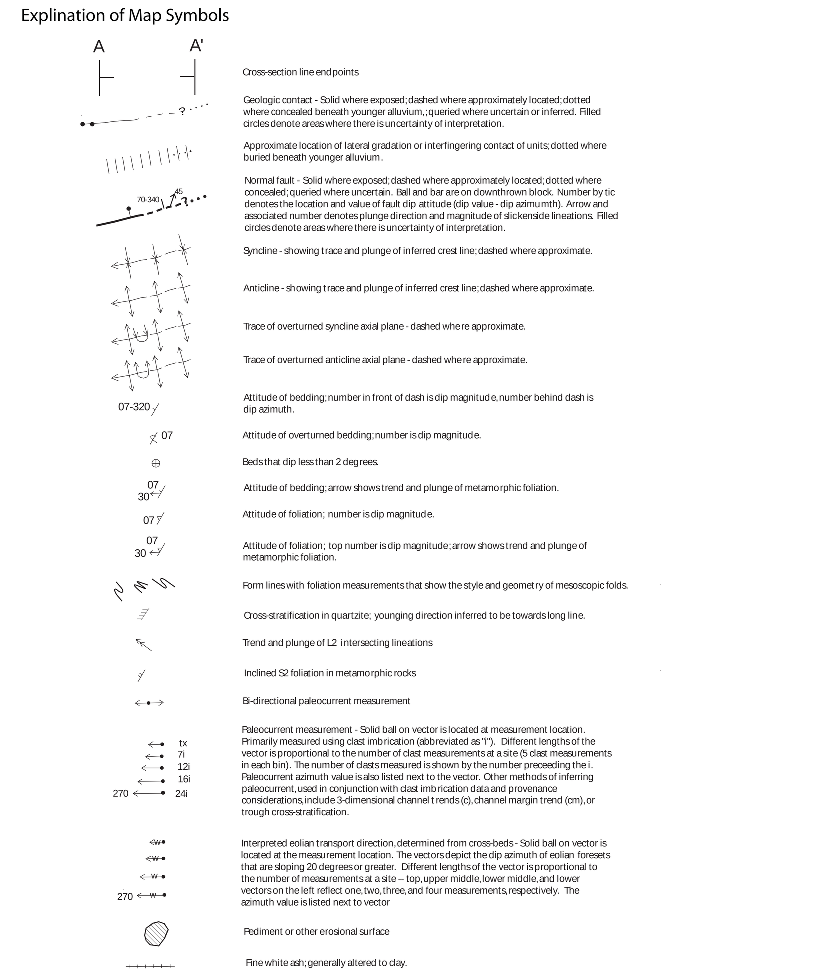
Xs **Feldspathic schist** – Light pink schist distinguished from unit Xms by the presence of feldspar. Consists of quartz, muscovite, feldspar and some iron oxides. This unit is not recognized in the Ojo Caliente Quadrangle to the south; this unit and Xms are mapped instead as Xms and Xbs.

Xms **Mica schist** – White to grayish-green fine-grained quartz-mica schist. Includes quartz-muscovite-biotite schist and gneiss. Consists primarily of quartz and muscovite. Accesory minerals include epidote, hematite, retrograde chlorite, and garnet. This unit is likely correlative to unit qms of Bingler (1965).

Xmql **Lower micaceous quartzite** – Coarse-to-fine-grained grayish-blue, micaceous quartzite. Consists of quartz, muscovite, biotite and hematite. Distinguished from unit Xmqu by recognized stratigraphic position (Lombardi, 1997), lower overall mica content, and absence of greenish layers. This lower quartzite has not been recognized in nearby areas, however this sediments that make up this quartzite may have sourced from the lower metarhyolite unit (Xrp) (Lombardi, 1997) and may previously been grouped together with Xrp.

Xrp **Porphyritic metarhyolite** – Foliated euhedral feldspar metarhyolite, consists mostly of quartz, plagioclase, microcline, and muscovite in the matrix and contains large pink feldspar and quartz phenocrysts ("quartz eyes" of Lombardi, 1997). This unit appears reddish-orange both on fresh and weathered surfaces, and is exposed as rounded, poorly layered outcrops with a rough, knobby, weathering surface. Accessory minerals include magnetite and apatite. Feldspar phenocrysts are up to 1 cm in diameter and are euhedral. This unit is likely correlative to unit fsg of Bingler (1965). More schistose layers of this unit are mapped separately from this unit in the Ojo Caliente quadrangle (unit Xrs of Koning and others, 2005).

Explanation of Map Symbols



Correlation of map units with respect to age.

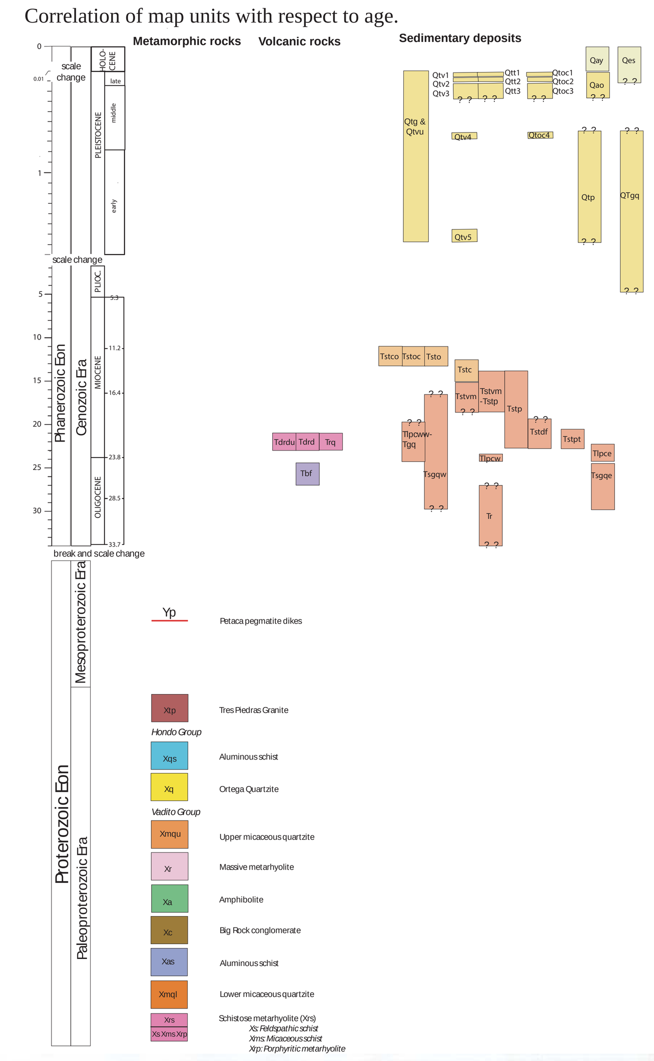
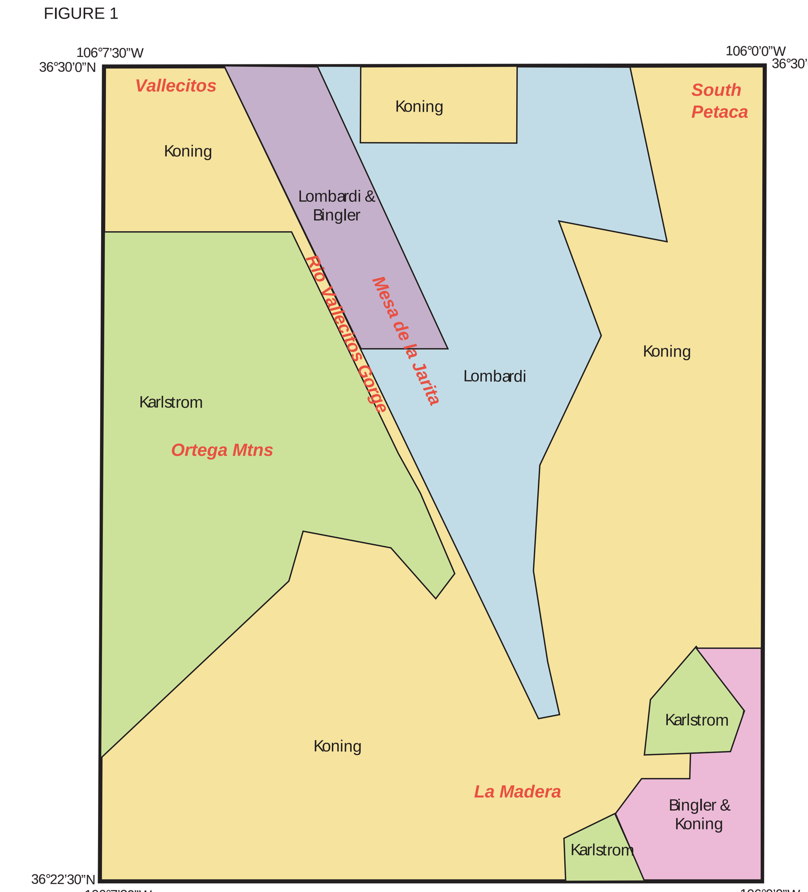


FIGURE 1



INDEX MAP OF AUTHOR MAPPING AREAS