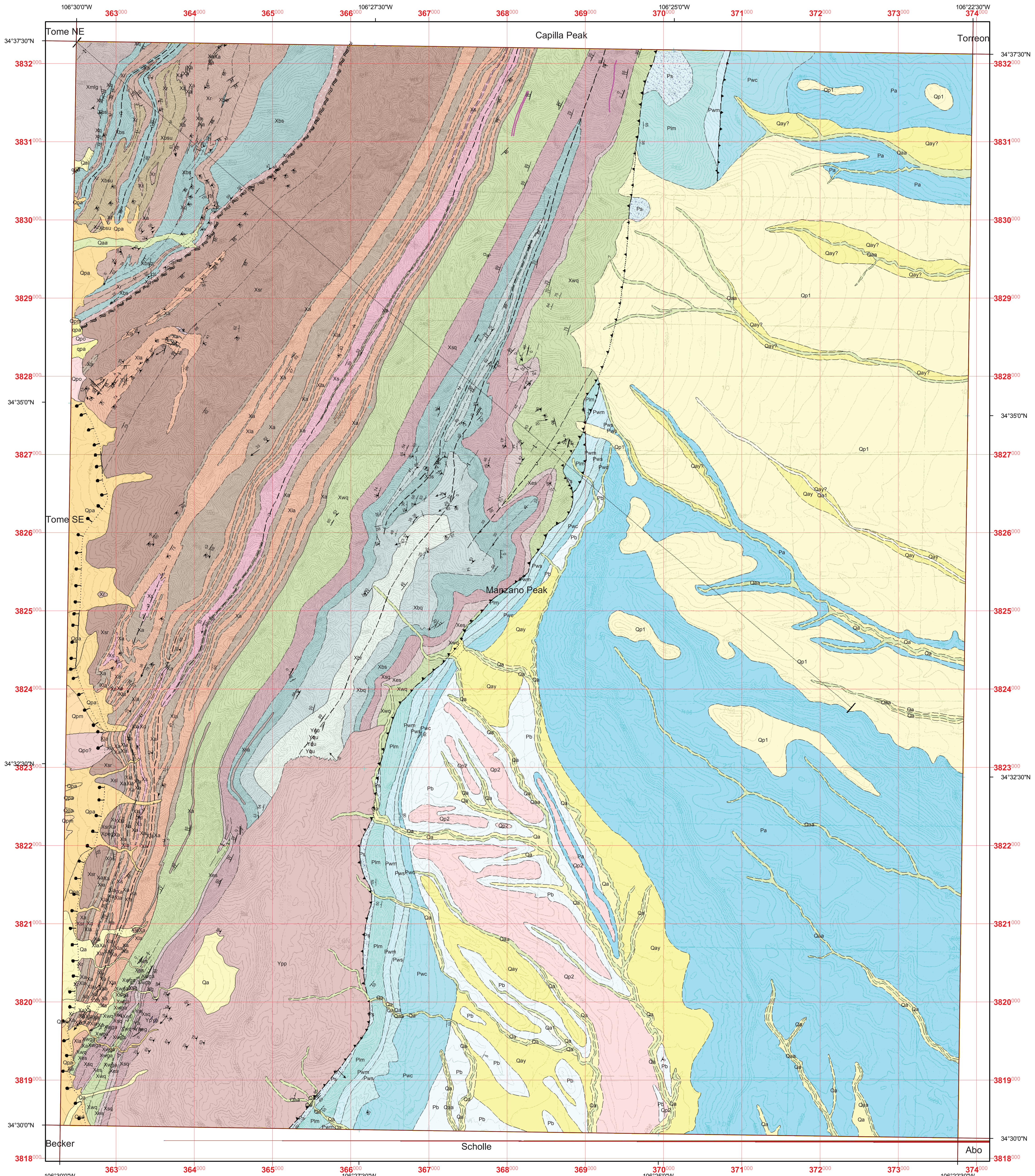
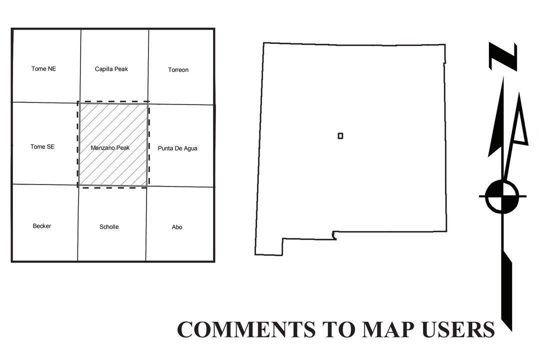


Base from U.S.Geological Survey 1986, from photographs taken 1980 and field checked in 1982.
Map edited in 1986
1927 North American datum, UTM projection -- zone 13N
1000- meter Universal Transverse Mercator grid, zone 13, shown in red



Magnetic Declination
July, 2004
10º 6' East
At Map Center

Geologic Map of the Manzano Peak 7.5 - minute quadrangle

by

Shannon Baer, Karl E. Karlstrom, Paul Bauer, Sean D. Connell

July 2004

1:24,000

0 0.25 0.5 1 1.5 2 Miles

0 0.25 0.5 1 1.5 2 Kilometers

CONTOUR INTERVAL 40 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

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map may be based on any of the following: reconnaissance field geologic mapping, compilation of published and unpublished work, and photogeologic interpretation.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

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http://geoinfo.nmt.edu/statemap

or contact:
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NMBGMR Geologic Information Center -- [505] 835-5145

DRAFT
NMBGMR OF-GM 00

This draft geologic map was produced from scans of hand-drafted originals from the author(s). It is being distributed in this form because of the demand for current geologic mapping in this important area. The final release of this map will be made following peer review and redrafting in color using NMBGMR cartographic standards. The final product will be made available on the internet as a PDF file and in a GIS format.

Description of map Units:

Quaternary

Qaa Active stream alluvium (Holocene) – Commonly brown to reddish-brown, poorly consolidated sand and gravel. Gravel contains abundant subrounded to angular granite and metamorphic rocks in drainages along western front of the Manzano Mountains; to the east, gravel contains granite, metamorphic, and dominantly reddish-brown sandstone. Deposits occupy active stream valleys. Base is not observed and is at least 2 m thick

Qa Stream alluvium, undivided (Holocene) – Commonly brown to reddish-brown, poorly consolidated sand and gravel, locally inset by unit Qaa. Base is not observed and is at least 2 m thick.

Qay Younger stream alluvium (upper Pleistocene-Holocene) – Brown to reddish-brown, poorly consolidated, subhorizontally bedded, poorly to moderately sorted, matrix- and clast-supported silty sand and sandy gravel. Recognized in larger drainages of the eastern dip-slope of the Manzano Mountains where it underlies broad valley floors about 3-6 m above incised active streams of units Qa and Qaa; commonly contains undivided deposits of unit Qa. Colluvial deposits present near the base of hillslopes near deposit margins. Base not observed, but estimated to be at least 2 m thick.

Qpa Piedmont deposits, undivided (Pleistocene-Holocene) – Undivided deposits of units Qa, Qpm, and Qpo. Mostly clast-supported gravel and dominated by granite and metamorphic rocks exposed east of the Manzano Mountains drainage divide. Deposits are locally matrix-supported near mountain front. Locally entrenched near mouths of mountain-front drainages. Base not observed west of the mountain front. Estimated thickness ranges from 1 m to more than 10 m.

Qpm Middle piedmont deposits (middle Pleistocene) – Brown to dark yellowish-brown, poorly consolidated, poorly sorted, cobble to boulder gravel and sand. Forms broad, slightly dissected constructional surfaces that are inset against unit Qpo. Deposits contain clast- and matrix-supported gravels. Soils are moderately to strongly developed. Base not exposed, but is at least 3 m in thickness.

Qpo Older Piedmont deposits (lower to middle Pleistocene) – Poorly consolidated, clast- and matrix-supported gravel and sand with sparse silt and clay. Deposits are dominated by pebbly to locally bouldery gravel containing abundant granite and metamorphic rocks. Forms deeply dissected hills near western front of Manzano Mountains where unit may represent younger aggradational units of the Santa Fe Group. Base not observed west of the Manzano Mountains, but is at least 6 m thick.

Qp2 Eastern-slope deposits (middle Pleistocene) – Poorly consolidated, cobble to boulder gravel and sand. Forms moderately dissected, southeast-sloping remnants of a formerly broad constructional surface that is about 50 m above local base level and is topographically lower than deposits of Qp2. Deposits are dominated by pebbly to locally bouldery gravel containing abundant pink granite of the Priest pluton. Base poorly exposed and probably less than 6 m in thickness.

Qp1 Eastern-slope deposits (lower to middle Pleistocene) – Poorly to moderately consolidated gravel and sand. Forms moderately dissected, southeast-sloping remnants of a formerly broad piedmont along the northeastern portion of quadrangle. Constructional tops range from about 335-525 m above local base level. Base poorly exposed and probably less than 6 m thick.

PERMIAN

Pa Abo Formation: Red shale, pale-reddish-brown to moderate-reddish-orange fine grained sandstone, and grayish- to dusky-red crossbedded arkosic sandstone and conglomerate. Upper beds of formation absent in quadrangle. Base of formation mapped at top of highest marine limestone bed. Thickness: >300ft. (Myers and Mckay, 1974).

Pb Bursum Formation: Reddish-brown, arkosic, hematitic, cross-bedded, locally conglomeratic, but dominantly fine-grained sandstone. Lower part has red shale and siltstone. Base of formation mapped at top of highest limestone bed.

PALEOZOIC

lPm Madera Formation, undivided (Pennsylvanian to Lower Permian?) (lPmu +lP ml).

lPwc Wild Cow Formation: Interbedded arkosic conglomeratic sandstone, sandstone, siltstone, mudstone, and limestone, mostly slope to ledge forming. Yellowish to reddish brown and light gray arkosic to feldspathic sandstone and conglomeratic sandstone are lenticular and grade into pale yellow-brown, gray and purple-gray mudstones and micaceous siltstones. Clastic units locally contain silicified wood. Tabular, ledge-forming, light to dark gray, fossiliferous limestones are commonly interbedded with mudstones and may locally contain feldspathic detritus. Red muddy soils are common on the upper arkosic member. Generally equivalent to Pine Shadow and La Casa Members of Wild Cow Formation of Myers (1973) or Pmuc and Pmud of Myers and Mckay (1974). Variable thickness of 400-600ft (~120m), with erosional top.

lPlm Los Moyos Formation: This unit is a cliff-forming, gray fossiliferous limestone with minor interbedded shales and quartzose to feldspathic sandstones and conglomeratic sandstones. Individual massive to nodular limestone beds are commonly ~7-10m thick and may reach ~20m. Irregular masses of black to reddish-orange chert are common in massive limestone beds. Nodular limestone often weathers to mottled gray and brown surfaces. Limestones are interbedded with light to dark gray and yellowish brown to greenish gray siltstones that are often micaceous. Siltstones locally grade up into lenticular to tabular quartz arenites and quartz pebble conglomerates of light gray to yellowish brown color. Clastic units locally contain silicified wood. Includes Los Moyos Limestone and Sol se Mete Member of Wild Cow Formation of Myers (1973). Pml and Pmub units of Myers and McKay (1974). Approximate thickness: 150-250m.

Xgb Metagabbro: Amphibolites interpreted to be meta-intrusive mafic igneous rocks, probable protolith gabbroic dikes. The emplacement of the dikes may be related to intrusion of the 1.65 Ga Ojito pluton and other plutons to the north. Although the dikes are common throughout the field area, they are dominant within a package of meta-lithic-arenite and may be responsible for local contact metamorphism of these units. These were mapped as part of the Basic Schist and Mixed Flow units by Myers and McKay (1974) and as non-rhyolitic components of the Sevilleta Formation by Bauer, 1983).

Xml Monte Largo Granite: Variably deformed granodiorite, quartz monzonite, and granitic rock. The granodiorite is medium-grained and consists of altered feldspar (30-40%, much sericitized), quartz (20-25%), chloritized biotite, rare hornblende (altered to chlorite and biotite), and epidote. Minor phases include calcite, apatite, zircon, tourmaline, and altered sphene. Mafic enclaves are common in the granodiorite; pegmatites are rare. U-Pb zircon date of 1656+/-10Ma (Bauer et al., 1993).

Xbsu Blue Springs Upper Schist: green to white chlorite muscovite schist. This rock is eroded out of the Manzano Peak synclinorium, but is found north of the Monte Largo thrust in the northwest corner of the quadrangle. Equivalent to the Metaclastics Series pCm of Myers and McKay (1974).

Xbr Blue Springs Rhyolite: Black and brown to gray with lenticular quartz-feldspar pink colored stripes within the darker unit. This is interpreted as a metaryholite because of the presence of potassium feldspar in the felsic lenses and geochemical composition close to rhyolite. Numerous folds, some of which may be reminiscent of a rhyolitic flow folds, others are clearly F1 folds that are then refolded by later generations of deformation. Equivalent to the part of pCa, the argillite of Myers and McKay (1974), named the Blue Springs Quartzite (bq1) by Bauer (1983).

Xbq Blue Springs Quartzite: Thin bedded medium grained quartzites interbedded with chlorite-muscovite schist and quartz-muscovite schist. Partly equivalent to Sais Formation and lower part of the Pine Shadow Springs of Myers and McKay (1974); mapped as Blue Springs Formation (bs1) by Bauer (1983).

Xbqr Blue Springs Red Quartzite: Red to pink in color, massive resistant hematitic quartzite. This single isolated bed of quartzite forms the ridge on the east side of the Manzano Peak synclinorium. Although the bed is well defined because of the color and resistant nature of the unit, it is not a continuous bed. Equivalent to the part of pCa, the argillite of Myers and McKay (1974) and the Sais quartzite (ss3) of Bauer (1983)

Xbs Blue Springs Schist: Green to white schist near the Priest pluton this rock contains, garnet, chlorite, quartz muscovite. Just west of the synclinorium, this unit is highly kinked. It is appears as a beautifully crenulated schist with well preserved garnet. Near the Priest pluton sericite nodules are common and probably formed during retrograde metamorphism after emplacement of the pluton. Equivalent to the part of pCa, the argillite of Myers and McKay (1974) and the Sais Quartzite (sq3) of Bauer (1983)

Xsq Sais Quartzite: Thin bedded reddish schistose quartzite however cleaner than Xqs. Bedding planes commonly show mica concentrations. Grains size ranges from very fine to coarse sand. Primary structures include preserved cross bedding. Originally called the White Ridge and Sais quartzites of Myers and McKay (1974), called the White Ridge Quartzite 2 (wq2) of Bauer (1983).

Xes Estadio Schist marker unit: staurolite, garnet biotite schist unit forms the main anticline exposed in Estadio Canyon. It is a coarse grained schistose unit. The schist's shows multiple episodes of deformation and contains local crenulation cleavage and at least three generations of foliation. Probably originally deposited as a mudstone layer within the sandstone. Equivalent to the Lower part of the Pine Shadow Springs of Myers and McKay (1974); called the White Ridge schist (ws1) of Bauer (1983).

Xwq White Ridge Quartzite: Course grained impure orange to gray thin-bedded aluminous quartzite. Fairly immature metasedimentary rock with well preserved cross bedding. Cross-bedding indicated that the bedding is overturned. The upper part of the unit has a distinctive andalusite –muscovite (Xwqa) foliated schistose layer. This unit forms the western limb of the Estadio Canyon fold. This may represent the base of a generally fining upward sequence of sediment. Part of the Lower part of the Pine Shadow Springs of Myers and McKay (1974); called the White Ridge Quartzite 2 (wq2) of Bauer (1983).

Xs Abajo Schist: Schistose metasedimentary rocks intruded by or interlayered with mafic meta-igneous dikes and flows. The metasedimentary rocks are rich in staurolite, garnet and amphibole porphyroblasts. Possible protoliths could be siltstones. Correlated with the Lower part of the Pine Shadow Springs of Myers and McKay (1974). Equivalent to units A,B,C of Parchman (1976) and Bosque metasediments of Edwards (1976)

Xla Abajo Lithic Arenite: This unit consists of a variety of metasedimentary rocks including meta-pelites, meta-arkose and impure quartzite. The chlorite schist, and some quartzites interbedded with metarhyolite are thinly bedded; more massive, quartzite domains are locally dominant. Locally, garnet staurolite schist and may be related to the intrusion of gabbroic dikes (now amphibolite). Compositional layering (S0) is commonly preserved and is generally at low angle to dominant schistosity (S1). Correlated with the lower metaclastic series of Reiche (1949), and the Flaggy Schist Zone of Myers and McKay (1974), Equivalent to units A,B,C of Parchman (1976) and Bosque metasediments of Edwards (1976)

Xd Lacoracah dacitic tuff and breccia: Gray to black with pink flecks. Matrix is granular and compositionally quartz with some potassium feldspar (pink flecks), and some rare plagioclase. Clasts range from mm to 3 cm and seem to be fairly well sorted with smaller clasts clustered together and gradig into larger clasts. The clasts are dark gray to black, and are mostly composed of biotite and hornblende. Correlated with the Lacorocah metatuff of the Mount Washington Quadrangle originally named by Reich (1949) and described by Parchman (1976). Equivalent to one of the units of the pCb "basic schist" of Myers and McKay (1974).

Xa Amphibolite: Black to dark green, fine- to coarse-grained amphibolites with varying amounts of macroscopic white plagioclase that ranges in texture from salt and pepper to smeared-out shear banding. Coarse-grained metadiorites are present locally. Mafic units have apparent widths up to 150+m and may thicken, thin, fork, and pinch out along strike. Equivalent to the pCb "basic schist" of Myers and McKay (1974). May be confused with the intrusive gabbro described above, but some units may be part of the supracrustal sequence. These were mapped as Basic Schist and Mixed Flow units by Myers and McKay (1974) and as non-rhyolitic components of the Sevilleta Formation by Bauer, 1983).

Xsr Sevietta Metarhyolite: Felsic meta-igneous rocks with quartz and feldspar phenocrysts interpreted as metarhyolite. The metarhyolite is generally pink to gray, blocky-fracturing porphyritic aphanites with quartz and feldspar clasts ~1mm in diameter. Texture ranges from thin, well developed compositional banding to massive. Planar features, such as flow bands or shear bands, are common and range considerably in thickness, ~1mm-~5cm. Quartz veins, pegmatite and massive schistose units are present locally and generally parallel foliation. Equivalent to the Sevietta metarhyolite of Reiche (1949) and Myers and McKay (1974).

Correlation of Map Units

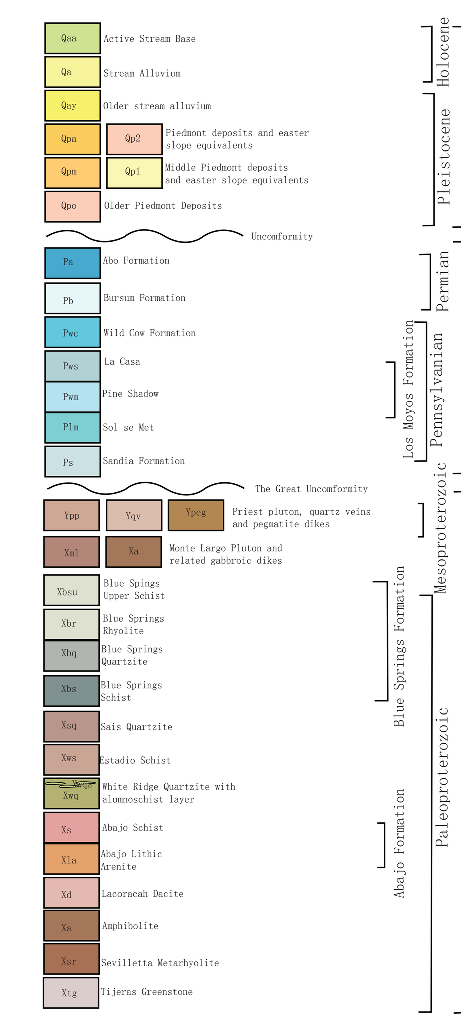

Plate 2

Manzano Peak Cross-Section
Shannon Baer
2004