NMBGMR Open-file Map Series
OFGM 131
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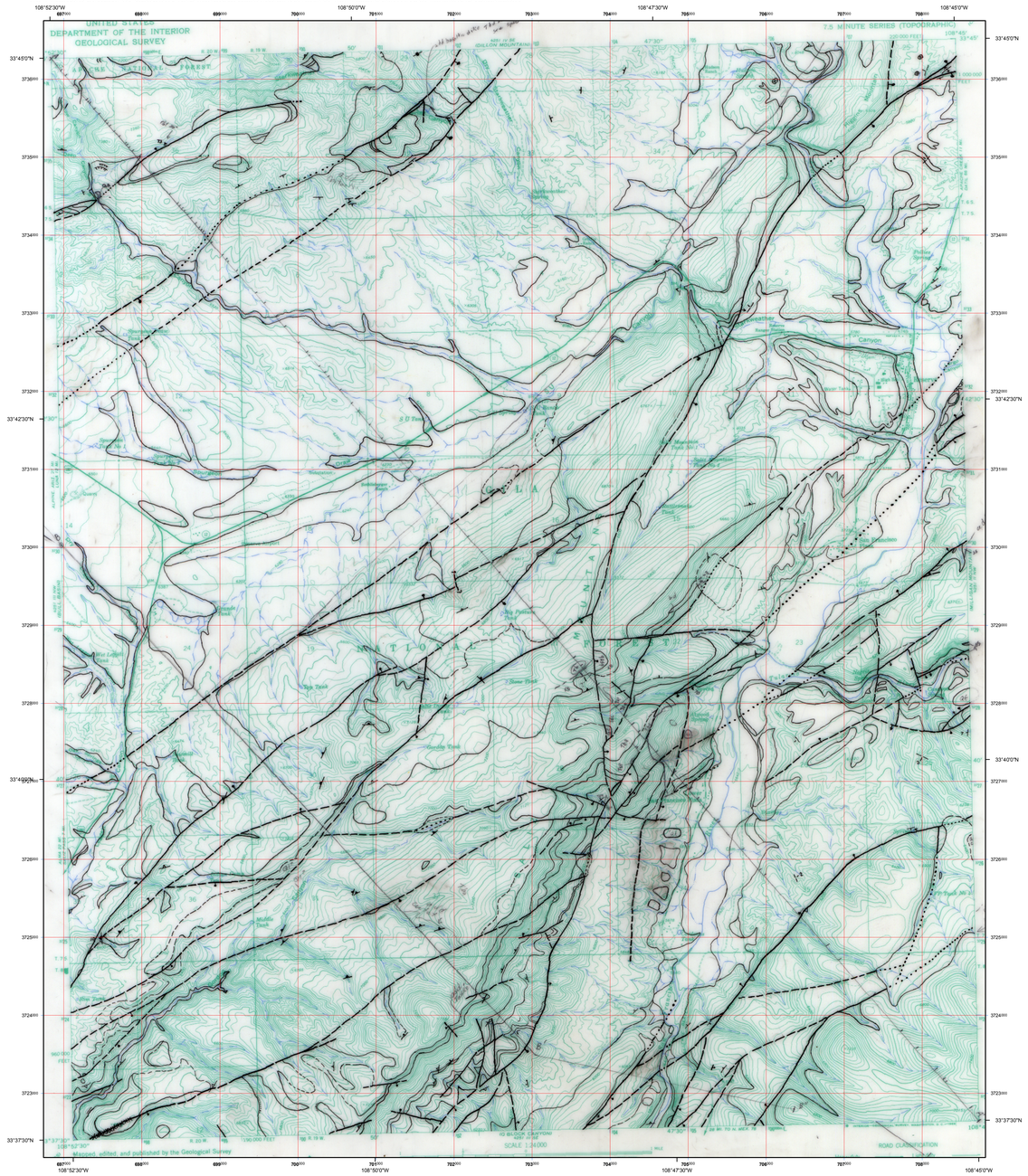
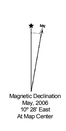



Base map from U.S. Geological Survey 1965, from photographs taken 1964, field checked in 1965.
1927 North American datum, UTM projection – zone 12N
1000-meter Universal Transverse Mercator grid, zone 12, shown in red


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**

# Geologic map of the Reserve quadrangle, Catron County, New Mexico.

**May 2006**

**by**
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New Mexico Bureau of Geology and Mineral Resources
Open-file Map Series
**OFGM 131**

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***http://geoinfo.nmt.edu/publications/maps/geologic/ofgm/home.html***

## DESCRIPTION OF MAP UNITS

Qaf - Alluvial fan deposits (Quaternary)- Small Holocene fans of poorly sorted sand, gravel, and boulders at the mouths of small tributary gulches and some larger drains Holocene.

Qal - Alluvium (Quaternary)- Unconsolidated stream deposits along main drainage channels; up to several meters thick.

Qt - Stream terrace deposits (Quaternary)- Unconsolidated to poorly consolidated Holocene (?) silt, sand, and gravel deposits. At Reserve, the Catron County Courthouse and main Street are on a lower terrace at an elevation of 5740 feet above sea level and 20 to 40 feet above the floodplain of the San Francisco River. The village schools and a concentration of homes is on an older, higher terrace at about 5840 feet elevation, and a city water tower is on a still earlier, 3rd terrace at about 5920 feet. Remanents of three terraces are also present on the south side of the Tularosa River about a mile above its confluence with the San Francisco River downstream from Reserve. Rare pebbles and cobbles of Precambrian granitic rocks are also present in terrace gravels between Cienega Canyon and the San Francisco River west of Higgins Mountain and are accompanied by Paleozoic limestone pebbles and cobbles in terrace gravels west of Reserve. These Precambrian and Paleozoic clasts are probably reworked from volcaniclastic conglomerate in the Pueble Creek Formation exposed in the northwest corner of the quadrangle in the footwall of the San Francisco Mountains fault zone.The conglomerate deposits are resources of unconsolidated sand and gravel.

Ql - Landslide deposits (Quaternary)-Mainly along San Francisco Mountains front in the northwest corner of quadrangle northeast of S U Canyon. Characterized locally by moderate to steep, opposing dips of conglomerate beds in that area.

Qao - Older alluvium (Quaternary)-Slopewash, colluvium, and alluvial fan deposits above the level of present streams.

QTg - Gila Group, undivided (Pleistocene to Late Oligocene)- Basin-fill deposits; mainly volcaniclastic conglomerate and calcareous-cemented sandstone, Conglomerate contains rare clasts of Precambrian granitic rocks and Paleozoic limestone reworked from older volcaniclastic deposits, as near the south edge of Section 32, T6S, R19W. Age of Gila sedimentary rocks is indicated by interlayered basaltic and andesitic lava flows that range from about 1 Ma to about 15 Ma in this and adjacent quadrangles. Gila Group rocks overlie Bearwallow Mountainnn Andesite (~23-25 Ma) and older volcanic rocks where Bearwallow is absent. Crews (1990, p. 151- 181) interprets the depositional environments and gives detailed descriptions of several facies of Gila rocks in this quadrangle and the adjoining Milligan Mountain Quadrangle (Ratte' and others, 1994 ). Maximum thickness is about 1000 feet (300 meters) in both the SU and San Francisco River grabens.

Tpb - Basalt of Pueblo Park (Miocene?)- Dark-colored, fine-grained to glassy flows contain sparse phenocrysts of plagioclase (labradorite) and augitic pyroxene. Flows are a few to several meters thick, and are interlayered in Gila conglomerate at several different levels. They occur mainly on dip slopes on the footwall block of the Saliz Mountains fault, but also are present in minor outcrops on the downthrown side of the fault, northeast of Lower San Francisco Plaza and in the northeast corner of the quadrangle. Basalt flows interlayered in the Gila in adjacent quadrangles have isotopic dates ranging from about 1 Ma to about 15 Ma (Pleistocene to early Miocene), but flows here are considered mostly, or entirely, of Miocene age for lack of dates showing otherwise. These flows are "true" basalts and are informally referred to as "big feldspar" basalts in contrast to the basaltic andesites and andesites of the older Bearwallow Mountain Andesite. However, the "big feldspar" basalts may be difficult to distinguish in the field from Bearwallow flows at some localities, in particular where they directly overlie Bloodgood Canyon Tuff on the western slopes of the Saliz Mountains, along the eastern edge of the quadrangle, and in adjacent parts of the Milligan Mountain Quadrangle (Ratte' and others, 1994). Chemical analyses contrasting the Pueblo Park and Bearwallow Mountain mafic lava flows are presented on the geologic maps of the Bull Basin Quadrangle (Ratte', 1989) and the Milligan Mountain Quadrangle (Ratte' and others, 1994).

Tbd - Basaltic dikes (Miocene?)- A basaltic dike about 20 m wide and ½ km long follows a fault that cuts basaltic flows, Tpb?, in the very southwest corner of the quadrangle. Dike contains sparse plagioclase phenocrysts, thus resembling the associated lava flows. However, the correlation of this and other basaltic to andesitic dikes, as well as the lava flows at this and similar localities where the flows have not been dated, remains uncertain.

Tba - Bearwallow Mountain Andesite (Miocene and/or Oligocene)- Typically multiple, thin (3-10 m) lava flows and flow breccia of the Hawaiian aa type, as exposed in road cuts in Starkweather Canyon, west of Reserve. Dark-gray, vesicular to amygdaloidal andesite and basaltic andesite commonly characterized by reddish-brown specks of tiny olivine crystals altered to iddingsite, a mixture of secondary iron silicates. Chemical composition of Bearwallow Mountain lava flows in contrast to Pueblo Park basalt flows is shown in Table 1 and figures 9 & 10 in Ratte' and others, 1994. Thickness increases toward southeast corner of quadrangle to about 200 m, indicating probable source(s) in a northeast-trending alinement of Bearwallow Mountain eruptive centers parallel to Sign Camp Canyon in the quadrangle of the same name (see USGS Map I-1619, Ratte', 2001) . Bearwallow Mountain Andesite, in cliffs on north side of Tularosa River, at very east edge of quadrangle, have circular to ellipsoidal structures that have been variously interpreted as filled lava tubes, ramped flows, or standing waves in flows (Fig. –) (Ratte', 1999).

SPEARS GROUP

Tss - Volcaniclastic Sandstone (Oligocene)-Buff to red, aeolian sandstone having large, sweeping crossbeds; commonly zeolite cemented; interlayered between Mogollon Group ignimbrites (tuffs) mainly in the northern part of the quadrangle. 0 to about 50 m thick, becoming generally thicker north and west of this quadrangle.

Tpu - Upper Pueblo Creek Formation ( Oligocene and Eocene)- Volcaniclastic debris flows of mainly andesitic and dacitic clasts as much as 1m or more dimensions. Includes two thin, discontinuous tuffs, about 15 cm each, in the northwest corner of the quadrangle. Exposed mainly in the east-facing slopes of the San Francisco Mountains, west of San Francisco Plaza, where it is about 60 m thick.

Tpl - Lower Pueblo Creek Formation ( Eocene)- Mainly volcaniclastic conglomerate and sandstone, but also contains boulders and cobbles of Precambrian granitic rocks and Paleozoic limestone locally. Underlies Andesite of Dry Leggett Canyon, Tla, and, or, Bishop Peak Tuff, Tpt.

MOGOLLON GROUP

Tbc - Bloodgood Canyon Tuff (Oligocene)- High-silica (>75 %) rhyolite ash-flow tuff (ignimbrite); moderately crystal-rich with 10-20 % small (1-4 mm) phenocrysts of chatoyant, blue sanidine (moonstones), quartz, and minor to rare black biotite and honey-yellow sphene (< 1mm) in a nearly white to light-gray, moderately to densely welded matrix of lenticular pumice lapilli and ash; accidental lithic fragments are generally lacking and small; compaction foliation is well developed in more densely welded tuff. Thickness varies widely from about 100 m in the Saliz Mountains fault block to 0 to 30 m in the San Francisco Mountains fault zone in the northwestern part of the quadrangle. This decrease in thickness from southeast to northwest is consistent with the source of the Bloodgood Canyon Tuff in the Bursum caldera in the Mogollon Mountains 40-60 km to the southeast.

Tsp - Shelley Peak Tuff (Oligocene)- Typically brick-red, phenocryst-rich, densely welded rhyolitic to dacitic ash-flow tuff contains 20-30 percent or more nearly white plagioclase, coppery to black biotite, and green pyroxene crystals several mm in size. Accessory opaque oxide minerals, zircon, apatite and sphene are characteristic of Shelley Peak Tuff . May have partially welded tuff preserved near base and top, and 0 to 5 m black, lithophysal vitrophyre locally near base. 30 m thick along east- facing front of Saliz Mountains; less than 10 m thick in San Francisco Mountains Fault Zone at north edge of quadrangle.

Tdc - Davis Canyon Tuff (Oligocene)- Nearly white to pink and light gray, partially to densely welded, crystal-poor, high-silica rhyolite ash-flow tuff ; typically contains 1-2 % tiny (1-2 mm) sanidine, quartz and biotite phenocrysts in a matrix of stringy, light gray and brown pumice and vitroclastic ash. Lithic fragments of older volcanic rocks vary in abundance and size, but are commonly a few mm or cm across and 1-2 % of the rock. Less welded tuff is commonly highly altered to secondary zeolites giving the rock a chalky white appearance. Densely welded tuff in the upper part of the Davis Canyon, in Gordon Canyon in the southwestern part of the quadrangle, locally contains more abundant and larger phenocrysts, including small, green pyroxene phenocrysts, which are unusual in this tuff. Maximum thickness is about 200 m on the east facing slopes of the Saliz Mountains, decreasing to less than 100 m along Starkweather canyon in the San Francisco Mountains Fault Zone near the northern border of the quadrangle.

DATIL GROUP

Tla - Andesite of Dry Leggett Canyon (Eocene)- Gray to olive-gray, vesicular, porphyritic lava flows have light-colored plagioclase and dark-colored pyroxene phenocrysts a few to several mm across in a fine-grained, aphanitic, matrix. Outcrops commonly exhibit spheroidal weathering between prominent joint fractures, which are lined with hydrothermal quartz and carbonate veins, of probable fumarolic origin, in many places. Flows on the order of 150 m thick in the northwest corner of the quadrangle are continuous with flows in the type area in the adjacent Bull Basin quadrangle (Ratte', 1989), where eruptive source(s) for these flows are thought to occur. Correlative flows also cropout in two sequences interlayered with volcaniclastic rocks of the Pueblo Park Formation , in the east-facing slopes of the footwall of the Saliz Mountains fault. There, the upper flow sequence (~ 15 meters thick) and the lower sequence (~ 25 to 35 m thick) pinch out northward within about 3 km of the southern border of the quadrangle.

Trb - Rhyolite breccia (Eocene)- Gray, aphanitic rhyolite breccia of uncertain origin; exposed only in east facing slope of Saliz Mountains near the southern border of the quadrangle. 0-5 m. thick.

Tvt - Datil Group Ignimbrites, Tvt1, Tvt2 , Tvt3 (Eocene)- Thin (0 to a few meters), poorly welded, locally reworked sandy, ignimbrites of uncertain correlation.

Tpt - Tuff of Bishop Peak(?)(Eocene)-Present only in northwest corner of quadrangle beneath Andesite of Dry Leggett Canyon, Tla, where it ranges from gray to reddish brown, densely welded ignimbrite containing 10-15 % tiny phenocrysts of feldspar and biotite (1-3 mm). Thickness, 10-20 meters; correlation uncertain.

## 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.

## GEOLOGY NOTES

Previous geologic studies in the Reserve area date back mainly to the reconnaissance geologic map of the Reserve 30 minute quadrangle (Weber and Willard, 1959), in preparation for the 1965 edition of the New Mexico State Geologic Map (Dane and Bachman, 1965). More recent studies include an analysis of synrift sedimentation patterns in the Reserve graben (Crews, 1994) and a road log from Alpine, Arizona to Datil, New Mexico, via the Reserve quadrangle (Ratté and others, 1994). The regional geologic setting of the Reserve quadrangle is shown on the Geologic Map of the Tularosa Mountains 3o X 60 minute quadrangle compiled by Ratté (2001).

The geology of the Reserve 7 ½ minute quadrangle is dominated by the northeast trending structural grain of the Reserve copound graben, which is part of the Morenci lineament, a major crustal flaw that has been long recognized, and described in various contexts by a number of authors (references). Within the frame of this 7 1/2 minute quadrangle, the Reserve graben can be subdivided into the San Francisco River graben in the southeast and the SU graben in the northwest, separated by the Saliz Mountains horst. The broad zone of extension that is the Morenci lineament extends well beyond the Reserve quadrangle both to the northwest into Arizona, and into adjacent quadrangles to the southeast for a total width on the order of 25 miles (40 kilometers).

The San Francisco River graben is the deepest part of the Reserve compound graben, and both it and the SU graben may be filled with as much as 700-1000 feet (200-300 meters) of Gila conglomerate. Cross-section A-A' shows a modified interpretation from Crews' (1994) diagrammatic section across the Reserve graben, which emphasizes a domino style offset of intra-basin fault blocks (fig -).

Although the stratigraphic sequence of the volcanic and volcaniclastic rocks in the quadrangle is well established for the most part, there are a few uncertainties regarding the correlation of some minor rock units. Specifically, all, or part, of the ignimbrite (ash-flow tuff) mapped as Tuff of Bishop Peak, in the Saliz Mountains, in the south-central part of the quadrangle, is now thought possibly to correlate with 31.7 Ma Caballo Blanco Tuff ; samples have been obtained recently for dating, which hopefully will resolve this correlation problem.

Another correlation problem exists, mainly on the west-dipping, dip-slopes of the Saliz Mountains, where it can be difficult to distinguish young (Miocene) alkali olivine basalt from Bearwallow Mountain Andesite (basaltic andesite). The young basalts, often referred to as "big feldspar" basalt", as a field term, in recognition of centimeter size and larger plagioclase crystals, of labradorite-bytownite composition, locally appear to directly overlie Bloodgood Canyon Tuff. Elsewhere, and more commonly, Bloodgood CanyonTuff is overlain by Bearwallow Mountain Andesite, and locally, as northwest of Lower San Francisco Plaza and Hightower Spring, young basalt flow(s) overlie Bearwallow , which in turn overlies Bloodgood Canyon in a normally expected sequence. Additional petrography and chemical analyses of both major oxides and trace elements should clarify these relationships.

Bearwallow Mountain Andesite along the Tularosa River canyon, at the eastern edge of the quadrangle, exhibits some unusual structures that have been tentatively interpreted as filled lava tubes, for want of a better explanation (Ratté, 1999),( figs ).

REFERENCES CITED

Chapin, C. E., R. M. Chamberlin, G. R. Osburn, and D. W. White, 1978, Exploration Framework of the Socorro Geothermal Area, New Mexico: Field Guide to Selected Cauldrons and Mining Districts of the Datil - Mogollon Volcanic Field, New Mexico, New Mexico Geological Society Special Publication NO.7, p 114-129

Dane, C.H., and Bachman, G. O., 1965, Geologic Map of New Mexico: U.S. Geological Survey, scale 1:500,000

Mayo, E.V., 1958, Lineament Tectonics and some Ore Districts of the Southwest: Transactions AIME, Mining Engineering, v.10, No. 11, p.1169-1175

Ratté, James C., 1999, Origin of Spheroidal and Elliptical Flow(?) structures In the Bearwallow Mountain Andesite, Mogollon-Datil Volcanic Field, New Mexico: New Mexico Geology,

----------,2001, Geologic Map of the Tularosa Mountains 30' x 60 ' Quadrangle, New Mexico: U.S.Geological Survey, Geologic Investigations Series, Map-I-2619, scale 1:100,000

----------, 1989, Geologic Map of the Bull Basin Quadrangle, U.S.Geological Survey, Geologic Quadrangle map, GQ-1651, scale 1:24,000

Figure—x-A: Outcrop of Bearwallow Mountain Andesite along south side of Reserve-Beaverhead road several miles east of Reserve quadrangle. Shows pseudo?-filled lava tube. Central, massive core is enclosed by concentric plates, within which tear-shaped vesicles are alined around the core.

Figure—x-B: Closer view of pseudo? Filled lava tube

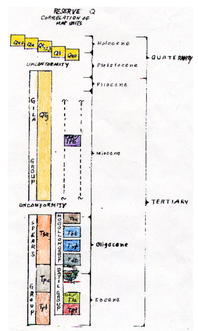



Figure----: Pseudo? filled lava tubes in Bearwallow Mountain Andesite in cliffs on north side Tularosa River at east edge of Reserve quadrangle. Shapes vary from ellipsoidal (1) to circular (2 & 3). Shape of (1) might suggests nose of a ramp structure with flow to left, but encasing rim completely encircles the structure.