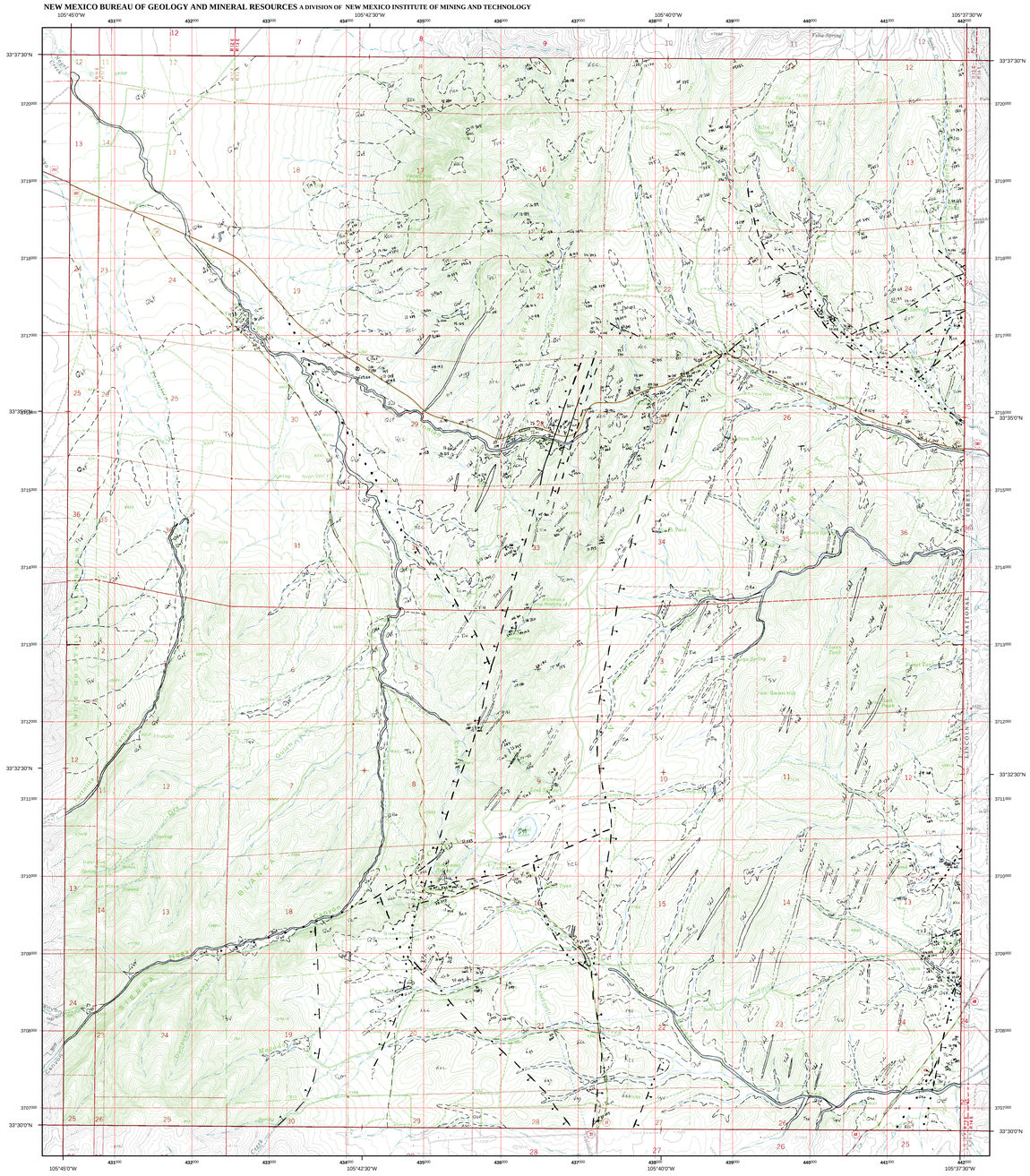

Base map from U.S. Geological Survey 1973 from photographs taken 1971, field checked in 1973.
1927 North American datum, New Mexico coordinate system, central zone, reprojected to UTM projection -- zone 13N
1000-meter Universal Transverse Mercator grid, zone 13, shown in red

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 20 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

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
Earth Science for the 21st Century

NEW MEXICO STATEMAP

New Mexico Bureau of Geology and Mineral Resources
Open-file Map Series
OFGM 195

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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 Nogal quadrangle, Lincoln County, New Mexico

June 2010

by
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New Mexico Bureau of Geology and Mineral Resources, Socorro, NM, 87801

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.

Anthropogenic Deposits

af Artificial fill for stock tanks and highway embankments.

Quaternary and Tertiary Surficial Deposits

QHa Alluvium (Holocene to Historic) – Unlithified gravel and poorly to moderately sorted clay, silt, sand in active stream channels and ephemeral arroyos. Generally incised into Qvf and terrace deposits. Only mapped where extensive; unit is otherwise lumped with Qvf. Thickness: 0 to 4 (?) meters.

Qvf Valley fill (upper Pleistocene to Holocene) - Unlithified valley fill composed of poorly sorted clay, silt, and sand, commonly with angular to subrounded cobbles of local bedrock. Matrix material is light to dark brown. Grades into minor alluvial and colluvial fans on toes of hillslopes. Anthropogenic disturbance common in developed areas. Generally incised by active drainages, floored by sand and cobble to boulder gravel of QHa . Thickness: 0 to 6 (?) meters

Qaf – Alluvial fan deposits (middle to upper Pleistocene) – Alluvial fans composed of poorly sorted cobbles, boulders, sand, silt, and clay. Fans head in short, steep tributary canyons and interfinger with and/or spread out onto Qvf and underlying bedrock. Stabilized by vegetation and apparently no longer active, and locally incised by drainages floored with QHa . They flank the steep slopes of Vera Cruz and Chruch Mountains. Thickness: 0 to 15 (?) meters.

Qbt – Bajada and fan toe deposits (middle to upper Pleistocene) - Low gradient, coalesced fan deposits at the base of large alluvial fans shed from Vera Cruz and Church Mountains. Contacts identified on aerial photographs. Similar in composition to adjacent alluvial fans. Thickness: 0 to 10 (?) meters.

QTg – Pediment gravel deposits (Pliocene to lower Pleistocene (?)) – Well lithified, moderately well-bedded pebble to boulder gravel with strong carbonate cement. Clasts are Sierra Blanca volcanic rocks and associated intrusive igneous rocks. Poor exposure other than in roadcuts on Highway 37 and extensive downslope colluvium makes base of unit hard to identify. Deposited by steep gradient streams draining the Sierra Blanca, predating incision of modern drainages. Unit is tentatively correlated with mesa-capping gravels in the Capitan, Fort Stanton, and Angus quadrangles to the east. Thickness: 0 to 30 (?) meters.

Cenozoic Igneous Rocks

Tiu – undetermined igneous rocks, undivided (Oligocene) – comprises dikes identified on aerial photos, probably largely Tdd , the most common dike rock observed in the field.

Tdd – Diabase/diorite and associated rocks, undivided (Oligocene) – Aphanitic to very fine-grained phaneritic and phaneritic-porphyritic mafic igneous rocks forming dikes, sills, and less commonly, irregular intrusive masses. Generally light to dark dark gray on fresh surfaces and brown to black on weathered surfaces. When phaneritic, often has a "salt and pepper" appearance due to fine-grained equigranular white feldspar and black to brown augite (?). Phenocrysts include augite, hornblende, and tabular intermediate (?) plagioclase. Tabular plagioclase phenocrysts are up to 4 cm in diameter and are usually aligned with the dike margins. Thickness: dikes are < 1 to 5 meters wide.

Tml – Monzonite/latite and associated rocks (Oligocene) – Tan to brown aphanitic to very fine-grained phaneritic igneous rocks forming dikes, sills and irregular intrusive masses. Typically composed of approximately equal amounts of white feldspar and tan to brown mafic minerals with little or no quartz. Feldspar is largely intermediate (?) plagioclase with lesser amounts of potassium feldspar and forms a felted network of interlocking crystals. Includes rocks ranging from syenite to diorite in composition. Thickness: dikes are < 1 to 5 meters wide; base and top of larger igneous masses are not exposed.

Tcd – Diorite of Champ Hill (Oligocene) - Dark gray to grayish-brown fine-grained phaneritic diorite with 10-35% phenocrysts of augite up to several centimeters across. Named for Champ Hill, a stock in the Angus quadrangle to the southwest. Rocks of similar appearance but varying phenocrysts percentage form dikes, sills, and irregular intrusive masses. Thickness: dikes are < 1 to 5 meters; base and top of larger igneous masses are not exposed.

Tmz – Monzonite (Oligocene) - Medium to fine-grained monzonite. Composed of approximately equal amounts of white feldspar and tan to brown mafic minerals with little or no quartz. Similar in color and composition to Tml, but coarser-grained. . Present mostly as irregular discordant intrusions, often associated with faults, and less commonly as dikes. Thickness: up to several tens of meters, base and top of irregular igneous masses are not exposed.

Trt – Rhyolite/Trachyte and associated rocks (Oligocene) – White to pale orange, aphanitic and usually aphyric igneous rocks forming dikes, sills and irregular igneous masses, often associated with faults. Where present phenocrysts are limited to quartz, usually less than 10%. Liesegang bands, flow-banding, and vesicles are common. Thickness: dikes are < 1 to 5 meters; base and top of larger igneous masses are not exposed.

Tvci – Vera Cruz Mountain intrusion – (Oligocene) – Complex felsic intrusion, probably a laccolith, underlying Vera Cruz Mountain. Composed of a core of biotite-phyric granite surround by aphyric rhyolite and/or trachyte and quartz-phyric rhyolite. Finer-grained rocks extend away from the main intrusion as sills and dikes. Thickness: base is not exposed; several hundred meters are exposed along mountain flanks.

Tsv – Sierra Blanca volcanic rocks (upper Eocene to Oligocene) - Walker andesite breccia of Thompson (1972). Interbedded dark purple, purplish-red, red, and light to dark gray and gray-green volcanic flow breccias, volcanic debris flows, shallow intrusive sills, lahars, and volcaniclastic sedimentary rocks from the Sierra Blanca volcanic center. Rocks are generally alkalic and range from mafic (tephrite, phonotephrite, trachybasalt) to intermediate (andesite and latite) to felsic (rhyolite, trachyte, phonolite) in composition. Flow breccias are dominant and consist of varicolored angular to subrounded clasts of volcanic and lesser intrusive rocks in a purple or purplish-gray fine-grained matrix. Matrix is often propylitically altered. Clast population may be monolithologic or varied. Outcrops are massive to crudely bedded and individual flow units are generally 2 to 3 meters thick. Shallow intrusive sills are light to dark gray and aphanitic. Lahar deposits and volcaniclastic sedimentary rocks are red to purple muddy sandstones to conglomerates with variably developed bedding and sorting. Sandstones are well-bedded, often with fining-upward graded beds less than 0.5 cm thick. Natural exposures of all units are poor and individual units are not laterally traceable. Thickness: at least 300 meters are meters are exposed in the quadrangle.

Cenozoic Sedimentary Rocks

Tcm - Cub Mountain Formation (Eocene) – White to tan sandstones, dark red sandy mudstones, and purplish-red silty mudstones. Sandstones are medium- to thick- bedded, cross-bedded, medium-grained, and arkosic to volcaniclastic. Pebble conglomerate lenses, mudballs, and ripup clasts of red mudstone, and olive, black, and gray siltstone and shale are locally common. Sandstones are more friable, and contain more varicolored lithic grains than than underlying sandstones of the Cretaceous Crevasse Canyon Formation. Sandy and silty mudstones are thick-bedded to massive and micaceous. Unit is ubiquitously intruded by igneous dikes, sills and irregular masses. Thickness: At least 150 meters; unit probably thickens greatly to the west towards the center of the Sierra Blanca Basin.

Mesozoic Sedimentary Rocks

Kcc – Crevasse Canyon Formation (upper Cretaceous) – Interbedded olive drab to gray to buff medium- to fine-grained sandstone, gray to black fissile carbonaceous shale, and coal. Unit is ubiquitously intruded by dikes, sill, and irregular igneous masses. Thickness: ~ 250 meters based on cross-section A-A' in the Capitan quadrangle; this estimate is probably high to due to numerous dikes and unmapped faults.

Kgs – Gallup Sandstone (upper Cretaceous) – Pale lavender to pale gray to tan, medium- to very thick-bedded, trough cross-bedded, clean quartz sandstone and minor chert and quartzite pebble conglomerate. Sandstones are noncalcareous and composed of moderately sorted subangular to subrounded quartz grains with 1-2% chert grains. Four major sandstone beds are present, separated by recessively weathering sandstones and minor shales that are poorly exposed. The unit forms prominent cliffs and ridges. Thickness: ~ 75 meters.

Km - Mancos Shale (middle to upper Cretaceous) - Black to purplish gray laminated fissile shale. Black to dark gray to olive thin-bedded fine-grained sandstone and siltstone beds less than 0.5 meters thick are minor constituents. Igneous intrusions are common. Generally only well exposed in stream cuts and manmade excavations. Thickness: ~ 215 meters.

Kd - Dakota Sandstone (lower to middle Cretaceous) - cross-section only

TrJsm - Morrison Formation (Jurassic) and San Pedro Arroyo Formation (upper Triassic), undivided – cross-section only

NOGAL QUADRANGLE - MAP AND CROSS SECTION SYMBOLS

A — A' Location of geologic cross section

Geologic contact, solid where exposed, dashed where approximately located, queried where inferred

20 295 Dip and dip direction of bedding

Horizontal bedding

80 295 Dip and dip direction of joints

90 295 Orientation of vertical joints

40 295 Dip and dip direction of plane of small fault

295 40 Trend and plunge of slickenside striae

Fault, dashed where approximately located, dotted where buried, queried where location or termination is uncertain. Ball and bar indicate sense of throw, usually based on map pattern. Most faults probalby have some component of oblique slip motion.

Sense of fault throw in plane of cross section

Nogal quadrangle correlation chart