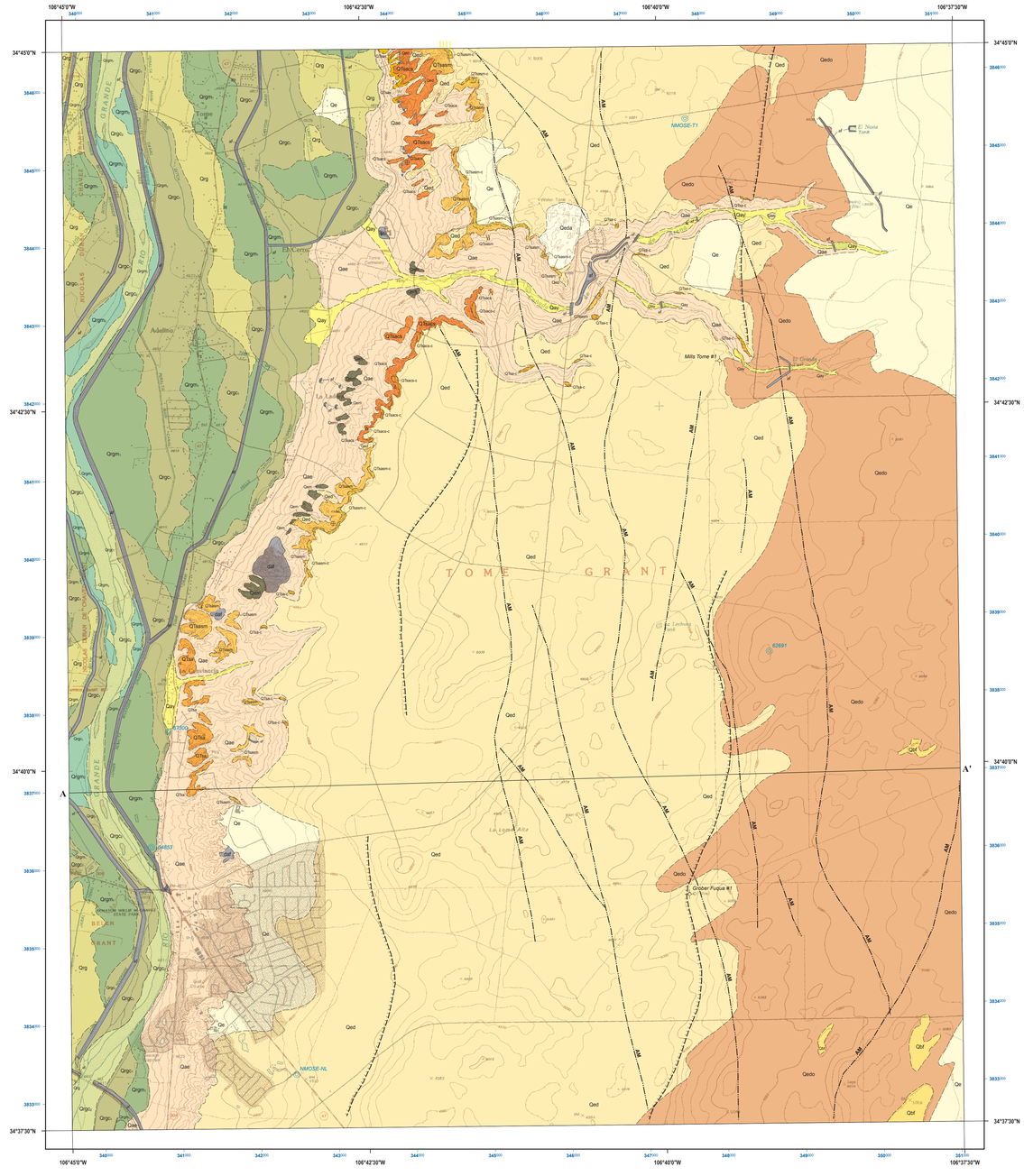

Base from U.S.Geological Survey 1984, from photographs taken 1976 and field checked in 1976.
Map edited in 1984. Base projected from NAD83 to NAD27
1927 North American datum, UTM projection – zone 13N
1000- meter Universal Transverse Mercator grid, zone 13, shown in red

QUADRANGLE LOCATION

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
801 Leroy Place
Socorro, New Mexico
87801-4796

[575] 835-5490

This and other STATEMAP quadrangles are available for free download in both PDF and ArcGIS formats at:

http://geoinfo.nmt.edu

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New Mexico Bureau of Geology and Mineral Resources
Open-file Geologic Map 90

Geologic map of the Tome quadrangle, Valencia County, New Mexico.

May 2004

by
Geoffrey Rawling and David J. McCraw

New Mexico Bureau of Geology and Mineral Resources, 801 Leroy Place, Socorro, NM 87801

DESCRIPTION OF MAP UNITS

QUATERNARY/NEOGENE

Anthropogenic deposits

af — **Artificial fill** — Dumped fill for highway and railroad grades as well as stock tanks.

daf — **Disturbed land and/or artificial fill** — Areas extensively affected by human disturbances, primarily associated with gravel mining and/or construction.

Alluvium of the Rio Grande Floodplain

Qrg — **Rio Grande alluvium, undivided (Historic to upper Holocene)** — Unconsolidated to poorly consolidated coarse-grained sand and gravel with lensoidal interbeds of fine-grained sand, silt, and clay. Forms the lowest inset fluvial deposit of the inner valley and floodplain of the Rio Grande and basal deposits are significantly coarser-grained. Largely disturbed by agricultural fields and housing developments. Interfingers with and is overlain by *Qae* at valley margins. Correlative to the Los Padillas formation of latest Pleistocene-Holocene age (Connell *et al.*, 2000). Thickness ≤ 30 m.

The Rio Grande floodplain alluvium is divided into four subunits, where possible, based upon geomorphic mapping of Pearce and Kelson (2004), who utilized both 1935-vintage aerial photography (depicting the floodplain prior to tamarisk infestation and significantly less disturbance from mechanized agriculture) and 2001 color orthophotography. These map units were modified following McCraw, *et al.* (2006), resulting in two channel deposits ($Qrgc_c$ and $Qrgc_y$) and two meander-bend deposits ($Qrgm_o$ and $Qrgm_y$), which are largely comprised of scroll bar sands and fines and mark former channel localities. The bases of these units are not exposed, but are commonly 20-25 m thick in this vicinity, based upon well logs.

$Qrgc_c$ — **Modern channel facies (Historic)** — Unconsolidated sand and gravel within the active channel of the Rio Grande. Generally modified from the unit W35 of Pearce and Kelson (2004) (i.e., the channel in 1935) using the 1996 digital orthophotoquad, and also includes units Rib35 and Rsb35 of Pearce and Kelson (2004).

$Qrgc_y$ — **Modern channel facies and scroll-bar deposits (Historic to upper Holocene)** — Unconsolidated sand and gravel deposits of former Rio Grande channels and scroll bars recognized in aerial photography. Corresponds to the units Hch, Hsb, and Hib of Pearce and Kelson (2004).

$Qrgm_o$ — **Meander-bend deposits (Historic)** — Deposits preserved along recently abandoned and active meander bends. Corresponds to units Rch35, Res35, and Rcb35 of Pearce and Kelson (2004).

$Qrgm_y$ — **Meander-bend deposits (Historic to upper Holocene)** — Deposits preserved along older abandoned meander-bend courses. Corresponds to units Hcb and Hcs of Pearce and Kelson (2004).

Alluvial, eolian, and playa deposits

Qay — **Arroyo and valley alluvial deposits (Holocene)** — Consists of variably bedded and stratified cobbles, pebbles, sand and silt. Pale brown (10YR 6/3) to brown (10YR 5/3). Locally incised up to 2 – 3 m by modern arroyos floored with recent sand and gravel. Includes local areas of eolian sand sheets less than 1 m thick, and broad areas of undifferentiated valley fill. Only mapped in large drainages. Thickness ≤ 10 m (?).

Qae — **Alluvium and eolian sand sheets, undivided (Holocene to upper Pleistocene)** — Generally forms low relief aprons and arroyo channels along valley margins. Pebbly sand is light brown (5YR 6/4) to grayish orange (10YR 7/4) to light yellowish brown (10 YR 6/4), unconsolidated, well sorted (eolian) to moderately or poorly sorted (alluvium), subangular to subrounded, and composed dominantly of quartz. Interfingers with and overlies *Qrg*. Thickness ≤ 5 m.

Qeda — **Active dunes (Historic to Holocene)** — Dune field north of Canada de la Loma de Arena. Dunes are steep sided and up to 4 meters high. Field has active blowouts and less vegetation than adjacent areas. Thickness 4 to 5 m.

Qe — **Eolian deposits with subdued or no dune forms (Holocene)** — Predominantly sand sheets. Deposit consists of light brown (7.5YR 6/4) to light reddish brown (5YR 6/4), fine to very fine grained, rounded to subrounded sand composed largely of quartz. Locally pebbly, possibly due bioturbation. Forms a broad undulating surface with little or no development of drainage incision or dune microtopography around shrubs. Unit typically has one or more episodes of soil development beneath the surface. Thickness ≤ 2 m.

Qed — **Eolian deposits with recent dune form development (Holocene)** — Deposits are pink (7.5 YR 7/4), light brown (7.5YR 6/4) to very pale brown (10YR 7/4) to brownish yellow (10YR 6/6), unconsolidated, very fine- to medium-grained, moderately well-rounded to well-rounded sand composed largely of quartz. Contains scattered pebbles. Dunes are less than one meter to several meters in height. In the northern half of the map area, unit contains local areas of sand sheets (unit *Qe*). Along bluffs flanking the inner valley of the Rio Grande unit includes small (<1 m) dunes and sand sheets generally less than 1 m thick. Linear, barchan, and parabolic dunes are present in the southern and southwestern portions of the quadrangle. Lateral contacts with *Qe* and *Qedo* are often difficult to distinguish, and are locally queried. Thickness <1 to 5 m (?).

Qbf — **Eolian and playa deposits on floors of small blowouts within *Qedo* (Holocene)** — Deposits are comprised of sand, silty clay, and clay. Thickness ≤ 2 m.

Qedo — **Eolian deposits with older dune form development (lower (?) Holocene)** — Composition is similar to *Qed*. Commonly buried by or reworked into *Qed*. Thickness < 1 m to 5 m (?).

Rio Grande sedimentary deposits and rocks

Qern — **Edith formation or Menaul formation (?) (middle Pleistocene ?)** — Ancestral Rio Grande deposits formed of cobble gravel with coarse sand matrix. Clast composition is similar to *QTsa* gravels (see below) but clasts appear to be smaller on average. Base of deposit is 21 to 25 meters above Rio Grande floodplain deposits (*Qrg*), similar to the Edith and Menaul formations in the Albuquerque area (Connell, *et al.*, 2000). Deposit forms scattered, gravel-mantled subcrops on the eastern slope of the Rio Grande inner valley. Thickness ≤ 10 m.

Sierra Ladrones Formation (Upper Santa Fe Group, (Lower Pleistocene (?) to Pliocene) — Poorly lithified axial river deposits composed of sandy gravel, sand, silt, and clay and deposited by the ancestral Rio Grande. Discontinuously exposed along bluffs of the inner valley of the Rio Grande. Sands are composed largely of quartz, with lesser amounts of rock fragments and chert. Gravel clasts are up to 10 cm in length and are composed of at least 50% granite and quartzite. The remainder is dominated by intermediate and basaltic (often vesicular) volcanic rocks and sparse Pedernal chert. Gravels generally occur in crude fining upward sequences, often scoured into subjacent unit. Buried soils consisting of horizons of carbonate nodules, clay accumulations, and rubification are present in both gravels and sands. Matrix in the gravels is poorly sorted coarse sand. A white, 1-2 m thick stage III+ (IV locally) calcic soil (Machette, 1985; Birkeland, 1999) is present in the uppermost sand and/or basal dune sand at the top of bluffs, delineated by northeast-trending hachures on the map where exposed. Thickness: Base not exposed; ~ 45 m exposed between floodplain and top of inner valley escarpment in the northern portion of the quadrangle.

QTsa / **QTsa-c** — **Axial river deposits of the ancestral Rio Grande, undivided** — Unit mapped where subdivision by texture is difficult due to poor outcrop. Consists of small rounded hills and bluffs usually mantled by gravel, even where gravel does not appear to be the main component of the unit. In general, unit is dominated by subequal amounts of medium bedded medium to coarse sand and sandy and silty clay, with subordinate gravel, and is probably *QTsas* or *Qtsasm*. A "-c" designation indicates gravel clasts are largely comprised of conglomerates.

Three compositionally distinct units can be identified in the north portion of the quadrangle. Nomenclature after Cather (1997):

QTsas — **Axial river deposits of the ancestral Rio Grande** — Unit is dominated by medium to coarse, moderately to poorly sorted, cross bedded sand and subordinate gravel in scoured channels. Contains buried soils consisting of carbonate nodules, clay accumulations, and rubification. Unit also includes dune sand composed of white, rounded to subangular, slightly frosted, medium to very coarse quartz sand with abundant elongate carbonate concretions.

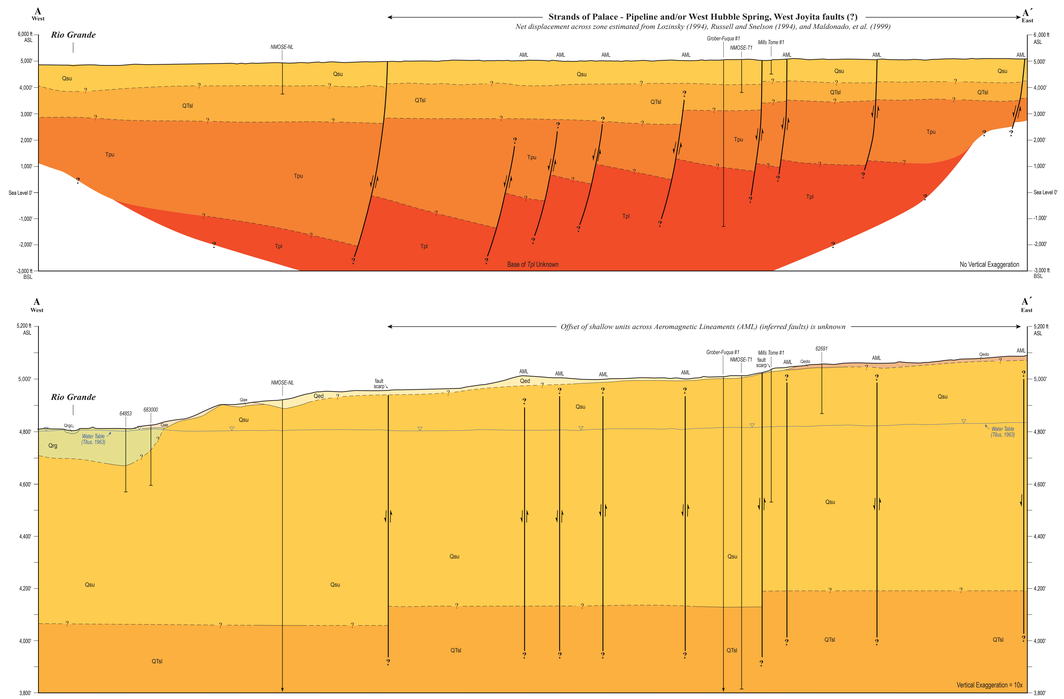
QTsacs / **QTsacs-c** — **Axial river deposits of the ancestral Rio Grande** — Subequal amounts of and gravel and moderately to poorly sorted cross bedded sand. A "-c" designation indicates gravel clasts are largely comprised of conglomerates.

QTsasm / **QTsasm-c** — **Axial river deposits of the ancestral Rio Grande** — Subequal amounts of sand and silty clay with sparse gravel. Sand is pink (7.5 YR 7/4) to pinkish gray (7.5 YR 7/2), fine to very fine, well rounded. Bedding is generally massive, and contains lenses of blocky and crumbly red to pale green clay up to 1m thick. A "-c" designation indicates gravel clasts are largely comprised of conglomerates.

Qsu — **Upper Sierra Ladrones Formation, undivided** — Dominantly well-sorted, sandy fluvial deposits with interbeds of silty and clayey sand formed into upward-fining sequences within an overall coarsening-upward sequence. Cross section only. Unit description from well logs in Connell and Jackson (1999a) and Connell and Jackson (1999b). Thickness: 250 – 265 m in the Nancy Lopez (NMOSE-NL) and Tome (NMOSE-T1) groundwater monitoring wells.

QTsl — **Lower Sierra Ladrones Formation, undivided** — Dominantly clayey sand with gravel fine- to medium-grained sand interbeds. Cross-section only. Thickness: The Nancy Lopez and Tome groundwater monitoring wells penetrated ~ 100 m of lower Sierra Ladrones Formation but did not encounter the base.

Tpu / **Tpl** — **Popatosa Formation (Middle and Lower Santa Fe Group, middle to upper Miocene)** — Light brown to pink, coarse grained sand with silty sand and clay interbeds, fining downward to fine to medium grained sand with clay interbeds. This overlies interbedded light reddish brown to red clay, fine sand, and silty sand. Unit is not exposed in the quadrangle and is only shown on the cross section. Description is from Lozinsky (1988) based on cuttings from the Grober Fuqua #1 oil test well. Subdivision into upper (*Tpu*) and lower (*Tpl*) subunits is based on an upsection change in lithic fragment composition from volcanic and sedimentary dominated to metamorphic dominated at 3999 foot depth in the Grober Fuqua #1 well (Lozinsky, 1988). Upper Popatosa thickens greatly to the west across faults due to rapid Miocene extension (May and Russell, 1994).



EXPLANATION OF MAP SYMBOLS

- A — A' — Location of geologic cross section.
- Geologic contact. Solid where exposed or known, dashed where approximately known, dotted where concealed or inferred.
- AM — Trace of aeromagnetic lineament inferred to represent trace of buried fault; data from Sweeney, *et al.* (2002).
- Topographic trace of fault scarp.
- Dip and dip direction of bedding
- Horizontal bedding
- Arrows showing mean direction of paleoflow, based upon pebble imbrication.
- Grober Fuqua #1 — Oil & gas exploration well.
- 64853 — Groundwater monitoring, or water supply well (with NMOSE W.A.T.E.R.S. database reference number)
- Elevation of water table (on cross section)

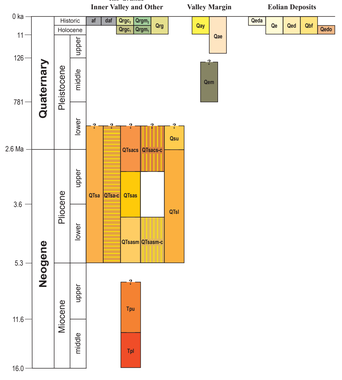
COMMENTS TO MAP USERS

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.

CORRELATION OF MAP UNITS



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