Revised 4/4/86

New Mexico Bureau of Mines and Mineral Resources Open-File 238

Explanation: Socorro County Geologic Map

Compiled by G. R. Osburn, 1984

Qa — Alluvial and colluvial deposits of upland valleys--mostly correlative with Qv. Unit mapped where more specific designation unknown or in areas of mixed lithologies too complex to separate at map scale.

Qb — Basalt flows of Quaternary age.

Qba — Basin-floor sediments -- Includes playa and alluvial deposits in closed basins. Consist mostly of mudstones with less voluminous siltstone and sandstone interlayers. Locally gypsiferous. Designated Qbs where sulfate deposits predominate (Jornada del Muerto). Qbc designates relict basin-floor sediments of mid-Pleistocene age with strong calcic soils; unit grades downward into QTs.

Qe — Eolian sand deposits undifferentiated--Includes sheet and dune sands, stabilized and active deposits. Mapped superimposed above underlying deposits (Qe/Qp) where thin and discontinuous and underlying lithology known.

Ql — Lacustrine sediments--Designated Qls where sulfate deposits predominate (Jornada del Muerto).

Qp
Qfy — Piedmont-Slope and Valley-Border alluvium--Includes alluvium of large fan and pediment surfaces bordering the Rio Grande valley and surrounding closed basins. In a few locations young alluvial fan deposits were reported as Qfy. Dominantly gravel and sand but grade from bouldery alluvium (proximal) to sand-silt-clay mixtures (distal). Grade laterally into axial river deposits or bolson/playa deposits. Thickness usually less than 100 ft (30 m); unit rest primarily on Santa Fe Group (QTsf, QTs, TP); but locally includes pediment veneers on various bedrock formations.

Qs — Basin-floor and distal piedmont slope deposits now covered with surficial gypsum-rich sediments. Gypsum may be spring-mound deposits or gypsum-rich dune deposits.

Qt — Terrace deposits--intermediate level terrace alluvium inset along sides of major arroyos or the Rio Grande.

Qtc — Talus, stabalized talus and colluvium -- Consists mainly of angular fragments with or without soil matrix. Locally includes small areas of other alluvium types.

Qvy
Qvyf — Alluvial and colluvial deposits of major stream -- Generally <15,000 yrs. valleys. Qv designates arroyo-channel deposits, arroyo-mouth fans, fans along

entrenched course of Rio Grande, and low terrace and fan deposits of valley borders. Soil development is generally weak. Qvyf designates floodplain deposits of the Rio Grande and Rio Puerco which characteristically consist mainly of sand, silt, and clay in contrast to the pebble and cobble-rich channel-fill and fan deposits of arroyos (Qvy).

Qps — Undivided piedmont-slope alluvium (Qp) and piedmont-slope facies of Sierra Ladrons Fm (QTsp). Primarily basin-fill units of early to middle Pleistocene age marking transition (gradational contact) from upper Santa Fe Group to post Santa Fe basin fill. Unit has discontinuous cover of Qa in many places.

QTsf — Upper Santa Fe deposits undivided -- In the Socorro area, rocks of the Santa Fe Group have been separated into a lower Popotosa Formation (Denny, 1940) and an overlying Sierra Ladrones Formation (Machette). Within the main valley of the Rio Grande, the break between these two formations is mapped at the first occurrence of main-stem river deposits, which signal the integration of drainage to form the ancestral Rio Grande. Outside the Ric Grande valley, where main-stem fluvial deposits are not present, the top of the Popotosa Formation is often problematic, because sedimentation was relatively continuous in closed basins. In these places the top of the Popotosa Formation is placed arbitrarily at a mappable stratum or unconformity, below which the strata tend to be better indurated, have steeper dips, contain clasts mainly of volcanic rocks, and are usually (but not always) redder in color. All Popotosa- and Sierra Ladrones-type deposits above this level are then mapped as Santa Fe gravels undivided (QTsf).

QTs
QTsp
QTsa — SIERRA LADRONES FORMATION (Machette, 1978) -- 0-1,000 ft (0-300 m), piedmont-slope, river-channel, and floodplain deposits. Fanglomerates shed from present highlands plus channel and floodplain deposits of the ancestral Rio Grande. Deposits consist of poorly indurated, buff to red fanglomerates intertonguing with light-gray, friable sandstones and red or green mudstones and siltstores. Basal deposits interfinger with earliest axial-river deposits of Rio Grande rift (about 4.5 m.y.). Divided locally into Piedmont-slope and alluvial-fan deposits (QTsp) and axial-river sandstones (QTsa).

QTb
QTbc — Basalt flows -- young but of uncertain age or dated near Pliocene-Pleistocene age boundary. Cinder deposits mapped separately as QTbc.

Tp
Tpl
Tpp
Tpf — POPOTOSA FORMATION (Denny, 1940) -- 0-3,000 + ft (0-900 + m); fanglomerates, mudflow deposits, mudstones, and sandstones. Bolson deposits interbedded locally with contemporaneous volcanic rocks. Near Socorro the

lowermost rocks are usually red, well-indurated mudflow deposits (Tpl), that are overlain by a thick sequence of red and green playa claystones (Tpp). Regionally, these facies interfinger with and grade into piedmont-slope and alluvial-fan deposits (Tpf).

Tv Tertiary volcanic rocks undivided. Volcanic rocks are separated by age into units roughly corresponding to those used on the New Mexico Geologic Highway map (T2, T3, T5, T6) and into lithology by the addition of an additional prefix (v = volcanic, a = andesite, b = basaltic rocks, r = rhyolitic rocks). Where volcanics have been mapped undivided they are mainly units T2 and T3.

(T6b) Basaltic lavas interlayered with the Sierra Ladrones Formation or equivalent units (4.5 to 0.5 m.y.).

(T5b,r) Basaltic and rhyolitic lavas and tuffs interlayered with the Popotosa Formation (26 to 4.5 m.y.).

(T3v,a,b,r,m) Regional Ash-Flow Tuffs -- Hells Mesa through South Canyon Tuffs, and interlayered units. T3m designates units deposited in the moat of an ash-flow tuff cauldron (see Osburn and Chapin, 1983) (34 to 26 m.y.).

(T2v) Datil Group (as used by Osburn and Chapin, 1983) volcanic rocks (39 to 34 m.y.). Includes volcaniclastic rocks of the Spears Formation and four interlayered ash-flow tuffs.

Tb BACA FORMATION (Eocene) -- Red to buff sandstones and claystones with minor conglomerates. Deposited in a lacustrine environment west of Rio Grande (Cather, 1980). Coarser deposits, dominated by conglomerates, predominate east of the Rio Grande.

Tkm McRAE FORMATION (upper Cretaceous to Tertiary) -- Fra Cristobal range only (McLeary, 1960). Dark-brown sandstones, conglomeratic sandstones, and mudstones. Contains abundant volcanic clasts and locally blocks of underlying Precambrian rocks.

Ti Tertiary intrusive rocks undivided. Separated by lithology and/or individual intrusive bodies in most localities including:

(Tiac) Anchor Canyon stock in northern Magdalena Mountains. Monzonite and Granite composition (Park, 1971).

(Tin) Nitt Stock in northern Magdalena Mountains. Mostly monzonite in composition.

(Tiwc) Water Canyon stock in east central Magdalena Mountains.

(Titm) Tres Mostosas stock about 15 miles west of Magdalena.

(Tihw) Hale Well Pluton about 5 miles west of Magdalena.

(Tir) Unnamed rhyolitic intrusive.

(Tim) Unnamed monzonitic intrusive.

K Cretaceous rocks undivided

(Kmv) Gallup Sandstone and overlying Crevasse Canyon Formation -- Consists of the Gallup Sandstone, a marine shoreface sand, and the overlying Crevass Canyon Formation which consists of thick sequence of nonmarine sandstones, shales and coals.

(Kdm) Dakota Sandstone (marine), all tongues of Mancos Shale (marine) and interlayered Tres Hermanos Sandstone (marine and non-marine).

TR
TRc
TRs Triassic rocks consisting of mudstones, and siltstones and red to purple sandstones of the Chinle Formation (TRc) and the underlying Santa Rosa Sandstone (TRs).

P Permian rocks undivided. Usually divided into several formations listed below.

(Pat) ARTESIA GROUP. Includes the Bernal Formation (Bachman, 1953; Smith, 1983, Smith and Budding, 1959).

(Ps) SAN ANDRES LIMESTONE (Permian) -- Consists of upper limestone and lower evaporite member in Sierra Lucero area (Machette, 1978); east of the Rio Grand, the San Andres is dominantly limestone and dolostone with abundant gypsum and minor mudstone and siltstone in the upper part.

(Pg) GLORIETA SANDSTONE (lower Permian) -- Cliff forming, well-indurated, well-sorted, cross-bedded quartzose sandstone.

(Pgs) San Andres -- Glorieta combined.

(Py) YESO FORMATION -- Undivided (Permian)

(Pyu) Torres, Canas, and Joyita Members consisting, respectively, of interbedded sandstone, shale, gypsum and limestone; gypsum limestone and siltstone, and quartzose sandstone.

(Pym) Meseta Blanca Member consists dominately of medium to fine-grained, well-sorted sandstone, minor siltstone and shale. Locally contains halito crystal casts.

(Pa) ABO FORMATION (lower Permian) -- Very dark reddish brown, fine-grained sandstones with interbedded mudstones and siltstones. Minor coarse-grained channel sandstones.

(Pay) ABO FORMATION and YESO FORMATION mapped together.

(Pb) BURSUM FORMATION (lower Permian) -- Dark purplish-red and green shales, limestones (often nodular) and in upper beds reddish arkose and arkosic conglomerates. Transitional beds between Pennsylvanian limestones and shales and Abo Formation sandstones.

P Pennsylvanian rocks undivided.

(Plp) LEAD CAMP LIMESTONE and PANTHER SEEP FORMATION (southeastern part of map; Bachman and Harbour, 1970).

(Pm) MADERA FORMATION (Upper and middle Pennsylvanian) -- Limestones, siltstones, sandstones, and shales.

(Pu) WILD COW FORMATION and LOS MOYOS LIMESTONE (Myers, 1973, 1982) -- Equivalent to Madera Formation (old usage). Mapped where Myers (1973) has elevated Madera to group status including the Bursum Formation.

(Ps) SANDIA FORMATION (Middle Pennsylvanian) -- siltstones, sandstones, shales with minor conglomerates. Locally contains a few sandy limstone beds.

MP Mississippian and Pennsylvanian rocks undivided.

MPs Mississippian Caloso Formation, Kelley Limestone, and Pennsylvanian Sandia Formation. Mapped together in Magdalena Mountains.

O-P Ordovician through Permian Strata in northern Sierra Cuchillo.

C-M Cambrian thru Mississippian strata.
Includes in southeast (Bachman and Harbour, 1970) Bliss Sandstone, El Paso Formation, Montoya Dolomite, Sly Gap and Onate Formations, and Lake Valley Limestone.
In southwest (eastern San Mateo Mountains, Furlow, 1965) includes Bliss Formation, El Paso Group, and Montoya Group.

pC Precambrian rocks. Locally subdivided by lithology into:

(pЄm) Metasedimentary and metavolcanic rocks

(pЄgb) gabbros

(pЄz) quartzites

(pЄg) granites. Several granite plutons are individually designated:

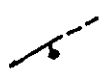
(pЄgc) Capirote pluton in Ladron Mountains (Condie,1976)

(pЄgl) Ladron pluton in Ladron Mountains (Cordie, 1976)

(pЄgm) Magdalena Granite (Sumner, 1980)

Explanation of Symbols:


- geologic contact, dashed where inferred

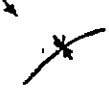

- normal fault, bar and ball on downthrown side

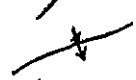

- low-angle normal fault (young over old), hachures on upper block


- reverse and thrust faults, teeth on upthrown block

- folds


-- anticline


-- syncline


-- monocline


- strike and dip of bedding


- dike


- volcanic vents


intrusive rocks

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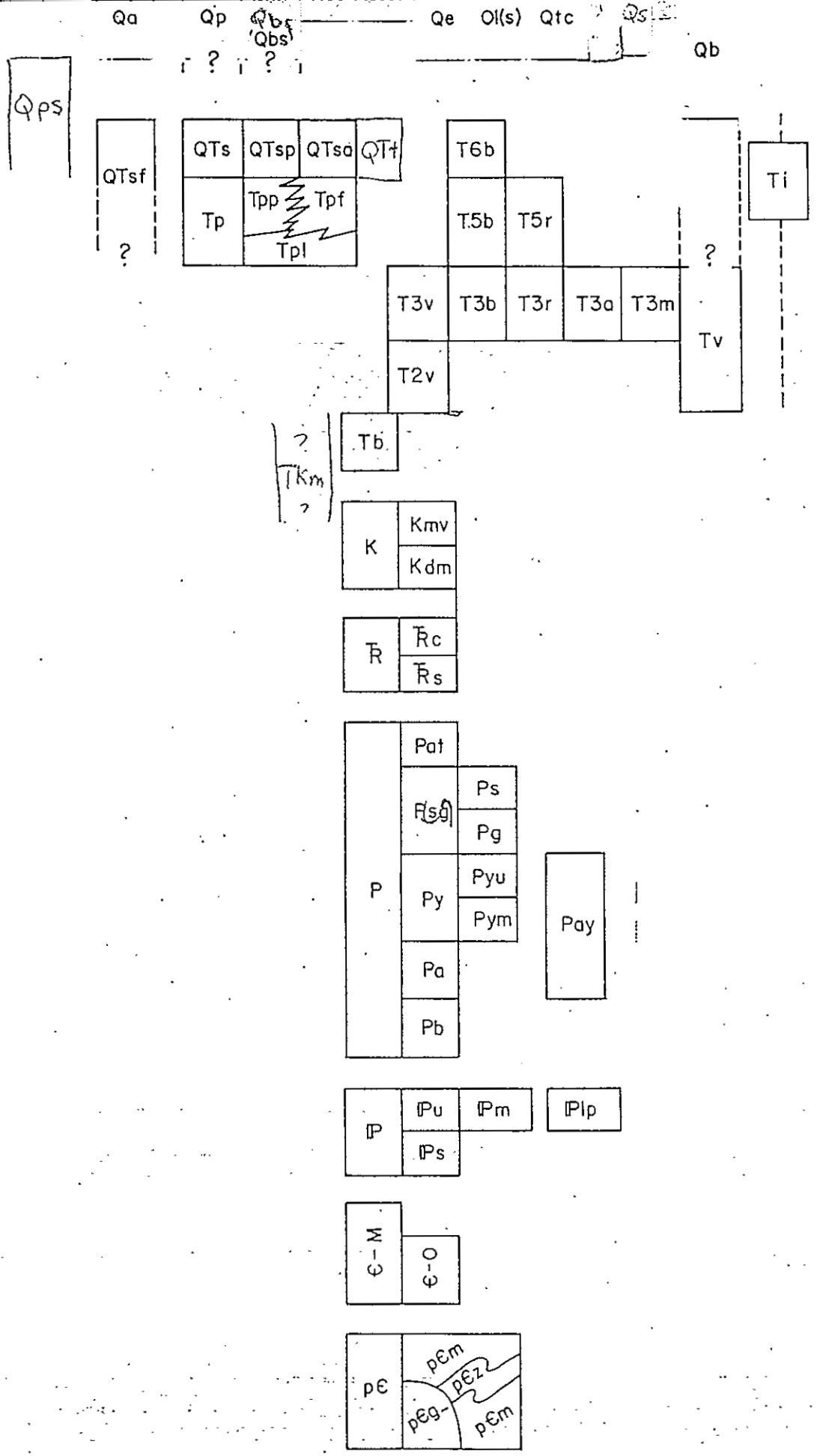

Correlation Diagram for County 1/200,000 map compilation

NMBM OFR#238

Geology of Socorro County

Compiled by Glenn R. Osburn, 1983-1984

Map 01