

Geologic Map of the Carson Quadrangle, Taos County, New Mexico

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**New Mexico Bureau of Geology and Mineral Resources
*Open-file Digital Geologic Map OF-GM 022***

Scale 1:24,000

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Geologic Map of the Carson 7.5-minute Quadrangle, Taos County, New Mexico

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DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

- Qal** **Stream channel and valley-floor alluvium, and active floodplains (Holocene)**-poorly to well-sorted, poorly sorted sand, pebbles, and boulders; clasts primarily of quartzite and slate
- Qp** **Playa deposits (Holocene and latest Pliocene)**-small playa deposits located on Quaternary landslide deposits in the southern part of map area. Generally present behind Toreva blocks.
- Qe** **Eolian sand sheets and dunes, undifferentiated (late Pleistocene to Holocene)**-well-sorted fine to medium sand with silt
- Qls** **Landslide deposit (late Pleistocene to Holocene)**-poorly sorted sand to boulders, includes large rotational slide blocks within the Rio Grande and Rio Pueblo de Taos gorges, which include large, rotated and detached beds of Servilleta Basalt (Tb)
- Qc** **Colluvial mantle on slopes (middle Pleistocene to Holocene)**-not shown in Rio Pueblo de Taos gorge
- QfyQt1** **Young alluvial-fan and stream terrace deposits (late Pleistocene to Holocene)**-poorly sorted silt, sand, pebbles, and boulders; stage I to II calcium carbonate development; clasts primarily of quartzite, slate, schist, granite, and volcanic rock types
- Qf3Qt3** **Alluvial-fan and stream terrace deposits (middle to Late Pleistocene)**-poorly sorted silt, sand, pebbles, and boulders; stage II to III calcium carbonate development; clasts primarily of quartzite, slate, and schist; granitic clasts also present east of Arroyo del Alamo
- Qf2Qt2** **Alluvial-fan and stream terrace deposits (middle Pleistocene)**; poorly sorted silt, sand, pebbles, and boulders; clasts primarily of quartzite, slate, and schist; granitic clasts also present east of Arroyo del Alamo; finer grained to the north, away from the Picuris Mountains range front; stage III to IV calcium carbonate development
- Qf1** **Alluvial-fan deposits (middle Pleistocene)**-poorly sorted silt, sand, pebbles, and boulders; clasts primarily of quartzite, slate, and schist; finer grained to the north, away from the Picuris Mountains range front; stage III to IV calcium carbonate development; within adjacent Taos SW quadrangle, ash probably within Qf1 deposits at locality near Stakeout Road dated at 1.27±0.02 Ma (⁴⁰Ar-³⁹Ar method, W. McIntosh, personal communication, 1996)

- Qfo **Alluvial-fan deposits (early? to middle Pleistocene)**-poorly sorted silt, sand, pebbles, and boulders; clasts primarily of quartzite, slate, and schist; fan surface is highly dissected and eroded, soil characteristics unknown; on Pilar Mesa, deposit is dominated by slate pebbles and cobbles
- Qfu **Alluvial-fan deposits (Pleistocene)**-undifferentiated, poorly sorted alluvial-fan deposits of silt, sand, pebbles, and cobbles.
- Qgrg **Fluvial gravel deposited by ancestral Rio Grande (early to middle? Pleistocene)**-poorly sand, pebbles, and cobbles; clasts of basalt, quartzite, slate, schist, other metamorphic rock types, other volcanic rock types, and (rarely) sandstone and limestone; overlies Tb north of Pilar Mesa, but is inset into Tb on Pilar Mesa

MIOCENE AND PLIOCENE ROCKS
RELATED TO THE RIO GRANDE RIFT

- TQg **Older alluvium (Pliocene and early Pleistocene)**-Poorly sorted sand and gravel deposits, typically with layers containing large rounded boulders of Proterozoic quartzite. Found on high erosional surfaces, and along the Pilar-Vadito fault. Maximum thickness of 10 m or more
- Tr **Rhyodacite cone of Tres Orejas (Pliocene)**-Dark, phenocryst-poor, locally flow layered rhyodacite. Phenocrysts of augite and hypersthene are sparse and small; SiO₂ is 62-64% (Lipman and Mehnert, 1979). Uppermost Tb flows locally overlap the flanks of Tres Orejas. Older Tb flows lie below rhyodacite volcanoes elsewhere on the Taos Plateau, so rhyodacite and olivine basalt (Tb) were erupted at about the same time. The rhyodacites of San Antonio Mountain and Guadalupe Mountain to the north have K-Ar ages of 3.1 Ma and 4.8 Ma, respectively (Lipman and Mehnert, 1979).
- Tb **Servilleta Formation, basalt (Pliocene)**-Dark-gray, diktytaxitic olivine tholeiite which forms thin, fluid, widespread pahoehoe basalt flows of the Taos Plateau volcanic field. These flows commonly form columnar-jointed cliffs in the Rio Grande Gorge. Tabular plagioclase and sparse olivine are the only phenocrysts. Individual flows, which are up to 12 m thick, are grouped into packages of from one to ten flows. These packages are separated by 0.3-4.5 m thick sedimentary intervals (Leininger, 1982). The mesa east of Pilar displays four basalt flows north of the Embudo fault and only one flow south of the fault. Five central volcanic vents to the north are sources for the Servilleta Formation (Lipman and Mehnert, 1979). K-Ar ages generally range between 3.5-4.5 Ma (Lipman and Mehnert, 1979), although an age of 2.8 Ma was reported from a flow west of the map area on Black Mesa (Manley, 1976)
- Tch **Chamita Formation of Santa Fe Group (Miocene and Pliocene)**-Composition ranges vertically. Lower section consists of buff-colored, moderate to poorly sorted sands with clasts of intermediate volcanic rock, quartzite, and other metamorphic rocks. Middle section contains fewer volcanic clasts and more metamorphic clasts. Upper section is devoid of volcanic clasts. Overall, unit coarsens upwards, and dips decrease from 30° NW at base to horizontal at top. Exposure just north of Pilar contains an internal angular unconformity of about 15° near top of exposure. Interfingering basal contact with Ojo Caliente Sandstone. Thickness about 230 m
- To **Ojo Caliente Sandstone of Tesuque Fm of Santa Fe Group (Miocene)**-Buff to white, well-sorted eolian sandstone. Dominant grain size is fine sand. Abundant 1.3-5.0 cm thick brown CaCo₃ concretions. QFL proportions average 62% quartz, 28% feldspar, and 10% lithics. LvLsLm ratio averages 82% Lv, 8% Ls, and 10% Lm. Thin reddish-brown, finely laminated siltstone horizons are found locally. Tabular crossbeds are common, with sets over 4 m in height. Transport was from southwest to northeast. Deposited at 13-12 Ma (Steinpress, 1980). Best exposures are in roadcuts along NM-68, northeast of Pilar. About 250 m thick

- Tce **Chama-El Rito Member of Tesuque Fm of Santa Fe Group (Middle Miocene)**-Volcanic-rich, non-fossiliferous sandstone (50%) and conglomerate (42%), with minor mudrock interbeds (8%). Conglomerates are generally purplish to gray due to predominance of pebble-size Tertiary volcanic clasts. Sandstones are pinkish-gray to buff, poorly to moderately sorted, with highly variable grain size. Sandstones are transitional between arkoses and volcanic arenites. Siltstone and clayey siltstone beds are reddish-brown and generally less than 1 m thick. Sandstone QFL percentages average 39% quartz, 31% feldspar, and 30% lithics. LvLsLm percentage averages 80% volcanic lithics. White beds of calcareous, pyroclastic volcanic ash, less than 2 m thick, are found locally. Fluvial and alluvial sedimentary structures are common. Represents braided stream deposits on a distal alluvial fan derived from a volcanic terrain to the northeast. Lower part contains 10-m-thick weakly consolidate, coarse, cobble to boulder conglomerate composed of rounded, white to gray quartzite clasts (up to 2 m) and subordinate granite clasts. This poorly sorted and unstratified deposit was previously mapped as Bradley Conglomerate by Leininger, 1982
- dd **Dacite dike (age unknown, but either Middle Proterozoic or Tertiary)**-Dark green-gray quartz diorite dikes intruded into Proterozoic rocks. Dikes are vertical, with strikes clustered around an azimuth of 150°. Composed of pale green clinopyroxene (Cr-diopside?), zoned plagioclase (labradorite?), and minor quartz, magnetite, and ilmenite. Commonly altered to chlorite and clay. Pyroxene and feldspar show normal plutonic textures. Locally, dikes are laced with carbonate veins. Dikes are generally less than 1 m wide. Contacts between diorite and country rock are sharp and commonly contain zones of brecciation and faulting. Faults are sub-vertical with dip slip fault striations. Dikes are parallel to the Pilar-Vadito fault and other southeast-striking faults.

PRECAMBRIAN ROCKS

- xxx **Pegmatite**-Simple pegmatites of quartz-K-feldspar-plagioclase-muscovite. Pegmatite bodies typically are dikes or lenses, locally aligned parallel to country rock foliation and fold hinges. Thicknesses range from a few cms to several meters
- Xhpl **Piedra Lumbre Formation, Hondo Group**-Exposed only in two small areas northeast of the Pilar-Vadito Fault. Includes quartz-muscovite-biotite-garnet-staurolite phyllitic schist with characteristic sheen on crenulated cleavage surfaces, and finely laminated, light gray, phyllitic quartz-muscovite-biotite-garnet schist and darker bluish gray fine-grained biotite quartzite to metasiltstone. Euhedral garnets are 1 mm, biotite books are 2 mm, and scattered anhedral staurolites are up to 5 mm in diameter. Calc-silicate layers exist locally. Original sedimentary structures such as graded bedding are locally preserved. Contact with underlying Pilar Formation is gradational. Apparent thickness is 200-400 m
- Xhplq **Piedra Lumbre Formation quartzite, Hondo Group**-Massive to layered, light-colored, crossbedded micaceous quartzite. Locally garnet-bearing. Approximate thickness of 25 m
- Xhplp **Piedra Lumbre Formation phyllite, Hondo Group**-Dark gray to black, fine-grained, garnet-bearing phyllite. Crops out only in the core of the Hondo syncline east of the Pilar-Vadito fault.
- Xhp **Pilar Formation, Hondo Group**-Exposed northeast of the Pilar-Vadito Fault. Dark gray to black, carbonaceous phyllitic slate. Extremely fine-grained homogeneous rock except for rare 1- to 2-cm-thick light colored bands of quartz and muscovite that may represent original sedimentary bedding. In thin section, fine-grained matrix consists of quartz (50-70%), muscovite (15-30%), and prominent streaky areas of graphitic material. Lenticular porphyroblasts (0.1 to 0.5 mm) are altered to yellow-brown limonite. Pervasive slaty cleavage is locally crenulated. Small isoclinal folds locally. Basal 1.5-m-thick, black to blue-black, medium-grained, garnet quartzite is distinctive. Garnets are anhedral, oxidized, and red-weathered. Gradational with Hpl. Thickness unknown due to extreme ductile deformation

- Xhr6 **Rinconada Formation, R6 schist member, Hondo Group**-Tan, gray, silver quartz-muscovite-biotite-staurolite-garnet schistose phyllite interlayered with fine-grained garnetiferous muscovite quartzite. Euhedral staurolites (<5 cm) abundant in some layers. Small euhedral garnets (<2 mm) throughout. Strong parting along well-developed foliation. Sharp contact with Hp. Thickness is approximately 90 m
- Xhr5 **Rinconada Formation, R5 quartzite member, Hondo Group**-Variety of white to blue medium-grained quartzites interlayered with fine-grained schistose quartzites and quartzose schists. Measured section by Hall (1988) from an area just to the south, from top to bottom: 1) tan to white, friable, thinly layered, crossbedded micaceous quartzite; 2) blue, medium-grained, thickly layered, resistant saccharoidal quartzite; locally crossbedded; 3) white to tan, friable schistose quartzite layered with blue, medium-grained saccharoidal quartzite; thin layers of fine-grained quartz-muscovite-biotite schist; basal 1.5 m massive blue medium-grained quartzite; 4) tan, thinly layered, micaceous quartzite layered with quartz-rich muscovite schist; abundant crossbedding; 5) blue and white streaked, thickly bedded, medium-grained quartzite with abundant crossbedding; and 6) tan, thinly layered, micaceous quartzite interlayered with quartz-rich quartz-muscovite schist; abundant crossbedding. Gradational contact with Hr6. Thickness is approximately 75 m
- Xhr4 **Rinconada Formation, R4 schist member, Hondo Group**-Medium- to coarse-grained, silvery gray, quartz-muscovite-biotite-staurolite-garnet schist containing one or more distinctive, 0.5-2.0 m thick, layers of glassy blue quartzite, rusty red weathering garnetiferous white quartzite, massive, extremely hard, red weathering, olive-brown biotite-staurolite-garnet-orthoamphibole rock, white, glassy, hornblende quartzite, gray biotite-hornblende calc-schist, mylonitic blue to pink and blue, glassy quartzite, and white to gray calcite marble. In this area, Hr4 is a transitional sequence of interlayered schist and quartzite, making the contacts with Hr3 and Hr5 indistinct. Thicknesses range from 50-175 m
- Xhr3 **Rinconada Formation, R3 schist member, Hondo Group**-White, gray, bluish-green and blue, medium-grained, thinly to thickly bedded, resistant quartzite with abundant crossbeds (Hr3q). Locally includes two mappable layers of pelitic schist (Hr3s) that resemble Hr4 and upper Hr1/2. Distinctive marker layer near center of unit is 25-m-thick, white, thinly bedded, ridge-forming quartzite. Sharp contact with Hr4. Thickness is approximately 75 m
- Xhr12 **Rinconada Formation, R1-R2 schist member, Hondo Group**-Lower unit of fine- to medium-grained, tan to silver, quartz-muscovite-biotite schist with small euhedral garnets (<2mm) and scattered euhedral staurolite twins (<1.5cm). Near base are black biotite books (<2cm). Locally contains andalusite porphyroblasts up to 8 cm across. Upper unit of gray to tan, red weathering, coarse-grained quartz-muscovite-biotite-staurolite-albite-garnet schist containing interlayers of 1-10 cm, red, gray, or tan weathering, fine-grained muscovite-garnet quartzite. Abundant staurolites are twinned, euhedral, up to 3 cm; abundant garnets are euhedral and small (<2mm). Strong parting along foliation plane. Sharp to gradational contact with Hr3. Lower and upper units have previously been subdivided into R1 and R2, respectively, based on mineralogy (Nielsen, 1972). Thickness is approximately 265 m
- Xhr **Rinconada Formation, undivided, Hondo Group**-Undivided schists and quartzites near the Pilar-Vadito fault are extensively fractured and faulted.
- Xho **Ortega Formation, Hondo Group**-Gray to grayish-white, medium- to coarse-grained quartzite. Generally massive and highly resistant to weathering. Locally well-crossbedded, with kyanite- or sillimanite-concentrated in thin, schistose, muscovite-rich horizons. Crossbeds are defined by concentrations of black iron-oxide minerals. Common accessory minerals are ilmenite, hematite, tourmaline, epidote, muscovite, and zircon. Gradational contact with Rinconada Formation. Thickness is approximately 800-1200 m

Xvvg **Glenwoody Formation, Vadito Group**-Feldspathic quartz-muscovite schist and quartzose schist exposed in cliffs southwest of Pilar. White, light gray, pink, or green. Commonly contains megacrysts of feldspar and rounded and flattened quartz in a fine-grained matrix of quartz, muscovite and feldspar. Contact with overlying Ortega Formation is a south-dipping ductile shear zone. Pervasive extension lineation in schist plunges south. Upper 40 m of schist is pinkish, and contains anomalous manganese and rare earth elements, and unusual minerals such as piemontite, thulite, and Mn-andalusite (viridine). L.T. Silver reported a preliminary U-Pb zircon age of ca. 1700 Ma (Bauer and Pollock, 1993). May be equivalent to the ca. 1700 Ma Burned Mountain Formation of the Tusas Mountains. Base unexposed; minimum thickness is about 200 m