

APPENDIX A—Map Unit Descriptions for Generalized Geology

MAP UNIT DESCRIPTIONS OF GENERALIZED GEOLOGY

- Qa** **Alluvium (middle Pleistocene to middle Pleistocene to Holocene)**-Includes both stream channel and valley-floor alluvium in active floodplains (Qal) and young alluvial-fan and stream terrace deposits (Qfy, Qty). Composed principally of poorly to well-sorted sand, pebbles, and boulders. Light-brownish sand, gravelly sand, and sandy gravel with minor mud and silt that underlie modern ephemeral or active channels. Beds are typically very thin to thin, and planar or cross-stratified. Gravel is generally poorly sorted, subangular to subrounded pebbles. Sand is generally coarse- to very coarse-grained, poorly to moderately sorted, and subrounded to subangular. There is no soil development and the sediment is loose.
- Qf** **Alluvial fan deposits (middle to late Pleistocene)**-Older alluvial-fan deposits (Qfo). Poorly sorted silt, sand, pebbles, and boulders. Clasts are primarily of Pennsylvanian sedimentary rocks and Proterozoic quartzite, slate, schist, granite, and rare volcanic rock types. poorly sorted silt, sand, and pebbles. Stage III and IV calcium carbonate development where soils are preserved, although soil horizons are commonly affected by surface erosion.
- Qto** **Older alluvial terrace deposits (middle Pleistocene)**-Poorly sorted silt, sand, pebbles, and boulders. Clasts are primarily of Pennsylvanian sedimentary rocks and Proterozoic quartzite, slate, schist, granite, and rare volcanic rock types. Stage III and IV calcium carbonate development where soils are preserved, although soil horizons are commonly affected by surface erosion.
- Tb** **Basalt (Pliocene)**-Dark-gray, vesicular, olivine tholeiite basalt flow found on high mesa in east-central map area, and as scattered, isolated remnants to the west. New $^{40}\text{Ar}/^{39}\text{Ar}$ date of 5.67 Ma indicates that this flow is time equivalent to rocks of the Ocate volcanic field to the east. Locally up to 10 m thick.
- Ttd** **Dixon member of Tesuque Formation of Santa Fe Group (Middle Miocene)**-Red, tan, beige, and locally greenish and/or yellowish sandy to clayey silt and silty clay. Loose to slightly friable, moderately well to moderately poorly sorted, mostly massive but sometimes thinly to moderately thickly bedded. Interbedded with tan, brownish, reddish, and characteristically light olive green, very friable to nonfriable, very fine lower to very coarse upper, moderately to very poorly sorted, generally subangular to subrounded, thinly to thickly bedded, locally carbonate cemented conglomerate to fine arkosic sandstone. Conglomerates contain abundant poorly to moderately rounded clasts of Precambrian quartzite and Paleozoic sandstone, limestone, and siltstone. Locally, conglomerates also contain clasts of Tertiary volcanic rocks. Sedimentary features other than plane lamination are not common, but include ripple marks, cross beds, and lateral accretion (point-bar) foresets. Contacts between beds are usually sharp, and bases of sandstones and conglomerates are typically scoured. Imbrication of clasts is not common, but is locally well developed. Sandstones and conglomerates are preferentially cemented with calcium carbonate. Paleocurrent indicators (imbrication and the strike of channel walls) show transport from the south, southeast, and southwest. Exposed thickness 75-100 m.

- Tpu/c** **Upper volcanoclastic member of Picuris Formation or Chama El-Rito Member of Tesuque Formation of Santa Fe Group (<19.78 Ma to > ~14.5(?) Ma)**-Red to purple, very friable to nonfriable, very poorly to moderately well sorted, poorly rounded to rounded, thickly to thinly bedded, commonly carbonate-cemented, pebble and gravel conglomerate. Composed predominantly of Tertiary volcanic and rounded Precambrian quartzite clasts, and tan, pinkish, and whitish, loose to slightly friable, very fine lower to very coarse upper, moderately well- to very poorly sorted, subangular to subrounded and rarely rounded, thinly to thickly bedded, locally carbonate-cemented, arkosic to lithic sandstone, and brick-red to pink, tan to brown, orange, and whitish, loose to slightly friable, moderately well- to poorly sorted, thinly to thickly bedded, locally weakly carbonate cemented, sandy silt to silty clay beds. Most contacts between beds are sharp and basal contact of coarser beds are commonly scoured. Upper contact appears to be depositional and possibly gradational and/or interfingering. The upper contact is placed at the top of the highest conglomerate bed that is dominated by Tertiary volcanic clasts. Approximately 10-100 m thick. A basalt clast from the basal part of the upper member at hill 7751' was dated at 19.8 Ma and the unit is overlain by the Dixon member, which is estimated to be 12.5 to 14.5 Ma regionally.
- Tpmc** **Cemented part of middle member of Picuris Formation (< ~23 Ma (?))**-This unit is characterized by silica cementation and is informally defined as the interval between the lowest and highest pervasively silica-cemented beds within the Picuris Formation. This unit is everywhere found at the top of the middle member and sometimes includes all or part of the gradational and/or interfingering contact with the upper member. Some beds in this interval, in some locations, are either poorly cemented or cemented with both calcium carbonate and(?) silica. Buff to white and/or pinkish, nonfriable to strong, very fine lower to very coarse upper, very poorly to moderately sorted, rounded to subangular, thinly to thickly bedded, silica-cemented, silty sandstone to fine cobble conglomerate. Locally contains a basal portion of poorly sorted pebbly/gravelly sandstone and/or cobble/boulder conglomerate composed exclusively of Precambrian clasts. This portion of the unit grades upward (or laterally) into pebbly/gravelly sandstone and conglomerate composed of an increasing proportion of Tertiary pumice and/or other volcanic clasts relative to Precambrian clasts. In exposures along NM-76 between Chamisal and Penasco, the lowest, exposed, cemented part of the middle member is at least 13 m of moderately well sorted, thickly bedded, sub-rounded to angular, cobble and boulder conglomerate composed of Precambrian granite(46%), quartzite(26%), amphibolite (26%), phyllite (1%), and schist (1%). Rare paleocurrent indicators suggest transport from the northwest, north, and northeast. Approximately 10-35 m thick.
- Tpm** **Middle tuffaceous member of Picuris Formation, (<28.3 Ma to >23 Ma)**-Light buff, yellowish, and locally white, very friable to somewhat friable, moderately(?) to very poorly sorted, commonly bimodal, silt to medium lower sand, fine to very fine silty sand, sandy to clayey silt, massive or very thickly to thinly bedded ashy/quartzose sand. Contains thin to thick (5 cm-1.5 m) interbeds and channel-fills of buff and black, friable, moderately to poorly sorted, subangular to subrounded, Precambrian Pilar slate and quartzite-rich and/or pumice-rich conglomerate. In Section 32, SW of Vadito, are rare channels of pebbly/gravelly granite, epidote, slate, amphibolite and schist(?), and an exposure of boulder conglomerate composed of porphyritic Penasco quartz monzonite, Precambrian quartzite, and amphibolite. Ash beds (15-65 cm) are found north of the Rio Pueblo. Some ash beds are distinctly bioturbated. Conglomerate beds seem to increase in abundance towards the upper contact. Some conglomerate beds contain

abundant rounded pumice lapilli that are white or pink, mafic-poor, with phenocrysts of quartz and plagioclase. Near and at the upper contact (and also within parts of T_{pmc}) a biotite-rich pumice is found. Lower contact not exposed in map area. Upper contact is the base of the first silica-cemented bed in the section. Sedimentary features and bedding are absent or very poorly expressed except where coarse-grained or ashy beds exist. At least 150 m thick in northern exposures. Primary ash fall from the Amalia Tuff eruption has been identified within the middle member on Cerro Blanco. Two additional populations of pumice of approximately 23 and 27 Ma have been identified within the middle member (Peters, 2005; Aby et al., 2004). Although the bulk of this unit is somewhat less effervescent than other Tertiary units in the area, it is mostly moderately reactive in hydrochloric acid.

- Tpl** Lower conglomerate member of Picuris Formation, (>25 Ma to >34.5 Ma)-Not exposed in the study area, but exposed nearby to the north and northeast. Greenish and pale yellowish, loose to strong, poorly sorted, moderately to well rounded sandy/silty conglomerate dominated by quartzite clasts from 2 mm to >2m.
- &/M** Undivided Mississippian and Pennsylvanian sedimentary rocks of the Tererro Formation of Arroyo Penasco Group (Mississippian, Meramecian and Chesterian), Espiritu Santo Formation of Arroyo Penasco Group (Mississippian, Osagean)-Alamitos Formation (late Desmoinesian) and Flechado Formation (Morrowan-Atokan-Desmoinesian)-Consists chiefly of Pennsylvanian, poorly exposed, olive, brown, red, and dark gray shale and siltstone plus fine- to coarse-grained sandstone with lesser amounts of conglomerate and limestone. Alamitos Formation is equivalent to the “upper arkosic limestone member” of the Madera Formation to the south. Flechado Formation is equivalent to La Posada Formation to the south, which is equivalent to the Sandia Formation and the “lower gray limestone member” of the Madera Formation. The Espiritu Santo Formation consists of the basal Del Padre Sandstone member of basal conglomerate, quartz sandstone, siltstone, shale, and minor limestone beds at top. It grades into the overlying Tererro Formation. Thickness unknown, but a minimum of approximately 2000 m.
- Xu** Precambrian, undivided-Complex metamorphic sequence of Early to Middle Proterozoic supracrustal and metaplutonic rocks of the Picuris Mountains. Principal rock types are granitic rocks, quartzite, pelitic schist, phyllite, metaconglomerate, biotite schist, amphibolite, quartzofeldspathic schist, pegmatite, and vein quartz.
- Xub** Brecciated Precambrian rocks-Zone of highly brecciated and fractured mixed Precambrian rocks along the Picuris-Pecos fault in the northeast map area.