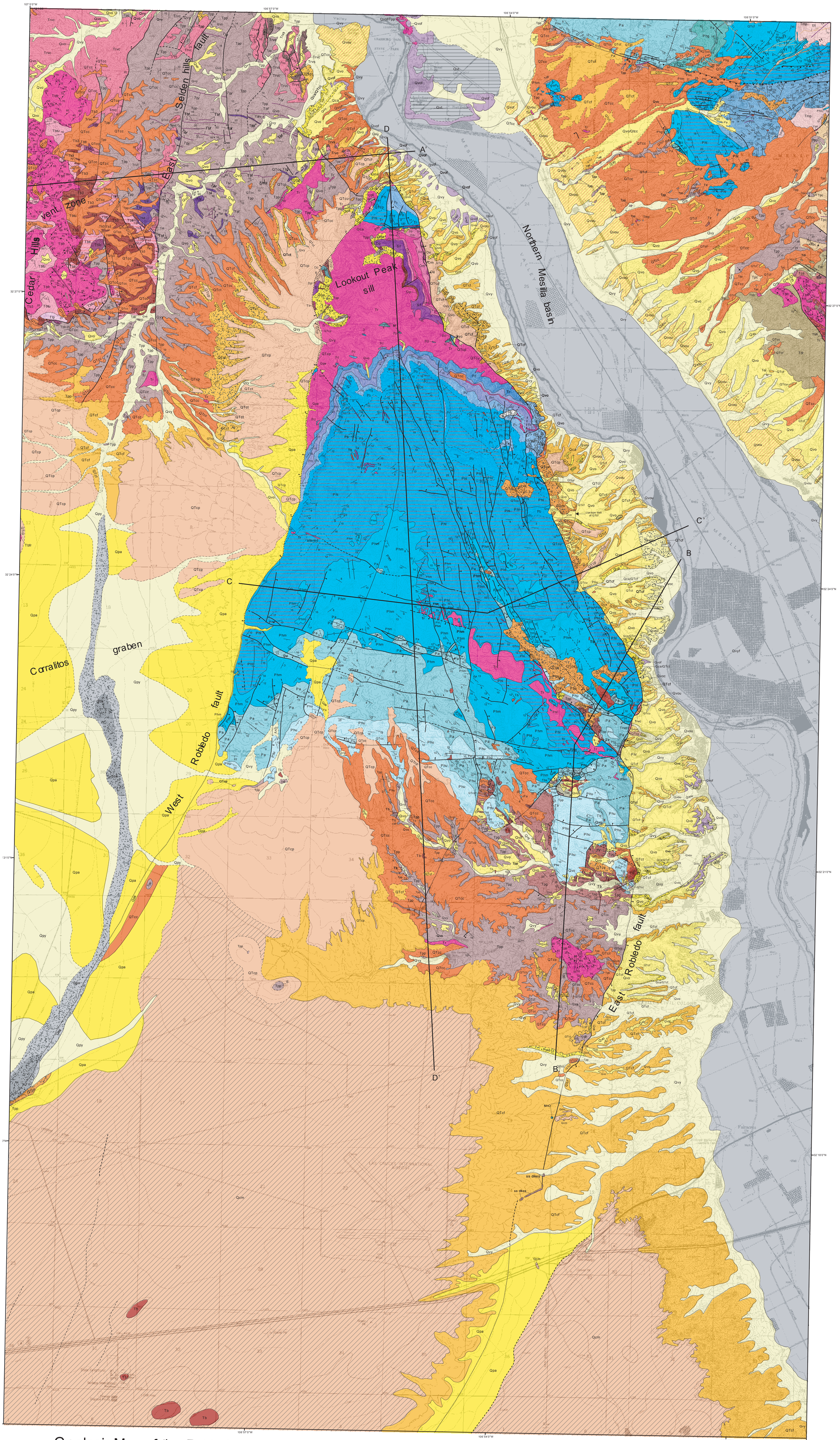
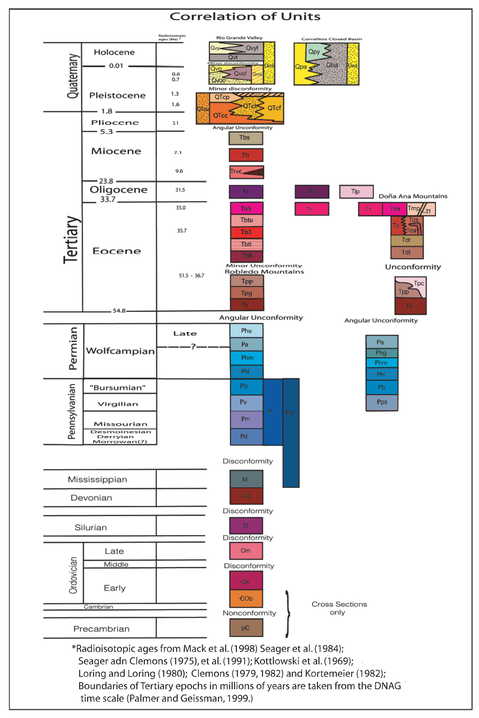


Correlation of Units



*Radioisotopic ages from Mack et al. (1998) Seager et al. (1984); Seager adn Clemons (1975), et al. (1991); Kottlowski et al. (1969); Loring and Loring (1980); Clemons (1979, 1982) and Kortemeier (1982); Boundaries of Tertiary epochs in millions of years are taken from the DNAG time scale (Palmer and Geissman, 1999.)

Description of Units

Qvy Younger valley-border alluvium (upper Mesilla Valley of the Rio Grande)—Arroyo (channel, terrace and fan) deposits and erosion-surface veneers, graded to or within a few ft of the river-valley floor. Gravel, sand and loamy sediments (sand-silt-clay mixtures). As much as 70ft (21.3m) thick.

Qvyf Younger valley-floor fluvial facies (Rio Grande Valley)—River-channel and overbank-floodplain deposits. Fining-upward sequence of basal gravel and sand capped by sand and silt-clay. As much as 70 ft (21.3m) thick.

Qvyt Younger river-terrace deposits (Rio Grande Valley)—Veneer of loamy sand and pebble gravel on low river terraces near Ft. Selden and Leasburg Dam (capping unit Qvof). As much as 5 ft (1.6m) thick.

Qpy Younger piedmont-slope alluvium (northwestern Mesilla Basin)—Arroyo (channel, terrace and fan) deposits and erosion-surface veneers, graded to closed-basin floors or playas of the Corralitos graben area. Mostly loamy gravel and gravelly to sandy loam. As much as 15 ft (4.6m) thick.

Qcm Basin-floor deposits (northwestern Mesilla Basin) Alluvial-flat, playa and local eolian deposits of the Corralitos graben. Veneer of silt-clay, loamy sand and sand on Camp Rice Fm basin fill. As much as 15 ft (4.6m) thick.

Qvo Older valley-border alluvium (Rio Grande Valley) Arroyo, fan, terrace and pediment veneers associated with a stepped sequence of geomorphic surfaces that are graded to ancestral river base levels as high as 250 ft (76.2m) above the present valley floor. Gravel, sand and loamy sediments, with local bodies of conglomerate, conglomeratic sandstone and mudstone. Soils with partly indurated zones of pedogenic-carbonate accumulation (stages 3 and 4 of Gile et al., 1966) cap deposits on remnants of higher (older) constructional surfaces. As much as 130ft (39.6m) thick.

Qvoc Older conglomeratic valley fill (Rio Grande Valley) Mostly alluvial-fan deposits (fanglomerate) primarily cemented by ground-water carbonate; with local tongues of fluvial sand/sandstone and gravel/conglomerate (unit Qvof), and some pedogenic carbonate. As much as 50 ft (15.2m) thick.

Qvof Older valley-fill fluvial facies (Rio Grande Valley)—Ancestral river-channel and overbank-floodplain deposits associated with the distal parts of unit Qvo adjacent to and as high as 250 ft (76.2m) above the present valley floor. Fining-upward sequence of well-sorted and rounded sand and gravel capped by sand and silt-clay. As much as 60ft (18.3m) thick. A volcanic-ash-fall deposit interbedded with oldest valley-fill deposits in the Selden Canyon–Broad Canyon area correlates with the Yellowstone-derived Lava Creek Ash (P0.63 Ma; Seager et al., 1975, Gile et al., 1995).

Qvou Older valley fill, undifferentiated (Rio Grade Valley)—Intertonguing Qvo, Qvoc, and Qvof.

Qca Colluvium—Hillslope deposits ranging from unconsolidated gravel to caliche-cemented, bouldery conglomerate. Wide range in age but mostly middle Pleistocene or younger. Mapped only where extensive deposits obscure underlying bedrock. As much as 15 ft (4.6m) thick.

Qpa Piedmont-slope alluvium—Undifferentiated (northwestern Mesilla Basin)—arroyo (channel, terrace and fan) deposits and erosion-surface veneers, graded to closed-basin floors or playas of the Corralitos graben area. Includes discontinuous cover of Qpy alluvium as well as somewhat older piedmont-slope alluvium (equivalent of Qvo in the Rio Grande valley) that is set against or buries the Camp Rice Fm basin fill in the Corralitos graben area. Mostly loamy gravel and gravelly to sandy loam. Soils with well-developed horizons of pedogenic-carbonate accumulation (stages 2 to 4) are extensively preserved in both buried (paleosols) and surficial positions (Gile et al. 1981, Mack et al. 1993). As much as 30 ft (9.2m) thick.

Qcmm Camp Rice Formation—Deposits associated with the La Mesa geomorphic surface, the constructional top of the Camp Rice Formation (Gile et al.1981, 1995). Mostly sandy to loamy sediments capped by calcic soils with thick (up to 6 ft), horizons of pedogenic-carbonate accumulation (stages 3 to 5; Gile et al. 1966, Machette 1985). Covered over broad areas by a veneer of eolian sand in form of coppice dunes. As much as 15 ft (4.6m) thick.

QTcp Camp Rice Formation, piedmont-slope facies—Primarily unconsolidated alluvial-fan deposits in the upper part of the Camp Rice Formation, mostly loamy gravel, and gravelly sand to loam. Soils with partly indurated zones of pedogenic-carbonate accumulation (stages 3 to 5) cap deposits on remnants of higher (older) constructional surfaces, and diastems marked by discontinuous calcic paleosols occur within the unit. As much as 150 ft (45.7m) thick.

QTcc Camp Rice Formation, conglomeratic phase—Primarily fan-piedmont deposits (fanglomerate) and rock-pediment veneers, which are cemented by groundwater carbonate. Mostly poorly sorted silty to sandy conglomerate and conglomeratic mudstone, with local tongues of fluvial conglomeratic sandstone (units QTcf and QTct), and some pedogenic carbonate. Typically best developed in lower parts of the Camp Rice piedmont facies. As much as 200 ft (61m) thick.

QTcu Camp Rice Formation, undifferentiated piedmont facies (units QTcp and QTcc).

QTcf Camp Rice Formation, fluvial facies—Primarily braid-plain channel deposits of the ancestral Rio Grande, commonly containing rounded siliceous pebbles and volcanic clasts from upstream sources. Mostly poorly cemented gravel, sandy gravel, and sand, with minor silt-clay and some sandstone, conglomeratic sandstone and varicolored mudstone. A rich fauna of middle Pliocene to early Pleistocene mammals is locally present, as well as petrified wood. As much as 300 ft (91.5m) thick in outcrop, the unit may be more than 650 ft (198.4m) thick in the subsurface of the north-central Mesilla basin (Hawley and Kennedy, in press).

QTct Camp Rice Formation, transitional facies—Deposits transitional between basin-floor fluvial (QTcf) and piedmont-slope (QTcp) environments. Mostly distal-piedmont, alluvial-flat and eolian deposits (fine-loamy to sandy sediments) that accumulated on low-gradient (0.001 to 0.01) surfaces adjacent to aggrading braided channels of ancestral Rio Grande. As much as 35 ft (10.7m) thick.

Trvc Rincon Valley Formation—Fanglomerate (tan) with interbedded conglomeratic sandstone, sandstone and mudstone, all derived primarily from underlying Bell Top and Palm Park volcanic and intrusive rocks. Represent "early rift" alluvial fan deposits. Generally rotated by block faulting with dips as much as 40 degrees. As much as 650ft (198.2m) thick.

Trvcs Rincon Valley Formation, Selden Basalt Member—Olivine basalt flows interbedded in Rincon Valley Formation in the Selden Canyon (Broad and Faulkner Canyons) area (Seager et al.), 1975. Basalt consists of at least two flows, each approximately 30 ft (9.2m) thick. K/Ar age is 9.6Ma (Seager et al., 1984).

Tbs Travertine mounds and calcareous, laminated, buff-colored siltstone/shale, which unconformably overlies an eroded plug of basalt (Tb) in southern Robledo Mountains. Approximately 30 ft. (9.2 m) thick.

Tb Basalt—Plugs, flows, and small dikes of olivine melilite (?) basalt in the Robledo Mountains and on La Mesa. A single whole-rock K/Ar age is 7.1 Ma (Seager et al., 1984).

Ta Andesite —Small dikes or irregular bodies of altered andesite, mostly in the northern Robledo Mountains.

Tbf Andesitic intrusives of Faulkner Canyon—Andesitic or basaltic andesite dikes and plugs in the Faulkner Canyon area. A K/Ar whole rock age of 31.5 Ma is consistent with stratigraphic relationships, but another K/Ar date of 38.2 Ma is too old (Seager and Clemons, 1975).

Tlp Latite porphyry—Gray to pink latite porphyry plug or dike, crowded with hornblende phenocrysts. Located in Cedar Hills flow-banded rhyolite "vent zone".

Tr Robledo rhyolite—Thick to thin sills and small dikes and plugs of non-flow-banded rhyolite in the Robledo Mountains and adjacent areas. Tan, cream or pink, the rhyolite is generally massive and slightly porphyritic, containing 2mm-long phenocrysts of orthoclase, biotite and quartz. Although the rhyolite intrudes rocks as young as the Palm Park Formation, thickness and extent of the intrusives increase downward through the Paleozoic section, culminating in the thick Lookout Peak sill within middle to lower Paleozoic strata in the northern Robledo Mountains. Age of the rhyolite is 35 Ma, based on a single whole rock K/Ar date (Kottlowski et al., 1969).

Tmp Monzonite porphyry—Light gray to tan, porphyritic to equigranular monzonite, which forms the Summerford Mountain laccolith and adjacent satellite plutons. Phenocrysts include both K-feldspar and albite-oligoclase as much as 1 cm in length, whereas plagioclase, biotite, and minor augite are important constituents of the groundmass. Although generally structureless, the monzonite grades locally along margins to flow-banded latite or rhyolite. Numerous dikes of felsite (Tf) cut the porphyry, especially in the Summerford Mountain laccolith.

Tf Felsite—Tan to cream-colored felsite and porphyritic monzonite dikes in the Doña Ana Mountains.

Tbfr Bell Top Formation, flow-banded rhyolite—Gray, yellow, pink and cream-colored flow-banded rhyolite in the Cedar Hills vent zone, at Picacho Peak and in the Dona Ana cauldron. Mostly aphyric but locally contains as much as 18 percent sanidine, oligoclase and biotite phenocrysts. Black to greenish-black vitrophyre is common along the margins of rhyolite domes and flows. Foliation shows that the rhyolite is in the form of a series of funnel-shaped masses, the eroded "roots" of flow-banded rhyolite domes. In the Cedar Hills vent zone these domes, aligned north-south, represent the devolatilized emnants of a siliceous magma chamber whose gas-rich cap was emplaced earlier as fissure eruptions of ash-flow tuff 3 and associated tephra of the Bell Top Formation. Similarly, in the Doña Ana cauldron, they represent devolitalized magma that was emplaced following the caldera-forming eruptions of the Doña Ana Rhyolite. Age of the rhyolite in the Cedar Hills (McIntosh, et al., 1991) is constrained by 40Ar/39Ar ages of underlying tuff 3 (35.7Ma) and overlying tuff 4 (35.0 Ma).

Tc Younger cauldron fill of Doña Ana cauldron—Includes megabreccia, minor ash-flow tuffs and volcaniclastic sedimentary rocks that represent late volcanic activity within the Doña Ana cauldron. Thicker sequences of tuffaceous, rhyolitic sedimentary rocks are labeled Tcs; minor andesitic flows and intrusives are labeled Tca. Unit is intruded by numerous flow-banded rhyolite intrusives (Tbfr) that are also part of the late-cauldron fill. Locally, more than 305m (1000 ft) thick

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Tdr Dona Ana Rhyolite—Brownish-gray to pale red, welded ash-flow tuff, eruption of which triggered collapse of the Doña Ana cauldron, Crystal and pumice rich in upper parts of the formation, locally lithic rich in middle and lower parts. Basal air-fall tuff Tdt) was mapped locally. At least 762 m (2,500 ft) thick.

Tdt Dona Ana Rhyolite—Brownish-gray to pale red, welded ash-flow tuff, eruption of which triggered collapse of the Doña Ana cauldron, Crystal and pumice rich in upper parts of the formation, locally lithic rich in middle and lower parts. Basal air-fall tuff Tdt) was mapped locally. At least 762 m (2,500 ft) thick.

Tbtu Bell Top Formation, upper tephra—Interbedded light-colored, siliceous air-fall tuff and breccia and epiclastic volcanic rocks, locally very coarse-grained. As much as 800 ft (243.9m) thick.

Tb3 Bell Top Formation, ash-flow tuff 3—Pink to cream to pale orange, pumiceous ash-flow tuff. Generally poorly welded, consisting of as much as 90 percent devitrified glass shards and uncollapsed pumice fragments. Locally steep contacts and foliation, as well as abundance of siliceous lithic fragments, suggest that, at least locally within the Cedar Hills vent zone, the ash-flow tuff is intrusive. This supports the interpretation that ash-flow tuff 3 was emplaced as a fissure eruption of gas-charged magma from the Cedar Hills vent zone. A 40Ar/39Ar age is 35.7Ma (McIntosh, et al., 1991). As much as 200 ft (60.9m) thick, thickening westward into the Goodsight-Cedar Hills half-graben.

Tbtf Bell Top Formation, lower tephra—Siliceous air-fall tuff, locally very pumiceous and grading upward into ash-flow tuff. Locally includes epiclastic, tuffaceous sandstone and mudstone. Approximately 70 ft (21,3m) thick.

Tbb Bell Top Formation, basalt flows—Dark- gray, scoriaceous, olivine-bearing flows interbedded with white tuffaceous sandstone. Individual flows are 10-50 ft thick, collectively approximately 230 ft (70.1m) thick.

Tpc Cleofas Andesite—Tan, purple or bluish-purple andesite, grading locally to andesite porphyry or to monzonite or diorite. Phenocrysts are plagioclase, hornblende, and biotite, which, together with the groundmass, are variably altered to sausserite, chlorite, epidote, hematite and clay. Probably a stock, or possibly a very thick flow, the andesite is generally massive and structureless, but locally exhibits a trachytic or even a flow-banded texture. Although the Cleofas Andesite apparently intrudes the Palm Park Formation, the two formations are compositionally similar and occupy a similar stratigraphic position beneath the silicic volcanic and intrusive rocks of the Doña Ana Mountains; they are therefore regarded as approximately cogenetic.

Tpp Palm Park Formation, volcaniclastic facies—Lahar breccia and interbedded volcaniclastic conglomerate; sandstone and mudstone, all tuffaceous and mostly purple, maroon, green, and gray in color. Clasts are entirely intermediate-composition, porphyritic, volcanic and hypabyssal (?) types with plagioclase and hornblende being common phenocrysts. Clasts range in size from very large, angular boulders (T3 ft P0.9mP in diameter) in some major lahar deposits to small cobble or pebble-size fragments in others; some lahar breccias are monolithologic, others contain a wide variety of clasts. Locally, thin (20ft thick) sheets of intermediate-composition ash-flow tuff (?) are interbedded with the volcaniclastic units. The unit is interpreted to represent a volcaniclastic apron deposited on the distal flank of one or more andesitic stratovolcanoes in the region. Radio-metric ages from Palm Park and correlative rocks in southern New Mexico range from approximately 51.5 to 36.7Ma (Kottlowski et al., 1969; Clemons, 1979; Loring and Loring, 1980; Clemons, 1982). Incomplete sections exposed in the southern Robledo Mountains and Faulkner Canyon drainage are approximately 1,100 ft (335.4m) thick, but the formation is known to thicken and thin dramatically in response to underlying Laramide topography.

Tpg Palm Park Formation, gypsiferous facies—Gypsum and interbedded red siltstone forms the basal part of the Palm Park Formation in the southern Robledo Mountains. Overlain by the volcaniclastic facies of the formation, the unit also interfingers with andesitic volcaniclastic units, particularly near the base. The gypsum and redbeds clearly indicate deposition on alluvial flats and playas. Approximately 260 ft (79.3m) thick.

Tltc Love Ranch Formation—Post-tectonic, Laramide (Late Cretaceous-early Tertiary) deposits consisting of well-cemented, red to grayish-red, boulder conglomerate, conglomeratic sandstone and mudstone. Undated, but believed to be Eocene in age in the Robledo Mountains area (Seager, et al., 1986; Seager and Mack, 1986; Seager et al., 1997). In the southern part of the Robledo Mountains, the formation is fluvial in character and fills south-flowing paleodrainageways incised into Abo-Hueco and upper Hueco strata. Clasts consist entirely of Abo redbeds and Hueco limestone. North of Lookout Mountain, the formation comprises talus deposits and various piedmont-slope alluvium, which was derived from and accumulated at the base of a paleoescarpment formed of Pennsylvanian strata. The deposits unconformably overlie Lake Valley, Percha and Fusselman strata that were exposed at the base of the paleoescarpment. (The modern escarpment below Lookout Peak, formed of Pennsylvanian strata, is a remnant of the Laramide paleoescarpment). The erosionally truncated Paleozoic rocks beneath the Love Ranch Formation, as well as the paleoescarpment, are parts of a major south-tilted Laramide fault block named Rio Grande uplift (Seager and Mack, 1986; Seager and others, 1986; Seager and others, 1997). The formation is as much as 200 ft (61.0m) thick in the deepest paleocanyons but may thin to zero across paleodrainage divides.

Phu Hueco Formation, upper member—Dark gray, normal, open-marine limestone; predominantly gastropod-echinoid wackestone and algal wackestone in nodular beds 6 in to 1 ft (0.2-0.3m) thick, interbedded with silty shale or silty limestone and an occasional Abo redbed tongue. Cephalopods and brachiopods are also abundant. As much as 350 ft (106.7m) thick but is locally absent because of Laramide erosion.

Pa Hueco Formation, Abo Tongue—Interbedded Hueco limestone and shale and Abo redbeds. Hueco strata include light gray, orange, yellow and greenish-gray fossiliferous wackestone, dolomitic limestone and green and gray shale deposited in normal marine and peritidal environments. Brachipods, pelecypods and gastropods are common fossils, crinoids, corals, nautiloids, trilobites, scaphopods, ammonoids, sharks, echinoids, stromatolites and ostracods, less so. Collectively they establish a Late Wolfcampian age for the unit (Kues, 1995; Kozur and LeMone, 1995) Abo beds include channelform, crossbedded, tan to red sandstone, ripple-laminated red sandstone and maroon shale of fluvial origin, as well as dark, organic-rich estuarine shale (Mack et al., 2003). Mud cracks, trackways of a variety of Permian Tetrapods (e.g., Lucas, et al, 1995), plant debris and raindrop impressions are locally present in sandstone/siltstone redbeds. Approximately 395 ft (120.4m) thick.

Phg Hueco Formation, middle member, gastropod-bearing limestone— Doña Ana Mountains only. Medium- to thick-bedded, dark gray fossiliferous wackestone, locally containing abundant accumulations of whole planispiral gastropods and lesser assemblages of scaphopods, echinoids, brachiopods and pelecypods; normal open marine. Several tan to red, ripple-laminated Abo beds are interbedded, as is soft, nodular, thin-bedded carbonate mudstone and fossiliferous wackestone. Unit may be correlative with middle fossiliferous section of the middle Hueco member in the Robledo Mountains. Approximately 400 ft (122.0m) thick.

Phm Hueco Formation, middle member—Basal sequence, 145 ft (44.2m) thick, consists of thin to medium-bedded, slightly to unfossiliferous, light gray, yellow, orange and cream-colored carbonate mudstone, dolomitic mudstone and interbedded shale and shaley limestone deposited in shallow, restricted marine water. Petrified wood is locally present The overlying 80 ft (24.4m) of medium to dark gray, medium-bedded bioclastic wackestone and fossiliferous carbonate mudstone contains gastropods, echinoids, brachiopods, algae and skeletal sand, representing more open, normal marine deposition. Uppermost strata are 50 ft (15.2m) of light-colored carbonate mudstone, and fossiliferous wackestone in thick to medium beds, which grade at the top into peritidal, dolomitic carbonates with "birdseye" textures and gypsum casts. Total thickness 275 ft (83.8m).

Phl Hueco Limestone, lower member-- The lower two-thirds of the lower member consists largely of normal open-marine shelf limestone in thick to medium beds that weather to cliffs or ledgy slopes. Medium to light gray bioclastic carbonate mudstone, nonfossilliferous carbonate mudstone, bioclastic wackestone, aggregate packstone, algal biostromes, and cherty carbonate mudstone are interbedded with lesser amounts of sandy limestone, brown sandstone, chert and limestone-pebble conglomerate, stabby, intraclastic packstone, and poorly exposed green to tan shale, shaley limestone and thin-bedded carbonate mudstone and wackestone. Sets of cross-bedded fossil and oolitic packstone as much as 15 ft (4.6m) thick indicate local submarine dunes existed on the shelf. Marine fossils are abundant and include gastropods, byozoans, brachiopods, pelecypods and Wolfcampian fusulinids (Thompson, 1942, 1954; Wahlman and King, 2002). In the Doña Ana Mountains, a prominent cliff-forming algal biostrome, 15 ft (4.6m) thick, was chosen as the base of the Lower Hueco member. The upper third of the lower member documents peritidal conditions. Nearly unfossiliferous, this section consist mainly of slope or ledge-forming, thin to medium-bedded, open-marine shelf limestone and interbedded red shale, siltstone and nodular limestone. Carbonate mudstone, bioclastic wackestone, phylloidal algae wackestone and pelloidal packstone are prominent. Siliceous streaks, blebs and spherical shells are present in the upper 30-40 ft (9.2-12.2m), and scattered chert nodules and thin chert beds are common in the middle parts of the section. Fossils include Bursum-age fusulines (Thompson, 1942, 1954), recently assigned to the latest part ("Bursumian") of the Pennsylvanian System (Wahlman and King, 2002); echinoids, brachiopods, gastropods, cephalopods and crinoidal debris are also present. Approximately 358 ft (109.1m) thick in the Robledo Mountains, according to Wahlberg and King (2002). In the Doña Ana Mountains, strata corr-elative with the Bursum Formation are nodular, thin-bedded, gray fossiliferous wackestone and packstone intercalated with intraclastic, stromatolitic and algae-bearing wackestone and mudstone, as well as with chert-pebble conglomerate. Common fossils include petrified wood, corals, gastropods, and crinoids, together with phylloidal and stromatolitic algae. At least 200 ft (61.0m) thick.

Pps Panther Seep formation— Doña Ana Mountains only. Unfossiliferous, sandy to silty, thin-bedded carbonate mudstone, stromatolitic mudstone, laminated, calcareous sandstone and quartzite, black shale and siliceous, blocky shale (porcellanite), typical of shallow water to peritidal, basinal facies of the Orogrande basin. Mainly Virgilian in age but ranges from Missourian to "Bursumian" (eg.Wilson and Jordan, 1988; Raatz,2002; Wahlman and King, 2002). At least 2,000 ft (609.8m) thick.

Pv Virgilian series—Robledo Mountains only.Intercalated open-marine shelf limestone, shaley or nodular limestone and red shale forming a series of prominent cliffs separated by recesses. Grades upward into Bursum strata; 20 ft (6.1m) of red shale marks the base of the series. Limestones include light to medium gray bioclastic and fusulinid wackestone, bioclastic packstone, carbonate mudstone, fossiliferous mudstone, and algal wackestone. The tops of several thick beds contain laminated carbonate mudstone, which may represent pedogenic carbonate indicative of periodical subaerial exposure. Besides 7 fusulinid zones, fossils include brachiopods, crinoids and corals. Two hundred ten ft (64.0m) thick.

Pm Missourian Series—Open marine shelf limestone and shale. Ledge-forming, thick-to medium-bedded fossiliferous and nonfossilliferous carbonate mudstone, fusulinid wackestone, pelloidal and bioclastic packstone and grainstone is interbedded with slope- or recess-forming, soft, nodular, thin-bedded gray to purple-gray carbonate mudstone, bioclastic wackestone and red to purple, calcareous shale. Mud-filled burrows are common. Basal 25 ft (7.6m) includes red to purple shale, sandy limestone and lenses of chert-pebble conglomerate. Fusulines, present at 9 horizons, appear to represent a complex fusuline range (Thompson, 1942; 1954). Crinoids, algae, bryozoans, brachiopods and gastropods are common. Two hundred fifteen ft (65.6m) thick.

Pd Derryan and Desmoinesian Series— Basal Derryan(?) or Morrowan(?) chert breccia, as much as 30 ft (9.2m) thick, overlies Mississippian strata in septa within the Lookout Peak sill. Except for these and the uppermost 12 ft (3.7m) of Derryan strata, Morrowan-Derryan rocks apparently were assimilated by the sill. Derryan rocks are calcareous, brown to green fissile shale and gray, brown or green shaley bioclastic wackestone and packstone containing crinoids, brachiopods and gastropods. Overlying normal, open-marine Desmoinesian beds include 9 carbonate facies recognized by Beebe(1986): carbonate silt-sponge spicule; whole fossil wackestone; bioclastic wackestone; foraminifera wackestone; sponge wackestone; phylloidal algae wackestone; Komia; and bioclastic packstone. These are interbedded with calcareous shale, greenish-black sandstone and pebbly sandstone. Marine burrows and local intraclastic zones are common. Cliff-forming, cherty limestone, 80 ft (24.4m) thick, marks the top of the Desmoinsian. Derrital chert at the Missourian-Desmoinesian contact is indicative of an unconformity, although fusuline control indicates a nearly complete Desmoinesian-Missourian section. (Thompson, 1942,1954) Desmoinesian fossils include sponges, brachiopods, conodonts, bryozoans, algae, fusulines and corals. Total exposed thickness, approximately 250ft (76.2m).

MP Undifferentiated Mississippian and Pennsylvanian rocks.

M Mississippian System—Caballero Formation, light gray to pale reddish-brown, thin-bedded, silty carbonate mudstone and siltstone, which gradationally overlies Percha Shale along the east Robledo fault; 36ft thick. Lake Valley Formation occurs only as isolated septa within the Lookout Peak sill. Four members are present: basal Andrecito Member consists of at least 59 ft (18.0m) of soft, thin, planar-bedded to nodular-bedded carbonate mudstone and calcareous shale with interbedded gray bioclastic wackestone containing bryozoans, crinoids and small rugose corals. Above this, the Alamogordo Member, 15 ft (4.6m) thick, is cliff-forming, gray carbonate mudstone containing pancake-shaped lenses and irregularly shaped nodules of chert. Poorly exposed reddish-gray to yellowish-gray soft, bioclastic and whole-fossil packstone and wackestone, 6 ft (1.8m) thick, is probably the Nunn Member, and thick-bedded gray fossiliferous carbonate mudstone containing abundant white chert nodules at the top of the Lake Valley Formation is the Tierra Blanca Member, 50-60 ft (15.2-18.3m) thick. Zones of crinoidal packstone are also present in the Tierra Blanca. Karst topography at the top of the formation is filled by the basal white chert breccia at the base of the Pennsylvanian System. Total exposed thickness of the Mississippian System is 168-178 ft (51.2-54.3m).

Dp Percha Shale—Light to medium gray and greenish-gray fissile, micaceous shale with numerous thin siltstone beds. Upper part of formation apparently was assimilated by the Lookout Peak sill. Exposed thickness is approximately100 ft (30.5m).

Sf Fusselman Dolomite—Grayish-brown, coarse-grained, thick-bedded, cherty dolomite that weathers to a dark-colored, double cliff beneath the Lookout Peak sill. Poorly preserved fossils include corals and gastropods. Top of the formation is an unconformity distinguished by an uneven, knobby surface and discontinuous silicification of uppermost Fusselman beds. Approximately 245 ft (74.7m) thick.

Om Montoya Formation—Basal Cable Canyon Sandstone Member is dark gray siltstone, sandstone, shale and dolomite, 16 ft (4.9m) thick; Upham Dolomite Member, 75 ft (22.9m) thick, is thick-bedded dark-gray, coarse-grained dolomite; Aleman Dolomite Member, 90 ft (27.4m) thick, consists of, medium gray, fine to medium-grained dolomite containing abundant nodules, thin beds and flakes of brown, gray or white chert; and the upper Cutter Dolomite Member consists of light-to medium-gray, fine-to medium-grained dolomite that weathers to a ledgy slope. Poorly preserved corals, brachiopods and worm tubes are present in the Upham and Aleman Members. Thickness of the Cutter is uncertain because of sills within the unit, but is at least 156 ft (47.6m). A regional unconformity truncates the top of the Cutter Member. Total thickness is at least 337 ft (102.7m).

Oe El Paso Formation—Mostly light-gray to bluish-gray, open-marine, shelf limestone, including carbonate mudstone, bioclastic wackestone, bioclastic, wholefossil, and intraclastic packstone, oolitic grainstone and pelletal packstone. Some beds are dolomitic. Numerous twig-shaped marine burrows, and siliceous flakes and laminae are present, together with small, flat chert nodules. Fossils include gastropods, trilobites, algae, cephalopods, and brachiopods. A regional unconformity truncates the top of the El Paso Formation. Only the uppermost 158 ft (48.2m) of the formation is exposed in the footwall of East Robledo fault.

Geologic Map of the Robledo Mountains and Vicinity, Dona Ana County, New Mexico

by

William R. Seager, Frank E. Kottlowski and John W. Hawley

Base from U.S. Geological Survey of 1:24,000 and 1:100,000 scale maps dated 1976,1987 and four 7.5 minute Quadrangles (Dona Ana, Las Cruces, Leasburg, Picacho)
Geographic Coordinate System, North American Datum 1927,
5282 meter Universal Transverse Mercator grid ticks for X axis
and 6194 meter Universal Transverse Mercator grid ticks for Y axis.

Geologic mapping: William R. Seager, Frank E. Kottlowski and John W. Hawley

Digital cartographic production: Sean Matthew Carrasco

1:24,000

1 centimeter equals 0.24 kilometers

0 0.5 1 2 3 4 Kilometers

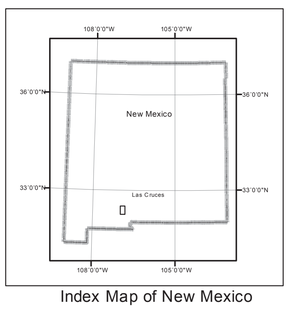
1 inch equals 0.38 miles

0 0.5 1 2 3 4 Miles

Mapping of this quadrangle was funded by the Lower Rio Grande Water Users Organization, EPA Region 6 and the New Mexico Water Resources Research Institute, beginning in the spring of 2002

Symbols

- Geologic Contact dashed where location is inferred, dotted line where contact is concealed.
- Thrust Fault showing dip; dashed where location is inferred, dotted where location is concealed, barbs on upthrown side.
- Normal Fault Showing dip; dashed where approximately located; dotted where concealed; ball and bar on downthrown side.
- Fault Dashed where approximately located, dotted where concealed.
- Anticline Showing direction of plunge; dashed where approximately located, dotted where concealed.
- Syncline Showing direction of plunge; dotted where concealed.
- Overturned Syncline dotted where concealed.
- Monocline Dashed where approximately located.
- Apparent Dip Direction and Amount
- Strike and Dip of Inclined Bedding
- Strike and Dip of Inclined Foliation
- Strike and Dip of Overturned Bed
- Strike of Vertical Foliation
- S Silicified zone
- ss Sandstone cemented with manganese oxide. mno
- Dikes Showing dip
- Landslide area



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