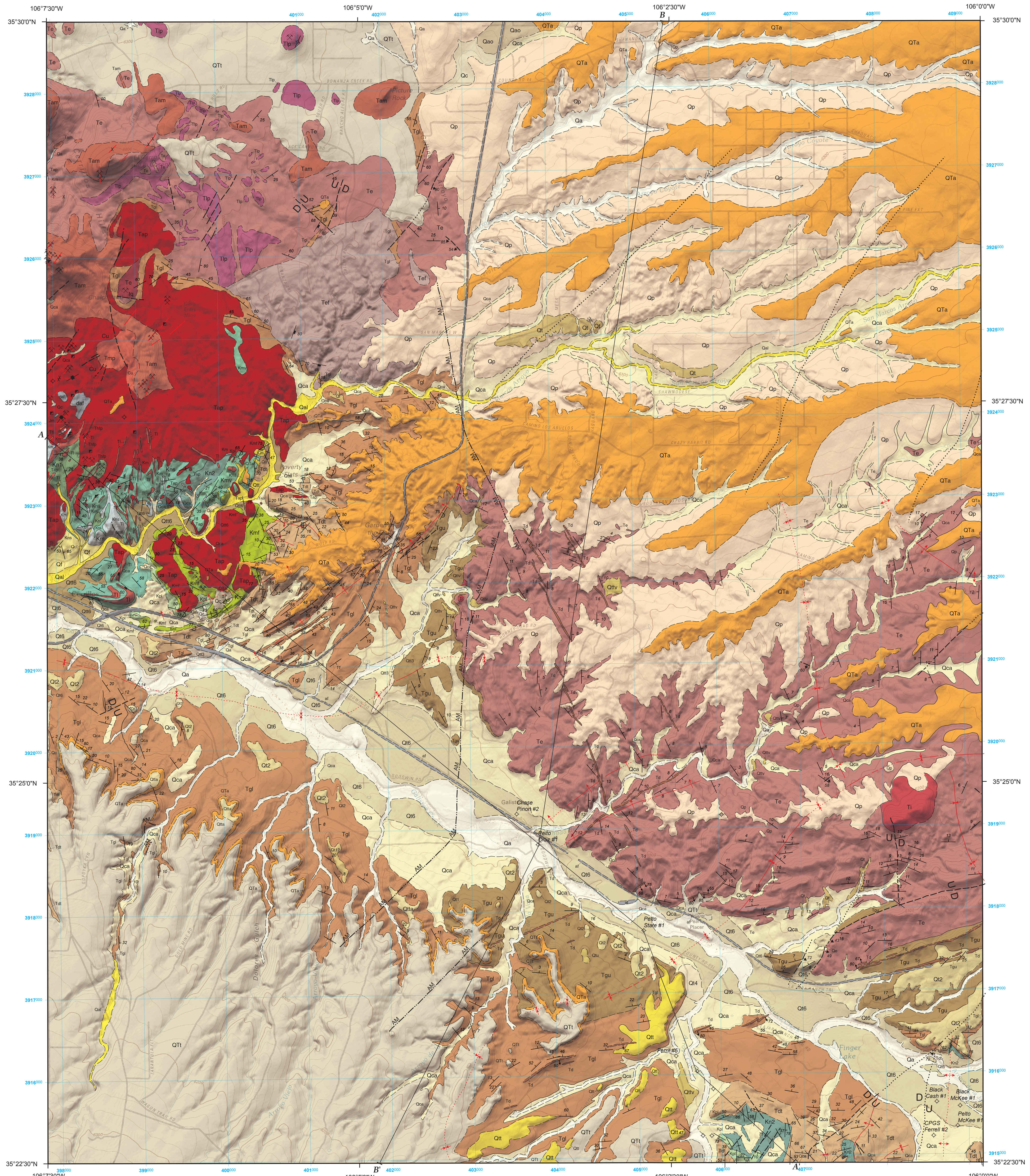


Map Unit Descriptions

NEOGENE AND QUATERNARY

Colluvial, eolian, and anthropogenic deposits

af — **Artificial fill (Historic)**—Dumped fill and areas affected by human disturbances. Locally mapped where areally extensive or geologic contacts are obscured. Includes mine dumps in the Cerrillos Hills area and the beds of the Santa Fe railroad and NM - 14.

Qal — **Alluvium**—Cobbles, sand, silt, and clay transported by seasonal flooding or in active channels. Coarser clasts are dominated by quartz and granitic material.

Qca — **Undivided colluvium and alluvium**—Along Galisteo Creek, may include pediment-covering deposits that grade to the Cerrillos Surface formed by terrace deposit Qt6. Also may include colluvium consisting of fluvial gravel from adjacent, higher terraces.

Qf — Alluvial fan deposits not covered by **Qa** and **Qca**.

Qc — **Colluvium**—Unconsolidated sand, silt and clay deposits along upper hill slopes or broad, flat hill crests. A few meters in maximum thickness.

Qe — **Eolian deposits**—Tan to light-pink, wind-blown silt and clay lying on gently inclined upland areas. Much of the area has a thin deposit of this material incorporated with the soil.

Alluvium and terrace deposits

Qa — **Alluvium**—Modern channel, floodplain, very low terraces (**Qt7**), some alluvial fans and colluvium at valley margins. May include terraces and colluvium in tributary drainages.

Qp — **Pediment gravels**—Deposits of gravel, sand and silt cover surfaces cut to a base level above the present Galisteo Creek. Most of the material is derived from the Tuerto Gravels or Ancha Formation.

Qst — **Stream terrace deposits (Pleistocene)**—Sand and gravel that underlie a suite of terraces above active drainages and associated valley-floor deposits. Some thick fill-terraces are dominated by clayey-silty very fine- to medium-grained sand and overlie a strath with pronounced relief. In a longitudinal profile, it is common for straths to diverge in a downstream direction. Beds are very thin to medium, and commonly lenticular or concave-up, ribbon-shaped. Gravel is clast-supported, moderately-to poorly-sorted, and generally composed of cobbles and pebbles with <5% boulders (boulders are more common within or near the Sangre de Cristo Mountains). Clast composition is mostly granite to granitic gneiss, with very minor amphibolite, schist, Paleozoic siltstone-sandstone, gneiss, and quartzite. Quartzite clasts are well-rounded to subrounded; for other rock types, cobbles are rounded to subrounded, coarse to very coarse pebbles are rounded to subangular, and very fine to medium pebbles are angular to subrounded. Sand is very fine-to very coarse-grained (mostly medium-to very coarse-grained), moderately to poorly sorted, subrounded to subangular, and arkosic. Sediment is unconsolidated and up to 18 m-thick (generally less than 8 m-thick).

Terrace deposits

Qt — **Terrace deposits of Galisteo Creek**—The numbering system for terrace deposits on Galisteo Creek was developed during the mapping of the Madrid quadrangle and has been applied to the Picture Rock quad.

Qt6 — **Fill terrace**—The youngest terrace unit in the area (late Holocene?). The top of this paired fill unit is roughly 10 to 20 feet above the modern channel. The village of Cerrillos is built on this surface; it is therefore informally known as the Cerrillos Surface.

Qt4 — **Strath terrace**—poorly defined fill-cut terrace deposit lying roughly 40 feet above grade of Galisteo Creek. Correlation with Qt4 or (possibly) Qt5 in the Madrid quad is tenuous.

Qt3 — **Qt3 – Fill(?) terrace**—strath terrace deposit lying roughly 60 ft above grade, this being the sole determinant in correlating with the Madrid Qt3.

Qt2 — **Qt2 – Fill/strath(?) terrace**—Terrace deposited on Galisteo Fm, typically 10 ft or less thick. The elevation above grade of the tread is between ss and ff feet. Qt2 and its tributary terraces, **Qtt2**, can be found along the entire stretch of Galisteo Creek. Some paired units occur on the north side of the creek. Qt2 correlates well with Qt2 found in the Madrid quad.

Qt1 — **Qt1 – Strath (?) terrace**— deposit less than 20 ft thick. The tread of Qt1 occurs roughly 200 ft above grade. Possibly middle Pleistocene.

Qtt — **Terrace deposits of tributary drainages**—May be variously correlated with terraces of Galisteo Creek. Locally includes alluvium and colluvium.

Qttu — **Tributary terrace deposit, undefined.**

Qtt_ — **Tributary terrace**—Terrace deposits underlain by Tutero and/or Ancha gravel. where _ is from 1 to 6, denotes a tributary terrace that correlates with the axial terrace of the Galisteo River bearing the same number.

Qtta — **Fill-cut terrace**—Terrace deposits underlain by Tutero and/or Ancha gravel.
Basin-fill deposits

Upper Santa Fe Group (Pliocene (?) – lower Pleistocene)

QTt — **Tuerto Gravels of Stearns (1953b) and Koning and others (2001) (lower Pleistocene to upper Pliocene)**—Yellowish-to reddish-brown and yellowish-red, moderately-consolidated and cemented by caliche, moderately-to well-stratified pebble to cobble conglomerate and pebbly to cobbly sandstone with scattered boulders and muddy sandstone interbeds. Matrix is fine- to very coarse-grained, very-poorly-sorted sandstone, and gravel clasts contain abundant subrounded to subangular clasts derived from the Ortiz Mountains and Cerrillos Hills (andesite porphyry and augite monzonite; black, reddish-brown, and banded hornfels; and lesser quartzite, chert, and petrified wood. The Tuerto Gravel contains no material derived from the Sangre de Cristo Mountains in its exposures on the flanks of the Ortiz Mountains. Flanking the Cerrillos Hills the Tuerto Gravel interfingers with the Ancha Formation and may contain up to 20% pink granite, schist, and gneiss derived from the Sangre de Cristo Mountains. Bedding in the Tuerto Gravel is subhorizontal. The unit is locally faulted by the La Bajada Fault and the Tano Fault.

QTa — **Ancha Formation of Spiegel and Baldwin (1963) and Koning and others (2001) - (lower Pleistocene to upper Pliocene)**—Pink to tan siltstone and sandstone capped by yellowish to reddish-brown and yellowish-red moderately-consolidated and caliche cemented, moderately- to well-stratified pebble to cobble conglomerate and pebbly to cobbly sandstone with scattered boulders and muddy sandstone interbeds. The matrix of the gravel cap consists of fine- to very coarse-grained, very-poorly-sorted sandstone, and gravel. Clasts are at least 20% pink granite, schist, and gneiss derived from the Sangre de Cristo Mountains and the Cerrillos Hills (andesite porphyry and augite monzonite similar to that found in the Ortiz Mountains, and subordinate shale and sandstone). Thickness to 30 m (100 ft).

PALEOGENE

Oligocene

Igneous Rocks

Tap — **Andesite porphyry**—Grayish-green to gray on fresh surfaces, fine-to medium grained, porphyritic. Described as hornblende quartz latite porphyry by Stearns (1953b) and hornblende monzonite porphyry by Disbrow and Stoll (1957). In similar rocks in the Ortiz Mountains (Coles, 1990), phenocrysts of plagioclase, lesser hornblende, and rare quartz make up 40 to 60 % of the rock. Groundmass is gray and aphanitic. Subhedral andesine plagioclase makes up about 75% of the phenocrysts and ranges 0.5 to 2 mm. Black euhedral hornblende phenocrysts (0.6-5 mm) constitute nearly all the rest of the phenocryst assemblage. Clear, highly resorbed quartz makes up perhaps 1% of the phenocrysts. Plagioclase, orthoclase, and quartz, and trace allanite, zircon, and rutile form the groundmass. Hornblende-rich (augite-cored?) xenoliths 2 to 10 cm in diameter are commonly found in the andesite porphyry. Rare xenoliths of basement granitic gneiss have been observed in the southwestern part of the Cerrillos Hills. Andesite porphyry forms laccoliths, sills, dikes, and irregular masses. Thermal metamorphism of surrounding sedimentary rocks is limited to a narrow contact zone usually less than 10 cm wide, except for the conversion of bituminous coal to anthracite at Picture Rock.

Tam — **Monzonite porphyry**—Medium grained feldspar-porphyry stock that forms the unmineralized core of the small porphyry copper deposit in the southern part of the Cerrillos Hills.

Tl — **Feldspar-porphyry latite**—Gray to tan, with tabular euhedral orthoclase phenocrysts 1.0 to 3.0 cm long in light gray groundmass. Commonly shows a trachytic texture. Forms stock-like bodies in the northwestern part of the Cerrillos Hills and a northeast-trending dike in southern part of the Cerrillos Hills on the eastern boundary of the Picture Rock quadrangle. Described as augite-biotite syenite-trachyte porphyry Disbrow and Stoll (1957).

Tlp — **Andesine porphyry latite.**

Ttl — **Latite and trachytic latite.**

Td — **Aphanitic and porphyritic dikes**—Hornblende-and feldspar-porphyry dikes. Ranges from hundreds of meters to several kilometers in length. Appear to radiate from Cerrillos and Ortiz igneous complexes. Commonly stand in topographic relief relative to intruded sedimentary rocks. North-northwest-trending, to northeast-trending.

Te — **Espinaso Volcanics of Stearns (1953a)**—Light grey to lavender grey, clast-supported agglomerate (lahars?), volcaniclastic sandstone, and minor white volcanic tuff. Latite clasts are subrounded to subangular and range up to 2m (7 ft). Kautz and others (1981) report ages ranging from 25.1 Ma to 34.6 Ma for the Espinaso Volcanics, which regionally lie conformably upon the Galisteo Formation and are unconformably overlain by Santa Fe Group sediments. Disbrow and Stoll (1957) measured more than 610 m (2000 ft) of latitic tuff, tuff-breccia, and flows at Sweet's Ranch in sections 23 and 24, T14N, R8E. The volcanic sources for these deposits were the Ortiz and Cerrillos intrusive centers.

Tef — **Espinaso Volcanics**—Volcaniclastic sedimentary rocks and pyroclastic flows.

Ti — **Intrusive rocks, undivided.**

Eocene

Sedimentary Rocks

Tg — **Galisteo Formation (Sensu latto)**—Steeply to locally overturned beds of pebbly sandstone and red mudstone of the Galisteo Formation are well exposed on the east side of the Cerrillos Hills forming the picturesque outcrops in the area known as New Mexico's Garden of the Gods along NM-14. Red and whitish sandstone of the Galisteo Formation forms low ridges on the east side of NM-14. The unit is also exposed more or less continuously along Galisteo Creek from NM-14 to the quadrangle's southeast corner. Regionally, an angular unconformity separates the Galisteo Formation from the underlying Diamond Tail Formation. The Galisteo Formation has a gradational contact with the overlying Espinaso Volcanics.

Tgu — **Upper Galisteo Formation**—Massively bedded, poorly-consolidated, white to light-tan sandstone. Locally contains petrified logs to 1 m (three feet) diameter and up to 8 m (25 ft) long. Approximately 280 m (900 ft) thick.

Tgl — **Lower Galisteo Formation**—Red siltstone and mudstone with interbeds of tan to white, pebbly sandstone. The proportion of granitic pebbles relative to Paleozoic sedimentary clasts increases upward in the section. Cobbles and boulders of limestone and granite occur in an interval 200 to 300 feet above the base of the lower Galisteo Formation over a strike length of 7.3 km (4.6 mi) in the southwestern part of the Picture Rock quadrangle. The thickness of the unit is approximately 1200 m (3000 ft).

Paleocene

Tdt — **Diamond Tail Formation**—Yellow, orange, and gray, medium- to coarse-grained arkose and subarkose that is commonly trough-cross bedded and variegated gray to maroon mudstone. Regionally the unit is locally conglomeratic and locally contains petrified wood in small fragments and ironstone concretions. Well-sorted pebbles in conglomerate beds are composed of white and gray quartzite and chert. In the southeastern part of the Cerrillos Hills strata of the Diamond Tail Formation, along with the subjacent Menefee Formation of the Mesa Verde Group and the overlying Galisteo Formation are steeply inclined to locally overturned due to emplacement of the Cerrillos igneous complex. Regionally, the Diamond Tail Formation lies with angular unconformity across strata of progressively younger age to the southwest (including the Menefee Formation) as a result of Latest Cretaceous-Paleocene Laramide uplift of the Sangre de Cristo block. The Diamond Tail Formation was subdivided from the Galisteo Formation of Stearns (1943) and Lucas (1982) by Lucas and others (1997), citing a disconformity and faunal break. In field practice, however, the contact is drawn at the base of the first continuous red mudstone. Lucas (1982) measured a thickness of 353 m (1,158 ft) for a lower sandstone unit of the Galisteo Formation that may be correlated with the Diamond Tail Formation in the southeastern part of the Cerrillos Hills. This thickness is considerably less than the 820 m (2700 ft) reported by Maynard and others (2001) about 2 km to the southwest in the Madrid quadrangle, or the 442 m (1459 ft) at its type locality in the Hagan Basin (Lucas and others (1997)). It is considerably greater than the 90 m (300 ft) reported by Lisenbee and Maynard (2001) east of the Ortiz Mountains.

CRETACEOUS

Upper Cretaceous

Mesa Verde Group – The Mesa Verde Group is exposed at the surface in the southeastern part of the Cerrillos Hills, where it is domed and intruded by andesite porphyry of the Cerrillos laccolith. The Mesa Verde Group was intersected in several petroleum exploration wells along the Galisteo Creek.

Kmv — **Mesa Verde Group, undivided.**

Kmf — **Menefee Formation**—Gray, tan to orange-tan, cross-bedded, and laminated to thick-bedded siltstone and sandstone; dark-gray to olive-gray and black shale; dull, dark-brown to shiny black coal; and maroon to dark-brown iron concretions. The thickness varies from 0 m to 300 m (0-1000 ft) in the Cerrillos Hills and exploration wells.

Kpl — **Point Lookout Sandstone**—Gray-tan to light-tan and drab-yellow, upward coarsening, very fine- to medium-grained, quartz sandstone with limonitic sandstone lenses and interbedded thin gray shale. Its lower contact with the upper Mancos shale is gradational. Thickness is 30m (100ft) in the Cerrillos Hills and varies from zero to 150 m (500 ft) in exporation wells as a result of Laramide erosion.

Mancos Shale

Km — **Mancos Shale, undivided**—In isolated exposures, determination of the Mancos Shale member was not possible.

Kn2 — **Upper shale member: Satan Tongue of the Mancos Shale**—Medium gray, calcareous shale; weathers olive-brown. Contains abundant concretions to three feet diameter: Gradational to the Point Lookout Sandstone. Poorly exposed, mostly in arroyos. Contains Cordiceramus muilleri, Crassatella pluchella, Cladoceramus undulatoplicatus. The thickness, based on cross section, is approximately 300 ft.

Kn1 — **Lower shale member**—Montezuma Shale Member of Mancos Shale Medium gray, calcareous shale; weathers olive-brown. Poorly exposed, mostly in arroyos. Thickness approximately 250 ft based on cross section.

Kd — **Dakota Formation (cross sections only)**—Thicknesses reported for the Dakota from petroleum tests range from 33 m (110 ft) to 125 m (385 ft) across short distances. As such extremes are not reported from outcrops within the region, this variance suggests selection of different contacts by different loggers.

J — **Jurassic (cross sections only)**—Includes the Morrison Formation, the Summerville Formation, the San Rafael Group (Todilto Fm), and Entrada Sandstone.

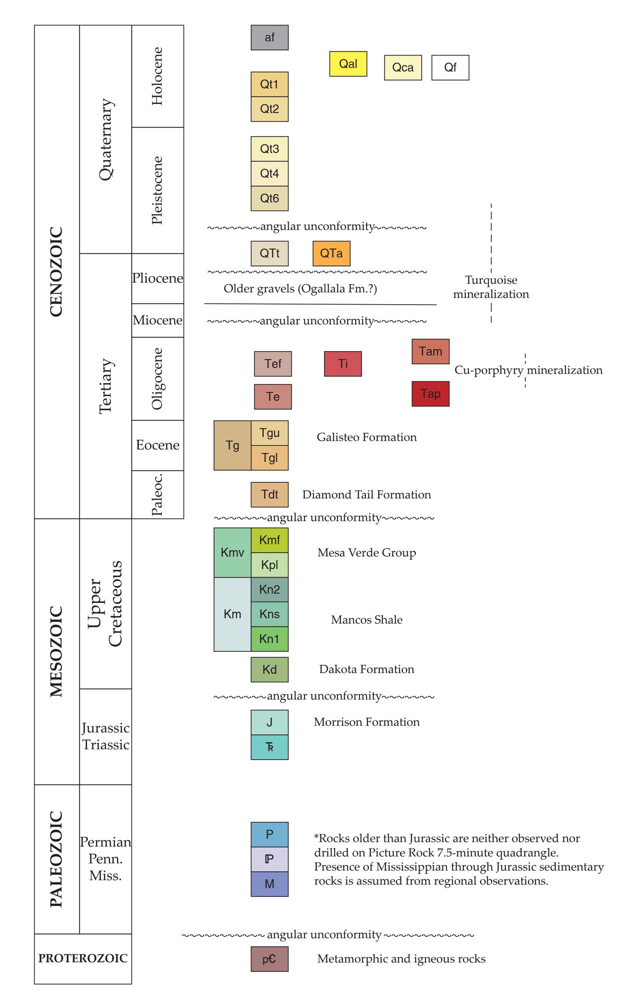
Ŧ — **Triassic (cross sections only)**—Includes Chinle Group, Moenkopi Formation

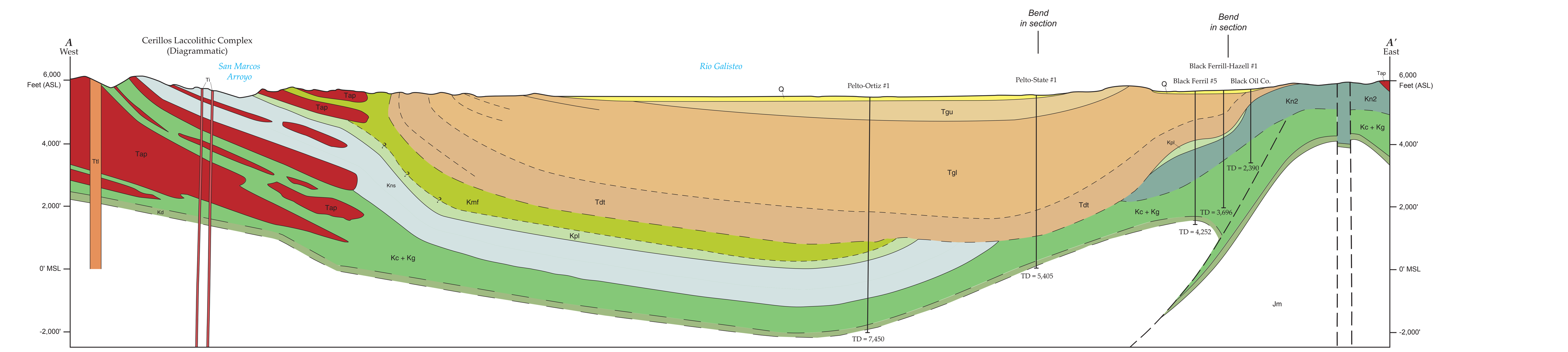
P — **Permian (cross sections only)**—Includes San Andres Formation, Glorieta Sandstone, Yeso, and Abo Formations

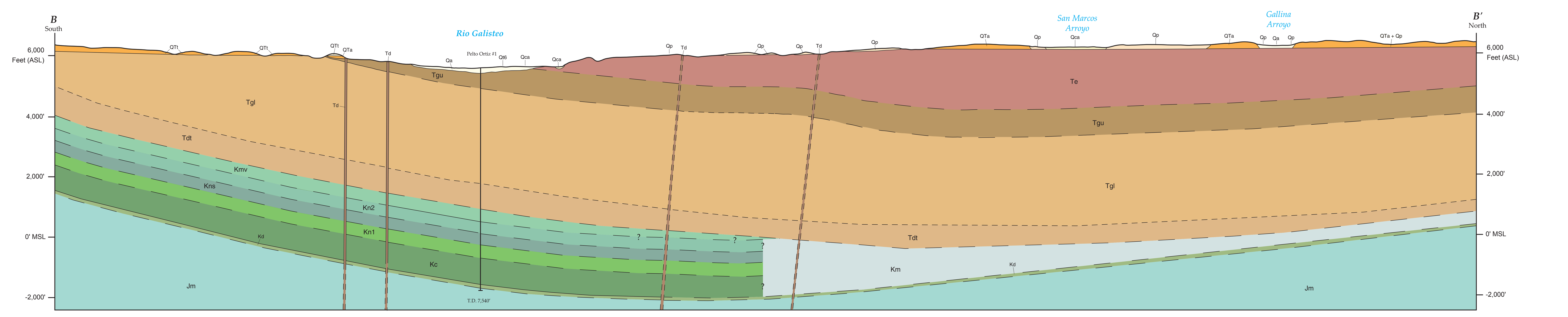
M, IP — **Pennsylvanian and Mississippian, undivided (cross sections only)**—Includes Madera Formation, Sandia Formation (?), and Mississippian Arroyo Peñasco Group (?).

p€ — **Precambrian, undivided (cross sections only)**—Includes metamorphic and granitic rocks. Rare xenoliths of gneissic granite of probable basement origin occur in the Cerrillos Hills laccolith.

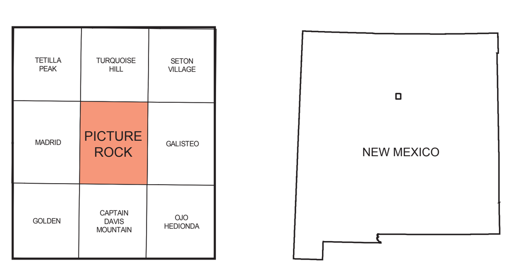
Correlation of Map Units







Base map from U.S. Geological Survey 1970, from photographs taken 1965, field checked in 1970, edited in 1993.
1927 North American datum, UTM projection -- zone 13N
1000-meter Universal Transverse Mercator grid, zone 13, shown in blue



QUADRANGLE LOCATION

Magnetic Declination
June 2002
10° 11' East
At Map Center

1:24,000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

New Mexico Bureau of Geology and Mineral Resources
Open-file Geologic Map 49

Mapping of this quadrangle was funded by a matching-funds grant from the STATEMAP program of the National Cooperative Geologic Mapping Act, administered by the U. S. Geological Survey, and by the New Mexico Bureau of Geology and Mineral Resources, (L. Greer Price, *Director and State Geologist*, Dr. J. Michael Timmons, *Assoc. Director for Mapping Programs*).

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

http://geoinfo.nmt.edu

Geologic map of the Picture Rock quadrangle, Santa Fe County, New Mexico.

June 2002

by
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Map Symbols

- Gelogic contact. Solid where exposed or well-known, dashed where approximately known.
- Normal fault. Dashed where approximately known, dotted where concealed. U and D showing normal offset. Point showing dip value and direction.
- Intrusive contact. Dashed where obscured.
- Anticline hinge—showing direction of plunge, dashed where inferred, dotted where buried.
- Syncline hinge—showing direction of plunge, dashed where inferred, dotted where buried.
- Fault located with aeromagnetic survey
- Mining pit margin, obscured by colluvium.
- A|—|A' Cross-section location
- Horizontal bedding
- Strike and dip of bedding
- Overturned bedding
- Vertical bedding
- Inclined foliation
- Vertical foliation
- Vertical joint
- Inclined joint
- Mine
- Prospect
- Shaft
- Spring
- Well location

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.