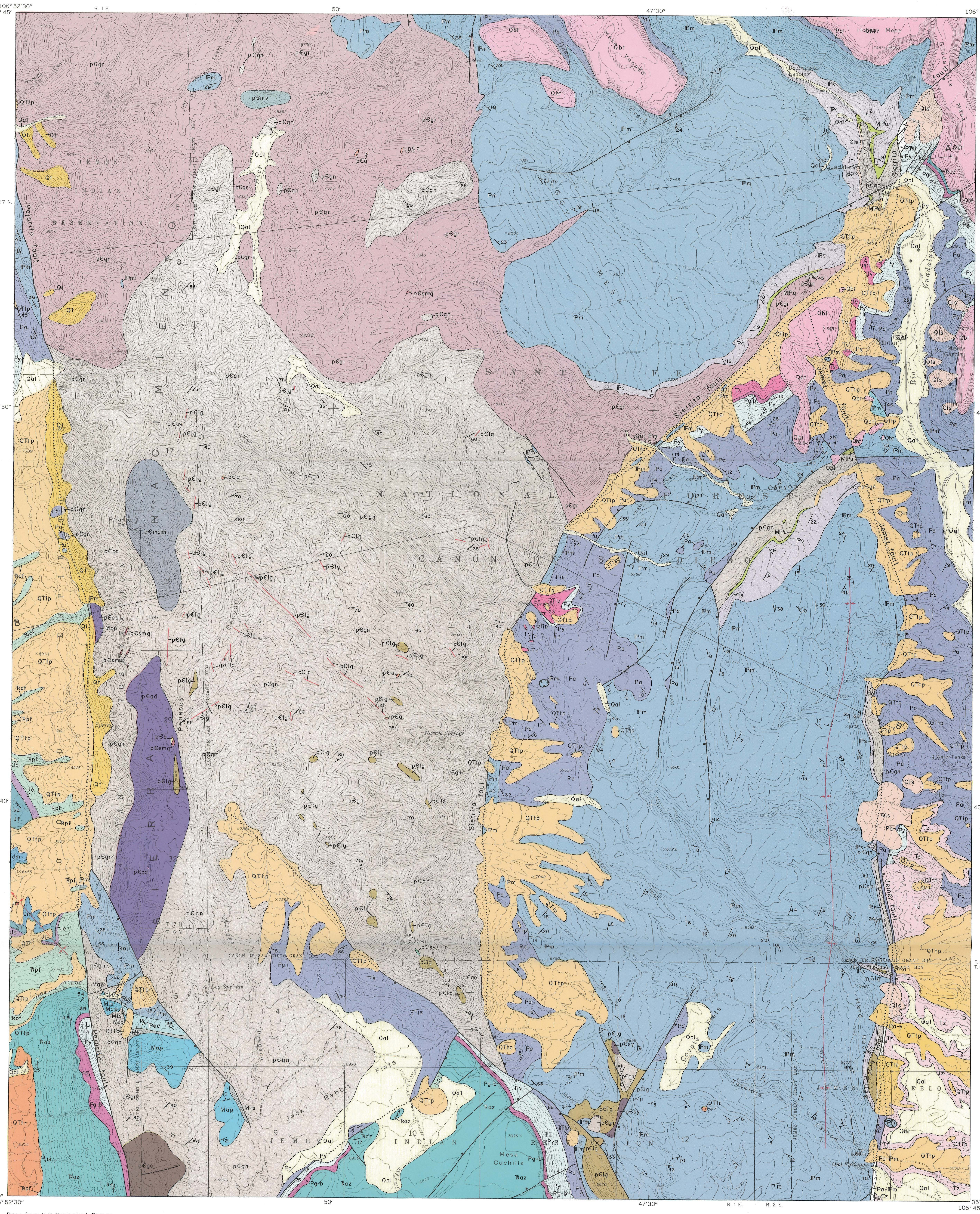
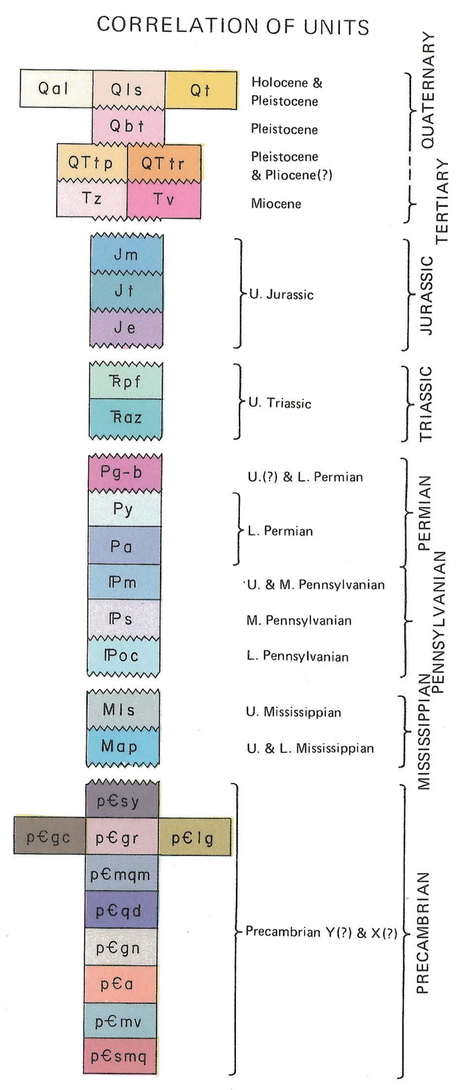


Base from U.S. Geological Survey

Geology by Lee A. Woodward, Harvey R. DuChene, and Ruben Martinez, 1972, 1973, and 1976



DESCRIPTION OF UNITS

Qal Alluvium — *Clay, silt, sand, and gravel, mostly along valleys; includes minor colluvium; 0 to 30(?) ft thick*

Qls Landslide deposits — *Mostly derived from Bandelier Tuff or Madera Formation; 0 to 50(?) ft thick*

Qt Talus — *Angular fragments, locally derived; 0 to 30(?) ft thick*

Qbt Bandelier Tuff — *Nonwelded to strongly welded ash-flow deposits composed of rhyolite and pumice; contains quartz, sanidine, and sparse to abundant inclusions of hornblende-rich quartz-latite pumice and lithic fragments; 0 to 650 ft thick*

QTtp Terrace and pediment deposits — *Mostly boulder and cobble gravel with clasts of Precambrian rocks or, locally, of Paleozoic and Mesozoic rocks; locally cemented by travertine; 0 to 30(?) ft thick*

QTtr Travertine — *Light-tan, thin-bedded to thick-bedded; 0 to 50(?) ft thick*

Tv Volcaniclastic rocks — *White to light-brown, thin-bedded, cliff-forming, locally calcareous, waterlain tuff; conglomeratic with volcanic clasts near base, becoming finer grained upward; sand-size clasts of quartz, microcline and granitic rock fragments abundant in lower part; 350 to 450 ft thick*

Tz Zia Sandstone — *Light-gray, medium-grained to coarse-grained, feldspathic sand and sandstone; 0 to 1,000(?) ft thick*

Jm Morrison Formation — *Four members in ascending order: lower member composed of reddish-brown and maroon-brown mudstone and very fine grained, gray sandstone, about 390 ft thick; Westwater Canyon Member composed of thick-bedded, cliff-forming, feldspathic sandstone and subordinate variegated mudstone, about 100 ft thick; Brushy Basin Member composed of red and green mudstone with sandstone interbeds, about 100 ft thick; upper member composed of whitish, kaolinitic sandstone and minor green mudstone, about 150 ft thick; total thickness about 740 ft, but only lower part of formation exposed in this quadrangle*

Jt Todilto Formation — *Basal brown, laminated, fetid limestone 4 to 5 ft thick, overlain by white gypsum 100 ft thick*

Je Entrada Sandstone — *Light-orange-tan, white, and pale-yellow (in ascending order), fine-grained to medium-grained sandstone; massively bedded; thickness about 100 to 130 ft*

Chinle Formation

Ꞧpf Petrified Forest Member — *Reddish-orange and brownish-maroon shale with subordinate reddish sandstone and minor green shale, brown clastic limestone, and small pebble conglomerate; approximately 1,000 ft thick*

Ꞧaz Agua Zarca Sandstone Member — *White to buff, medium-grained to very coarse grained, cliff-forming, quartzose sandstone, grit, and conglomerate; 100 to 130 ft thick*

Pg-b Glorieta Sandstone and Bernal Formation undivided — *Bernal Formation (upper); reddish-brown, very fine-grained to medium-grained, thin-bedded sandstone and intercalated reddish-brown siltstone; thickness 20 to 80 ft. Glorieta Sandstone (lower): white to tan, fine-grained to coarse-grained, thick-bedded, cliff-forming quartzose sandstone with local lenses of gypsum in lower part; thickness 30 to 100 ft*

Py Yeso Formation — *Orange-buff to tan-brown, even-bedded, fine-grained to very fine grained sandstone; contains minor gray, thick-bedded limestone or dolomite; 300 to 525 ft thick*

Pa Abo Formation — *Reddish-brown mudstone and lenticular arkose and sandstone; subordinate light-gray sandstone, arkose, and nodular nonfossiliferous limestone; 400 to 850 ft thick*

ℙm Madera Formation — *Light-gray, fossiliferous limestone; white to buff orthoquartzite; coarse-grained arkose; reddish to light-gray shale; arkosic limestone; 0 to 760+ ft thick*

ℙs Sandia Formation — *Beige to light-brown, massive, coarse-grained quartzose sandstone; green, yellow, and gray shale; fossiliferous, argillaceous, light-gray limestone; 0 to 225 ft thick*

ℙoc Osha Canyon Formation — *Light-gray, fossiliferous limestone grading upward into light-gray shale and nodular limestone; 0 to 40 ft thick*

Mls Log Springs Formation — *Dark-red, ferruginous shale near base, overlain by red to mottled-pale-orange, arkosic sandstone and intercalated red shale; 0 to 55 ft thick*

M-ℙu Mississippian and Pennsylvanian rocks undivided — *Arroyo Peñasco Group, Log Springs Formation, and Osha Canyon Formation*

Map Arroyo Peñasco Group — *Brownish-gray to gray, thickly bedded to massively bedded limestone with chert nodules; minor white to gray, medium-grained to coarse-grained quartzose sandstone near base; and minor calcareous gray shale; thickness 0 to 115 ft*

p€sy Syenite — *Brick-red, fine-grained to coarse-grained, this unit consists of alkali feldspar with very minor opaque minerals and interstitial quartz*

p€lg Leucogranite — *Pink, medium-grained to coarse-grained; consists of microcline, oligoclase, and quartz; includes pegmatite aplite, and fine-grained to medium-grained pink quartz monzonite*

p€gr Granite — *Pink, fine-grained to medium-grained; slightly porphyritic in some areas having microcline megacrysts; locally has weak foliation; grades into quartz monzonite near contacts with gneiss; contains gneissic inclusions in various stages of assimilation; exposed in northern part of quadrangle*

p€gc Granite — *Pink, coarse-grained; consists of microcline, oligoclase, and quartz with minor biotite; locally may be weakly foliated; exposed in southwestern corner of quadrangle*

p€mqm Muscovite-quartz monzonite — *Fine-grained, equigranular, buff quartz monzonite consisting of quartz, microcline, plagioclase, muscovite, and minor stilpnomelane*

p€qd Quartz diorite — *Dark-gray, faintly foliated to moderately foliated, medium-grained; contains plagioclase, quartz, hornblende, and biotite*

p€gn Gneiss — *Pink to gray, fine-grained to coarse-grained, lenticular quartz-feldspar gneiss that commonly contains pink feldspar porphyroblasts; biotite is common and hornblende is present locally; moderate foliation to strong foliation, mostly trending northeast; locally includes pink granitic, aplitic, and pegmatitic dikes*

p€a Amphibolite — *Dark-gray, very fine grained to medium-grained plagioclase and hornblende with minor quartz and epidote; occurs as inclusions to 100 ft across that are enclosed by gneiss and granite*

p€mv Metavolcanic rocks — *Very fine grained, strongly schistose metarhyolite and subordinate interbedded very fine grained, strongly schistose amphibolite*

p€smq Muscovite-quartz schist — *Irregularly shaped lenses of pinkish-gray schist composed of quartz with subordinate muscovite and minor garnet*

Contacts of surficial deposits

Bedrock contacts, dashed where approximate

High-angle fault, dashed where approximate, dotted where concealed; ball and bar on downthrown side

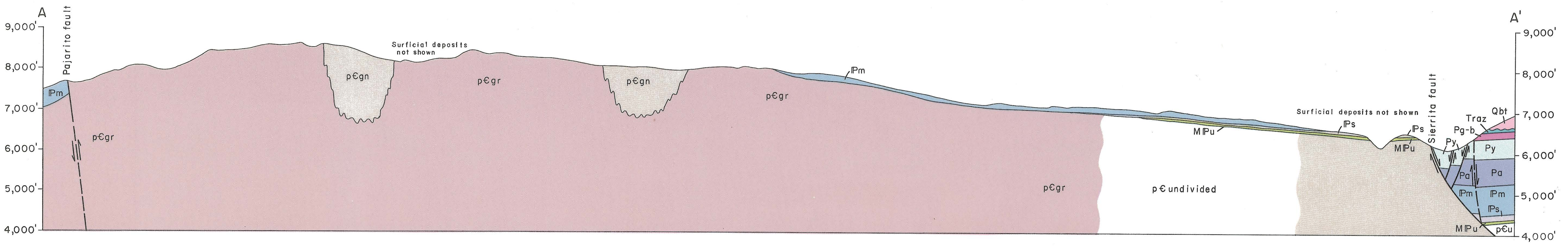
Gravity slide fault, barbs on upper plate

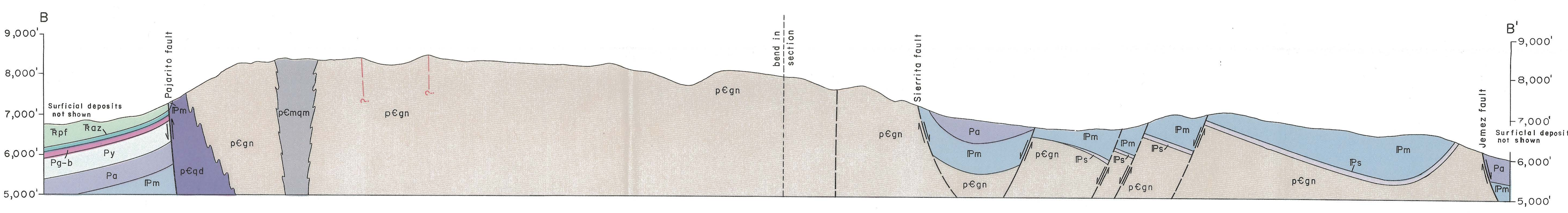
Syncline, dashed where approximate, dotted where concealed

20 *Strike and dip of bedding*

60 *Strike and dip of foliation*

Prospect with copper mineralization





GEOLOGY OF GILMAN QUADRANGLE, NEW MEXICO

by Lee A. Woodward, Harvey R. DuChene, and Ruben Martinez, 1977

Scale 1:24,000 Contour interval 40ft

1 0 1 mi

1 0 1 km

PREVIOUS AND PRESENT WORK

The Gilman quadrangle was included in a reconnaissance map by Wood and Northrop (1946). Renick (1931) covered the western and southern margins of the quadrangle in a reconnaissance map. Smith, Bailey, and Ross (1970) included the eastern half of the quadrangle in a map concerned principally with the Cenozoic volcanic rocks but generalized for the earlier rocks.

Responsibility for mapping this quadrangle is shown on fig. 1. The mapping by Martinez was partly modified and remapped by Woodward.

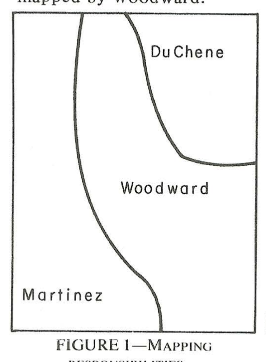


FIGURE 1—Mapping responsibilities.

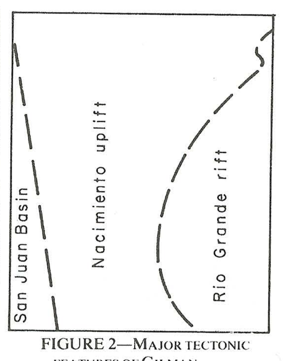


FIGURE 2—Major tectonic features of Gilman quadrangle.

ROCK UNITS

Precambrian rocks are shown in the explanation in suggested chronologic order. Published radiometric ages are lacking for any of these rocks; in many cases the structural and chronologic relationships cannot be determined from field and petrographic evidence.

A few small lenses of pinkish-gray, fine-grained muscovite-quartz schist (p€smq) are enclosed by gneiss and granite. Foliation of the schist is sharply truncated by the gneiss, suggesting that the schist was metamorphosed before being engulfed by the igneous parent of the gneiss. Metavolcanic rocks (p€mv) are enclosed by granite (p€gr) and apparently were metamorphosed then engulfed by the granite. The chronologic relationship of the muscovite-quartz schist and the metavolcanic rocks is not known.

Some of the amphibolite (p€a) xenoliths in the gneiss and granite appear to have undergone regional metamorphism prior to being engulfed by the igneous parent of the gneiss. The amphibolite may be remnants of mafic volcanic rocks older than the gneiss or, in some cases, may be dikes emplaced into the parent of the gneiss prior to regional metamorphism.

The gneiss probably represents several plutons that were later regionally metamorphosed, imparting a general northeast-trending foliation.

Granitic rocks are intrusive into the gneiss, but the age relationship of the coarse-grained granite (p€gc) in the southwestern part of the quadrangle, the finer grained granite (p€gr) to the north, and the leucogranite (p€lg) in the southeast is not known.

Syenite (p€sy), because it cuts across the leucogranite (p€lg), appears to be the youngest Precambrian rock.

Mississippian strata (Map and Mls) are only locally present; part of the area was uplifted and eroded prior to deposition of Pennsylvanian rocks. Pennsylvanian strata (ℙoc, ℙs, and ℙm) also are locally absent as the south-central part of the quadrangle was a positive area during Pennsylvanian time (DuChene, 1974; DuChene, Kues, and Woodward, 1977). The Madera Formation (ℙm) varies in lithology; proximity to the Precambrian source terrane is the major factor controlling the various facies of the Madera (Martinez, 1974).

Volcaniclastic rocks (Tv) were previously mapped as Abiquiu Tuff by Smith, Bailey, and Ross (1970) but the lithologic difference between the volcaniclastic rocks and the type Abiquiu Tuff is sufficient to map them as different units. Preliminary palynological work suggests that the volcaniclastic rocks are probably Miocene, therefore contemporaneous with the Zia Sand Formation.

Travertine (QTtr) and pediment and terrace gravels (QTtp) were deposited during the same broad interval (as one may overlie the other), and gravels are locally cemented by travertine.

STRUCTURE

Precambrian Deformation

Regional synkinematic metamorphism of the muscovite-quartz schist (p€smq), and possibly the metavolcanics (p€mv) and some of the amphibolite (p€a), represents the earliest deformation recorded in this quadrangle. Emplacement of the igneous parent rocks of the gneiss (p€gn) occurred next and was followed by another episode of regional synkinematic metamorphism resulting in the northeast-trending foliation of the gneiss.

Quartz diorite (p€qd), muscovite-quartz monzonite (p€mqm), and granitic rocks (p€gc, p€gr, and p€lg) were intruded into the gneiss. The younger intrusive rocks locally have weak foliation along their margins, probably as a result of primary flow during intrusion. The mechanisms of emplacement were probably dilation and minor assimilation.

Paleozoic Deformation

Isopach maps by Wood and Northrop (1946) show that the Nacimiento area was a positive structural element during Pennsylvanian time and continued to show positive tendencies during Permian time. Our mapping in the Gilman quadrangle indicates the south-central part of the quadrangle was higher than the area in the northern part of the quadrangle and was bounded on the west by a steep escarpment.

Cenzoic Deformation

The major tectonic features extending into this quadrangle are the Nacimiento uplift, the San Juan Basin, and the Rio Grande rift (fig. 2). The Nacimiento uplift and San Juan Basin began to form during the early Cenozoic, whereas the Rio Grande rift formed during late Cenozoic. On the west the Nacimiento uplift is bounded by the reverse Pajarito fault dipping steeply to the east; the eastern margin of the uplift and the western margin of the rift is marked by the normal Sierrita fault that dips to the east. The last episode of movement of the Nacimiento uplift was probably synchronous with late Cenozoic rifting.

Structural relief between the Nacimiento uplift and the adjacent San Juan Basin is about 7,300 ft. Stratigraphic separation along the Pajarito fault is much less because of monoclinal bending along the fault. Near Guadalupe Box the stratigraphic separation across the Sierrita fault is about 2,250 ft.

Within the southern part of the Nacimiento uplift are several northeast-trending and northwest-trending normal faults. Stratigraphic separation is mostly a few hundred feet but is about 1,000 ft on the northernmost of these faults.

East of the Sierrita fault are several antithetic and synthetic faults that create small grabens and a horst within the Rio Grande rift (structure section *B-B'*).

MINERAL AND ENERGY RESOURCES

Gypsum in the Todilto Formation is exposed along a dip-slope on the western edge of the quadrangle. Large tonnages of gypsum are available in this quadrangle and the adjacent Holy Ghost Spring quadrangle to the west (Woodward and Martinez, 1974).

A small copper prospect is located in the central part of the quadrangle where carbonaceous plant remains and minor copper sulfides are surrounded by halos of malachite and chrysocolla in arkose of the Abo Formation (Pa).

Thermal springs and travertine deposits along the southwestern and southeastern margins of the Nacimiento uplift suggest possible potential for geothermal energy.

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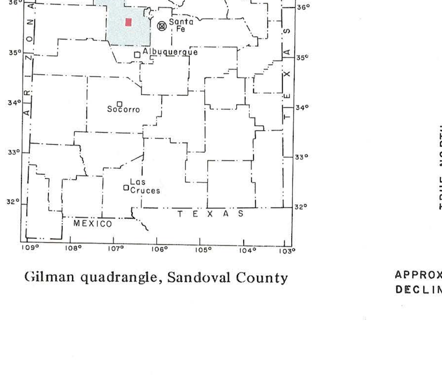
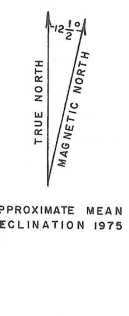


Gilman quadrangle, Sandoval County



APPROXIMATE MEAN DECLINATION 1975