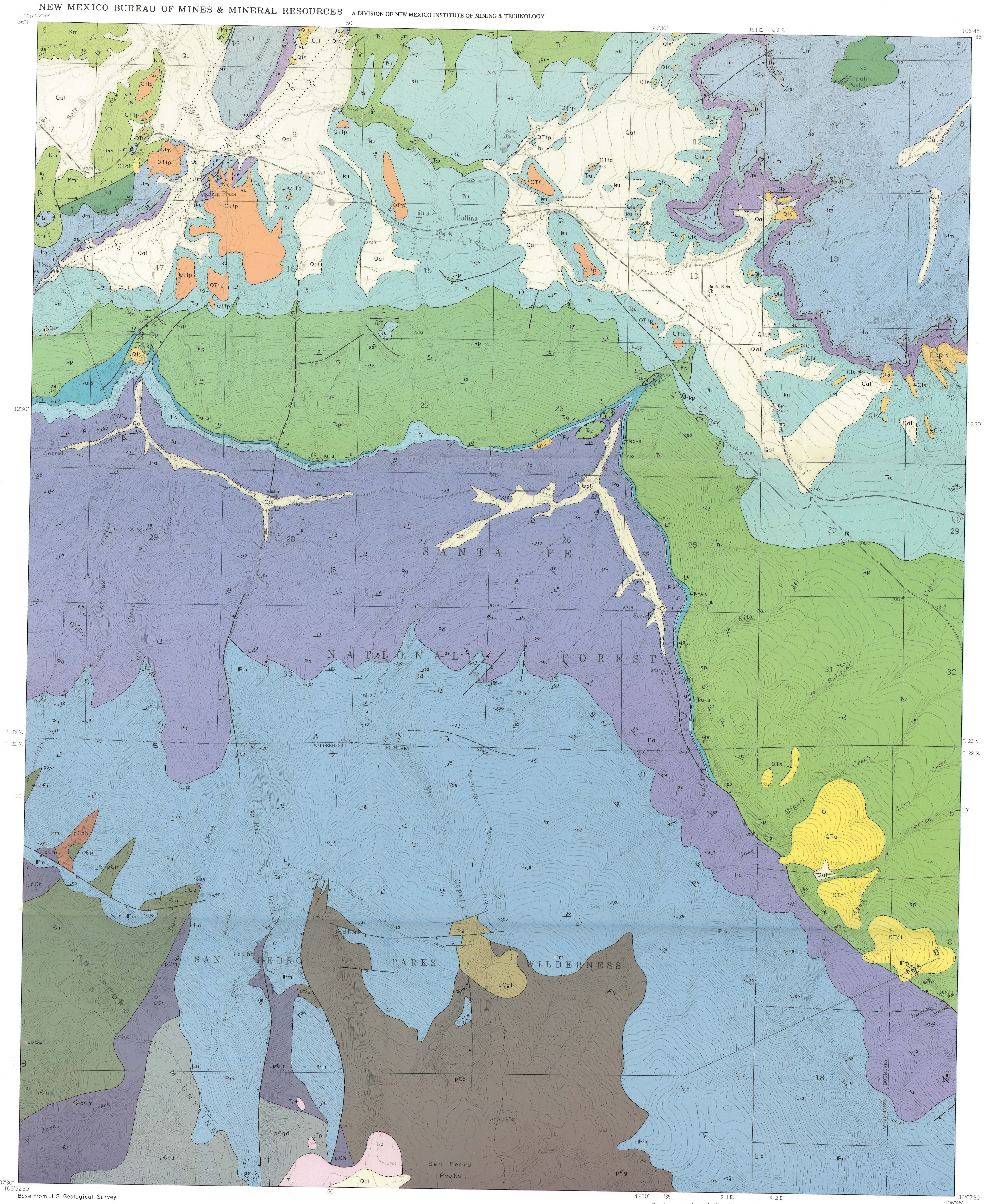
NEW MEXICO BUREAU OF MINES & MINERAL RESOURCES A DIVISION OF NEW MEXICO INSTITUTE OF MINING & TECHNOLOGY



Base from U.S. Geological Survey

Geology by Lee A. Woodward, Gail G. Gibson, and Douglas McLelland, 1972, 1973, 1974, 1975

QUATERNARY

Qal — Alluvium
Clay, silt, sand, and gravel; locally includes some colluvium; thickness 0 to 30 (?) ft

Qls — Landslide deposits
Mostly large, angular blocks of sandstone derived from the Morrison Formation; thickness 0 to 50 ft

QTal — Older alluvium
Pebble-to boulder-gravel; comprised of clasts of limestone from Madera Formation; forms old alluvial fans; thickness 0 to 100 (?) ft

QTtp — Terrace and pediment deposits
Mostly gravel with cobbles and boulders of Precambrian rocks, or locally, Paleozoic and Mesozoic rocks; includes minor lag gravel; thickness 0 to 30 (?) ft

TERTIARY

Tp — Pedernal Chert Member of Abiquiu formation
Massive, white to bluish-gray chert with local red, yellow, and brown mottling; thickness 10 (?) to 20 (?) ft

CRETACEOUS

Km — Mancos Shale
Dark-gray to black shale; thin-bedded calcareous siltstone and fine-grained sandstone; thin lenses of finely crystalline limestone; septarian concretions; thickness about 2,000 ft with the lower 300 (?) ft exposed in this quadrangle

Kd — Dakota Formation
Three units: lower, carbonaceous, fine- to medium-grained, locally conglomeratic sandstone; middle, black to dark-gray shale; upper, fine- to medium-grained sandstone; total thickness about 110 ft

JURASSIC

Jm — Morrison Formation
Three members in ascending order: brownish-maroon siltstone and very fine grained sandstone with light-gray sandstone and maroon shale; brick-red and pale-green mudstone and gray to yellowish-buff sandstone with minor nodular limestone; white to tan sandstone, locally conglomeratic, kaolinitic near the top, with minor green and red shale interbeds; thickness 300 to about 900 ft

Jt — Todilto Formation
Basal brown laminated limestone, thickness 4 to 12 ft; locally overlain by massive limestone breccia, thickness 0 to 14 ft; upper white gypsum, thickness 0 to 130 ft

Je — Entrada Sandstone
Fine- to medium-grained, white, yellow, and tan-brown, massive sandstone; thickness 150 to 300 ft

TRIASSIC

Chinle Formation

Ŧu — Upper shale member
Red shale with interbedded reddish-brown and gray, thin-bedded, fine- to coarse-grained sandstone; thickness about 600 ft

Ŧp — Poleo Sandstone member
Yellow-brown to olive-gray, fine- to coarse-grained, micaceous sandstone with pebble conglomerate near the base; thickness 90 to 130 ft

Ŧa-s — Agua Zarca Sandstone Member—Salitral Shale member undivided
Dark-red-brown, maroon, and beige shale with red to gray, fine- to coarse-grained sandstone and subordinate pebble conglomerate; thickness 0 to 120 ft

PERMIAN

Py — Yeso Formation
Tan-brown and orange-buff, even-bedded, fine-grained to very fine grained sandstone; thickness 10 (?) to 150 ft

Pa — Abo Formation
Reddish-brown mudstone and lenticular sandstone and arkose; minor conglomerate with metaquartzite pebbles and cobbles; locally light-gray sandstone, arkose, and minor limestone; thickness 1,100 (?) to 2,900 ft

PENNSYLVANIAN

IPm — Madera Formation
Light-gray, commonly fossiliferous limestone; gray to buff orthoquartzite; pink arkose; reddish and minor light-gray shale; arkosic limestone; thickness 760 to 1,550 ft

PRECAMBRIAN

p€gb — Biotite granite / **p€gf — Fine-grained granite** / **p€g — Muscovite-biotite granite**
p€gb: Pink, medium-grained; consists of microcline-microperthite, quartz, and sodic plagioclase with accessory biotite
p€gf: Pink, fine-grained; consists of microcline, sodic plagioclase, and quartz with accessory muscovite and biotite
p€g: Pink-weathering, weakly porphyritic with elongate megacrysts of pink microcline widely scattered in medium-grained groundmass of quartz, microcline, and sodic plagioclase; contains accessory muscovite and biotite; locally contains small, irregular-shaped bodies of simple pegmatite and small inclusions of pink, very fine grained metarhyolite

p€h — Hybrid zone
Numerous irregular-shaped bodies of quartz diorite and pink hybrid porphyry consisting of quartz and milky-white plagioclase megacrysts to 5 mm long in fine-grained groundmass of microcline, quartz, sodic plagioclase and minor biotite; contacts with other rock units are broadly gradational

p€qd — Quartz diorite
Gray, medium-grained, equigranular composed of milky-white sodic plagioclase, blue-gray quartz, and accessory biotite, hornblende, and microcline; may be locally granodioritic where microcline is particularly abundant

p€a — Amphibolite
Fine-grained, dark-gray, slightly schistose, composed of hornblende and plagioclase with minor epidote, chlorite, quartz and opaque minerals

p€m — Metamorphic rocks
Very fine grained, light-tan to medium-gray or rarely pink; mainly meta-quartz wacke, meta-arkose, metaquartzite, and metagraywacke with minor meta-quartz latite; texture ranges from granoblastic to moderately schistose

Contacts of surficial deposits

Bedrock contacts, dashed where approximate

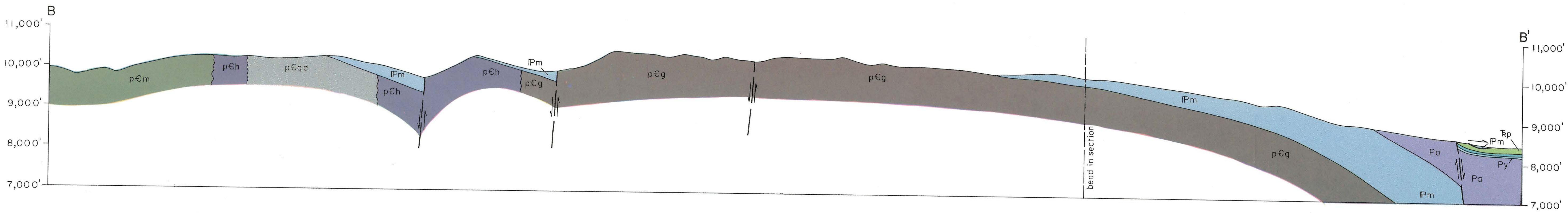
High-angle fault, dashed where approximate, dotted where concealed; with ball on downthrown side

Thrust fault, dashed where approximate, dotted where concealed, barbs on upper plate

Strike and dip of bedding

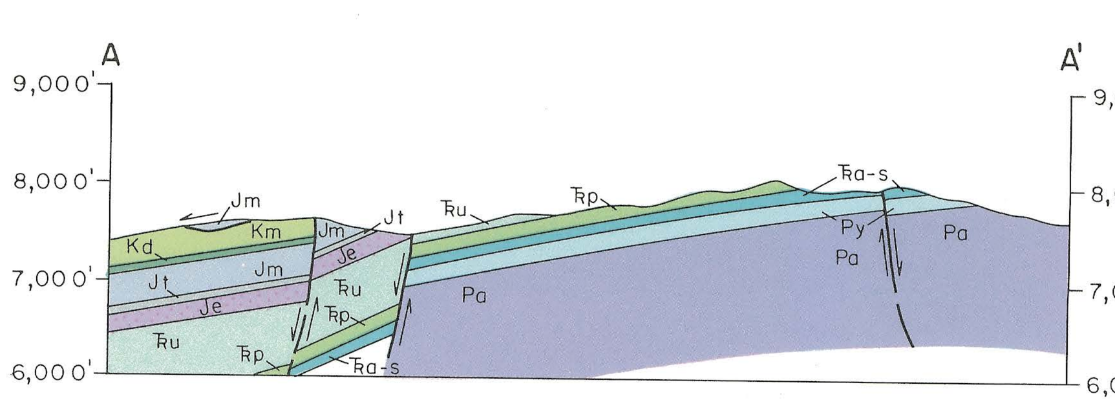
⚒ Cu *Prospect with copper mineralization*

× *Prospect with no apparent mineralization*



GEOLOGY OF GALLINA QUADRANGLE, NEW MEXICO

by Lee A. Woodward, Gail G. Gibson, and Douglas McLelland, 1976

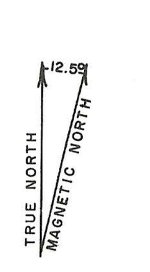


Scale 1:24,000

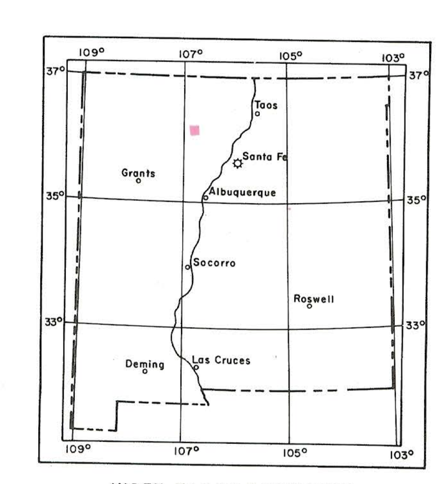
0 — 1 — 2 miles

0 — 1 — 2 kilometers

Contour interval 20 ft



APPROXIMATE MEAN DECLINATION 1975



INDEX MAP OF NEW MEXICO

PREVIOUS WORK

A reconnaissance map of the Nacimiento Mountains and adjacent areas by Wood and Northrop (1946) included this quadrangle. The western part of the quadrangle was mapped by Hutson (1958) and the southeastern part by Acosta (1973) for master's theses.

ROCK UNITS

There are no radiometric ages reported for Precambrian rocks in this quadrangle. However, Brookins (1974) reported ages of 1,800 ± 50 m.y. and 1,840 ± 170 m.y. for metamorphic rocks in adjacent quadrangles to the south and to the west.

The suggested relative ages of the Precambrian rocks are shown in the map explanation. Relative ages of the granite bodies are not known, but it seems likely that they are contemporaneous and that the fine-grained granite is a facies of the more extensive muscovite-biotite granite.

The Madera Formation (Pennsylvanian) rests nonconformably on Precambrian rocks and may locally include beds of Mississippian age at the base (Fitzsimmons and others, 1956). We were not able to find any diagnostic fossils nor any lithologies similar to nearby known Mississippian rocks, and therefore included those strata resting on the Precambrian with the Madera Formation.

The upper contact of the Madera with the Abo Formation was placed at the top of the stratigraphically highest, thick bed of limestone containing marine fossils of Pennsylvanian age. There is lateral intertonguing between the Madera and the Abo insofar as the uppermost limestone beds of the Madera pinch out toward the southeast. Thus, the Madera-Abo contact is stratigraphically lower in the southeast part of the quadrangle.

The Yeso Formation (Permian) thins eastward and its presence along Cecilia Canyon is inferred from float.

Strata in the lower part of the Chinle Formation were mapped as Agua Zarca Sandstone Member-Salitral Shale member undivided because this interval does not consist of basal whitish sandstone (Agua Zarca) overlain by maroon shale (Salitral). Rather, the interval is comprised of intercalated shale and sandstone with laterally discontinuous conglomeratic sandstone lenses at various horizons. The Agua Zarca-Salitral is missing in the central part of the quadrangle where the Poleo Sandstone member lies directly upon the Yeso Formation.

The Morrison Formation thickens from 300 ft near Gallina Plaza to about 900 ft at Capulin Peak to the northeast.

STRUCTURE

The Gallina quadrangle is located at the junction of four major tectonic features: the Nacimiento uplift, the San Juan Basin, the Gallina-Archuleta arch, and the Chama basin (fig. 1).

The northern end of the north-trending Nacimiento uplift is separated from the San Juan Basin by a monocline that is broken by a zone of steeply dipping faults that trend northeast near Gallina Plaza. There is about 8,600 ft of structural relief between the Nacimiento uplift and the San Juan Basin in this quadrangle. A low saddle separates the Nacimiento uplift from the structurally lower Gallina-Archuleta arch to the north.

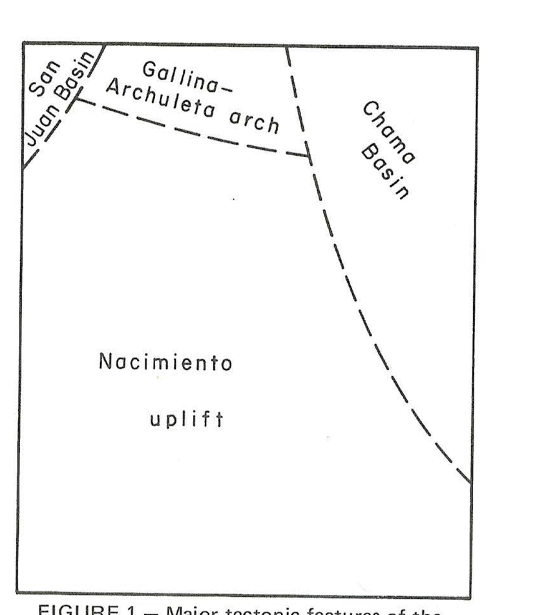


FIGURE 1 — Major tectonic features of the Gallina quadrangle.

Thus, the Nacimiento uplift plunges north and the Gallina-Archuleta arch plunges south with the two merging just north of NM-96; these two structurally high areas merge eastward with the Chama basin through a broad area of beds dipping gently to the east and northeast.

Precambrian Deformation

Amphibolites presumably were formed from basic dikes emplaced into a sedimentary and volcanic sequence. These rocks were later regionally and synkinematically metamorphosed in the upper greenshist and lower amphibolite(?) facies to form p€m and p€a.

The mechanisms of emplacement of the quartz diorite (p€qd) and the granitic rocks (p€g, p€gf, and p€gb) are not known.

Mesozoic Deformation

Absence of the lower members of the Chinle Formation (Triassic) along the present axis of the Nacimiento uplift (sec. 22, T. 23 N., R. 1 E.) suggests that the uplift was relatively positive during that part of Late Triassic time.

The rapid eastward thickening of the Morrison Formation (Jurassic) indicates differential subsidence, with the western part of the Nacimiento uplift undergoing less subsidence than to the west or east (Gibson, 1975).

Cenozoic Deformation

Development of the major tectonic features in the Gallina quadrangle began in early Cenozoic time. The Nacimiento uplift continued to rise at least into late Cenozoic time, as seen by tilting of the Pedernal Chert Member of the Abiquiu formation (Church and Hack, 1939) of probable Miocene age (Smith, 1938).

Tilted fault-blocks in the southern part of the quadrangle (section *B-B'*) probably formed in response to stretching of the crest of the uplift as it was free to expand laterally over the San Juan Basin along a range-marginal upthrust on the west side of the uplift (Woodward and others, 1972). The high-angle fault along Cecilia Canyon cuts a monocline marking the northeast margin of the Nacimiento uplift (section *B-B'*).

Small, gravity-slide plates of Poleo Sandstone (secs. 23 and 24, T. 23 N., R. 1 E.), Madera limestone (sec. 8, T. 22 N., R. 2 E.), and Morrison Formation (secs. 8 and 18, T. 23 N., R. 1 E.) have the age relations of overthrusts, but appear to have formed by downslope gravitational movement after development of the major tectonic features (Nacimiento uplift, San Juan Basin, and Chama basin).

ECONOMIC GEOLOGY

Sandstone-type copper mineralization is present at several prospects in the Abo Formation in sec. 31, T. 23 N., R. 1 E. These deposits do not appear to be economic due to small reserves. The genesis of these deposits has been discussed by Woodward and others (1974).

Gypsum in the Todilto Formation is exposed over about 300 acres and has a thickness of 90 ft at Cerro Blanco (secs. 4,5,8, and 9, T. 23 N., R. 1 E.). Distance from a market and low unit value make the gypsum uneconomic at this time.

Terrace and pediment deposits (QTtp) have been used extensively for aggregate. The clasts consist mostly of pebbles, cobbles, and boulders of Precambrian crystalline rocks.

Several uranium occurrences in the Abo Formation south of Gallina were noted by Chenoweth (1974), but we did not observe any uranium mineralization during our mapping.

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