NEW MEXICO STATE BUREAU OF MINES AND MINERAL RESOURCES

GEOLOGIC MAP 25

GEOLOGIC MAP AND SECTION OF CUBA QUADRANGLE, NEW MEXICO

by Lee A. Woodward et al.

Base from U.S. Geological Survey Cuba quadrangle

Geology by Lee A. Woodward, Douglas McLelland, John B. Anderson, and William H. Kaufman, 1970

0 1 2 Miles

EXPLANATION

QUATERNARY

Qal — Alluvium
Clay, silt, sand and gravel, mostly along valleys, includes some colluvium; 0 to 25(?) feet thick

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

QTtp — Terrace and pediment deposits
Mostly boulder gravel with clasts of Precambrian age, or, locally, Paleozoic and Mesozoic age; includes minor sand and lag gravel, 0 to 50 feet thick

TERTIARY

Tsj — San Jose Formation
Basal part yellow and buff, arkosic sandstone and conglomeratic sandstone, with minor gray shale; overlain by, and intertongues with, pale maroon, gray, tan, and greenish shale with argillaceous and conglomeratic sandstone interbeds; 800 to 1400 feet thick

Tn — Nacimiento Formation
Gray and olive-gray shale and siltstone with subordinate white, yellow, and buff sandstone and argillaceous sandstone; 500 to 700 feet thick

Toa — Ojo Alamo Sandstone
Tan to buff, thick-bedded sandstone with local lenses of conglomerate and gray and olive shale; 90 to 115 feet thick

CRETACEOUS

Kkf — Kirtland Shale and Fruitland Formation undivided
Olive-gray to dark-gray shale and light-gray to buff sandstone, locally carbonaceous; 85 to 100 feet thick

Kpc — Pictured Cliffs Sandstone
Gray to buff, thin-bedded sandstone and gray shale; grades laterally into Lewis Shale and is absent north of sec. 23 T. 21 N., R. 1 W., 0 to 45 feet thick

Kl — Lewis Shale
Gray to black shale with minor light-gray to buff sandstone and yellowish nodular limy concretions; 1500 feet thick

Kmv — Mesaverde Group
Lower unit: medium-grained, light-gray, salt-and-pepper-textured sandstone; middle unit light-to dark-gray, carbonaceous shale, light-gray sandstone, and coal; upper unit: light-gray medium-grained, salt-and-pepper-textured sandstone with minor gray shale interbeds; 320 to 450 feet thick

Km — Mancos Shale
Black shale with minor thin-bedded, light-gray sandstone and yellowish limy concretions; 2200 feet thick

Kd — Dakota Formation
White, fine- to medium-grained sandstone with gray to black carbonaceous shale, yellowish to buff sandstone: locally, coal near the middle; 115 to 180 feet thick

JURASSIC

Jm — Morrison Formation
Four members in ascending order: brownish-maroon siltstone and very fine-grained sandstone with minor light-gray sandstone and maroon shale; brick red and pale green mudstone and very fine-grained sandstone with gray to yellow-buff sandstone and minor pellet limestone; yellow, white, buff, and pink sandstone with minor shale and conglomeratic sandstone; green shale; 700 to 900 feet thick

Jet — Entrada and Todilto Formations undivided
Todilto: basal black to brown, laminated limestone, 5 to 10 feet thick, overlain by white gypsum, 60 to 140 feet thick; Entrada, white, yellow, buff, and tan-brown, massive sandstone, 95 feet thick

TRIASSIC

Chinle Formation

Ru — Upper Shale Member
Red shale and minor green and maroon shale and red siltstone and sandstone; 460 to 600 feet thick

Rp — Poleo Sandstone Member
Greenish, very fine- to coarse-grained, micaceous sandstone with subordinate green and reddish-maroon shale and minor pellet limestone and maroon micaceous sandstone; 20 to 135 feet thick

Rs — Salitral Shale Member
Maroon shale with subordinate green shale and, locally, minor, very coarse-grained, green, limy sandstone; 305 to 335 feet thick

Ra — Agua Zarca Member
White to light-buff, very thick-bedded, coarse-grained, quartzose sandstone, conglomerate, and conglomeratic sandstone; 80 to 120 feet thick

PERMIAN

Py — Yeso Formation
Tan-brown and orange-buff, even-bedded, fine-to very fine-grained sandstone; 0 to 60 feet thick; absent north of Eureka Mesa

Pa — Abo Formation
Reddish-brown mudstone and lenticular sandstone and arkose; locally light-gray sandstone, arkose, and minor limestone; 150 to 750 feet thick

PRECAMBRIAN

p€d — dikes
Very fine-grained, greenish, chlorite-biotite-quartz-feldspar dikes; most are strongly sheared

p€h — hybrid zone
Hybrid zone of medium-grained quartz diorite injected by pink, fine-grained leucogranite; contacts of this zone with p€qd are broadly gradational.

p€qm — quartz monzonite
Porphyritic biotite quartz monzonite; coarse-grained pink microcline phenocrysts in a medium-to coarse-grained matrix

p€qd — quartz diorite
Equigranular, medium-grained quartz diorite; locally includes porphyritic granodiorite with medium-to coarse-grained, pink microcline phenocrysts

p€u — ultramafic rocks
Dark-gray to black, medium-grained; composed mostly of pyroxene, olivine, and calcic plagioclase with subordinate amphibole and biotite; partially assimilated by quartz diorite

Contact of surficial deposits

Contact of bedrock
Dashed where approximate or gradational

High-angle fault
Dashed where approximate, dotted where concealed

Upthrust fault
Dashed where approximate, dotted where concealed; teeth on upthrown side

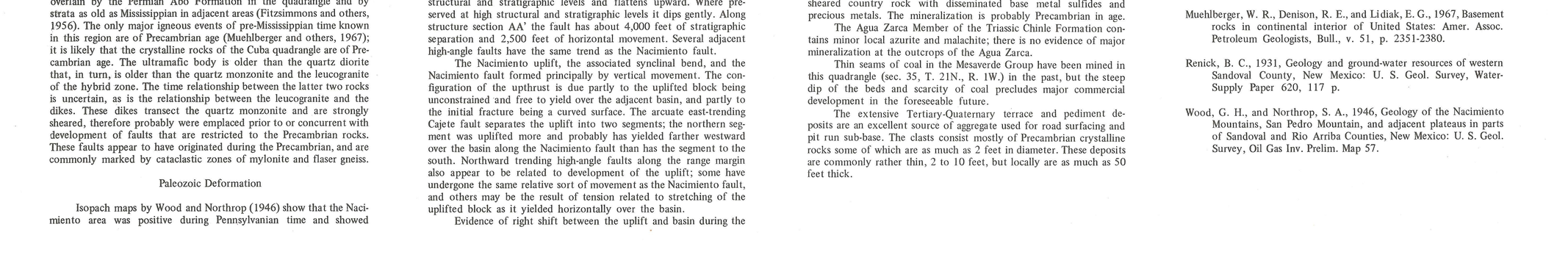
Strike and dip of beds

Strike and dip of overturned beds

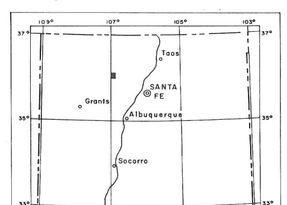
Strike and dip of vertical beds

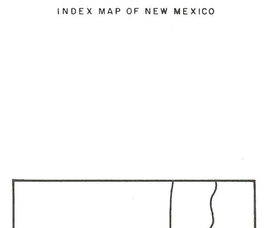
APPROXIMATE MEAN DECLANATION 1963

TRUE NORTH / MAGNETIC NORTH



INDEX MAP OF NEW MEXICO





Mapping responsibilities

PREVIOUS AND PRESENT WORK

Geologic maps by Renick (1931), Wood and Northrop (1946), and Baltz (1967) cover parts of the Cuba quadrangle. Areas of responsibility for this geologic map are shown on the accompanying source map.

STRUCTURE

Precambrian Deformation

Crystalline rocks of the Sierra Nacimiento are unconformably overlain by the Permian Abo Formation in the quadrangle and by strata as old as Mississippian in adjacent areas (Fitzsimmons and others, 1956). The only major igneous events of pre-Mississippian time known in this region are of Precambrian age (Muehlberger and others, 1967); it is likely that the crystalline rocks of the Cuba quadrangle are of Precambrian age. The ultramafic body is older than the quartz diorite that, in turn, is older than the quartz monzonite and the leucogranite of the hybrid zone. The time relationship between the latter two rocks is uncertain, as is the relationship between the leucogranite and the dikes. These dikes transect the quartz monzonite and are strongly sheared, therefore probably were emplaced prior to or concurrent with development of faults that are restricted to the Precambrian rocks. These faults appear to have originated during the Precambrian, and are commonly marked by cataclastic zones of mylonite and flaser gneiss.

Paleozoic Deformation

Isopach maps by Wood and Northrop (1946) show that the Nacimiento area was positive during Pennsylvanian time and showed positive tendencies during the Permian, as the Permian strata are thinner here than in adjacent areas.

Laramide Deformation

The major structural features are of Laramide age. They consist of the Nacimiento uplift in the eastern part of the quadrangle and the San Juan Basin to the west, separated by a belt of steeply dipping and faulted beds at the western foot of Sierra Nacimiento. Maximum structural relief within the quadrangle is at least 10,000 feet.

In a zone as much as 1 mile wide to the west of the Nacimiento fault (structure section AA'), the beds are vertical to strongly overturned, forming a synclinal bend at the eastern margin of the San Juan Basin.

The Nacimiento fault is an upthrust that dips steeply at deep structural and stratigraphic levels and flattens upward. Where preserved at high structural and stratigraphic levels it dips gently. Along structure section AA' the fault has about 4,000 feet of stratigraphic separation and 2,500 feet of horizontal movement. Several adjacent high-angle faults have the same trend as the Nacimiento fault.

The Nacimiento uplift, the associated synclinal bend, and the Nacimiento fault formed principally by vertical movement. The configuration of the upthrust is due partly to the uplifted block being unconstrained and free to yield over the adjacent basin, and partly to the initial fracture being a curved surface. The arcuate east-trending Cajete fault separates the uplift into two segments; the northern segment was uplifted more and probably has yielded farther westward over the basin along the Nacimiento fault than has the segment to the south. Northward trending high-angle faults along the range margin also appear to be related to development of the uplift; some have undergone the same relative sort of movement as the Nacimiento fault, and others may be the result of tension related to stretching of the uplifted block as it yielded horizontally over the basin.

Evidence of right shift between the uplift and basin during the early development is seen in several minor northwestward-plunging folds arranged en echelon along the synclinal bend that marks the eastern margin of the San Juan Basin (Kelley, 1955; Baltz, 1967). The minor folds are older than the synclinal bend, but are of Laramide age (Baltz, 1967). Thus, right shift between the uplift and basin was followed by the principal movement that was vertical.

ECONOMIC GEOLOGY

A small prospect in the Precambrian rocks near the Rio Puerco (sec. 12, T. 21N., R. 1W.) was being worked in 1970 by the Morningstar Mining Corporation. It consists of a vein 3 to 4 feet wide of sheared country rock with disseminated base metal sulfides and precious metals. The mineralization is probably Precambrian in age.

The Agua Zarca Member of the Triassic Chinle Formation contains minor local azurite and malachite; there is no evidence of major mineralization at the outcrops of the Agua Zarca.

Thin seams of coal in the Mesaverde Group have been mined in this quadrangle (sec. 35, T. 21N., R. 1W.) in the past, but the steep dip of the beds and scarcity of coal precludes major commercial development in the foreseeable future.

The extensive Tertiary-Quaternary terrace and pediment deposits are an excellent source of aggregate used for road surfacing and pit run sub-base. The clasts consist mostly of Precambrian crystalline rocks some of which are as much as 2 feet in diameter. These deposits are commonly rather thin, 2 to 10 feet, but locally are as much as 50 feet thick.

REFERENCES

Baltz, E. H., 1967, Stratigraphy and regional tectonic implications of part of Upper Cretaceous and Tertiary rocks, east-central San Juan basin, New Mexico: U. S. Geol. Survey, Prof. Paper 552, 101 p.

Fitzsimmons, J. P., Armstrong, A. K., and Gordon, Mackenzie, Jr., 1956, Arroyo Peñasco Formation, Mississippian, north-central New Mexico: Amer. Assoc. Petroleum Geologists, Bull., v. 40, p. 1935-1944.

Kelley, V. C., 1955, Regional tectonics of the Colorado Plateau and relationship to the origin and distribution of uranium: N. Mex. Univ., Pub. Geology, n. 5, 120 p.

Muehlberger, W. R., Denison, R. E., and Lidiak, E. G., 1967, Basement rocks in continental interior of United States: Amer. Assoc. Petroleum Geologists, Bull., v. 51, p. 2351-2380.

Renick, B. C., 1931, Geology and ground-water resources of western Sandoval County, New Mexico: U. S. Geol. Survey, Water-Supply Paper 620, 117 p.

Wood, G. H., and Northrop, S. A., 1946, Geology of the Nacimiento Mountains, San Pedro Mountain, and adjacent plateaus in parts of Sandoval and Rio Arriba Counties, New Mexico: U. S. Geol. Survey, Oil Gas Inv. Prelim. Map 57.