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1956, pp. 143-146. https://doi.org/10.56577/FFC-7.143

in:

Southeastern Sangre de Cristo Mountains, Rosenweig, A.; [ed.], New Mexico Geological Society 7 th Annual Fall Field Conference Guidebook, 151 p. https://doi.org/10.56577/FFC-7

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PRECAMBRIAN GEOLOGY OF THE PICURIS RANGE, NORTH CENTRAL NEW MEXICO

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INTRODUCTION

The Picuris Range, or prong, is a semi-isolated mountain spur of Precambrian rocks that juts westward into the Rio Grande trough or valley between Espanola and Taos, New Mexico. The entire range is in Taos County except for a small area in the vicinity of Dixon, which is in Rio Arriba County. The area investigated covers approximately 150 square miles, most of which lies east of U. S. Highway 64.

The author became interested in the geology of this area while he was operating the Harding Mine and undertook in 1947, 1948, and 1949 geologic field work and laboratory studies that permitted the preparation of Bulletin 30, New Mexico Bureau of Mines and Mineral Resources. The report was also submitted in November, 1950, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

PRECAMBRIAN ROCKS

The Precambrian rocks other than the Embudo granite are grouped into two formations, the older of which has been termed the Ortega formation and the younger the Vadito formation. In turn each of these formations has been divided into members and in some places the members were still further subdivided into minor mappable units.

Ortega formation. – The Ortega formation was first proposed by Just who used it for quarzite that is exposed in the Ortega Mountains some 25 miles northwest of the Picuris Range and across the Rio Grande valley. Both at the type area and in the Picuris Mountains the Ortega formation consists of meta-sedimentary rocks and has been divided into several members. The basal member is a sequence of quartzites and has been termed the lower quartzite member by the author. It consists of coarse-grained quartzite in thin beds of sillimanite-kyanite gneiss. It is at least 2,500 feet thick as exposed in the Picuris Mountains.

Overlying the lower quartzite member with apparent conformity is the Rinconada schist. The Rinconada schist may be locally subdivided into andalusite-biotite hornfels at the base, staurolite-rich schist and gneiss, quartzite with a distinct local cliff forming bed, and muscovite-quart-biotite-garnet phyllite with thin calcareous beds. The combined thickness of these intervals varies from 800 feet to as much as 1,850 feet in the Picuris Mountains. The Pilar phyllite which conformably overlies the Rinconada schist consists of gray to black carbonaceous quartz-muscovite phyllite with a slaty cleavage and is as much as 2,300 feet in thickness.

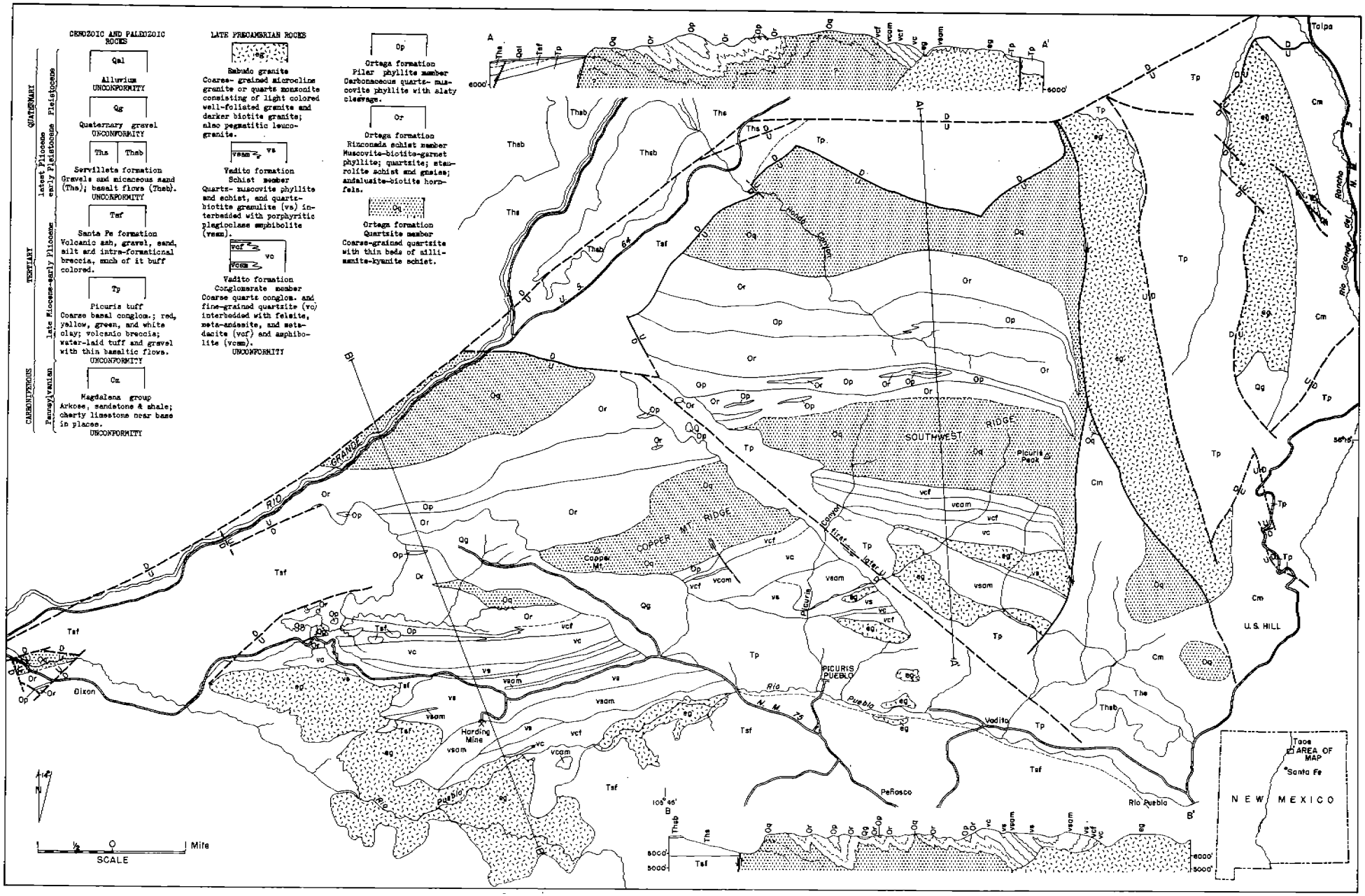
Vadito formation. – The Vadito formation unconformably overlies the Ortega formation and has been divided by the author into the lower conglomerate member and the upper schist member. In turn, the lower conglomerate member has been divided into basal quartzite and conglomerate interbedded with felsites, meta-dacites, and meta-andesites, conglomerate and quartzite interbedded with amphibolites, coarse quartz conglomerate, and fine-grained quartzite with minute scales of muscovite. The schist member which overlies the conglomerate member with conformity , has been divided into two minor units. The lower one consists of quartz-muscovite schist interbedded with with flows of plagioclase amphibolites and containing sills of partly porphyritic plagioclase amphibolites. Overlying this is a sequence of quartz-muscovite schist, quartz-muscovite, and quartz-biotite granulite. The total thickness of the Vadito formation is as great as 4,500 feet; the conglomerate member ranges up to 2,000 feet in thickness, and the schist member varies up to as much as 2,500 feet in thickness.

Embudo granite. – The Embudo granite intrudes the older meta-sedimentary rocks in the Picuris Range, and the exposed areas are believed to be only apophyses and stock-like bodies from a much larger underlying granitic mass. The granite is microcline-rich, but is also relatively rich in soda. The modal analyses of thin sections of various occurrences show the following percentage ranges: quartz, 26-50%; microcline, 20-35%; albite-oligoclase, 26-33%; biotite etc., 0-10%.

In addition, there are limited exposures of biotite granite, gneissic granite, and neutral granite in the area.

Dikes and veins. – Pegmatites are locally very abundant in the Picuris Mountains, their general distribution being apparently controlled by proximity to major granitic bodies. The pegmatites of the Picuris Range vary in size

* Editor's note: This discussion is an abstract of Bulletin 30 of the State Bureau of Mines and Mineral Resources, New Mexico Institute of Mining and Technology. The abstract was prepaired by the editorial staff with the Author's permission.



GEOLOGIC MAP OF THE PICURIS RANGE. AFTER MONTGOMERY.

from thread-like veinlets to large dikes several feet thick and hundreds or thousands of feet in length. However, a thickness of greater than 10 feet is unusual.

Pegmatites of the Picuris Range are of the common coarse-grained granitic types with only a few exceptions. In general they are simple in compostion, but locally may be more complex. Coarse aggregates of flesh pink microcline and white to pale smoky quartz usually form about 90% of the masses. Partly perthitic microcline occurs as blocky masses near the centers and locally along the sides of the thicker dikes. Quartz, however, is likely to occupy the cores. Coarse books of silvery gray to grayish green muscovite appear near the centers and also along the borders of the pegmatites. Platy to sugary and fine-grained albite commonly is present as a partial replacement of the microcline. Thin sprinklings of tiny brownish red spessartite crystals are also common. A number of the smaller pegmatite veins in the Picuris Range contain rough prisms or knobby crystals of white beryl several centimeters or larger in maximum dimensions. Platy crystals of black columbite-tantalite are sparingly present in some of the pegmatites. Cleavelandite is a common associate of the beryl and columbite. The Harding pegmatite is characterized by immense concentrations of lithium, tantalum, and beryllium, but only one other complex pegmatite is known in the Picuris Range. This occurrance is in the lower quartzite of the Ortega formation about a mile up Fletcher Canyon in the vicinity of Pilar. This small pegmatite is regarded as complex because it contains fairly abundant lepidolite in coarse platy aggregates. In the southern part of the range coarse black tourmaline is common in some of the pegmatites, but is rare or unknown in the northern part.

Aplite dikes. – Aplite dikes as stringers that cut the granite and some of the metamorphic rocks are common at a number of places in the range. Aplites of the Picuris Range are fine-grained flesh pink to gray-white rocks that form dikes only a few centimeters in average thickness. Thin sections show that they are a mosaic of microcline and quartz.

Quartz veins. – Quartz veins are also abundant in the Picuris Range. Locally these are ore bearing and contain traces of copper, gold, tungsten, lead, silver, and bismuth.

Diabase dikes. – A few scattered diabase dikes lie east and west of the strip of Picuris tuff that crosses the range from Pilar to Vadito. Most of these dikes are as much as 50 or 75 feet in thickness. The material is quite typical of diabase inasmuch as it is coarse-grained, dark olive green to brownish-black in color, exhibits closely spaced, square set blocky jointing, and breaks down on weathering to nodular bodies. The diabase has the usual ophitic texture with criss-crossing lathes of plagioclase and interstitial patches of coarse rounded grains of augite.

PALEOZOIC AND CENOZOIC ROCKS

A lithologic study of the Precambrian rocks in the Picuris Range formed the major part of the investigation, but inasmuch as both Paleozoic and Cenozoic strata are exposed in the area some attention is given to these sediments.

Pennsylvanian rocks

Folded but relatively unmetamorphosed Pennsylvanian rocks assigned to the Magdalena group overlap the Precambrian crystalline rocks uncomformably or are faulted against these rocks along the eastern boundary of the Picuris Range. These Paleozoic rocks extend along the structural sag between the Picuris Range and the Sangre de Cristo Mountains from the lower reaches of the canyon of Rio Ranchos de Taos across U. S. Hill and to the canyon of the Rio Pueblo. They consist chiefly of arkose, quartzite, conglomerate, shale, and some limestone. They are believed to be Des Moines in age.

Tertiary and Quaternary rocks

Picuris tuff. – Tuffs that have been assigned to the Picuris tuff of Cabot are exposed at a number of areas in and adjacent to the Picuris Range and notably so in Arroyo Miranda. At the base there is usually a coarse conglomerate derived from Precambrian and Paleozoic strata above which there are thin layers of red, yellow, olive-green, or white clay. Above this are boulder beds with a clayey or tuffaceous matrix overlain by beds of coarse, hard, pinkish volcanic breccia that is associated with soft white volcanic breccia as well as with beds of shale and compact marl. Locally there are thin and highly altered basalt flows. Higher in the section are thick strata of gray-white water-laid tuff interbedded with coarse and fine gravel and some very coarse boulder beds. Toward the top, the sequence consists of pebbles, cobbles, and boulders of these strata, the cobbles and boulders being derived largely from volcanic rocks in contrast with the dominantly Precambrian and Paleozoic types near the base of the sequence. The Picuris tuff is estimated to be as much as 1,250 to 1,750 feet in thickness.

Santa Fe formation. – Tilted alluvial beds of the late Miocene or early Pliocene Santa Fe formation border much of the western half of the range. The unit is characterized by its usual pale pink to buff color and its extremely fine sandy or clayey texture. Thin layers of gravel are present locally, the pebbles frequently consisting of volcanic material. The Santa Fe overlies the Picuris formation locally, but elsewhere rests directly on the Precambrian.

Servilleta formation. – Unconformably overlying both the Picuris and Santa Fe beds north of the range are nearly horizonal beds with intercalated flows of basalt. These have been named the Servilleta formation by Butler. Gravel and basalt flows of this formation also are downfaulted against Santa Fe beds north of the northeast part of the range and near Pilar. Near Rinconada and Embudo thick beds of buff colored sand and clay of the Servilleta formation are faulted against Santa Fe beds.

GEOLOGIC STRUCTURE

The metasediments of the Picuris Range show a general east-west strike and steep southward dips as the result of intense isoclinal folding. Two major anticlines and two major synclines with amplitudes of one to two miles are exposed. The folds are doubly plunging, and the angles of plunge average from 20° to 30 . In addition, there are numerous small folds of several hundred feet in average amplitude that are associated with the major folds. Their plunges and axial planes conform to those of the larger folds. The longer folds, from north to south, have been named the Pilar anticline, Hondo syncline, Copper Hill anticline, and Harding syncline.

Two major faults cut across the east-west structure of the range, the Pilar-Vadito fault and the fault paralleling Alamo Canyon. These are believed to be older tear faults, but very recent movement has occurred along the Pilar-Vadito fault. A third major fault may occur along the alluvial area bordering Copper Mountain road. No direct evidence could be found for it and there has been no observable dislocation of beds as in the case of the Pilar-Vadito tear fault. It is possible that the two great faults for which good evidence exists may have formed originally in very late Precambrian time, but evidence in support of this is very indirect. They could have been associated with Laramide deformation. Small faults can be observed at several places in the range and are both transverse and longitudinal.

The border faults of the range are normal faults along which the ancient crystalline rocks have been uplifted to their present high level above the flanking Tertiary beds. Most of this normal faulting occurred between middle and late Tertiary time although some of the movement may be Quaternary.