Volcanic rocks of southwestern New Mexico

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are thin-bedded oyster-rich limestones with several massive local limestone beds. These limestones are overlain by brown shales, which grade into both the underlying and overlying limestones. Above the shales are thin beds of limestone bearing echinoids and **Orbitolina**. The echinoid limestones are overlain by a massive limestone bed several hundred feet thick, which contains **Orbitolina** and **Toucasia**.

The upper clastic formation, is composed mostly of quartz sandstone with some shale, and is locally interbedded at its base with thin limestone beds of the uppermost part of the medial limestone formation. Fossil wood is abundant. Several silty marine limestone beds occur in the uppermost beds exposed. This formation is overlain unconformably by Tertiary rocks.

These same three formations are recognized in the Sierra Rica, the Apache Hills, and in the Animas Mountains.

In the Cerro de Muleros, near El Paso, Böse (1910) describes a Cretaceous section composed of 250 feet of limestone of Fredericksburg and Washita age, overlain by 350 feet of quartzose sandstone of Eagle Ford age. This section is lithologically similar to the upper part of the limestone formation and the lower part of the upper clastic formation of the Big Hatchet area. However, the age of the limestone in the Big Hatchet Mountains is tentatively considered as the same as that of the similar limestone of the Little Hatchet Mountains, which is Trinity in age. A more thorough study of the lithology and faunas of these areas is required before a final correlation is made.

The lithologic and faunal similarity of the Big Hatchet Mountains Cretaceous succession with that at Bisbee, Arizona, (Ransome, 1904) is significant. At Bisbee the three lithologic subdivisions are recognized. The lower clastic unit, the Morita formation, is composed largely of red beds. It is overlain by a limestone unit, the Mural limestone, which has most of the general characteristics described for the corresponding unit in the Big Hatchet Mountains. The thin-bedded oyster-rich limestone is overlain by brown shale, which in turn is overlain by thin-bedded limestones bearing echinoids and **Orbitolina**, and which is capped with a massive limestone bearing **Orbitolina** and **Toucasia**. The limestones are overlain by a thick sandstone unit, the Cintura formation. At Bisbee the basal clastic formation is thicker and the limestone formation is thinner than in the Big Hatchet Mountains. The total measured thickness of Lower Cretaceous rocks at Bisbee is about 4200 feet, and in the Big Hatchet Mountains is about 7000 feet.

Anomalous to this apparently simple stratigraphic picture of southwestern New Mexico and southeastern Arizona is the 20,000 feet of Lower Cretaceous rocks reported by Lasky (1947) in the Little Hatchet Mountains. The writer believes that Lasky's section may include at least one duplication. If this contention is true, the section in the Little Hatchet Mountains will be virtually the same in lithology, fauna, and in thickness as that of the Big Hatchet Mountains.

VOLCANIC ROCKS OF SOUTHWESTERN NEW MEXICO

by
Eugene Callaghan

There can be little doubt that almost all of southwestern New Mexico as well as the adjoining part of Arizona was once covered by a great blanket of extrusive igneous rock which is co-extensive with similar rocks in the Sierra Madre Occidental of Mexico. Where this blanket overlaps the Colorado Plateau, as in the Datil region of New Mexico, it is still an unbreached cover but in the Basin and Range Province it is warped and broken. In many of the positive blocks the volcanic cover is stripped so that underlying formations are revealed and the volcanic succession is exposed.

The relation of the various units in the volcanic sequence can be important in the search for mineral deposits. Some units contain mineral deposits, some are later, and many cover or hide a deposit. The accident of erosion permitted the stripping of the post-mineral volcanic cover from the Santa Rita area so that the mineral deposits were revealed.

Probably the most abundant and certainly the most prominent part of the volcanic sequence is the group dominated by rhyolites and associated welded rhyolitic tuffs which is later than most of the intrusive igneous rocks and mineral deposits. These rocks tend to stand out prominently in cliff slopes and to make up large parts of many of the ranges, particularly near the Arizona line. The group differs from place to place and contains basaltic andesites, possibly some andesites, and latites of varying composition. The exact age of these rocks is un-

known. For the most part, they are probably of late Miocene age but doubtless extend into the Pliocene. They are overlain and in part are interbedded with the gravels and conglomerates of the basin-filling Santa Fe group.

Basaltic lavas which are of several different ages represent the latest phase of igneous activity. Some are interbedded with gravels and conglomerates; some cap buttes and mesas as in the vicinity of Hachita, and some have spread over the floors of valleys as at Animas.

Volcanic rocks that underlie the great group of rhyolitic rocks noted above provide many more problems. The great bulk of these rocks is of intermediate composition and consists for the most part of gray or purplish andesitic or latitic breccias. Basaltic rocks doubtless occur with these rocks as do rhyolites. The rocks of this intermediate group are much less extensive in their distribution than the later rocks of the rhyolite group. In many places, they were removed by erosion before rocks of the rhyolitic group were extruded. They generally erode to rounded or mature slopes in contrast to the cliff slopes of the rhyolite group and may be partly covered by debris or by the later volcanics and basin-filling rocks. Of particular importance is the fact that in many places such as Silver City, Kingston, Tres Hermanas, Pyramid Mountains and other areas they are intruded by grani- anitoid rocks, and are extensively altered and mineralized. In many of the intrusive areas these volcanics are converted to hornfels.

In some reports, such as the Silver City Folio, these intermediate rocks are designated as Upper Cretaceous. In the Little Hatchet Mountains and in the Pyramid Mountains, Lasky has called these rocks Lower Cretaceous. In other places they are regarded as Tertiary. In the Little Hatchet Mountains andesitic breccias are interbedded with Lower Cretaceous limestones and seem almost certainly to be of Lower Cretaceous age. Elsewhere these rocks lie upon other rocks such as the Upper Cretaceous sediments in the Silver City area, and are overlain by other volcanic rocks or by later conglomerates and gravels so that no exact dating is possible. By analogy with other regions it seems reasonable to regard these rocks as of Tertiary age. Some may be as late as Mid-Miocene, but some might be Oligocene or Eocene. It is hoped that the detailed mapping now under way in the southwest will permit sorting out the units of different ages in this group. Owing to the fact that these rocks are commonly the hosts of ore deposits, this study is of very real importance.

Intrusive igneous rocks have been worked out in great detail in the Santa Rita area and the reader is refered to the article on Santa Rita for a resume devoted in part to the intrusive sequence.

TERTIARY – QUATERNARY SEDIMENTS OF THE RIO GRANDE VALLEY IN SOUTHERN NEW MEXICO

by
Frank E. Kottlowski

Cenozoic sediments in southern New Mexico are extensively confluent with the Cenozoic volcanic rocks as the sediments are interbedded with and are in large part derived from volcanic series. As exposed and preserved near the Rio Grande Valley, the Cenozoic sediments are divisible into five broad units: (I) conglomerate, red sandstone, red clay, and gypsum unconformable on strata from Precambrian to Cretaceous in age, interbedded or interlensing with latitic, andesitic, and purplish rhyolitic volcanics; (II) arkosic, pumiceous, and tuffaceous sandstones interbedded with rhyolite welded tuff, and beneath the Uvas* basaltic andesite; (III) lower conglomerates and pebbly sandstones of Santa Fe group**; (IV) upper varicolored unit of Santa Fe group which contains a Pliocene fauna; (V) the uppermost bolson and valley fill sediments, contains many Pleistocene vertebrate fossils, and includes river sands and gravels, eolian sands, playa silts, local pediment gravels, lake clays, and three series of basaltic volcanics. The above units are covered in many places by Recent alluvium and in places are difficult to differentiate from their own debris.

Near El Paso the late Cenozoic sediments consist of two series equivalent to units IV and V above. A thin mantle of Pleistocene and Recent fluvial sand and gravel, eolian sand, and lacustrine clay, cemented in part by caliche, caps La Mesa west of Mesilla Valley and the surface of the Hueco bolson northeast

*Manuscript name.

**Manuscript report of Santa Fe Area proposed the Santa Fe formation be raised to group status, upper Miocene to Pleistocene age (Baldwin, Kottlowski, and Spiegel).