Stratigraphy of Outcropping Permian Rocks in Parts of South-Central New Mexico

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STRATIGRAPHY OF OUTCROPPING PERMIAN ROCKS IN PARTS OF SOUTH-CENTRAL NEW MEXICO

INTRODUCTION

The ensuing account of Permian stratigraphy in parts of south-central New Mexico is based on field observations, both published and unpublished, by a number of observers who have worked in the basins and uplifts of that area during the last thirty years. Although the subsurface data that are available have been taken into account in preparing this resume they add only a small quantity of information to that available in the outcrops. It seems likely, however, that in the next decade considerable information derived from drilling will be available and will both modify and refine concepts expressed here.

BELTS OF OUTCROPPING PERMIAN ROCKS COVERED

This account considers the belts of outcropping Permian rocks in the central and northern parts of the Sacramento, the Oscura, San Andres, Caballo, and Mimbres Mountains as well as in several minor ranges of hills. In all except the Mimbres Mountains the Permian belts of outcrop are sufficiently continuous to provide information regarding lateral changes in lithology. However, in the Mimbres Mountains, the exposures of Permian strata are very discontinuous and lateral relations can be determined only by inference.

SEQUENCE OF PERMIAN ROCKS IN CENTRAL NEW MEXICO

Permian rocks ranging in age from Wolfcamp to Guadalupe(?) crop out in parts of central New Mexico. In ascending order these are the Bursum, Abo, Hueco, Yeso, Glorieta, San Andres, and Bernal formations. Although it is possible that younger Permian strata were deposited in parts of the area, the pre-Upper Triassic erosion surface has truncated older formations to depths sufficient to preclude the possibility of preservation of such strata.

BURSUM FORMATION

The Bursum formation was first described by Wilpolt and his associates (1946), the type exposures being in the northern foothills of the Oscura Mountains. The Bursum formation consists, at the type locality, of red sandstone, shale, and siltstone interbedded with and overlain by limestone. The sequence is approximately 200 feet thick and contains species of *Schwagerina* as well as numerous larger invertebrates that have not been adequately studied. The Bursum formation is regarded as lower Wolfcamp in age and hence Permian in the sense of the West Texas sequence.

Inasmuch as the Bursum formation rests with apparent conformity, at many localities, on the underlying Pennsylvanian strata, some geologists (Wilpolt, 1946; Read, et al., 1947) have included it in the Magdalena group. Such usage, although out of accord with concepts of systems, is reasonable in the sense that in this area the marine incursion of Pennsylvanian time persisted through early Wolfcamp.

ABO FORMATION

Overlying the Bursum formation conformably is the Abo formation believed to be dominantly of Wolfcamp age. However, the upper part may be of lower Leonard age as indicated by King (1942). Named by Lee (1909), the Abo formation at the type section in Abo Canyon in the Manzano Mauntains is over 800 feet thick (Needham and Bates, 1943). These authors, however, included a part of the lower or Meseta Blanca member of the Yeso formation in the Abo according to more recent definitions of the boundary.

The Abo formation at the type section consists of arkosic and quartzose sandstone and conglomerate, limestone conglomerate, siltstone and shale. The sequence is dominantly reddish-brown and many of the sandstone beds are characterized by irregular bases that are suggestive of old buried channels.

All of the available data indicate that the Abo formation is nonmarine. It locally contains remains of land plants and a few stegocephalians have been reported from it.

As earlier stated, most of the Abo is believed to be of Wolfcamp age. It seems likely, however, that the uppermost beds may be early Leonard age (King, 1942). The early data bearing on this were largely paleontological, but more recently (King, 1945) subsurface studies have confirmed the correlation.

In south-central New Mexico the Abo formation ranges in thickness up to as much as 1,400 feet. Locally, it thins to about 300 feet and in extreme southern New Mexico disappears as a result of interfingering with the Hueco limestone.

HUECO LIMESTONE

As originally defined in the Hueco Mountains, the term Hueco limestone included rocks of Mississippian , Pennsylvanian, and Permian ages (Richard-

son, 1904). However, usage was restricted (King, 1942) by several later authors and at the present time the term is applied to a carbonate and shale sequence of Wolfcamp and early Leonard ages.

In the Hueco Mountains of Texas and southern New Mexico the faunally and lithologically distinct Hueco limestone rests on rocks of the Magdalena group and is overlain by the Bone Spring limestone or its equivalents. However, traced northward, the Hueco interfingers with the Abo and with the lower part of the Yeso in the southern part of the Sacramento Mountains as well as in the San Andres Mountains.

Yeso Formation

The Yeso formation was first described by Lee (1909) based on exposures in the vicinity of Mesa del Yeso, a landmark east of Socorro, New Mexico, and on the margin of the Rio Grande trough. More recently, Needham and Bates (1943) redescribed the formation and still later Wilpolt and his associates (1946) made a minor adjustment in the position of the base.

The type sequence of the Yeso formation includes, in ascending order, the Meseta Blanca, Torres, Canas, and Joyita members, and is about 1,700 feet in thickness. The basal or Meseta Blanca member consists of rather uniformly bedded reddish-brown fine-grained sandstone and siltstone that locally contain an abundance of casts of halite crystals. The Meseta Blanca member is locally as much as 355 feet thick and is overlain by the Torres member. The latter consists of beds of fine-grained orange-red and buff sandstone and siltstone, gray dense limestone, and gypsum, and ranges up to 1,000 feet in thickness. The lower part of the Torres member interfingers with the Meseta Blanca member southward and southeastward from the type area.

The Canas member of the Yeso formation is chiefly gypsum and locally is as much as 150 feet thick. It is overlain in the type section by cross-bedded orange-red sandstone about 200 feet thick and named the Joyita member of the Yeso formation. Although both of these members are locally well developed neither can be widely traced and over wide areas have been included in the Torres member.

Glorieta Sandstone

Resting conformably on the Yeso formation and locally interfingering with it is the Glorieta sandstone. Named by Keyes (1915) from exposures near the town of Glorieta in Santa Fe County, it was at first believed to be Cretaceous in age but was shown by Hager (1919) and Rich (1921) to be Permian.

The Glorieta sandstone is well developed in parts of northern and north-central New Mexico where it locally attains a thickness of as much as 250 feet but decreases in thickness southward and southeastward.

San Andres Formation

The San Andres formation was named by Lee (1909) from exposures in Rhodes Pass in the San Andres Mountains, Sierra County (formerly Socorro County), New Mexico. At that locality the San Andres formation is approximately 600 feet thick although an unknown interval is absent due to pre-Triassic and pre-Cretaceous erosion.

Typically, the San Andres formation consists of dark-gray limestone, many beds of which are quite dense. One or more beds of sandstone may be present in the sequence. In the Oscura Mountains as well as in the vicinity of Socorro the San Andres formation contains several beds of gypsum (Wilpolt, 1951; Kelley and Silver, 1952)

The San Andres formation is conformable on and transitional with the Glorieta sandstone. Traced southward from the type locality of the Glorieta in Santa Fe County, the San Andres thickens as the upper part of the Glorieta thins. In consequence the two formations may be regarded as different facies of sediments deposited during a single stage of Permian time.

Bernal Formation

Overlying the San Andres formation with apparent conformity is the Bernal formation of some authors (Bachman, 1953). Although probably absent in much of south-central New Mexico it is locally present in the Jicarilla Mountains and adjacent parts of the Tularosa Basin and it seems likely that it will be noted elsewhere in southern New Mexico.

The Bernal formation is chiefly a sequence of orange and brownish-red siltstone and fine-grained sandstone beds although there are interbedded limestones and gypsums at many localities. Its thickness is quite variable owing to the irregular depths of the pre-Triassic and pre-Cretaceous erosional planes and it is rare that the Bernal interval exceeds 300 feet.

The Bernal formation is believed to represent some part of the "Whitehorse" or Chalk Bluff group of the Pecos Valley. In view of uncertainties regarding details of its correlation it seems appropriate to continue the use of the term Bernal formation until more data are available regarding its lithologic variations and geographic distribution.

REGIONAL VARIATIONS

In Figures 1, 2, and 3, some of the regional variations in stratigraphy are graphically shown.

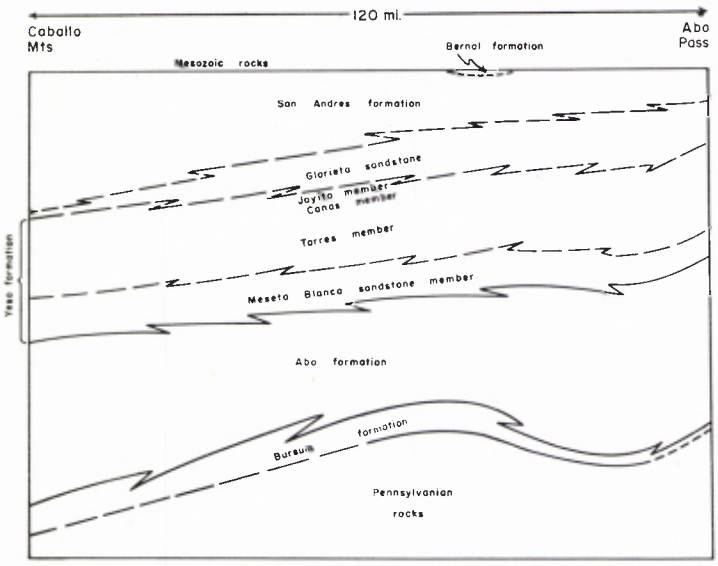

FIGURE 1. DIAGRAM SHOWING RELATIONSHIPS OF PERMIAN ROCKS BETWEEN ABO PASS AND CABALLO MOUNTAINS, SOUTH-CENTRAL NEW MEXICO

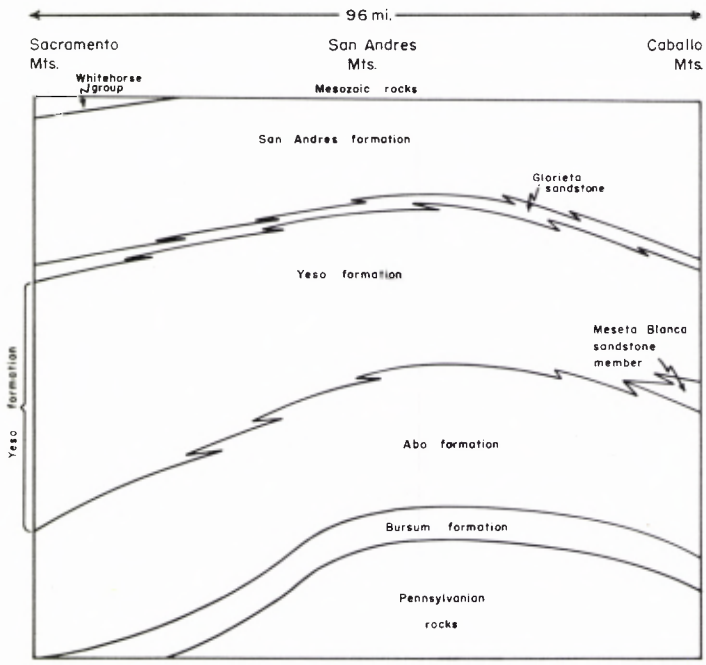

FIGURE 2. DIAGRAM SHOWING RELATIONSHIPS OF PERMIAN ROCKS BETWEEN CABALLO MOUNTAINS AND SACRAMENTO MOUNTAINS, NEW MEXICO

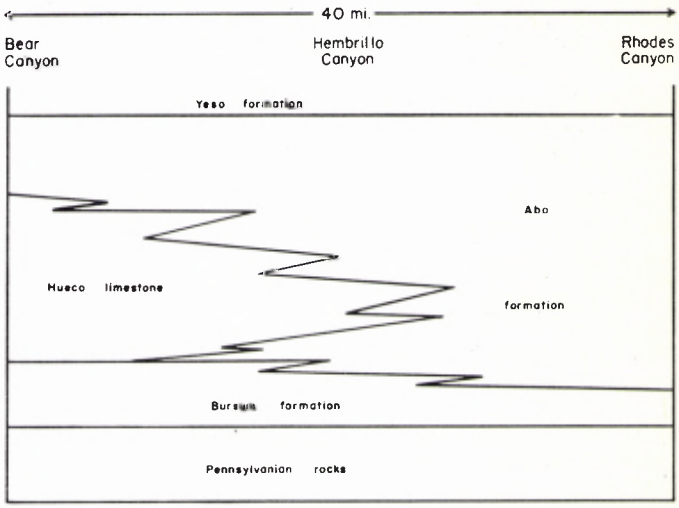

FIGURE 3. DIAGRAM SHOWING THE RELATIONSHIPS OF THE HUECO LIMESTONE TO THE ABO AND BURSUM FORMATIONS IN THE SAN ANDRES MTS.

The line of Figure 1 extends from Abo Pass in the Socorro area south to the Caballo Mountains and shows the gradual southward thickening of the Bursum formation, as well as local irregularities of the Abo.

The Yeso formation is apparently rather constant in thickness although it shows a gradual southward change from a gypsiferous to carbonate facies. The Glorieta sandstone is seen to diminish in thickness southward and to interfinger both with the underlying Yeso and the overlying San Andres formations. The latter notably increases in thickness southward although it is, except in one small area in the line of the section, truncated by Mesozoic planes of erosion. Locally, the Bernal formation rests conformably on the San Andres but along much of the line it has been removed by pre-Upper Triassic or pre-Cretaceous erosion.

In Figure 2, regional trends along a line from the Caballo Mountains to the Sacramento Mountains and normal to Figure 1 are shown. It is clear that both the Bursum and Abo formations show little change in character or thickness. The Yeso formation as well as the San Andres gradually thickens to the east while the intervening Glorieta sandstone is relatively constant in thickness.

Projected into the line of the section from the area around Sierra Blanca is the Whitehorse group which is believed to be equivalent to the Bernal formation and is preserved at many localities in the Jicarilla Mountains.

Some of the general relationships of the Hueco limestone to the Abo formation in parts of the San Andres Mountains are shown in Figure 3. In the southern part of the mountains, in the vicinity of San Augustin Pass, a tongue of Hueco rests directly on the Bursum formation and the thin sequence of red beds locally present is assigned to the upper part of the Abo. In the vicinity of Bear Canyon, about 9 miles north of Organ, the upper Abo tongue is 180 feet thick. About 15 miles to the north of Bear Canyon a thin tongue of Abo has been noted below the Hueco and at Hembrillo Canyon, 30 miles north of San Augustin Pass, the last remnant of the Hueco interfingers with the Abo.

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