Basin and range structure in southwestern New Mexico

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Sun is reported to have quit-claimed the portions of the Armendariz Grant which they leased from the Victorio Land and Cattle Company prior to the drilling of their two wildcat oil tests.

Future outlook

Geological information which will enable the industry to make more adequate evaluations of the potentialities of southwestern New Mexico is just beginning to become available. The New Mexico Bureau of Mines, under the direction of Dr. Eugene Callaghan, has made tremendous strides in the past few years in making additional geological information available to the public. Reports such as those now being compiled by Dr. Frank Kottlowski on the Las Cruces area, and Robert A. Zeller, Jr. on the Big Hatchet Mountains, together with other reports in progress, will be invaluable in assisting the petroleum industry to interpret the geology of this region.

BASIN AND RANGE STRUCTURE IN SOUTHWESTERN NEW MEXICO

by
Eugene Callaghan

A glance at the Tectonic Map of the United States will show that southwestern New Mexico is within the zone of Basin and Range structure at the southeastern point of the Colorado Plateau. A second look will show that the Basin and Range structural elements which trend northwesterly south of the international border split in New Mexico into those following a northerly course in the Rio Grande and Tularosa valleys and those trending northwesterly along the south side of the Colorado Plateau through Arizona. Long ago it was pointed out that base and precious metal mining districts are distributed through the Basin and Range area outside of the Colorado Plateau.

Folds and faults together with the variable erosional and depositional history of different blocks provide for the present appearance of this region. In Basin and Range areas, certain blocks are elevated and others are depressed. Adjustments between adjoining blocks may be accomplished by folding or warping, but commonly the relative movements cause breaks or faults of varying pattern, length, and displacement. The pattern is controlled by regional horizontal pressures; the vertical movements are caused by vertical pressures of varying intensity acting from below and in line with the force of gravity.

The various blocks do not necessarily move simultaneously. Seemingly, a few blocks in a large area are particularly active and will rise rapidly to produce very abrupt slopes that are in marked contrast to their surroundings. At the same time other positive blocks will remain at about the same position and may be reduced to a mature erosion surface. Thus a block such as the Big Hatchet Mountains will stand out distinctly in contrast to its subdued neighbors. Doubtless, some blocks that tend to remain low for long periods later rise as positive blocks.

As a consequence of their varying structural and erosional history, the various positive blocks will differ in their formational content. For example, the Big Hatchet Mountains are characterized by Paleozoic formations in contrast to Mesozoic formations in the Little Hatchet Mountains and Mesozoic and Tertiary formations in the Animas Range. Long ranges such as the Peloncillo Mountains may reveal cross warps so that older formations are exposed where relative elevation has been greatest and younger formations where upward movement has been less.

The internal structure of both positive and negative blocks may be complex, in part from internal adjustments during Basin and Range faulting, and in part from older structural disturbances. During Paleozoic time positive and negative movements of relatively slight differential amounts caused changes in thickness and lithologics of the various formations, as well as accounting for non-deposition in certain areas. Of Mesozoic rocks, only the Lower Cretaceous is thick and extensive. The occurrence of conglomerates and volcanic rocks in Lower Cretaceous beds suggests that some movements had taken place or were taking place at this time. Subsequent to the deposition of Cretaceous rocks a compressional epoch, generally called Laramide, produced extensive thrust faulting which was probably followed by some normal faulting.

The Tertiary record is obscure, particularly of the earlier Tertiary history. Presumably structural disturbances and some volcanic and intrusive igneous activity and mineral deposition as well as erosion took place in the early Tertiary. Middle and later Tertiary time saw the accumulation of a great blanket of volcanic rocks, dominated by rhyolite, but containing a wide variety of types. Domes of rhyolite were in part intrusive and in part extrusive. Doubtless some deformation accompanied this igneous activity. Some water-laid sediments were deposited in basins in the volcanic area. As volcanic activity waned, erosion and deposition of debris became the dominant characteristic of the region. Probably Basin and Range faulting became active as volcanism subsided. Certainly the great volcanic cover was warped, folded gently, and broken by the pattern of Basin and Range faults so that today many of the ranges show volcanic rocks in the positive as well as in the negative areas. The negative areas and positive areas that now are deeply eroded are largely covered with debris so that the structural pattern is largely obscured. The incision of the Rio Grande drainage pattern with consequent removal of debris cover has exposed some negative blocks as well as positive areas so that structure as well as other bedrock features are revealed. In some places, particularly in the Tularosa basin, recent fault scarps show that Basin and Range structural dislocation is still in progress.

SOME GEOLOGICAL FEATURES OF THE SANTA RITA QUADRANGLE, NEW MEXICO

by
R. M. Hemon, W. R. Jones, and S. L. Moore*

Introduction

The basic geology of the Santa Rita quadrangle is well known from the published reports by Paige (1916), Spencer and Paige (1935), Lasky (1936), Schmitt (1939), and Lasky and Hoagland (1948). Since 1948 the U. S. Geological Survey has remapped the quadrangle and a preliminary report is in preparation. Some of the conclusions of the report as well as observations of previous workers in the area are incorporated in this resume of the geology.

Regional Setting

The Santa Rita quadrangle lies on the north rim of the Sonoran geosyncline near the southeastern margin of the Colorado Plateau (See Index map of Sonoran geosyncline). The geologic map of New Mexico shows that it also lies within a prominent belt of east-northeast trend characterized by abrupt changes in the regional strike of the rocks, structural disturbances, and prominent igneous intrusions. A prominent set of northwest-striking faults crosses the northeast belt of adjustment within the limits of the Silver City 30-minute quadrangle. Being on the rim of the Sonoran geosyncline, the region is underlain by a relatively thin blanket of sediments of Paleozoic and Mesozoic age. The comparative lightness of this load had a profound effect on the mode of intrusion of the rocks of Late Cretaceous and early Tertiary age, which is described later in this report.

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Rocks

General statement – The rocks of the Santa Rita quadrangle consist of sedimentary rocks, intrusive igneous rocks, metamorphic rocks, volcanic debris, lava flows, and gravel deposits. These rocks, which range in age from Precambrian to Recent, include Precambrian spotted hornfels and mica schist; limestone, shale, and sandstone of Paleozoic age; shale, sandstone, and quartzite of Mesozoic age; diorite sills of Late Cretaceous or early Tertiary age, andesitic volcanic breccia and associated intrusives of Late Cretaceous or early Tertiary age, intrusives of intermediate composition of early Tertiary or Late Cretaceous age, latitic intrusives of Tertiary age, rhyolitic pyroclastic rocks and basaltic flows of Miocene (?), valley fill deposits of Miocene (?), Pliocene, and Pleistocene (?) age, and Quaternary alluvium. The areal distribution of the rocks, grouped and generalized for simplicity, can be seen on the accompaning Generalized Geologic Map of the Santa Rita quadrangle.

Sedimentary and volcanic rocks – The general character of the sedimentary and volcanic formations within the quadrangle is given in the table on pages 120 and 121.

The rocks of Paleozoic age are predominantly limestone with some shale and a little sandstone. Dolomite and dolimitic limestones are restricted to the lower beds of Paleozoic age. The aggregate thickness of the Paleozoic rocks is only about 2800 feet. No rocks of Triassic, Jurassic, or Early Cretaceous age were deposited – – at least, no evidence of them remains. The Upper Cretaceous sedimentary rocks aggregate about 1100 feet, which, added to the Paleozoic section, gives a total thickness of only 3900 feet.

Intrusive igneous rocks – The major types of igneous