

GEOLOGY OF THE CAMERON AND LEUPP QUADRANGLES, ARIZONA

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Two geologic maps, one of the Cameron quadrangle and one of the Leupp quadrangle in the Navajo Indian Reservation in northern Arizona, are being prepared for publication by the U. S. Geological Survey. The maps will be accompanied by structural cross sections and a brief text discussing stratigraphy, structure, geomorphology, mineral deposits, and ground water.

The geology of the two 15-minute quadrangles was mapped by James H. Irwin, Peter R. Stevens, and Robert L. Jackson in 1951 through 1953 as part of a regional investigation by the Ground Water Branch of the U. S. Geological Survey in cooperation with the Bureau of Indian Affairs. The geology was checked in the field and several levels of Pleistocene gravel were mapped by Neal F. McClymonds and J. P. Akers in 1959. The text and cross sections were prepared by J. P. Akers.

Consolidated sedimentary rocks exposed in the Cameron quadrangle range from Permian to Jurassic in age; their combined thickness is about 2,800 feet. Unconsolidated rocks include alluvium of Pleistocene and Recent age and terrace gravel of Pleistocene age. Three lava flows and one cinder cone of Pleistocene age occur within the area. One of the flows temporarily dammed the Little Colorado River.

The bedrock dips generally about 1° to 3° northeast, except in the extreme southwestern corner of the quadrangle near the Black Point segment of the East Kaibab monocline, and in the western part of the quadrangle where small folds, faults, and grabens have deformed the strata and where dips are as much as 11° . Most of the structures in the Cameron area trend north or northwest.

As of July 1, 1959, the Cameron uranium-mining district had produced 270,000 tons of uranium ore, worth an average of \$19 a ton. Forty-four mines within the Cameron quadrangle have produced 160,000 tons of that total. The ore occurs in the upper 30 feet of the Shinarump member and in the lower 60 feet of the Petrified Forest member of the Chinle formation of Late Triassic age. Ore bodies are oxidized at the surface and unoxidized at depth. Complex uranium oxides, sulfates, silicates, phosphates, and carbonates are present in the oxidized zone. Uraninite is common in the unoxidized deposits.

Potable ground water is extremely scarce in the Cameron quadrangle. It is present at depths below 1,300 feet in the Coconino sandstone of Permian age near the anticlinal axis of the monocline in the southwestern corner of the quadrangle, and in lava near Tappan Spring 2-1/2 miles southwest of Cameron. Water in bedrock in the rest of the quadrangle and in the alluvium along the Little Colorado River is marginal or unfit for domestic or stock use, as it contains excessive dissolved solids.

The geology of the Leupp quadrangle is simple. Only two formations, the Moenkopi of Early and Middle(?) Triassic age, and the Chinle of Late Triassic age, are exposed; their total thickness is about 1,600 feet. Unconsolidated alluvium, and a few scattered deposits of terrace gravel of late Pleistocene age, border the Little Colorado River. No folds and only two small faults occur in the quadrangle. The strata dip uniformly northeast at about 1° or 2° . No igneous rock is present within the quadrangle.

Airborne-radioactivity surveys have revealed several anomalies in the Chinle formation, but to date (August, 1959) no ore has been produced from the area.

About 400 gpm (gallons per minute) of water of good quality is available from the Coconino sandstone at depths less than 400 feet in the area within the quadrangle and southwest of the Little Colorado River. Water in the Coconino sandstone northeast of the river contains excessive chloride. Water from the alluvium in the Tolani Lake area and along the Little Colorado River is marginal for domestic use, as it contains excessive sulfate or chloride. Wells in the lake area produce about 15 gpm, and those in the alluvium near Leupp produce about 50 gpm.