STRUCTURAL CONTROL OF THE CANADIAN RIVER IN WESTERN OKLAHOMA*

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INTRODUCTION

The area discussed in this report encompasses more than 4,000 square miles in western Oklahoma (fig. 1) and is bounded on the west by the Texas-Oklahoma state line and on the east by the east line of R. 14 W. The north and south boundaries are the north line of T. 21 N. and the south line of T. 13 N., respectively. Southern Ellis, northern Roger Mills, and all of Dewey Counties are included in the area. The Canadian River flows eastward across the area, dividing it nearly in half. The North Canadian River flows southeastward across the northeast corner of the project area, and the Washita River flows east-southeastward across the southwest quarter.

The surface is slightly rolling and slopes gently S. 50° E. The Canadian River and associated tributaries have cut downward, sharply dissecting the land surface with steep-sided, V-shaped canyons. The present channel of the Canadian River is about 450 feet below the north divide, which is from 2 to 18 miles away, and about 300 feet below the south divide, which is generally less than 3 miles away but is as much as 12 miles distant at a few places.

The dip of the near-surface strata in the area is toward the southeast at less than 1 degree, and, because of the low dip, the surface geology reveals little about the shallow subsurface structure. In such a situation, the question arises as to whether subsurface structures can be revealed by stream patterns. If stream drainage can be related to structure, much time and expense can be saved in the selection of promising seismograph prospects for petroleum exploration. The conclusion of this study is that the course of the Canadian River does reveal such structural control in this area.

The near-surface rocks in the area are red shale, quartzose sand and conglomerate, and anhydrite and salt (no salt is exposed at the surface). Figure 2, a typical electric log for the area, illustrates the stratigraphic sequence immediately beneath the surface. The exposed rock units are, in ascending order: the Permian Blaine anhydrite, Dog Creek Shale, Marlow Formation, Rush Springs Sandstone and the Cloud Chief Formation; the Pliocene Laverne and Ogallala Formations; and various sandstone and gravel units of Pleistocene age. The Blaine anhydrite crops out in the northeast corner of the area and is at a depth of about 900 feet in the western part. The base of the Blaine is the shallowest horizon that can be reliably correlated on electric logs throughout the area.

SURFACE DRAINAGE

The Canadian River originates in the Sangre de Cristo Mountains in northeastern New Mexico. It flows eastward across the Texas Panhandle, following a generally straight course, and enters the western part of Oklahoma where it forms the boundary between Ellis and Roger Mills Counties. The river forms three anomalous U-shaped bends across the area before leaving at the southeast corner, beyond which it follows a straight southeasterly course.

Aerial photographs reveal the braided nature of the river channel, indicating that the sediment load exceeds the transport capacity of the water. It may be that a greater volume of water travels under the surface than within the channel; Reed and Loninecker (1932, p. 13) reported that the river bed is notorious for its treacherous quicksands. According to Lobeck (1939, p. 193), the braided channel and the absence of downcutting classifies the Canadian River as mature and not youthful, despite the steep banks and poorly developed flood plain.

The drainage area of the river is narrow. It is less than 20 to 25 miles wide throughout the area and narrows downstream instead of widening. Logically, the principal source of the water that incised the channel may have been the mountains in New Mexico rather than local rainfall. Alexander (1965, p. 5) and Birchum (1963, p. 5) reported that the Thornthwaite climate classification places this area in the subhumid, mesothermal province, with a deficiency of moisture in all seasons. The mean annual precipitation is 24.3 inches, based upon 27 years of record. Apparently the river has a much greater function carrying water through the area than draining local rainfall, a characteristic typical

*This research paper was done at the University of Oklahoma as a partial requirement towards a BS degree. It was published in the July, 1967 issue of Oklahoma Geology Notes. We would like to express our appreciation to Alex Nicholson, Editor, and to the other members of the State Geological Survey for their co-operation in the reprinting of this article and on many other occasions.- EWMc.