A MAGNETOMETER SURVEY OF AN ANOMALY SOUTH OF VALLEY PARK, MISSOURI, IN SAINT LOUIS AND JEFFERSON COUNTIES

Digest

by

Durward Dudley Young, Jr., B.S.
First Lieutenant, USAF

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The geology of the Ozarks and the geologic features that result from the central doming have been the subject of many of the structural and tectonic investigations carried out in the state of Missouri. The particular feature investigated by this author appears as an elliptical magnetic anomaly on the state magnetic map. This anomalous feature is located in southern Saint Louis County and in northern Jefferson County. It lies roughly between the towns of High Ridge and Valley Park, Missouri. The extent of the area investigated, including the anomalous area, was about 55 square miles.

The problems to which answers were sought through the results of the field investigation are as follows:

a) Determine from the observed field data the configuration of the basement complex in the area of the magnetic high.

b) Determine whether or not the magnetic high indicates a structure which could have controlled the course of the Meramec River in this area.

The choice of the geophysical method to use in this field survey was no problem since the existing magnetic anomaly on the state map showed that ample contrast in susceptibilities existed to warrant the magnetic method. The vertical component magnetometer wasused to outline the structure with stations spaced at approximately one-half mile intervals. The horizontal component magnetometer

was used along a traverse at right angles to the strike (N 63° W) of the major anomaly.

Several interpretation procedures were used in analyzing the observed field data. The first approach at an interpretation involved the use of total intensity vectors in a model experiment. The best agreement of the anomalous vectors in the model experiment occurred with the representative magnet at a depth of 6,720 feet and with a hade angle of about 10° to the southwest. In the next approach at interpretation the anomaly-causing structure was assumed to be a single pole placed at a depth of 2 km. A susceptibility value was experimentally chosen which would give the most sensible geologic answer. This value of K was .015 c.g.s. units. The length was assumed to be 5 km. The body will then have a cross-sectional area of 5 km.^{2}. The vertical field due to this structure was then computed and matched with the observed vertical anomaly curve. A fairly good fit was obtained. This approach was then broadened by assuming that the single pole could be replaced by a series of single poles stacked together and oriented in the direction of N 63° W. This led to the conclusion that this structure could well be some sort of dike. Computed curves over known dikes with similar attitudes and angles of polarization were then presented and compared to the observed vertical curve. A reasonable agreement was noted to exist. The final interpretation

technique, as developed by Peters, gave indications that the anomaly-causing structure was a ridge in the igneous basement complex. Thus, it is seen that two possible answers are obtained; either one alone could satisfactorily explain the anomaly. However, it is also geologically possible that the two structural features are compatible and could possibly exist together and be related to each other. The most favored conclusion proposed is that the basement ridge is the expression of a dike-like intrusion (which is vertical or nearly so) down in the basement. The zone occupied by this dike-like structure could also possibly be a zone along which differential movement has occurred (fault-plane). It is further concluded that this structure could have controlled the Meramec River in its peculiar course around the anomaly. A structure contour map of the St. Peter formation as well as the vertical intensity map helps to corroborate this conclusion.