A MAGNETOMETER SURVEY

OF THE

MAGNETIC HIGHS TO THE EAST OF SAINT CLAIR, MISSOURI

by

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DIGEST

Many magnetic features exist in the State of Missouri that require detailed investigation. One such feature, several miles to the east of Saint Clair, Missouri, has been the subject of the writer's research thesis. The anomaly was first noted on the "Magnetic Map of Missouri," and later on the aeromagnetic map of portions of the Saint Clair Quadrangle published by the United States Geological Survey.

The anomaly lies on the Meramec River, one of the major rivers flowing off of the Ozark Plateau. This river is an intrenched meander that has a variable course through the area. Just to the north of the anomalous conditions, at the coordinates $90^{o}55$ W and $38^{o}25$ N, the epicenter of an earthquake was located. Its depth was placed at 44 kilometers. Still further to the northwest there exists the surface expression of the northwest-southeast striking Moselle Fault. The existence of the above mentioned factors led the author to make a detailed vertical magnetometer survey of the area with the hope of making some positive contribution toward solving the following problems:

1. By means of a vertical magnetometer ground survey in the area of Moselle, Missouri, an investigation of the configuration of the basement complex was made.

2. The results of the ground survey gave control so that:

a. A geophysical investigation of the Moselle fault can be made.

b. Determination of what effect the basement configuration has on the overlying sediments may be realized.

The results of the surface survey, embracing fifty five square miles to the east of Saint Clair, Missouri, and north of State Route 30, revealed a situation not unlike the one that was shown to exist on the State magnetic map and on the aeromagnetic survey map. These features are:

1. A magnetic high on the order of 1300 gammas, four miles long and one and one half miles wide, with a north-south axial orientation;

2. A magnetic low with the same areal extent and orientation;

3. A magnetic high, on the order of 1400 gammas, with the main body orientated N 10° E and a lesser extension axially directed N 35° E.

Remarkable agreement in areal extent and orientation of the anomalies was found to exist between the ground survey and the aeromagnetic survey.

The author utilized a method, developed by the Gulf Laboratories, Pittsburgh, Pennsylvania, for calculating directly from the field observed at the surface a distribution of magnetized rock that will produce this field. To achieve this, the surface intensity was continued downward to the 1600 foot level and then

a structure that could account for this continued intensity was calculated.

The calculated anomaly at the 1600 foot level was found to have very nearly the same size, shape, and location as the surface anomaly, but the range of intensity increased to 2100 gammas.

From the downward continued intensity values a structure with a relief of about 300 feet was proposed. The value for the susceptibility used was 0.0150 cgs units. This value is too high for the porphyry granite that is thought to underlie the Ozark area, and it suggests a basaltic type rock. If the rest of the proposed structure follows the observed field as closely as did the portion calculated, then a block type structure composed of contrasting polarized material (perhaps basalt) seems to have produced the observed field. The block type structure receives strong support from the excellent correlation in size and location that exists between the author's work and that of the gravity work done in the area by Mr. Debkumar Ganguli.

The possibility that the polarization contrast does not actually form the proposed topographic feature seems not unreasonable. A profile of the calculated intensity, when compared with a similarly located profile on the observed field, seems to indicate that the source, while close, is still at a lower depth. Thus it appears that some of the proposed structure above the 1600 foot level is still composed of a granitic material with the

polarization contrast beginning at a lower and still undetermined depth.

The structural feature postulated appears to be pre-Cambrian in origin and not too closely related to the surface geology. Thus the Moselle Fault seems unrelated to it. The Moselle earthquake is to the north of the anomalous condition and its relation to the proposed structure can only be thought of in terms of extending the zone of weakness to the north. The cause of the earthquake would seem to be related to the overall tectonic aspect of the Ozark region and the proposed structure is perhaps an early phase in the same zone of weakness.