

**SOME GRAVITY AND MAGNETIC INTERPRETATION
PROBLEMS IN EASTERN MISSOURI
AND VICINITY**

By

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DIGEST

The objects of this thesis are to determine the cause of the high values of apparent susceptibility in eastern Missouri, to determine the cause of the gravity inversions, and to show how these affect interpretation of magnetic and gravity data in this region.

The high assumed values of apparent susceptibility were found to be due to high magnetite content, as a constituent mineral of the solidified magma, and to high remanent magnetization. The effusive magma of the Missouri basement probably solidified rapidly from above the Curie-point, in the presence of the earth's field, a large remanent polarization being induced. A core sample study showed that the ratio of remanent magnetization to induced magnetization by the present earth's field averaged 1.75. Since the direction of the remanent magnetization was found to be approximately parallel to the present earth's field, interpretation of magnetic data on the basis of high assumed values of apparent susceptibility is valid. The process of thermoremanence is also discussed.

Gravity inversions were found over several structures which were known to be faulted. In every

area of gravity inversions, the same stratigraphic conditions existed. These inversions occurred where the sedimentary section consisted of the Mississippian through the Cambrian. The Devonian and Silurian may or may not be present. Gravity profiles run over the post-Pennsylvanian faulting in Perry County proved that the inversions are not present where the lower Ordovician sediments are at the surface. It was also shown that the basement complex had a density of approximately 2.6 gm/cc. Since the basal sediment had a lower density than the basement and because of the stratigraphic conditions already mentioned, it was concluded that the low density formation must lie in the sedimentary section from the St. Peter sandstone of Ordovician age, up through the Mississippian. It was also shown that the St. Peter-Everton formations were the only formations of some thickness with a very low density. However, the known maximum thicknesses were found to be insufficient to explain the magnitude of the observed anomalies. It was concluded that either abnormally low densities, large thicknesses of known low density layers, or a combination of these two must exist to give rise to the inverted anomalies.

This investigation also revealed that the classical determination of quantitative values for the fault parameters is not valid if several density

contrasts exist at various intervals along the fault plane. The basic assumptions are not fulfilled in this case.

The proposed extension of the post-Devonian faulting in Ste. Genevieve county was located by a gravity survey. It was shown that the gravity data were inverted along the fault, which was found to extend into the area where the known faulting disappears under the Mississippian sediments on the west and into Randolph County, Illinois, on the east. It is postulated that this fault might continue eastward into the Shawneetown-Rough Creek fault zone.

It is also postulated that certain ambiguities in the gravity data found by Whipple and Whitmore may be due to gravity inversions.