

GEOPHYSICAL INVESTIGATIONS OF NEAR-SURFACE GEOLOGIC
STRUCTURE IN THE NEIGHBORHOOD OF SAINT CHARLES,
MISSOURI

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CHAPTER I

INTRODUCTION

Statement of the Problem

The geomagnetic map of the state of Missouri (14)^{*} presents a striking anomaly in vertical magnetic intensity over a region situated immediately south and east of Saint Charles in Saint Louis County. The anomaly occurs as a series of closed elliptic 'highs' attaining a maximum value of nearly one thousand gammas just south-east of St. Charles. These 'highs' are aligned almost parallel to the course of the Missouri River extending in an approximately northeast to southwest direction. The region covered by this anomaly is roughly thirty miles in length and five miles in breadth. A detailed investigation of the geologic cause of this anomaly and its possible effect on the course of the Missouri River which, in this region, alters its course abruptly from a southeastward to a northeastward direction to join the Mississippi River at Alton, Illinois, was first taken up, at the suggestion of the Reverend James B. Macelwane, S.J., in 1949 by a group of graduate

^{*}For references, vide Bibliography.

students of the Saint Louis University, consisting of G. Schaefer, K. C. Chandio, W. Schwendinger, and W. Gabriel. Chandio and Schaefer surveyed the area using the gravimetric and magnetic methods respectively, while Schwendinger and Gabriel employed the electrical resistivity method. These investigators, however, came to rather different conclusions as to the cause of the observed magnetic anomaly and their results were indecisive. Nowadays it is a customary and standard practice in geophysical exploration work to employ as many independent methods as may be found necessary to determine unambiguously the reality of an anomaly which yields only a doubtful indication to one method only, consistent, of course, with considerations of economy and time. In view of the rather indecisive results of the previous investigators of the problem, it was suggested to the author and L. Oriard by Professor Macelwane, S.J., in the fall of 1950 that a seismic survey of the area be made with a view to detect any possible near-surface expression of subsurface geologic structure that would account for the observed magnetic anomaly on the surface. The Institute of Technology of Saint Louis University had just then acquired a portable shallow "refraction" * seismic equipment from the Century Geophysical Corporation

*See page 22

of Tulsa, Oklahoma. The southern portion of the area that had been surveyed electrically by Schwendinger was assigned for seismic investigation to Oriard, while the northern portion which had been previously studied by Gabriel was taken up by the author.

A Brief Review of Previous Work

The magnetic survey of the area was made by Schaefer (16) using the Ruska vertical and horizontal magnetometers. As sedimentary rocks generally possess a low magnetic susceptibility as compared with the high susceptibility of igneous rocks, especially basic igneous rocks, it is but natural to suspect that the cause of as high an anomaly as occurs in this area lies in the igneous basement. The peak of the magnetic anomaly obtained by Schaefer is located roughly at a distance of less than two miles from the river to the south-east as indicated in the map of Fig (1). On the basis of his magnetic survey, Schaefer concludes that the anomaly could be attributed to a narrow dike-like zone of highly susceptible magnetic material within the basement rock at a depth of about 8000 feet directly under the highest part of the anomaly. He, however, states that it is possible that some vertical movement has taken place along the magnetic zone and that separate magmatic