GRAVITY SURVEY OF PART OF ST. CLAIR QUADRANGLE, MISSOURI

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DIGEST

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A magnetically anomalous region, confined more or less within the St. Clair Quadrangle, Missouri and indicated in the State Magnetic Map, was subjected to detailed study by the U.S.G.S. with the help of an airborne magnetometer. The results indicate the presence of a number of magnetic "highs" and "lows".

Interpretation of these anomalies was not available due to the absence of additional information, geophysical or geological, about the area. This, together with other interesting features such as an alteration in the course of the Meramec River and the evidence of faulting in the neighborhood of the area, led the author to undertake a gravimetric survey in the area. The main objects of the investigation were:

1. To see whether gravity anomalies exist and if so, whether they are coincident with the known magnetic anomalies.
2. To investigate the cause of these anomalies and, if possible, to study

the relief of the basement structure.

3. To account for some possible faulting in the area, suggested by other authors.

The field work consisted of a detailed gravimetric survey with the help of an Atlas Gravimeter, Model F, No. 22. Standard methods were used for reduction of the data, though in some cases approximations were accepted. These and the details of the experimental part have been discussed.

The Bouguer Gravity Map indicated a strong regional trend. A Second Derivative gravity map was therefore prepared for interpreting the results. The method suggested by Elkins and also by Rosenbach was used for obtaining the Second Derivative Map.

The results of the survey indicate that gravimetric anomalies, of order undoubtedly much greater than that of the expected experimental error, are present. Besides, these are in good agreement with the known magnetic anomalies. The U.S.G.S. Total Intensity Aeromagnetic Map coincides fairly well with the author's Second Derivative gravity map, and the agreement of the latter with the vertical intensity magnetic map, obtained as a result of another survey made simultaneously with the present one in the same area, is excellent.

In view of the probable values of rock densities and susceptibilities in the area, the main cause of these anomalies are suggested as the irregularities in the basement surface. Part of these irregularities are accepted as erosional remnants on the Pre-Cambrian surface; but, it is believed that some sort of subsequent uplift is also partly responsible. Though positive conclusions regarding this uplift could not be reached due to the lack of geological data, the author is inclined to suggest faulting as the cause.

The interpretation is mainly qualitative with some numerical solutions. One of the prominent features of the Second Derivative map, a closure of gravity "high", can be supposed to represent the elongate upthrown block of a "horst and graben" like structure. Assuming such a structure and with the second derivative values obtained from the map, it has been shown numerically that a block, about 3.5 miles long and 2.0 miles wide, should have a "throw" of about 350 feet if faulting is accepted. Structures of such dimensions are possible. Similar numerical computation for another prominent "high" in the Second Derivative Map has not been done. The reason is that the spacingof contours at the edges of both these "highs" are similar. Therefore, the dimensions of the

associated structures in two cases are expected to be of the same order if similar mathematical treatment is done with the same assumption of faulting.

The change in the course of the Meramec River may be due to the subsequent uplift. The position of the prominent second derivative "high" in the map is such that (if it is supposed to represent the upthrown part of a subsurface structure) the change of the river from the old course to the new one is quite possible.

The gravity map does not indicate the presence of a fault all across the area. This is not in agreement with the idea suggested by Frank that the Moselle Fault extends considerably to the southeast of the town of Moselle. Two possible explanations are offered for this. The direction of the extension may be slightly different from what has been suggested by Frank. Or, the main Moselle Fault may actually be a combination of minor faults in the neighborhood of the surveyed area.