AN INVESTIGATION OF A MAGNETIC DISCONTINUITY IN THE IRON RIVER DISTRICT OF MICHIGAN

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A recent aeromagnetic survey conducted by the United States Geological Survey in cooperation with the Geological Survey Division of the Michigan Department of Conservation revealed the presence of a magnetic gap or discontinuity in the area a few miles southwest of the city of Iron River, Michigan. No attempt was made on the part of the investigators in that study to pursue the matter further although several suggestions were offered as to the cause of this peculiarity.

The bedrock structure of the southern part of the Iron River district is reflected in a series of magnetic anomalies which parallel each other and extend across the whole area. These anomalies trend in a direction slightly north of west except in the immediate vicinity of the discontinuity where an abrupt variation in direction is noticeable on either side of the gap.

The existing topography is of glacial origin, having been sculptured by the Chippewa Lobe of the Wisconsin Ice Sheet. Present topography is considered to be less rugged than the pre-glacial bedrock surface but it is characterized by varying depths of glacial debris, the greater depths occurring in the hills and ridges rather than in the valleys. In other words, the

A ground magnetometer survey of the area was undertaken by the author in an attempt to delineate the extent of the discontinuity and, with the aid of proper interpretation of the anomalies immediately surrounding the discontinuity, to determine a plausible explanation for the lack of magnetics in the area of the gap.

An area of approximately 14 square miles, encompassing the central portion of Township 42 North, Range 35 West, was covered by this investigation. The results of the vertical magnetic intensity survey very emphatically pointed out the lack of magnetic anomalies in sections 9, 10, 15, and 16 as compared with the areas immediately to the east, south and west of these sections. In several instances the magnetic anomalies occurred directly over exposed surfaces of greenstone so that there is no doubt as to their relationship.

Susceptibility determinations on pulverized samples of rock taken from the scattered outcrops in the area proved to be of little assistance in interpreting the magnetic anomalies in terms of the geologic subsurface bodies causing them. Pulverization is believed to have rendered the samples useless for susceptibility analysis so that theoretical assumptions were required to achieve the necessary relationships between the various anomalies

and their associated geologic bodies.

In every case the magnetic anomaly could be reproduced with calculations relating an assumed susceptibility contrast and a vertical dike of infinite depth and of various widths, and depths of burial. Based on such comparisons, the anomalies can thus be attributed to sheet-like masses of intrusive greenstone with a high susceptibility contrast. The lack of correlation between the number of such sheets, their respective susceptibility contrasts, widths, and depths of burial, and the strike at which these sheets approach the area of the discontinuity is an encumbrance upon a forthright and logical explanation. Theoretically, at least, the investigation showed that the discontinuity was the result of a complete absence of the geologic bodies and their associated magnetics which gave rise to the anomalies in the balance of the area covered by the survey.

An explanation for the lack of magnetic anomalies or the absence of the geologic bodies causing such anomalies must take into account the original mode of formation of these bodies. It is assumed from their petrological character that the greenstones were poured out onto a flat surface subaqueously and contemporaneously with the deposition of the lower members of the Michigamme slate series. A method is needed whereby these greenstones were excluded from the area of the

discontinuity. Several plausible solutions are presented:

1) The area now occupied by the discontinuity was originally an elevated land area and never received any of the lava flows.

2) The area was uplifted after the accumulation of the lava and subsequently suffered severe erosion of only that portion of the area prior to the time it was tilted to its present vertical position.

To attempt to explain the lack of this particular rock in this area in terms of a fault, fold or facies change is hazardous in that the variables involved are too numerous and diversified to account for on the basis of present geologic knowledge.