ANOMALOUS MAGNETISM PROJECT
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In the spring of 1957 the Geology Department, College of Mines, University of Arizona, received a $10,000 grant from the Columbia-Geneva Steel Corporation for the purpose of investigating the causes of magnetic anomalies associated with western iron deposits. Magnetic anomalies located in the region of the deposits do not always appear to be directly associated with ore, and in some instances known ore does not exhibit strong anomalies. The grant was made for the purpose of trying to ascertain the reasons for this behavior.

Laboratory space for the project was made available at the U. S. Department of the Interior, Forest Service Research Station on Tumamoc Hill, west of Tucson.

Lines of attack to the problem are three: First, detailed studies of the magnetic properties of field oriented samples are being made. Magnetic orientation and intensity will be determined. Second, the mineralogical nature of the samples is being studied to find correlations between magnetism and mineral composition. Third, an approach to the problem will be attempted through the growth of artificial magnetic minerals under various conditions of magnetic fields.

The first approach is being accomplished with the aid of an astatic magnetometer built by project personnel. This instrument consists of two sensitive magnets suspended from a delicate quartz fibre in a null-field region. The null-field is created by three pairs of six-foot helmholtz coils arranged on the faces of a cube. Direct current of such intensity as to cancel the earth's magnetic field is passed through the coils. Oriented cores or cubes cut from samples are brought into position directly beneath the sensitive suspension which then tends to align itself with the direction of magnetism of the sample. By changing the position of the sample it is possible to determine three magnetic vectors and, consequently, the plunge, bearing, and polarity of the sample's magnetism.

A tiny mirror attached to the quartz fiber suspension reflects a beam of light from a fixed source onto a glass meter scale. Turning the sample so that its direction of magnetism is parallel to the suspended magnets causes the light beam to move on the glass scale. When the light beam is brought to a null point corresponding to the rest point of the sensitive elements when no sample is present, the angle of the magnetic vector is read directly from a protractor attached to the specimen holder.

Cores 3/4 inch in diameter and 1-1/2 inches long have proved satisfactory for ore samples, but country rock containing very little magnetic mineral content does not have enough mass to affect the instrument. It has been determined that cubes about two inches on an edge are suitable in this latter case. Attitude of the cores and cubes with respect to the field oriented samples from which they are cut is found on an orienting machine devised for the purpose.

Reproducibility of determination of the direction of magnetism is attainable within one or two degrees, which is probably within the error in sample collecting in the field.

Instrumentation for determining intensity of remanent magentism and magnetic susceptibility has not been completed. When these properties can be measured, correlations between them and sample mineralogy will be attempted.

It is hoped that when the current project is completed the astatic magnetometer will be used to investigate other problems of geological interest. Workers in this field have had some success in correlating lava flows through measurements of their magnetic properties. Investigations into paleomagnetism are being conducted in a number of laboratories throughout the world and results of these studies are contributing data to the controversial concepts of polar wandering and continental drift.