VIII ELEMENTS OF AEROMAGNETIC INTERPRETATION

In general, the earth is a uniformly magnetized sphere with a generally uniform external magnetic field. This phenomenon has been known since the beginnings of civilization as attested by such primitive practices as navigation by the magnetic compass.

There are local distortions to this magnetic field, and man has long been aware of these also. Several centuries ago, even in 1640, the so-called distortions or anomalies were employed for the search of iron ores; so magnetic exploration is one of the earliest geophysical methods.

The local distortion suggested by Figure 1 is occasioned by a mass of more easily magnetized material, soft iron for example, than the surrounding space where the magnetic susceptibility is zero. It is more convenient for the magnetic lines of force to travel through the material than through space so they are crowded together in the vicinity of the material. In other words, the magnetic intensity is increased and a positive distortion or anomaly is created above and below the mass.

A geologic explanation of a magnetic anomaly must translate the disturbing mass into a geologic entity of some sort. Where to begin? Fortunately there is a magnetic classification that follows a geologic classification. For the most part, sedimentary rocks have little, if any, magnetic susceptibility, whereas igneous and metamorphic rocks, the basement rocks, have susceptibilities that range from 100 to 10,000 times that of sedimentary rocks. Therefore, rock masses of variable susceptibilities will, in the main, be confined to basement rocks.

Can the distorting basement masses be further defined by examining their possible configuration? First of all, what is the nature of these common local distortions to the normal field? Commonly, anomalies of several hundred gamma, normal intensity is tens of thousands of gamma, are observed over several tens of square miles. Such anomalies cannot originate in thin sheets of highly magnetized rocks because the opposing polarity of the top and bottom layers would essentially obliterate the magnetic effect. Therefore, the anomalous rock mass must have great depth extent.