ABSTRACT

The thesis embodies the magnetic investigations on the deposits of hematatic iron ores, occuring in Singhbhum Iron Ore Range of eastern India. The investigation covers the palaeomagnetic studies, susceptibility measurements and detailed magnetic mapping of three iron ore deposits of Singhbhum Range. The geological informations have been summarized and presented. Palaeomagnetic measurements over a large number of samples collected from different parts of Singhbhum Range show high value of remanent intensity. The study also reveals wide scatter in the palaeomagnetic direction. The random distribution supports the theory that the origin of hematites of Singhbhum is due to residual accumulation formed by surface leaching. Removal of gangue minerals by leaching causes slumping of hematite bands in random orientation.

Studies have been made on the magnetic susceptibility of large and small hematite grains to aid the magnetic computations and to study the effect of pulverization. The effect of percentage content of hematite on its susceptibility has been studied. Hematite is found to be similar to magnetite in general susceptibility characteristics though its magnitude is much less. The susceptibility for very small grains is found to be erratic.

Vertical intensity measurements over hematite deposits in three areas of Singhbhum range show appreciable magnetic anomaly. The ore bodies in these three areas, i.e. Meghatuburu, Bijoy mines and Gua mines differ in nature of occurance and dimensions. In Meghatuburu the deposit is very shallow, the top of the ore body being covered by a thin out crop of phyllites. In Bijoy mines the bodies occur as isolated lenses; most of these lenses have been unexplored. In Gua the ore body is exposed on the surface and the dimensions are extensive. In all the cases the anomaly contours follow the general strike of the formations. The presence of large remanent magnetism in the hematite imposes the restriction on the interpretation by the conventional induction theory.

In the Bijoy mines where the ore bodies are hidden under the latertic and phyllitic overburden the magnetic anomaly map has been interpreted by following three different techniques. The remanent intensity and direction were incorporated in the interpretation. The depth and dimension of the bodies, obtained by three different methods, show consistancy in most cases.

The effect of the large remanent magnetization has been studied for Meghatuburu deposit. As this deposit is fairly well established by bore holes the magnetization induced by the earths field has been computed by the method of polygons. The induced anomaly map bears little

resemblance to the observed field map. Large number of smaller peaks over a massive body is caused by random variation in remanent intensity and surface inhomogeneities. The comparison of computed and field anomaly maps illustrate that the presence of high remanence distort the anomaly map to a considerable extent.

The influence of remanent magnetism on magnetic interpretation has also been illustrated by using the methods of analytical continuation and spectral analysis. Depth has been determined at Bijoy Mines by downward continuation of magnetic intensity along two profiles. In both the cases the depths calculated are lower than the values obtained by other methods. The discrepency has been inferred to be caused by random polarization direction, surface inhomogeneity and rugged terrain.

An attempt has been made to use the newly developed spectral analysis method to find the depth of the ore bodies. The decay of spectral power with increasing frequency is the basis of such determination. Auto-correlation and power spectrum computed along two profiles in Meghatuburu and one profile in Bijoy mine show expected nature. The depths upto anomalous bodies, however, is lower by this method. It can be inferred from this study that variation of polarization direction, surface inhomogeneities and rugged terrain effect the spectral power also.