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Regional magnetic surveys in part of Delhi Fold Belt, Rajasthan (India) and implications for basement structure and mineralization

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ABSTRACT

This paper presents the results of regional ground magnetic surveys carried out over an area of 4200 sq. km in parts of Ajmer and Bhilwara districts, Rajasthan, India. The study area falls in the Obvious Geological Potential (OGP) zone associated with economic mineral deposits of India. The survey was conducted for delineating the extension of various rock sequences within the Proterozoic Delhi Fold Belt (DFB). The survey brought out a strong NE-SW trending magnetic anomaly over the rocks of DFB and a mild anomaly in the northwestern part of the area, which is covered by the thick sediments of the Marwar Basin (MB) basin. The NE-SW trending anomaly in the area could be attributed to the exposed/near-surface Archaean basement that has come closer to the surface as a result of Delhi Fold Belt (DFB) tectonics. The anomaly trend brought out the clear picture of the magnetic basement within the Bhilwara Supergroup and their sub-surface structures and associated mineralization, if any. The qualitative analysis of the magnetic data delineated the contact of the significant litho units (Marwar Basin and Delhi Fold Belt). The Euler depth solutions also provided an idea about the magnetic source depths and a cluster of shallow depth solutions have been generated over the Delhi Fold Belt, which may be due to the weak susceptibility of the weathered layer. The amplitude power spectrum has been attempted for estimating the depth interfaces for each selected profile. The average depth to the basement of each profile is estimated as 1.5 km. The contacts between different litho units are also marked. The 2D modeling of a few representative profiles across the DFB reveals that the average magnetic basement depth is about 1.5 km. It is concluded that, the contact zone between Marwar Basin (MB) and Delhi Fold Belt (DFB) is structurally controlled. The results of this study has brought out significant structural features which can form favorable target areas.

Keywords: Magnetic basement, spectrum, Delhi Fold Belt, Euler solutions, Marwar basin, Aravalli craton

INTRODUCTION

The present study area (Figure 1) in South Delhi Fold Belt (SDFB) is located in the northwestern part of the Indian continent, which partly occupies Ajmer and Bhilwara districts of Rajasthan. This region in Rajasthan state comprises litho units ranging from Archaean to Cenozoic age, having a history of multiple deformation and geotectonics. The objective of the present study is to delineate the extensions of the various rock sequences within DFB and its basement interface. Further, attempts have been made to identify the potential areas favorable for mineralization, if any. The survey brought out strong NE-SW trending high magnetic zones in the area which trends along with the primary regional control of mineralization in the Delhi Fold Belt area (Tweto et al., 1968).

The high-resolution gravity surveys in the study area brought significant gravity features, which could be useful in identifying the favorable areas for mineralization (Bangaru Babu et al*.,* 2015). The high gravity zones have been noticed in SW of Agucha Pd-Zn deposit, which delineated the framework of mineralization. The anomalous gold values were noticed near the Kalab-Kalan area from geochemical studies, which is well corroborated with the significant-high gravity zone. A massive sulphide zone with a total strike length of 910 m was identified at Boyo Ki Nandi block from 1090 m depth core drilling, discussed in an unpublished report of the Geological Survey of India. The current geophysical study presents the basement structures below Delhi Fold Belt from magnetic data analysis and the same can be witnessed by different techniques adopted for calculating the average depth of the magnetic interface. The rocks in Sandmata Granulite Gneiss (SGG) of Mangalwar Complex were materialized as tectonic silvers. In the central parts of the Mangalwar Complex, the basement has a number of meta-sedimentary basins (Sinha-Roy, 1995, 1998). In the present study, we provide average depth to the basement interface using magnetic data through different interpretation techniques. Further, boundaries/contacts of different litho units have been marked. These boundaries are indicative of possible faulting, which is favorable for identifying potential target areas for mineral exploration. These major faults have been marked by the interpretation of ground magnetic data.