

MAGNETIC ANOMALIES ON MARS ARE DEEP SEATED

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Magnetic data set from 400 km satellite altitude of Mars obtained by Mars Global Surveyor mission launched in 1996. Sources of magnetic anomalies have been discussed [1, 2] but the investigation of the source depth is still unclear and need more investigation. The variations of magnetic anomalies are greater in magnitude than the anomalies on Earth [3, 4]. The part of the southern hemisphere of the Martian crust is strongly magnetized, as indicated by large intensities of respective magnetic anomalies, while the northern hemisphere has lower magnetic signatures suggesting either lower magnetizations or deeper location of magnetic sources in respect to satellite altitude 400 km.

Different factors considered in the formation of the strong crustal magnetic sources on Mars can be classified into the following: hydrothermal alteration of pre-existing crustal materials to produce efficient remanent magnetization carriers [5], water rich fluids that precipitate iron rich carbonates for which we have evidence in Martian meteorites [6], and highly magnetized intrusions, which are rich in iron [7, 8]. Magnetic remanence carriers on Mars include magnetite, hematite, and pyrrhotite [9].

The estimation of the depth of magnetic sources on Mars is done by using a second moving average (SMA) method [10]. Twelve profiles were chosen across significant magnetic regions. Each profile was subjected to the SMA separation technique. SMA residual anomalies were obtained from magnetic data using filters of successive spacing. Depth estimates were obtained by using filters of different successive window lengths. Each profile was subject to inversion technique yielding shape (q) and depths to the top surfaces of the buried sources. The results show that the approximate distance to the tops of magnetic sources on Mars varies between 53 km and 227 km. Sources are positioned deeper in the area between Hellas impact structure and Tharsis volcanic province (160 - 227 km), while shallower sources (53 - 117 km) are in the area southeast from Tharsis volcanic province.

References:

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