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Edge detection of magnetic body using horizontal gradient of pseudogravity anomaly

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Abstract: Potential field methods are used extensively in mineral exploration. These methods also are used as reconnaissance method in oil and gas exploration. In Contrast with gravity anomaly the magnetic surveying produces dipolar anomaly which is caused complicated interpretation rather than gravity anomaly. The observation magnetic anomaly in each location other than magnetic poles has displacement rather than causative body. Several methods are used to overcome to this problem such as reduction to the pole (RTP) that an asymmetric anomaly is converted to symmetrical anomaly. Boundary analysis is another method to distinguish causative magnetic body from observed magnetic data directly. One of the applicable methods in boundary detection of local scale magnetic anomaly is total gradient of pseudogravity anomaly.

In this method, pseudogravity anomaly is calculated in the first step. Pseudogravity converts the magnetic field into gravity field that would be observed if the magnetization distribution were to be replaced with an identical density distribution. This filter is a linear filter that is created in the frequency domain. Poisson's relationship between magnetic and gravity potential can be used for magnetic and gravity anomaly transformation to each other. Pseudogravity transformation is done in 3 steps (1) Fourier transform of magnetic data to frequency domain. (2) Multiplying the result of step (1) on to pseudogravity filter expression. (3) Inverse Fourier transform to space domain. It is a useful technique for the interpretation of major magneto- tectonic provinces as it simplifies anomaly patterns and focuses on large scale features rather than local details. After this process the horizontal gradient of calculated pseudogravity anomaly is computed and mapped in surveying scale. In this image maximum value of total horizontal gradient determines magnetic body edge.

In this work we applied this method to synthetic magnetic data from prismatic model and also in magnetic data from Gol-Gohar mining area from Iran. This area is one of the iron ore in Iran and located in 1:250000 map in Neyriz geological block. For implementation the described method to studied area observation magnetic anomaly was transformed to pseudogravity anomaly at the first step. Then horizontal gradient of this anomaly was calculated and mapped. Maximum value of horizontal gradient of psedogravity as form of two bands located in magnetic anomaly trend direction. Field observations show an iron vein with 30m width that using described technique as a boundary detection method, confirms this feature.

Keywords: Magnetization, Edge detection, Reduction to the pole, pseudogravity, Poisson's relationship, Horizontal gradient, Gol-Gohar.