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Separation of contributions for induced and remanent magnetizations from magnetic data modeling

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We propose two methods to separate the contributions of induced and remanent magnetizations by inverting for and processing the magnetic data. Both methods are based on the assumption that the Koenigsberger report is known or approximately deducible for the rocks of the investigated area.

In the first method, we estimate the direction of the total magnetization vector by studying the reduced-to-pole anomaly and its correlation with different magnitude magnetic transforms. Then we invert the magnetic data to obtain the volumetric distribution of the magnetization intensity. As a third step, based on the priori information about the Koenigsberger ratio derived from petrophysical measurements, we extract the distributions in the source volume of the induced and remanent magnetization intensities, based on a generalized relationship involving the total and remanent magnetizations, and the true susceptibility. In this way, we are able to produce separate maps of the anomaly fields attributed to the physical magnetic source parameters: remanent and induced magnetization.

In the second method, to begin with the direction of the total magnetization is estimated from the observed magnetic anomaly. The contributions of induced and remanent magnetizations in total magnetization are then calculated on the basis of known relationships. We present a new transformation of potential field in the frequency domain to compute the magnetic anomalies resulting from the separate induced and remanent magnetization components. Subsequently, the susceptibility and remanent magnetization are recovered from the separated magnetic anomaly components.

Both methods are tested on synthetic data and they are then applied to study the magnetic anomalies of mineral deposits in China.