



## **Analysis incorporating electric conductivity and magnetic permeability on loop-loop EM data for detecting the magnetite ore body**

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As the price of mineral resources goes up, exploring small amount of mineral deposits, which have been considered non-economic in the past, is getting more economic. Loop-loop EM survey system can be the best choice for exploring small mineral mines because no ground contact is required and portable loops are freely positioned. EM responses are affected by electric conductivity, magnetic permeability and electric permittivity. In many cases, variation ranges of latter two components are so small and ignorable. However, changes of magnetic permeability affect the data in a serious way. Multidimensional EM inversion technique incorporating both electric conductivity and magnetic susceptibility is on the developing stage. EM responses are calculated in a model of layered earth embedding a magnetic anomaly. Considering the size of the reactions, changes of relative magnetic permeability are frequency-independent effects that can be seen as static. Loop-loop EM survey using PROMIS system was conducted on a small magnetite mine. Inversion with and without considering magnetic permeability was conducted for EM data with multi-frequency and multi-separation between a transmitter and a receiver. Ferromagnetic anomalous feature was distinguishable from the subsurface media, though, enhancement by incorporating magnetic permeability was not sufficiently noticeable.