

MAGNETIC SUSCEPTIBILITY AS A TOOL FOR CHARACTERIZATION OF AN ASTEROID REGOLITH AND SAMPLE RETURN.

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Introduction: Magnetic susceptibility of a rock is dependent on concentration of ferromagnetic minerals. It proved to be reliable non-destructive tool in distinguishing various types of extraterrestrial materials [1], [2], [3] and in searching for compositional variations of meteorite falls [4], [5]. Magnetic susceptibility of an asteroid regolith can be compared to database of known meteorites in order to diagnose its mineralogy, homogeneity and maturity.

In-situ susceptibility measurement of the asteroid regolith: A simple susceptibility measurement coil can be incorporated into lander or surface drop probe. Its design can be similar to commercially available handheld susceptibility meters or to one described in [6] or [7]. The regolith homogeneity can be tested by spot measurements in various locations around asteroid.

Regolith on airless bodies is subject to space weathering often associated with production of iron nanoparticles. These particles are often in super-paramagnetic state exhibiting high frequency dependence of magnetic susceptibility. Thus degree of susceptibility frequency dependence is quantitatively related to regolith maturity [8].

Susceptibility measurement of the sample return: The magnetic susceptibility measurements of a sample return will provide similar information as in-situ measurements, but laboratory instrumentation provide higher precision. Additionally magnetic susceptibility results can be directly compared with mineralogical and chemical analysis. However, any sample return is likely to be a rather small, localized quantity.

Conclusions: Magnetic susceptibility can provide diagnostic parameters to determine regolith mineralogy and meteorite analogue. Additionally regolith maturity can be estimated from frequency dependence of regolith susceptibility.

References: [1] Rochette P. et al. (2003) *Meteoritics & Planet. Sci.*, 38, 251-268. [2] Rochette P. et al. (2008) *Meteoritics & Planet. Sci.*, 43, 959-980. [3] Rochette P. et al. (2009) *Meteoritics & Planet. Sci.*, 44, 405-427. [4] Consolmagno G. J. et al. (2003) *Meteoritics & Planet. Sci.*, 41, 331-342. [5] Kohout et al. (2010) *Meteoritics & Planet. Sci.*, 45, 1778-1788. [6] Rochette P. et al. (2004) *Planet & Space Sci.*, 52, 987-995. [7] Bentley M. S. (2009) *Planet & Space Sci.*, 57, 1491-1499. [8] Bentley M. S. (2011) *Planet & Space Sci.*, 59, 79-91.