INHOMOGENEITY OF THE 2008 TC_3 ASTEROID MATERIAL (ALMAHATA SITTA METEORITES) REVEALED THROUGH PHYSICAL PROPERTIES MEASUREMENTS

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Introduction: On October 6, 2008 a small asteroid 2008 TC_3 was discovered in space 20 hours prior to impact on Earth [1]. So far over 600 fragments (designated Almahata Sitta meteorites) were recovered at impact site in Nubian Desert, Sudan. We characterized these meteorites through measurement of their magnetic properties, density and porosity.

Magnetic susceptibility and rock magnetism: Most recovered samples are anomalous polymict ureilites, which are found to have a magnetic susceptibility in the narrow range of 4.96 ± 0.12 log 10^{-9} Am^2/kg identical to the range of ureilite falls 4.95 ± 0.14 log 10^{-9} Am^2/kg reported by [2].

However in our data set a large number of samples with anomalously high susceptibility were found. Some of these samples were analyzed and mostly belong to ordinary or enstatite chondrites [3]. Moreover, most of these anomalous samples have fresh appearance pointing on their common impact origin with ureilites. Further, the high scatter among small (< 5 g) samples reveals inhomogeneity within the 2008 TC_3 material at scales below 2-3 cm.

Thermal susceptibility curves of ureilite samples as well as room temperature hysteresis loops show multi-domain kamacite and low-Ni iron to be dominating magnetic minerals. The natural remanence is extremely soft, almost completely demagnetized by 3 mT alternating field thus do not provide reliable paleomagnetic information.

Density and porosity: The preliminary results indicate the bulk density around 3 g/cm^3 and the grain density around 3.9 g/cm^3 respectively resulting in higher microporosity estimate of approx. 20% compared to other ureilites reported in [4].

Implications on structure of 2008 TC_3 asteroid: Based on our finding the 2008 TC_3 asteroid may represent a compositionally heterogenous body composed of ureilites with mix of chondrite materials and is most likely an assemblage of material left after a catastrophic collision between ureilite and chondrite parent bodies.

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