CONSORTIUM STUDY OF THE CHELYABINSK METEORITE.

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Introduction: On February 15, 2013 a ~17 m asteroid hit Earth, causing shock waves and air blasts over a portion of Russia. A significant amount of material has been recovered from this meteorite fall, officially named Chelyabinsk [1]. NASA-JSC has obtained three masses of the Chelyabinsk meteorite to study in detail. The aim of the studies (detailed below) will be to reconstruct the history of the material and help to complete the story of how and why this material impacted Earth.

Initial observations: All three masses (CHEL 101, 102 and 103) were weighed (18.672 g, 19.594 g, and 15.310 g, respectively) and measured for magnetic susceptibility (log χ = 4.38-4.51, 4.30-4.54, and 4.50-4.60, respectively). The latter values are consistent with the classification of this material as LL chondrite [2]. Mass CHEL 101 contains both a light unshocked lithology (LL5) as well as significant volume of impact melt veins and pockets. Masses CHEL 102 and 103 appear to be dominantly impact melt material, with little to no unshocked lithology.

Planned analyses: Textures in the impact melted portions will be examined to determine thermal history and conditions prevailing during the melting event, including possible shock pressures from the detailed mineralogy (using optical microscopy, raman and FTIR spectroscopy, SEM/TEM, EMPA and FIB). Mössbauer spectroscopy will be used to identify the speciation of iron in Fe-bearing minerals in both the interior and exterior of the sample. Bulk analyses will be carried out for major and trace elements as well as H, C and S (ICP-MS and GC-MS) to compare the meteorite bulk composition to other fresh falls as well as to support subsequent cosmogenic nuclide measurements. Unshocked bulk rock will be analyzed for Rb-Sr and Sm-Nd isotopic compositions to characterize the meteorite. Unshocked and shocked melts will be analyzed using Ar-Ar techniques to determine its gas retention ages, and cosmogenic nuclides (noble gases, Sm, and Cr) will be used to determine possible exposure ages of the samples. Cr isotopic composition of shocked and unshocked lithologies, and the components of the unshocked lithology will be measured to understand the initial Cr isotopic signature of the meteorite, to complement noble gas and REE cosmogenic nuclide measurements, and to study Mn-Cr systematics to see how it may have been altered during the shock melting.

It is anticipated that the combined approach taken here will help to better understand the geologic and dynamic history of the meteorite and its parent asteroid, and place this event into context with other previous such meteorite impacts.

References: [1] Meteoritical Bulletin, no. 102, *Meteoritics & Planetary Science* 48, in preparation (2014). [2] Folco, L. et al., (2006) *Meteoritics & Planetary Science* 41, Nr 3, 343–353.