FORMATION AND EVOLUTION OF THE HIGHLY UNCONSOLIDATED ASTEROID 2008 TC_3.

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Introduction: From asteroid 2008 TC_3 that impacted the Earth in northern Sudan October 7, 2008, Bischoff and coworkers [1,2] studied 40 small pieces from different fragments collected in the Almahata Sitta (AS) strewn field and found that these fragments can be subdivided into achondritic (ureilitic; 23 samples) and chondritic lithologies (17 samples). At least 10 different ureilitic lithologies were classified as well as a similar number of different chondritic lithologies (7 E chondrites, 2 ordinary, 1 unique chondrite with affinities to R chondrites [1,2]).

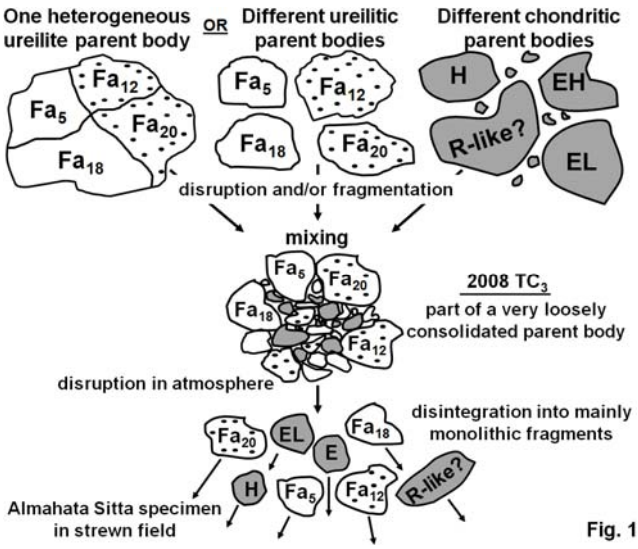

Fig. 1

Discussion: Considering the extraordinary diversity of ureilitic lithologies it is clear that their coexistence in AS is only explainable by a gigantic and catastrophic disruption of a heterogeneous ureilite parent body (Fig. 1; white: coarse-grained lithologies; stippled: fine-grained lithologies) and subsequent mixing, or by the previous existence, fragmentation, and mixing of several ureilitic parent bodies in a similar nebula region as revealed by similar oxygen isotope compositions of individual fragments. The delivered material probably re-accreted into a smaller daughter asteroid [3] and was simultaneously mixed with chondritic rocks (Fig. 1; grey lithologies) that were present at the same time in the same debris disk around the sun. Clearly, 2008 TC_3 is part of a second-generation asteroid. Almahata Sitta is very different to other polymict ureilites: In other polymict samples ureilitic and exotic (chondritic) components can be found in one thin section. Asteroid 2008 TC_3 consisted of cm-sized(?), loosely agglomerated components that broke up mainly into monolithic fragments along their original boundaries during breakup in the atmosphere.

References: [1] Bischoff A. et al. 2010. Abstract #1763. 41st Lunar and Planetary Science Conference. [2] Horstmann M. and Bischoff A. 2010. Abstract #1784. 41st Lunar and Planetary Science Conference. [3] Herrin J. S. et al. 2010. Abstract #1095. 41st Lunar and Planetary Science Conference.