

UREILITE METEORITES FROM DAR AL GANI (LIBYA) AND FRONTIER MOUNTAINS (ANTARCTICA): ANALOGUES OF THE ALMAHATA SITTA (ASTEROID 2008TC₃) FALL?

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Introduction: Almahata Sitta is the first recorded meteorite to have been tracked as an asteroid (2008TC₃) and then recovered after falling to Earth [1]. At least 600 separate stones have so far been found in a strewn field in the Nubian Desert of Sudan as a result of the break-up of the asteroid in the atmosphere. It has been identified as a polymict ureilite [2], a brecciated carbon-bearing ultramafic rock. Ureilites are the second most common group of achondrite meteorites. They are considered to be the remnants of the mantle of an asteroid that was disrupted by impact early in the Solar System and reaccreted into a rubble-pile asteroid [3]. Almahata Sitta stones are very variable in their compositions and textures, ranging from very porous pyroxene-dominated lithologies to compact olivine-rich lithologies [2]. The individual stones show a wide range of olivine compositions (Fo79-97) [2] covering the known range of unbrecciated ureilites.

Is the Almahata Sitta fall unique? The Almahata Sitta fall is remarkably similar to ureilites found in Dar al Gani (Libya) and Frontier Mountains in Antarctica. In Dar al Gani (DaG), 31 ureilite meteorites have so far been found, 25 of which were discovered in an area of only 25 km². Several others have been found in what may constitute a 40km long strewn field. The stones within the field range from 8g to 2.1kg, the largest being polymict sample DaG 999. The total amount of ureilitic material found in the area is close to 7kg. Polymict ureilites account for nearly 30% of the individual stones, but form >50% of the samples by weight. Polished sections of some pieces of known polymict samples are single clasts, showing no brecciation. Thus many of the so-called unbrecciated stones may in fact be single clasts in brecciated varieties. The variety of lithologies of clasts within the DaG polymict ureilites is strikingly similar to that reported from Almahata Sitta, containing varieties of ureilites and chondritic fragments [3, 4]. In Frontier Mountains (FRO), 15 ureilite stones have been found, of which only two are officially polymict, but many others contain two or more ureilitic lithologies [5] similar to those described from Almahata Sitta. One FRO fall at 110kyr represents a polymict breccia with 9 members [6].

Discussion: From our analysis, it seems clear that most of the individual DaG ureilites were formed from a single large (>7kg) polymict ureilite meteorite that broke up in the atmosphere in the same manner as the Almahata Sitta fall. The DaG fall thus may represent the remains of another single large fragment of the regolith of the Ureilite Parent Body. The FRO fall represents a third example of a polymict ureilite meteorite shower.

References: [1] Jenniskens P. et al. 2009 *Nature* 458: 485-488; [2] Zolensky et al. 2009 *MAPS* 44 (Supp): A227. [3] Downes et al. 2008. *GCA* 72, 4825-4844. [4] Ross A J et al. 2010. 41st LPSC Abst # 2361. [5] Smith C L et al 2000. *MAPS* 35, A150. [6] Welten K C et al. 2006 37th LPSC, Abst.# 2391.