A 4548 Ma $^{40}Ar/^{39}Ar$ AGE OF A FELDSPATHIC CLAST IN ALMAHATA SITTA: IMPLICATIONS FOR THE UREILITE PARENT BODY AGE AND THE ASSEMBLY AGE OF ASTEROID 2008 TC_3

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Introduction: Almahata Sitta (AhS) is the product of the breakup of asteroid 2008 TC_3 in the Earth's atmosphere on 10/7/2008 [1]. A large portion of the meteorite is classified as polymict ureilite [1,2]. Numerous ureilitic lithologies and exotic clasts have been recovered, among them MS-MU-011 [3], an unbrecciated, feldspar-enriched clast with an oxygen isotope signature that lies within the mixing array defined by ureilites [4]. The mineral assemblage of MS-MU-011 is dominated by albitic feldspar (80-85%) with minor amounts of clinopyroxene (10-12%), K-Si glass (3-5%) and oxides/sulfides 0.05-0.1%) [3]. This object shares several characteristics with the felsic lithologies found in other polymict ureilites and is thought to be the product of early differentiation of the ureilite parent body (UPB) [5,6].

We present $^{40}Ar/^{39}Ar$ results from albitic plagioclase and pyroxenes that contain small (10-20-μm), roughly spherical, high-K (2-2.5 wt% K_2O) glass inclusions from MS-MU-011. Our goals were to date may the time of differentiation on the UPB and add new constraints on the assembly age of the AhS as sampled by Asteroid 2008TC_3.

Argon analysis: Glass-bearing pyroxene (GBP, 31 μg) and albitic plagioclase (26 μg) were co-irradiated with Fish Canyon sanidine (28.201 Ma [7]) and Hb3gr (1080 Ma [8]) for 80 hours, without Cd shielding at the USGS TRIGA reactor of USGS in Denver. Argon isotopes were analyzed as in [10] with decay constants from [9]. The samples were heated to fusion in 8 to 10 steps

Results and discussion: Albitic plagioclase did not yield a meaningful age. For GBP, however, we obtained a ten-step plateau age of 4548 ±11 Ma (100% of the ^{39}Ar derived from K) and a total fusion age of 4538 ±17 Ma. When cast on an isotope correlation diagram, the isotope data yield an age of 4556 ±15 Ma, and trapped $^{40}Ar/^{36}Ar$ and $^{38}Ar/^{36}Ar$ ratios of -1.6 ±2.6 and 0.200 ±0.003, respectively.

The isochron age of 4556 ±15 Ma for glass-bearing pyroxene is within 10-20 Ma of the UPB and the CAI formation ages [see 5]. It also is contemporaneous with old ages (4560 and 4500 Ma) obtained on L4-, H5-, and EL-6 clasts within AhS [11-12] and consistent with an early assembly age of asteroid 2008 TC_3.

References: [1] Jenniskens et al., 2009, *Nature* 458:485-488. [2] Jenniskens and Shaddad, 2010, *M&PS*, 45:1553-1556. [3] Horstmann et al., 2010, *M&PS* 45:1657-1667. [4] Rumble et al., 2010, *M&PS* 45:1765-1770. [5] Goodrich et al., 2010, *EPSL* 295:531-540 [6] Cohen et al., 2004, *GCA* 68:4249-4266. [7] Kuiper et al., 2008, *Science* 320:500-504. [8] Jordan and Renne, 2007, *GCA* 71:387-402. [9] Steiger and Jäger, 1977, *EPSL* 36:359-362. [10] Turrin et al., 2010, *G^3* 11, doi:10.1029/2009GC003013. [11] Turrin et al., 2013, *76th Annual Meteoritical Society Meeting*, 5335.pdf. [12] Turrin et al., 2015, *LPSC* 45, 2784.pdf.