

ALMAHATA SITTA SAMPLE MS-181: THE FIRST CARBONACEOUS CHONDRITE (CB_a) FROM ASTEROID 2008 TC₃.

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Introduction: Among the numerous meteorite fragments collected in the Almahata Sitta strewn field after asteroid 2008 TC₃ impacted Earth in 2008 a huge diversity of different types of meteorites including various ureilites and chondrites were recovered [e.g., 1,2]. 30 new samples were studied recently [3]. MS-181 studied here and classified as a Bencubbin-like (CB) chondrite represents the first carbonaceous chondrite sample from asteroid 2008 TC₃.

Mineralogy: MS-181 weighing 58.6g is a metal-rich rock (~60 vol%) and contains silicates (~40 vol%) of various textures similar to those described by [4,5] for CB-chondrites. Metal appears as large kamacite globules (up to ~8 mm) with highly variable abundances of predominantly arcuate Cr-bearing FeS (0.6-10.8 wt% Cr) inclusions that sometimes appear as disconnected networks surrounding smaller kamacite spheres within the large grains. Other metal globules contain spherules of FeS or are nearly free of FeS. Subtextures in metal are similar to those in Gujba [5]. Kamacite has mainly 6-8 wt% Ni, Co (~0.5-0.9 wt%), and traces of P (~0.4 wt%), and Cr (below 0.4 wt%). Rarely, tiny metal grains contain up to ~31 wt% Ni. Silicates occur as spheroidal or ellipsoidal globules in complex intergrowths with smaller metal grains interstitial to the large ones. Frequently, chondrules (e.g., cryptocrystalline, barred pyroxene, porphyritic olivine (-pyroxene)) were identified. Pyroxene is $\text{Fs}_{2.7\pm 1.1}\text{Wo}_{3.1\pm 2.9}$ on average with a total range of $\text{Fs}_{0.9-5.9}\text{Wo}_{0.7-10.8}$. Olivine has $\text{Fa}_{3.4}$ and Ca-pyroxene gives $\text{Fs}_{1.1-3.5}\text{Wo}_{35.0-46.8}$. Ca-pyroxene shows variable Al contents (7.6-12.8 wt% Al_2O_3). Chondrules and silicate fragments are mainly surrounded by a silicate-rich rim dispersed with numerous metal spherules. One large silicate domain (~7 mm in apparent diameter) exhibits very low metal abundances and has a texture like a barred pyroxene. This texture also appears in some of the smaller silicate fragments intermingled with metal interstitial to the large metal globules.

Isotopes: Based on oxygen isotopes MS-181 can clearly be characterized as being a Bencubbin-like chondrite ($\delta^{17}\text{O}$: -1.57‰, $\delta^{18}\text{O}$: 1.15‰, $\Delta^{17}\text{O}$: -2.18‰). The cosmogenic nuclides of a 37g piece of MS-181 were determined. The detection of ⁵⁴Mn (half-life: 312.14 days), ²²Na (2.602 years), and ⁶⁰Co (5.27 years) is characteristic of a fresh meteorite fall consistent with the Asteroid 2008 TC₃-Almahata-Sitta event in early October 2008.

References: [1] Bischoff A. et al. 2010. *Meteoritics & Planetary Science* 45:1638-1656. [2] Horstmann et al. 2010. *Meteoritics & Planetary Science* 45:1657-1667. [3] Horstmann et al. 2012. *Meteoritics & Planetary Science* 47 (this volume). [4] Krot et al. 2007. *Chemie der Erde* 67:283-300. [5] Rubin et al. 2003. *Geochimica et Cosmochimica Acta* 67:3283-3298.