Hydrogen Isotopic Analysis of CM2 Chondrite Murchison

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Asteroid Bennu, a Cb-type asteroid, is the target of the ongoing OSIRIS-Rex mission. Bennu's spectral features are similar to those of aqueously altered CM-type carbonaceous chondrites [1], making the CM2 chondrite Murchison a suitable analogue for the anticipated samples being returned from Bennu. Previous whole-rock analysis of Murchison yielded a δD value of -61‰ [2], while a study of its insoluble organic matter yielded δD enrichments of +777±27‰ [3]. Discerning the water storage characteristics of the remaining components within Murchison, and other C-class objects can provide important constraints on the origin and delivery of Earth's post-accretionary supply of water. Accordingly, we investigated the D/H ratio within nominally anhydrous minerals (NAM) in Murchison using nano scale secondary ion mass spectrometry (NanoSIMS). A new thick slab of Murchison was cut, dry polished and measured using protocols described in [4].

The δD values in olivine, clinopyroxene, and orthopyroxene within Murchison were relatively uniform, varying between ~ -200‰ and 300‰ collectively. We observed no clear D/H trend between NAM within chondrules and those isolated in the matrix. Our findings agree well with previous results, [4] suggesting that D/H within the NAM component of chondrites is not distinctly different from SMOW, allowing for a large contribution to Earth's water by NAM-rich objects.

[1] Hamilton *et al., Nat. Astron.* 3 (2019) **[2]** Alexander *et al.*, *Science* 337 (2012). **[3]** Alexander *et al., Geo. et Cosmo. Acta* 71 (2007). **[4]** Jin *et al., Sci. Adv. 5* (2019).