MAGNETITE AS POSSIBLE TEMPLATE FOR THE SYNTHESIS OF CHIRAL ORGANICS IN CARBONACEOUS CHONDRITES.

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Introduction: The main goal of the Japanese Aerospace Exploration Agency (JAXA) Hayabusa-2 mission is to visit and return to Earth samples of a C-type asteroid (162173) 1999 JU3 in order to understand the origin and nature of organic materials in the Solar System.

Life on Earth shows preference towards the set of organics with particular spatial arrangements, this 'selectivity' is a crucial criterion for life. With only rare exceptions, life 'determines' to use the left- (L-) form over the right- (D-) form of amino acids, resulting in a L-enantiomeric excess (*ee*). Recent studies have shown that L-*ee* is found within the α-methyl amino acids in meteorites [1, 2], which are amino acids with rare terrestrial occurrence, and thus point towards a plausible abiotic origin for *ee*.

One of the proposed origins of chiral asymmetry of amino acids in meteorites is their formation with the presence of asymmetric catalysts [3]. The catalytic mineral grains acted as a surface at which nebular gases (CO, H_2 and NH_3) were allowed to condense and react through Fisher Tropsch type (FTT) syntheses to form the organics observed in meteorites [4]. Magnetite is shown to be an effective catalyst of the synthesis of amino acids that are commonly found in meteorites [5]. It has also taken the form as spiral magnetites (a.k.a. 'plaquettes'), which were found in various carbonaceous chondrites (CCs), including C2s Tagish Lake and Esseibi, CI Orgueil, and CR chondrites [e.g., 6, 7, 8]. In addition, L-*ee* for amino acids are common in the aqueously altered CCs, as opposed to the unaltered CCs [1]. It seems possible that the synthesis of amino acids with chiral preferences is correlated to the alteration process experienced by the asteroid parent body, and related to the configuration of spiral magnetite catalysts. Since C-type asteroids are considered to be enriched in organic matter, and the spectral data of 1999 JU3 indicates a certain degree of aqueous alteration [9], the Hayabusa-2 mission serves as a perfect chance to attest this argument.

In order to understand the distribution of spiral magnetites among different meteorite classes, as well as to investigate their spiral configurations and correlation to molecular asymmetry, we observed polished thin sections of CCs using scanning electron microscope (SEM) imaging. Individual magnetite grains were picked, embedded in epoxy, thin-sectioned using an ultra-microtome, and studied with electron backscatter diffraction (EBSD) in order to reconstruct the crystal orientation along the stack of magnetite disks.

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