EBSD STUDY OF LATTICE PREFERRED ORIENTATION (LPO) OF THE HARZBURGITE NWA 5480

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Introduction: Classified as belonging to the Howardite-Eucrite-Diogenite (HED) group of achondrites, Northwest Africa 5480, like other olivine-rich diogenites, is thought to represent an ultramafic cumulate formed within a magma chamber in the upper mantle of the differentiated asteroid 4 Vesta, or a Vesta-like body [1]. Dominated by olivine (57 vol%) and orthopyroxene (42 vol%) NWA 5480 has further been classified a harzburgite [2], whereby the distribution of olivine and orthopyroxene is very heterogeneous, with some areas displaying up to 90% of either of the two minerals. In this study, structural analysis was performed on the olivine grains of NWA 5480 using electron backscatter diffraction (EBSD), which allows us to measure and visualize the crystallographic orientation of the crystal axes to discover any lattice preferred orientation (LPO) [3].

NWA 5480 Analysis: The sample was categorized into two regions for targeted analysis: (a) Zone A, dominated by coarse-grained olivine, and (b) Zone B, dominated by orthopyroxene-olivine schlieren. A total of 1361 EBSD crystallographic orientation measurements of coarse-grained olivine were recorded from 58 sites (each site covering 1 mm^2) within Zone A and a total of 148 measurements of finer-grained olivine were recorded from 20 sites within Zone B. Only EBSD measurements with a mean angular deviation (MAD) of <1 were accepted and recorded. The EBSD results of Zones A and B display pronounced yet distinctly differing LPOs, suggesting two separate deformation processes and/or events. A comparison with olivine LPO in terrestrial cumulates and deformed mantle peridotites illustrates the unlikeliness that the olivine LPO from Zone A of NWA 5480 was formed through cumulation or compaction processes. In contrast, a distinct similarity to the olivine LPO formed by pencil glide ((0kl)[100] glide system), typical of plastic deformation in the terrestrial mantle, causes us to consider alternative formation processes for NWA 5480, including the feasibility of convection within the Vestan mantle.

References: [1] McSween H.Y.Jr. et al. 2010. *Space Science Reviews* DOI 10.1007/s11214-010-9637-z. [2] Beck A.W. & McSween H.Y.Jr. 2010. *Meteoritics & Planetary Science* 45, pp. 850–872 [3] Prior D.J. et al. 1999. *American Mineralogist* 84, pp. 1741-1759.