NWA 5717, AN UNUSUAL NEW CHONDRITE WITH SULFIDE-RICH CHONDRULE RIMS

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Introduction: NWA 5717 was interpreted to be a highly primitive (type 3.05) ordinary chondrite-related meteorite described as having remarkable features [1]. It consists of two unusual lithologies. The major lithology (A) has an oxygen isotopic composition similar to H chondrites and the other (B) has oxygen that plots on the terrestrial fractionation line near E chondrites. However, their petrologic features are unlike H or E. NWA 5717 may provide the opportunity to study a new meteorite parent body. Here we present a petrologic study of NWA 5717 in order to evaluate its classification and origin in relation to ordinary and enstatite chondrites.

Petrography: NWA 5717 appears to consist of two lithologies, a major darker lithology (A) and a lighter lithology (B) [1]. The differences between these lithologies in thin section are subtle and the boundaries between them are gradational. Lith B may have a higher abundance of enstatite-rich chondrules, but our section showed only small amounts of B and thus further work is needed to confirm this observation. Both A and B have a high density of chondrules, similar to that of O and E chondrites. In lith A, chondrules range from about 50 µm up to about 4 mm in size and show a variety of textures and olivine to pyroxene ratios. Many chondrules (in A) have sulfide-rich rims consisting of troilite, FeNi metal and sparse micrometer-sized fragments of ol and pyx with a range of compositions. Rims occur on both chondrules and chondrule fragments and appear to be unevenly distributed around some objects. In some cases the rims contain smaller (200 µm-size) chondrules. Beyond the rims is a fine-grained matrix material similar to that in highly unequilibrated chondrites such as Semarkona. In some cases, rims are discontinuous and are truncated by the matrix. Since metal is a sensitive indicator of metamorphic grade in OCs [2], we studied the texture of metal in lith A in order to test the designation of NWA 5717 as a type 3.05 [1]. The metal we observed thus far (in chondrules and matrix) appears to be either low-Ni metal or coarse assemblages of high- and low-Ni metal. We did not observe the plessite intergrowths that are characteristic of the Semarkona type 3.05 chondrite [2].

Discussion: NWA 5717 is a primitive chondrite with unusual characteristics including the ubiquitous occurrence of sulfide-rich rims around chondrules. It is highly unequilibrated with ol compositions suggesting it is petrologic type 3.05 [1]. However, metal textures suggest it may have experienced slightly higher metamorphic temperatures than Semarkona and is a minimum of 3.1. The origin of the sulfide-rich chondrule rims is perplexing. Their ubiquitous occurrence suggests that sulfide was mobilized on the parent body. However, the primitive matrix in contact with rims and presence of small chondrules within the rims suggests that the rims may be accretionary and formed in the nebula.

References: [1] Bunch T. E. et al. (2010) *LPSC* 41, abs. # 1280. [2] Kimura M. et al. (2008) *MAPS* 43, 116-1177. NASA/Cosmochemistry Grant # NNX09AG94G (MKW) and NNX10AI42G (DES).