PETROLOGY AND GEOCHEMISTRY OF THE NWA 3368 EUCRITE

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Introduction: A considerable amount of debate exists on the petrogenesis of eucrites, basaltic meteorites believed to have originated on 4 Vesta [1]. Many scientists have speculated on the formation event, supplementing ideas to Mason's fractional crystallization model and Stolper's partial melting model ([2-5]). Thus, an understanding of major and trace element compositions of all eucrites is imperative. Here, we report the petrology and trace element geochemistry of NWA 3368.

Methods: Two thin sections and one 20.5 gram polished slab were studied using a Cameca SX-50 electron microprobe. Six sub-samples including four clasts, a section of light-colored matrix, and a section of dark-colored matrix were extracted from the polished slab, and each piece was analyzed by both INAA and ICP-MS using the UA Nuclear Reactor Laboratory-LPL Gamma Ray Analysis Facility and the LPL ICP-MS facility, respectively [6]. A series of custom-made solutions of basaltic composition and the Geological Society of Japan standard basalt JB-2 were used as standards. Two small chips of NWA 3368 were sent to Open University to determine oxygen isotope composition.

Results: NWA 3368 has a variety of dark and light angular clasts that range in size from several millimeters to a couple of centimeters in length. They range in texture from coarse- to fine-grained. The fine-grained texture is composed of abundant plagioclase and lamellae-free pyroxene, while the coarse-grained texture contains abundant pyroxenes with varying degrees of exsolution lamellae. Electron microprobe analyses yielded pyroxene compositions of $Wo_5En_{36}Fs_{59}$ for low-Ca pyroxene and $Wo_{43}En_{30}Fs_{27}$ for high-Ca pyroxene. Plagioclase has a composition of $An_{90}Ab_{10}Or_{0.4}$. Ilmenite and troilite grains are abundant, along with chromite containing 5 to 27% TiO_2 and ~5% Al_2O_3. Other phases include iron metal and silica. All Fe/Mn ratios lie between 28 and 32, typical for eucrites. Trace element data reveal a flat REE pattern with a slightly negative Eu anomaly. Sm vs. Sc, La, and Eu plots all reveal a pattern normal to eucrites. Similarly, O-isotope data are consistent with other HEDs [7].

Conclusions: NWA 3368 is a non-cumulate, monomict eucrite breccia related to known eucrites. The two separate lithologies, particularly the pyroxene exsolution, probably represent two separate thermal events that may be either metamorphic or primary igneous in origin. The REE abundances and patterns, as well as other trace element abundances, are typical of normal or main group eucrites.

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