TRACE ELEMENTS IN NWA 480: STILL MORE DIVERSITY IN THE BASALTIC SHERGOTTITE GROUP.

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Introduction: NWA 480 was recently recognized as a basaltic shergottite [1,2]. It is mainly composed of pyroxenes and feldspathic glass (originally plagioclase) with minor amounts of phosphates (merrillite and chlorapatite), oxides and sulfides. The pyroxenes are complexly zoned as in QUE 94201 and Los Angeles, two other basaltic shergottites. However, unlike these meteorites, NWA 480 does not contain subequal proportions of pyroxene and shock metamorphosed plagioclase.

To better define the relationship between basaltic shergottites and to gain information about the petrogenesis of NWA 480, we made in-situ trace element analyses of various phases.

Results: The REE pattern of the fusion crust mimics that of the whole rock [2] and is unlike that of any of the basaltic shergottites. Although not as LREE-depleted, it most closely resembles the REE pattern of the ALHA 77005 lherzolitic shergottite (chondrite-normalized Yb/La in NWA 480 and ALHA 77005 are respectively 1.3 and 2.3 and both patterns have a maximum around Gd). Despite its low modal abundance, merrillite, as in other shergottites, is the main REE carrier. REE concentrations in apatite are lower (La ~3.4 ppm compared to ~60 ppm in merrillite) but the REE patterns for the two phosphates are similar and, with the exception of a negative Eu anomaly, almost parallel to that of the whole rock. Feldspathic glass has the positive Eu anomaly (Eu/Eu*>35) that always characterizes plagioclase. Although no significant major element zoning of this glass was noted by [2], REE concentrations and patterns for two spots are different. All pyroxenes (highly magnesian pigeonite, augite, and ferroan pigeonite) are depleted in LREE and have a negative Eu anomaly and all but one of the nine low-Ca pyroxenes analyzed have elevated La due to terrestrial contamination, despite the fresh appearance of this meteorite. As in other basaltic shergottites, pyroxenes in NWA 480 are extensively zoned. In low-Ca pyroxenes, Zr abundances increase by a factor of ~100, whereas the corresponding increases in Ti and Y abundances are by a factor of ~10, giving clues to the detailed crystallization history of this meteorite.

Inferences: Our data, as well as calculated equilibrium melts for the phases analyzed, indicate that NWA 480 had a crystallization history similar to that of QUE 94201 and Los Angeles [3,4]. Magnesian low-Ca pyroxene was the first phase to crystallize in all these meteorites. It was then mantled by augite, crystallization of which was interrupted by the appearance of plagioclase. In NWA 480 and QUE 94201, the later formed ferroan low-Ca pyroxenes crystallized along with merrillite, whereas in Los Angeles they formed with Fe-Ti oxides but prior to the onset of merrillite crystallization. In addition, as for all basaltic shergottites studied so far, the NWA 480 data are consistent with simple fractional crystallization of a parent melt whose REE pattern is the same as that of the whole rock. The increasing diversity of basaltic shergottite parent melt compositions may either imply distinct sources for each of these rocks or be the result of different degrees of interaction of partial melts from a LREE-depleted mantle source with a LREE-enriched (crustal) component [5,6].

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