PETROGENESIS OF A NEW NAKHLITE FROM RARE EARTH AND OTHER TRACE ELEMENT MICRODISTRIBUTIONS. M. Wadhwa[1], J. A. Barrat[2] and G. Crozaz[3], [1]Dept. of Geology, The Field Museum, 1400 S. Lake Shore Dr., Chicago, IL 60605, USA (mwadhwa@fieldmuseum.org), [2]CNRS UMR 6112 (Géodynamique et Planétologie) and Université d'Angers, Faculté des Sciences, 2 bd Lavoisier, 49045 Angers Cedex, France, [3]Dept. of Earth and Planetary Sciences and Laboratory for Space Sciences, Washington University, St. Louis, MO 63130, USA.

Introduction: NWA 817 is a new Martian meteorite found in the Moroccan desert [1]. It is classified as a nakhlite and is now the fourth member of this subgroup (the others being Nakhla, Lafayette, and Governador Valadares). Like the other three nakhlites, it is a cumulate rock composed mainly of augite (~69 vol.%) and olivine (~15 vol.%). However, unlike the other nakhlites, it contains abundant intercumulus mesostasis (~15 vol.%) that is composed of glass with fine-grained feldspar, pyroxene, and opaques. A hydrous ferrous silicate phase (most likely resulting from pre-terrestrial alteration) is also present [2].

We report here the results of *in-situ* analyses of trace elements (including REE) in augites, olivines, mesostasis, and a magmatic inclusion in an olivine grain. Our goal was to constrain the petrogenetic history of this new nakhlite and its relationship to the other three nakhlites (which are so similar that they could have originated within a single lithologic unit on Mars [3,4]).

Results: Augites in NWA 817 have slightly LREE-depleted (chondrite normalized Yb/La ~1.1-1.7), concave-downwards REE patterns similar to those of augites in the other nakhlites [4]. However, average abundances of REE as well as other incompatible elements such as Ti, Al, Zr and Y are higher than in augites of other nakhlites. For example, the range of La concentrations is 0.44-1.3 ppm in NWA 817 augites compared to 0.10-0.64 ppm [4] in the other nakhlites. Nevertheless, NWA 817 augites fall along extensions of the same compositional trends in element-element plots as those defined by augites of other nakhlites.

Olivine has the lowest REE abundances and its LREE concentrations appear to be affected by terrestrial contamination. However, its HREE abundances (Yb ~0.1-0.2 ppm; chondrite normalized Yb/Gd ~5-7) are similar to those of olivines in other nakhlites. The REE pattern of a magmatic inclusion in an olivine (chondrite normalized La/Yb ~5) is similar to that of the bulk rock (which, in turn, closely corresponds to that of the Nakhla whole rock [5], although absolute concentrations are higher in NWA 817 by a factor of ~2.5). Of all the phases in NWA 817, the mesostasis has the highest REE abundances (La ~22 ppm), higher by a factor of ~4 than in the whole rock although their REE patterns are similar (chondrite normalized La/Yb ~6 for the mesostasis).

Inferences: The parallelism of the REE patterns of the bulk rock, the magmatic inclusion and the mesostasis suggests that the NWA 817 parent melt was LREE-enriched, with a chondrite normalized La/Yb ~5-6. Crystallization began with olivine and augite fractionation from the parent melt, followed by crystal accumulation. The fractionated parent melt was then trapped in the interstitial areas between the cumulus crystals and subsequent fast cooling resulted in formation of the intercumulus mesostasis.

The similarity of the bulk rock REE patterns of NWA 817 and the other nakhlites, and of the trace element zonation trends in augites of these meteorites indicates that parent melts of all the nakhlites were comagmatic. However, the higher abundance of the intercumulus mesostasis compared to the other nakhlites may imply a somewhat different crystallization environment for NWA 817 (*e.g.*, formation at shallower depth in the same cumulus pile in which the other nakhlites formed).

References: [1] *Meteoritical Bulletin 85* (2001). [2] Gillet Ph. et al., this volume. [3] Harvey R. P. and McSween H. Y., Jr. (1992) *GCA, 56*, 1655. [4] Wadhwa M. and Crozaz G. (1995) *GCA, 59*, 3629. [5] Nakamura N. et al. (1982) *GCA, 46*, 1555.