INVESTIGATION OF A BROWN WEATHERING PRODUCT FOUND IN NAKHLA MELT INCLUSIONS. D. Rost[1], J. Fritz[2], A. Greshake[2], E. K. Jessberger[1], T. Stephan[1], D. Stöffler[2] and I. Weber[1], [1]Institut für Planetologie / ICEM, Wilhelm-Klemm-Str. 10, 48149 Münster, Germany, rostd@uni-muenster.de, [2]Museum für Naturkunde, Invalidenstr. 43, 10115 Berlin, Germany.

Introduction: In the course of a comprehensive study on melt inclusions in olivine of Martian meteorites, a brown microcrystalline phase was discovered in two vitrophyric Nakhla inclusions from different thin sections [1,2]. Its optical properties resemble those of the typical weathering product ("iddingsite") primarily found in olivine cracks of Nakhla and Lafayette [3–5]. This material (WPO hereafter) is supposed to be a result of hydrothermal alteration processes that took place on Mars: Invading saline fluids dissolved the precursor material (olivine, Si-rich mesostasis glass) and substituted it by the WPO – retaining some chemical signature of the precursor material, *e.g.*, in the Al, Si, Fe, and Mn compositions [5,6].

The brown phase in Nakhla inclusions (BPI hereafter) cannot be related to an olivine precursor because olivine was never found within typical vitrophyric melt inclusions [7]. Therefore, we investigated the relation of the BPI to the WPO and another similar phase found adjacent to pyroxene grains to get new insights into the involved alteration processes.

Experimental: The major element composition was analyzed with an electron microprobe. High resolution (~0.3 µm) TOF-SIMS [8] was used to obtain the concentration and lateral distribution of major, minor, and trace elements.

Results and Discussion: The BPI in the two inclusions show remarkably similar element compositions. This indicates an identical precursor material and little variation in the composition of the intruding fluid.

Contents of 46.3 wt% SiO_2, 29.5 wt% FeO, 10.1 wt% MgO, and 9.6 wt% Al_2O_3 (normalized to 100 wt%) are unlike usual WPO compositions [4] but resemble those of the also analyzed alteration product adjacent to pyroxene. However, absolute and especially relative abundances of a set of minor and trace elements, Li, K, Rb, Sr, Cs, and Ba, show a signature different from Lafayette "iddingsite" [6] as well as from all other analyzed phases including the alteration phases adjacent to olivine and pyroxene.

It seems little plausible that the composition of the fluid is responsible for this particular signature. It is more likely that the signature results from the precursor material. Concerning the textural position of the BPI, pyroxene seems implausible, because the BPI occurs as intersertal phase inside the well-preserved pyroxene framework. Another proposed precursor would be siliceous glass [5]. However, none of the analyzed glasses within Nakhla inclusions matches the trace element signature. It seems more plausible that the precursor material of the weathering product in Nakhla olivine inclusions was an amphibole. Amphiboles were found in melt inclusions before [9]. Typical partition coefficients are consistent with the concentrations of the trace elements in this phase and the neighboring glass.

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