P230-021 **Room: 201B** **Time: May 18 11:33-11:45**

Mineralogical characteristics of nakhlite Martian meteorites and their burial depths

Takashi Mikouchi[1]

[1] Dept. of Earth & Planet. Sci., Univ. of Tokyo

Nakhlites are augite-rich cumulate rocks with variable amounts of olivine and groundmass plus minor Fe, Ti oxides. Currently seven samples are known: Nakhla (Nak), Governador Valadares (GV), Lafayette (Laf), NWA817, Y000593 (Y), NWA998 and MIL03346 (MIL). All the nakhlites show a similar unbrec-ciated cumulate texture, but the groundmass abundance shows clear variation from one sample to another. In Nak, GV and Laf, the groundmass abundance is about 7-8%. Y and NWA998 have a slightly higher abundance of 10%, while NWA817 and MIL have much higher abundance of 20-24%. The groundmass texture is related to its abundance. The groundmass of Nak, GV, Laf and Y is mainly composed of lathy feldspar grains. Y plagioclase lath is slightly thinner than the others. In contrast, NWA817 and MIL have glassy mesostasis with few or no feldspar crystals. In NWA998, feldspar is a large blocky crystal with clear twinning.

Augite grains in all samples have a nearly identical core composition of En39Fs22Wo39 and there are thin Fe-rich rims where augite grains abut groundmass. The degree of chemical zoning towards the Fe-rich rims varies from one sample to another. The interior portions of the Fe-rich rims have a fairly uni-form Wo content, but the Wo contents drop at the outer edge of the grain except for MIL pyroxene. NWA998 has the most Mg-rich edge composition. The edge composition becomes more Fe-rich in the order of Laf, Nak/GV, Y and NWA817. MIL shows a qualitatively different zoning pattern from the oth-ers as the Fe-rich edge is zoned to the hedenbergite composition.

Olivine grains in all samples except Laf and NWA998 show extensive chemical zoning whose degree is clearly related to the zoning patterns in pyroxenes. MIL and NWA817 have the widest compositional ranges (Fa54-93). Y shows a similar but slightly narrower compositional range of Fa58-85. Nak and GV have even narrower ranges (Fa58-72). In contrast to these samples, olivines in Laf and NWA998 are quite homo-geneous (Fa66-67 and Fa61-62, respectively). Such chemical zoning of nakhlite olivines, especially Fe-Mg and Ca, is useful to estimate their cooling rates and burial depths. The obtained burial depths are 4 m for MIL, 7 m for Y and deeper than 30 m for NWA998. MIL has a deeper burial depth than that of NWA817 (1-2 m). The Y burial depth of 7 m is slightly shallower than those for Nak and GV (~10 m). The burial depth of NWA998 (deeper than 30 m) is consistent with the result of Laf (deeper than 30 m).

According to the obtained burial depths, nakhlites are located from the top to the bottom in the order of NWA817, MIL, Y, Nak/GV, Laf/NWA998. This order is generally related to mineralogical character-istics of each sample as the degree of chemical zoning of pyroxene systematically varies with these rela-tive burial depths. It is not clear why MIL augite shows a different zon-ing pattern and the calculated buri-al depth is slightly deeper than NWA817. MIL may have derived from another related flow. If we con-sider that gravitational settling of crystallizing grains played a significant role in the nakhlite igneous body, cumulus phases should have been more densely packed in deeper areas. This could produce loose cumulus framework for shallower sam-ples, forming abundant groundmass or mesostasis areas. The abun-dance and mineralogy of nakhlite groundmass are consistent with this hypothesis. The presence of large blocky feldspar in NWA998 is distinct from other samples. NWA998 is likely to represent the deepest sample among nakhlites.

Nakhlites are important samples in relation to surface geology of Mars. The TES of Mars Global Sur-veyor identified Fe-rich olivine in Syrtis Major and can be a potential nakhlite source area. Because the obtained burial depths of nakhlites suggest that some samples are near the surface, further exploration may be able to locate a particular nakhlite igneous body from the remote sensing data.