Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

PPS02-12 会場:203 時間:5 月 20 日 14:15-14:30

始原的なメソシデライトＮＷＡ 1878
A primitive mesosiderite NWA 1878

杉浦 直治 [1*], 木村真 [2]
naoji sugiura[1*], makoto kimura[2]

[1] 東京大学大学院理学系研究科, [2] 茨城大学理学部理学科地球環境科学領域
[1]University of Tokyo, [2]Ibaraki University

The silicate part of mesosiderites is similar to HED achondrites. The parent body solidified early. Mesosiderites were located close to the surface of the parent body as evidenced by rapid cooling rates after a reheating event (Delaney et al., 1981) and also by excess neutron fluence (Hidaka and Yoneda, 2011). Hence mesosiderites may remember the early solar nebula environment which was very energetic as suggested by chondrule formation. In fact, mesosiderites were reheated to high temperatures after the mixing of silicates and metal. The heat source of this reheating event is not well established and mesosiderites may have been heated by an external (nebular) heat source. For understanding mesosiderite formation and the reheating event we need to study the most primitive mesosiderites. The following features can be used as criteria for primitiveness. They are plagioclase composition heterogeneity, pyroxene lamellae width, metal grain size and olivine corona development. Plagioclase compositions in mesosiderites are in a restricted range (Delaney et al., 1981). The compositional variation was probably inherited from the precursor materials though it may be partly due to evaporative loss of Na at high temperatures. In either case, the heterogeneity would be reduced during subsequent cooling in a closed system. A wider compositional range could be an indicator for weaker reheating. Plagioclase in NWA 1878 shows the widest range in composition, ranging from An79 to An99. This was measured with SEM-EDS and need to be confirmed by EPMA. Pyroxene lamellae width seems to be a promising criterion because this is not affected by original heterogeneity of brecciated samples. But in order to make this a quantitative criterion, bulk pyroxene composition effects have to be corrected because the exsolution temperature depends on the bulk pyroxene composition. In the case of NWA 1878, pyroxene lamellae are observed only in Fe-rich pyroxenes (Fs38~Fs43). This suggests relatively rapid cooling, although the exact cooling rate has not been established yet. The metal grain size seems to be a good criterion for relatively primitive mesosiderites which show spheroidal metal grains. The size determination was made by fitting spheroids to spheroidal grains. This procedure is somewhat subjective because grains are not perfectly spheroidal, somewhat sintered with each other. As the grain size grows by metamorphism, the metal shape becomes more irregular and quantitative size determination becomes more difficult. In spite of such difficulties, metal grain sizes could be determined precise enough for the purpose of sub-classification of primitive mesosiderites. The metal size is ~250 micrometer in diameter in NWA 1878 which is the smallest among the mesosiderites in this study. Incipient corona formation around an olivine grain ~2 micrometer in size is observed in NWA 1878. Fe-poor pyroxenes occur close to the olivine, followed by anorthite. Chromites are located farther away in Fe-rich pyroxenes. Many phosphates are found on metals grains facing the olivine. These are in contrast with stage I corona described by Nehru et al., (1980) and Delaney et al., (1981) where chromites are located in a distinct corona layer next to the olivine and many phosphates are also located close to the corona. The locations of chromite and phosphate in NWA 1878 suggest that both Cr and P did not diffuse over long distances during the reheating event. This petrographic feature cannot be quantized, however, and should be used as supporting evidence for primitiveness. Based on the four criteria, NWA 1878 appears to be the most primitive mesosiderites among 7 mesosiderites I observed so far.

References. Delaney et al., (1981) Proc. Lunar Planet. Sci., 12B, 1315-1342. Hidaka and Yoneda, (2011) GCA 75, 5706-5715. Nehru et al., (1980) GCA 44, 1103-1118.

キーワード: メソシデライト, 再加熱, 始原的
Keywords: mesosiderite, reheating, primitive