AMOEBOID OLIVINE AGGREGATES IN THE NWA 760 CV3 CHONDRITE. M. Komatsu[1], A. N. Krot[2], T. Mikouchi[3], T. Tagai[1], M. Miyamoto[3], and K. Keil[2], [1]The University Museum, University of Tokyo, 7-3-1 Hongo Bunkyo-ku Tokyo 113-0033 Japan (mutsumi@um.u-tokyo.ac.jp), [2]Hawai'i Institute of Geophysics and Planetology, School of Ocean and Earth Science and Technology, University of Hawai'i at Manoa, Honolulu HI 96822, USA. [3]Department of Earth and Planetary Science, University of Tokyo, Japan.

Introduction: Amoeboid olivine aggregates (AOAs) are important components of carbonaceous chondrites and have been interpreted to represent solar nebular condensates that experienced high-temperature annealing, but largely escaped melting [1]. Their properties can be used as sensitive indicators of metamorphic or alteration processes [1,2], because they are generally composed of fine-grained minerals (forsterite, anorthite, spinel) that are easily modified during these processes [2]. In order to understand the alteration history of the CV3 chondrites, we performed mineralogical studies of AOAs in the recently discovered CV chondrite NWA 760 [3]. Here we report the preliminary results of the mineralogy and petrology of AOAs in this meteorite and compare them to those in other CV3 chondrites.

Analytical techniques: A small chip of NWA 760 was made into thin sections. AOAs in the thin sections were identified by optical microscope and backscattered electron images using a Hitachi S-4500 scanning electron microscope and combined X-ray elemental maps [Mg (red) + Al (green) + Ca Kα (blue)]. Chemical analyses and X-ray maps were obtained using a JEOL JCM-733 and a JX-8900 EMPA.

Results: NWA 760 consists of chondrules (65 vol%), AOAs (5 vol%), Ca-Al-rich inclusions (1 vol%) and fine-grained matrix (28 vol%) with a few isolated mineral fragments (<0.4 vol%). Chondrules have porphyritic olivine, porphyritic olivine-pyroxene, and porphyritic pyroxene textures; barred olivine and cryptocrystalline chondrules were not observed. AOAs are irregularly-shaped objects, 50 μm to 2 mm in size, composed of anhedral, fine-grained (1-20 μm) olivines and refractory, Ca-Al-rich nodules (Figs. 1, 2). In many cases, the refractory nodules have a concentric texture: an anorthite ± spinel ± Al,Ti-rich diopside core is surrounded by Al-diopside (Fig. 3). AOAs also contain tiny grains of Fe,Ni-metal (mainly kamacite) in olivine regions; troilite is rare to absent. Olivine grains show minor enrichment in FeO along edges and cracks. Anorthite is partially replaced by nepheline (Fig. 4). Texturally, the AOAs in NWA 760 are very similar to those in the reduced CV3 chondrites Efremovka, Leoville, and Vigarano described by [1].

Histograms of olivine compositions in the NWA 760 AOAs together with those in the reduced CV chondrites Efremovka, Leoville, Vigarano, and oxidized CV chondrite Allende are shown in Fig. 5.

Olivines in AOAs from NWA 760 have higher fayalite contents (Fa_{1-12}), than those in AOAs from the reduced CVs. However, they are less ferrous and show smaller compositional ranges than those in the Allende AOAs (Fa_{7-40}). There are two types of diopside in AOAs: Al-diopside and Al,Ti-diopside. The Al-diopsides that occur between anorthite and olivine show significant compositional variations in Al_2O_3 contents (1-17 wt%). Tiny grains of Al,Ti-diopside are associated with spinel. Although they are too fine-grained to be analyzed by EPMA, EDS analyses and X-ray mapping show that they have high Ti contents. Plagioclase grains have compositions close to end-member anorthite. They are partially replaced by a fine-grained Na-bearing phase, probably nepheline. Spinel grains contain 6-10 wt% FeO which increases towards the edges of the grains.

Discussion: AOAs in NWA 760 are texturally and mineralogically similar to those in the reduced CV3 chondrites. However, their olivines are slightly enriched in FeO compared to those in the reduced CVs, suggesting a higher degree of thermal metamorphism experienced by NWA 760. Chizmadia et al. [2] described a systematic increase of ferroan olivine rim widths in the CO AOAs with increasing petrologic types of their host meteorites. Ferroan olivine rims in the NWA 760 AOAs are ~10 μm in thickness, comparable to those in Efremovka AOAs, but thinner than those on Allende AOAs (~20 μm). These observations suggest that NWA 760 is petrologically intermediate between the reduced and oxidized, Allende-like CV chondrites.

References: [1] Komatsu M. et al. (2001) *MAPS, 36,* 629-641. [2] Chizmadia L. J. et al. (2002) *MAPS, 37,* 1781-1796. [3] Grossman J. N. and Zipfel J. (2001) *MAPS, 36,* A293–322. [4] Komatsu M. (2003) Ph.D thesis. University of Tokyo.

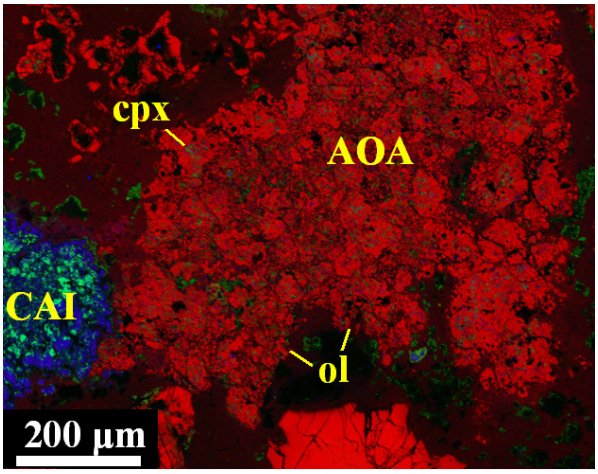

Fig. 1. Combined X-ray elemental map in Mg (red), Al (blue) and Ca Kα (green) of an AOA in NWA 760. ol = olivine; cpx = Al-diopside.

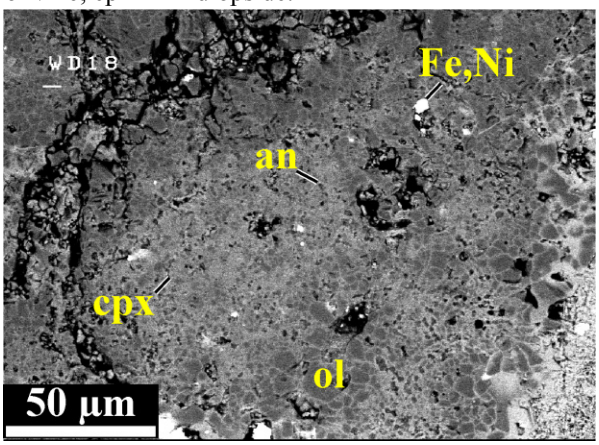

Fig. 2. BSE image of an AOA in NWA 760. AOA is composed of 1-20 µm sized olivines (ol; dark gray) and refractory nodules (light gray) largely composed of anorthite (an) and Al-diopside (cpx). Tiny grains of FeNi-metal (FeNi; white) are enclosed in olivines.

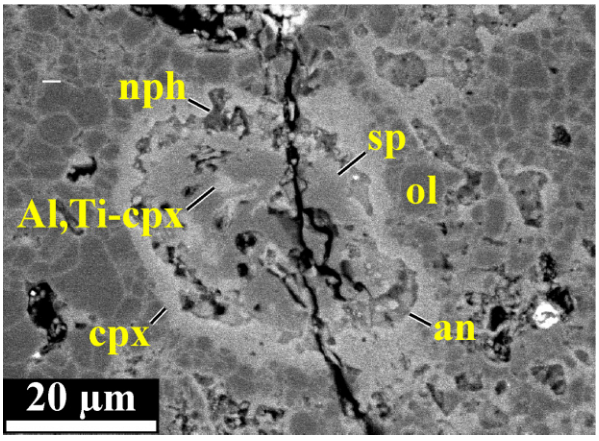

Fig. 3. BSE image of refractory nodules in an AOA. They have a concentric texture: spinel (sp) + Al,Ti-diopside (Al,Ti-cpx) core is surrounded by the layers of anorthite (an) and Al-diopside (cpx). nph=nepheline.

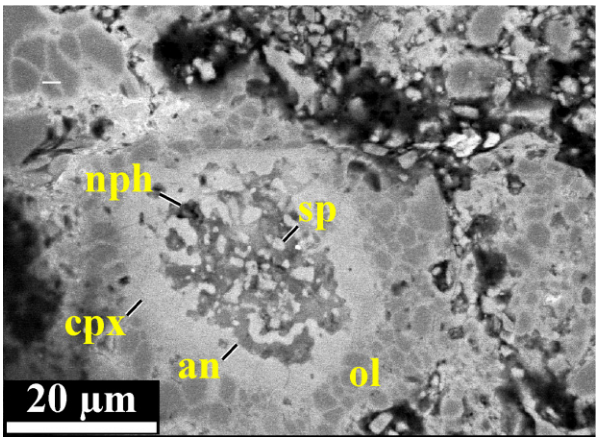

Fig. 4. BSE image of refractory nodules in an AOA. Anorthite (an; dark gray) is partly replaced by nepheline (nph; black). ol=olivine; cpx=Al-diopside; sp=spinel.

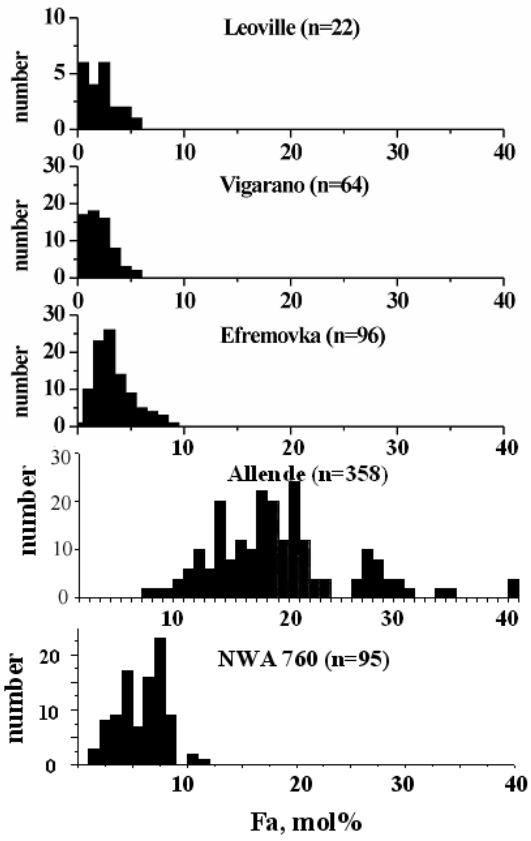

Fig. 5. Histograms of olivine compositions in AOAs from NWA 760, Leoville, Vigarano, Efremovka [1], and Allende [4]. Olivines in NWA 760 are less ferrous than those from the Allende AOAs and show smaller compositional ranges. They are more ferrous than those from the reduced CV chondrites.