MINERALOGY AND OXYGEN ISOTOPES OF UNMELTED ANTARCTIC MICROMETEORITES. R. Okazaki and T. Nakamura, Department of Earth and Planetary Sciences, Faculty of Sciences, Kyushu University, Hakozaki, Higashiku-ku, Fukuoka 812-8581, Japan (okazaki@geo.kyushu-u.ac.jp).

Introduction: Cosmic spherules and micrometeorites account for the major fraction of extraterrestrial material accreting on the Earth. The amount of micrometeorites arrived on the terrestrial surface is up to 16000 ton [1], which is around 10 times as much as that of meteorites.

The JARE-39 expedition recovered great amounts of micrometeorites from Kuwagata and Tottuki areas in Antarctica in 1998 [2]. We have collected unmelted Antarctic micrometeorites (AMMs) from the 40-100 µm fractions of these collections. The Kuwagata AMM collection catalog is available in http://dust.cc.gakushuin.ac.jp.

In order to know the origin and history of AMMs, we started to investigate them one by one in respects of oxygen isotopes, rare earth element abundances and noble gas isotopes, as well as petrologic and mineralogical studies. A new sample preparation has been developed to carry out these multidisciplinary analyses. Here we report mineralogical characteristics and the preliminary results of oxygen isotope analysis.

Experimental: Kuwagata AMMs were embedded in crystal bond and then polished. The polished AMMs were investigated with a scanning electron microscope at the Kyushu Univ. Chemical compositions were determined using an electron microprobe analyzer at the Kyushu Univ.. Oxygen isotope analysis is now in progress. For the present, three Kuwagata AMMs were measured with a cameca 6f ion microprobe at the Kyushu Univ. The 0.6nA Cs^+ primary ion beam was focused in aperture-illumination mode to produce a ~20µm spot. The secondary mass spectrometer was operated at 9.5kV with a mass resolving power of ~5500 and an 80eV energy window. The normal-incident electron flood gun was used for charge compensation. San Carlos olivine grains were used for standardization.

Results and Discussion: Kuwagata AMM of Y98K11KS201 (abbreviated as KS201) consists of fine-grained minerals and the SEM image suggest that the constituent minerals appear to be homogeneously distributed within this AMM. Thus the spot analysis on this AMM would represent its bulk composition. Fig. 1 is a Si-Mg-Fe ternary diagram. The composition of KS201 is close to the CI matrix composition [3].

Y98K11KS212 consists of two lithologies: one is fine-grained porous matrix with many vesicles, and another is a compact clast (enclosed by a white dotted line in Fig. 2). The compact clast of KS212 contains round-shaped objects. The cores of the round-shaped objects are enriched in Fe (point A in Figs. 1 and 2), while the composition of groundmass of the compact clast (point C) is close to that of fine-grained phyllosilicates in Tagish Lake carbonaceous chondrite [4]. Also the porous matrix (point D) has the chemical composition similar to the point C (Fig. 1). The groundmass of the compact clast and the porous matrix are saponite or decomposed saponite. The porous matrix appears to form from the compact clast during atmospheric entry heating, probably under subsolidus temperature. The rim-like area surrounding the Fe-rich core (point B) is intermediate between the core and groundmass compositions as shown in Fig. 1, which is produced by interaction between the saponite groundmass and the Fe-rich core.

Y98K11KS213 is a coarse-grained AMM with Fe-depleted phase as a core surrounded by olivines (Fig. 3). The core is close to the enstatite composition on the Si-Mg-Fe diagram but the stoichiometry is not of pyroxene.

Oxygen isotopes were determined for KS201, the porous matrix of KS212 and the olivine phase of KS213. As shown in Fig. 4, KS201 is plotted on TFL but within an area limited by unmelted AMM [5]. Oxygen isotope composition of one spot of KS212 was measured twice but varies somewhat, especially in ^{17}O abundance. This might be due to heterogeneous distribution of ^{17}O-rich phases. The olivine phase of KS213 has the most ^{16}O-rich composition among three AMMs measured here.

The oxygen data for KS212 is next to the carbonaceous chondrite anhydrous minerals (CCAM) mixing line [6], in contrast to the similarities in chemical compositions to Tagish Lake or CI-chondrite matrix (Fig. 1) which contains hydrous minerals with ^{16}O-depleted oxygen isotopes [e.g., 7]. We need to measure oxygen isotopes more, especially on the spot KS212-C, in order to solve the contradiction between oxygen and mineralogical data.

References: [1]Yada T. et al. (2004) *Earth Planets Space,* **56***,* 67–79. [2] Yada T. and Kojima H. (2000) *Antarct. Meteorite Res.*, **13**, 9-18. [3] Tomeoka K. and Buseck P. R. (1988) *Geochim. Cosmochim. Acta*, **52**, 1627-1640. [4] Nakamura T. et al. (2003) *Earth Planet. Sci. Lett.* **207**, 83-101. [5] Engrand C. et al. (1997) *Meteorit. Planet. Sci.*, **Supp. vol 32**, A39. [6] Clayton et al. (1973) *Science* **182**, 485-488. [7] Clayton R. N. and Mayeda T. K. (1984) *Earth Planet. Sci. Lett.* **67**, 151-161. [8] Zolensky et al. (1993) *Geochim. Cosmochim. Acta*, **57**, 3123-3148.

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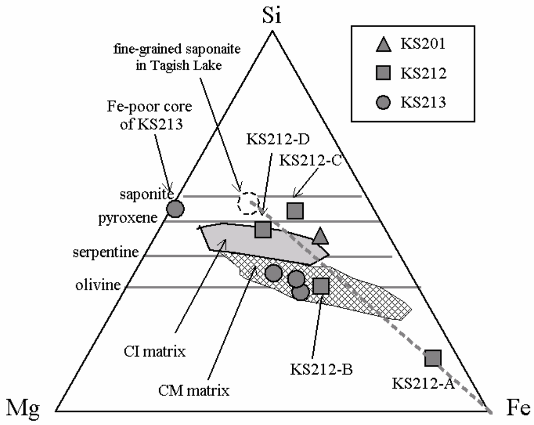

Fig. 1. Si-Mg-Fe ternary diagram of Kuwagata AMMs measured here. For comparison compositional ranges of CI [3] and CM [8] chondrite matrices are also shown.

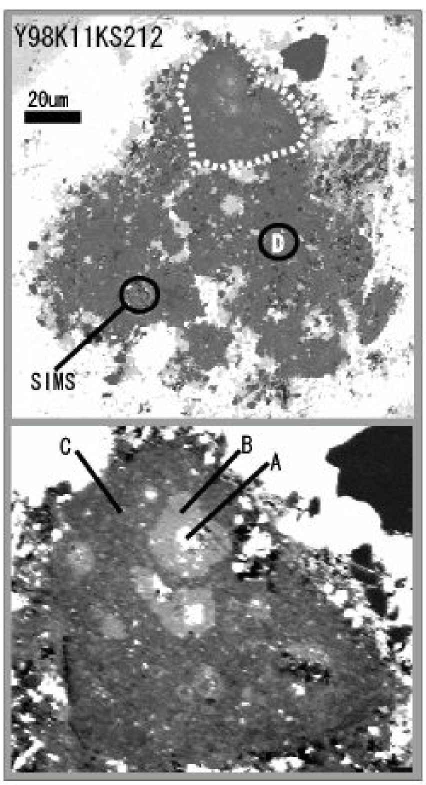

Fig. 2. Backscattered electron image of Kuwagata AMM Y98K11KS212. This AMM consists of porous matrix and compact clast (enclosed by a white dotted line in the upper photo). Characters A-D in this figure are points analyzed with an electron microprobe analyzer, corresponding to those shown in Fig. 1. The spot analyzed for oxygen isotopes is shown as "SIMS."

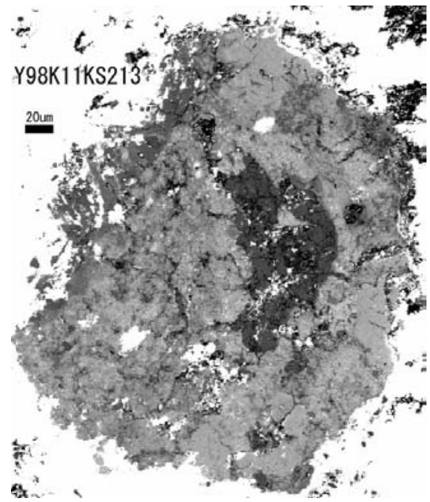

Fig. 3. Backscattered electron image of Kuwagata AMM Y98K11KS213. The core is depleted in Fe compared to the surrounding olivine grains.

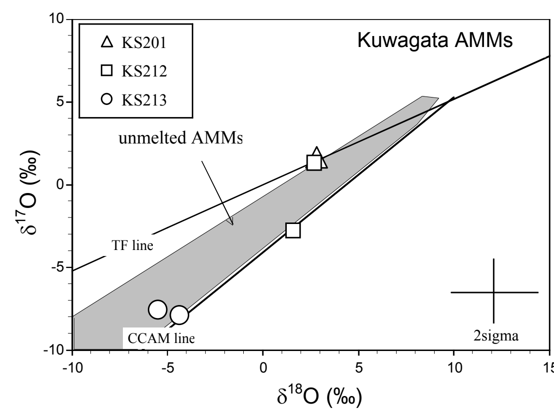

Fig. 4. Oxygen isotope compositions of AMMs Y98K11KS201, KS212 and KS213. The Compositional area of unmelted AMMs [5] is also shown.