CONSORTIUM STUDY OF THE ASUKA 12209 ANGRITE.

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Introduction: Asuka (A) 12209 is a new angrite recovered by the joint Japanese and Belgian Antarctic meteorite research expedition (JARE54 and BELARE-SAMBA) during the 2012-2013 season [1,2]. It was collected on the blue ice at Nansen Icefield located south of Sør Rondane Mountains on Jan. 6, 2013. It is a 43.65 g complete stone partly covered with fusion crust (Fig. 1). Large olivine crystals (~5 mm) with pale green color are exposed on the dark surface and mm-sized vesicles are present. We have organized a consortium study of this meteorite to first check its pairing with A 881371 angrite which was found in the same ice field [3] and subsequently to analyze it in more detail (mineralogy, bulk chemistry, trace element of olivine megacrysts, isotopes including chronology) in order to fully utilize its larger mass compared to A 881371 (original main mass: 11.3 g). In this abstract we report a preliminary result (petrology and mineralogy) of this consortium study.

Sample: A polished thin section (PTS) was prepared for optical microscopy and electron microprobe analysis as a normal procedure for classification of Antarctic meteorites at NIPR. Small fragments were removed for oxygen isotope analysis. Then, one slice was cut by a diamond wire saw from the main mass for mineralogical and isotopic studies performed in Belgium.

Ongoing Analysis: Optical microscope observations and Raman spectroscopy have been performed on a PTS, for a preliminary evaluation of the amount of shock experienced by the sample. The thin section has been mapped by μ-XRF under different experimental conditions, mostly to test the potential of the method. EDS maps were also acquired with FEG-SEM at NIPR (JEOL JSM-7100F). Electron microprobe analysis was performed at Univ. of Tokyo (JEOL JXA 8530F). The trace element composition of olivine megacrysts were determined using a Teledyne CETAC Technologies Analyte G2 193 nm ArF*excimer laser ablation system coupled to a Thermo Scientific Element XR ICP-MS unit at Ghent Univ. Oxygen isotopes were measured by infrared laser-assisted fluorination at Open Univ.

Fig. 1 A 12209 on the blue ice.

Pairing with A 881371: The PTS of A 12209 exhibits a porphyritic texture characterized by olivine megacrysts (up to 5 mm in size) embedded in medium-grained groundmass (Fig. 2), which is typical of quenched angrites. Olivine megacrysts show different degrees of deformation (kink bands, tilt boundaries and partial recrystallization) although the groundmass appears essentially unshocked. Olivine megacrysts show variable compositions ($Fo_{89\sim84}$), but each grain is homogeneous. The extremely large size and disequilibrium Mg-rich compositions of megacrysts suggest that they are xenocrysts. There are smaller olivine xenocrysts with Mg-rich cores ($Fo_{90\sim75}$). Overgrowths enriched in Fe and Ca developed at the xenocryst rims. Hercynite spinel (Al_2O_3=52 wt%) shows a partial resorption texture implying that they are also xenocrysts. More detailed study of xenocrysts is found in [4]. Groundmass minerals are olivine ($Fo_{65\sim0}La_{1\sim35}$), Al-Ti-rich clinopyroxenes (molar Fe/Fe+Mg=0.39~1, Al_2O_3=5-11 wt%, TiO_2=0.8-6 wt%) and anorthite ($An_{>99.5}$). The doleritic texture and extensive chemical zoning of olivine and pyroxene suggest rapid cooling from magma. Thus, the petrology and mineral chemistry of A 12209 are all identical to A 881371 [5] and it is likely that these two angrites are paired.

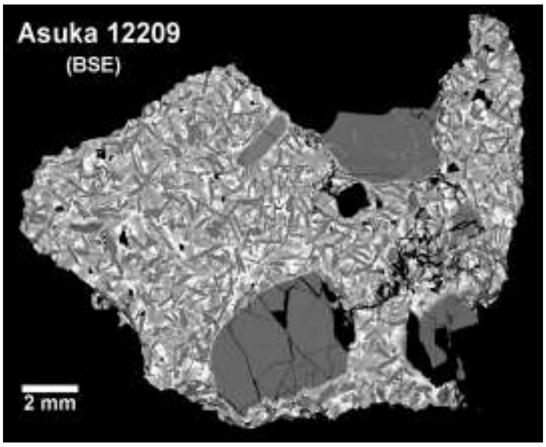

Fig. 2 Back-scattered electron image of A 12209. Note the presence of large olivine xenocrysts.

Perspectives: A 12209 can be an important sample because of its much larger mass compared to A 881371. The remarkable presence of olivine xenocrysts is highlighted by different degrees of deformation. These features will be more quantitatively measured by EBSD and combination with trace element data are useful to deduce their deformation origins (e.g., shock or some other process) [6]. Furthermore, A 12209 has a potential to be a good benchmark of the Pb-Pb and Mn-Cr + Al-Mg ages as used for Sahara 99555 and D'Orbigny [e.g., 7]. The finding of A 12209 thus could advance our knowledge of the angrite parent body to better understand very early differentiation processes in the solar system.

References: [1] Yamaguchi A. et al. (2016) Meteorite Newslett. 25. [2] Imae N. et al. (2015) Antarct. Record 59, 38-72. [3] Yanai K. (1994) Proc. NIPR Symp. on Antarct. Meteorites 7, 30-41. [4] McKibbin S. et al. (2016) Antarct. Meteorites XXXIX, this volume. [5] Mikouchi T. et al. (1996) Proc. NIPR Symp. on Antarct. Meteorites 9, 174-188. [6] Mikouchi T. (2015) LPS 46, #2065. [7] Amelin Y. (2008) GCA 72, 4874-4885.