**NOBLE GAS AND MINERALOGICAL STUDIES OF NWA 7325 UNGROUPED ACHONDRITE.**

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**Introduction:** The study of ungrouped achondrites is key to understand the degree of asteroidal diversity in the early solar system as well as as well as the style and timescale of igneous differentiation. Northwest Africa 7325 (NWA 7325) is an ungrouped achondrite discovered in the western Sahara in February 2012 and does not belong to any known achondrite groups. It has been proposed that NWA 7325 may be the first meteorite sample from the planet Mercury [1]. However, the ancient Pb-Pb date and $^{54}Cr/^{52}Cr$ composition suggests a link with ureilites [2]. In this study, we report on the mineralogy as well as the elemental and isotopic composition of noble gases in NWA 7325 to better understand its magmatic history.

**Experimental Procedures :** Noble gases were measured for two fragments #01 and #02 of NWA 7325 weighing 20.2 and 114.9 mg, respectively with a modified-VG5400/MS-III at the Geochemical Research Center, University of Tokyo. For extraction of noble gases the #01 sample was totally melted at ~1800˚C, while the #02 sample was heated stepwise at 300, 800, 1100, 1400 and 1800˚C. In addition, we observed thin sections of NWA 7325 by using optical microscope and scanning electron microscope (FEG-SEM: Hitachi S-4500) with energy dispersive X-ray spectrometer (EDS). Electron probe microanalyzer (EPMA: JEOL JXA8900L) was used to obtain elemental maps and perform quantitative analysis of constituent minerals.

**Results and Implication:** NWA 7325 has a well degassed composition of trapped noble gases, e.g., $^{84}Kr = (82–119) \times 10^{-12}$ and $^{132}Xe = (24–31) \times 10^{-12}$ ccSTP/g, compared to carbonaceous chondrites [3]. Excess $^{129}Xe$ from β decay of $^{129}I$ ($t_{1/2}$ = 15.7 Myr) was measured with a high $^{129}Xe/^{132}Xe$ ratio of 2.6 at 1400ºC. These indicate that the parent body of NWA 7325 was degassed very well (e.g., differentiation by complete melting) and then cooled rapidly while $^{129}I$ was still alive. This observation is consistent with the early formation indicated from the U-Pb age of 4562.5 ± 4.4 Ma [4]. NWA 7325 would be a part of the mantle of its parent body because $^{244}Pu$ was not present as indicated by the absence of fissiogenic $^{134}Xe$ and $^{136}Xe$, which is consistent with its cumulate mineralogy and the low concentrations of incompatible elements such as U, Th [3], and REEs [1]. Cosmic-ray exposure age ($T_3$ and $T_{21}$) of ~20 Ma was calculated using the formulae in [5]. NWA 7325 shows evidence of *in-situ* partial melting at mineral grain boundaries and subsequent quenching. We suggest that the parent body of NWA 7325 has experienced a break-up event to melt the mantle rock by shock and quench it. This event may have taken place while the body was still hot because high temperature reaching ~1300ºC is required to melt forsterite-diopside-anorthite assemblages.

**References:** [1] Irving A. J. et al. 2013. Abstract #2164. 44th Lunar and Planetary Science Conference. [2] Kita, N. et al. 2014 Abstract #1455. 45th Lunar and Planetary Science Conference. [3] Mazor E. et al. 1970. *Geochimica et Cosmochimica Acta* 34:781-824. [4] Amelin Y. et al. 2013. *Meteoritics and Planetary Science* 48:#5165. [5] Eugster O. and Michel Th. 1995. *Geochimica et Cosmochimica Acta* 59:177-199.