H AND C ISOTOPES OF C-GRAINS FROM MARTIAN METEORITE NWA 6162

Y. Lin[1], A. El Goresy[2], J. Zhang[1], M. Miyahara[3], J. Hao[1], M. Zhang[1], E. Ohtani[4] & Ph. Gillet[5]. [1]Key Laboratory of Earth and Planetary Sciences, Chinese Academy of Science, Beijing, China, LinYT@mail.igcas.ac.cn. [2]Bayerisches Geoinstitut, Universität Bayreuth, 95447 Bayreuth, Germany. [3]Graduate School of Science, Hiroshima University, Hiroshima, 739-8526, Japan. [4]Tohoku University, 980-8578, Sendai, Japan. [5]EPFL, CH-1015, Lausanne, Switzerland.

Introduction: Organic carbon matter from Martian meteorites is an unique probe for study of possible biotic activity, paleoclimate and carbon cycle on Mars. Step combustion of bulk Martian meteorites showed several peaks of carbon components [1]. Organic carbon grains were in situ found in Martian basaltic meteorites, explained as an igenous origin [2]. We found two kinds of petrographic settings of organic carbon in Tissint, and analyzed their chemical and isotopic compositions with NanoSIMS. Our observations favor for a biotic activity on Mars [3]. Here, we reported more NanoSIMS analyses of carbon grains from other Martian meteortes.

Results and Conclusions: NWA 6162 is a Martian olivine-phyric shergottite. It consists of subhedral olivine grains up to 1.6 mm in size in basaltic matrix. The meteorite was heavily shocked and contains shock-induced melt pockets and veins. Carbon grains were found in some melt pockets, destributed as black dots (<2 μm in size) in the fine-grained host melt. They are usually round. Raman spectra of the carbon grains show broad bands at ~1360 cm^{-1} and ~1580 cm^{-1}, indicative of kerogen and/or amorphous carbon. TEM observations of FIB extracted slices from one of the C-bearing melt pockets reveal that few C-grains consist of nano-scaled carbon and SiO_2-rich glass.

H and C isotopes of carbon grains in the other two melt pockets were analyzed with NanoSIMS 50L. One graphite, two coals and one natural bitumen were used as working NanoSIMS references. The analyses reveal large variations in both H and C isotopes, with δD (2SD= 80~210 ‰) from -10 to +650 ‰ and $\delta^{13}C$ (2SD= 2~4 ‰) from -24 to +6 ‰. Those carbon grains with $\delta^{13}C$ < -15‰ are normal in H isotopes (δD<160‰), except for one grain ($\delta^{13}C$= -20±3‰, δD=540±75‰). Terrestrial contamination cannot entirely be excluded for carbon grains with normal H isotopes. In contrast, several carbon grains with $\delta^{13}C$ of -4 ~ +6‰ show significant D-enrichment (δD= 490~590‰). It is also noticed that these D-rich carbon grains have low H/C ratios and high $^{12}C^-$ counting rates, similar to the graphite standard but different from coal. They are probably graphite instead of organic carbon. We suggest that the D-rich carbon grains were formed by reaction of $CO_2+CH_4 = 2H_2O+2C$, which has been proposed to explain graphite found in hydrothermal system on the Earth. NanoSIMS analyses of carbon grains from NWA 6162 reveal rather complex carbon reservoirs on Mars. Further details will be presented at the meeting.

References: [1] Grady M. M., et al. 2004. *International Journal of Astrobiology* 3: 117-124. [2] Steele A., et al. 2012. *Science* 337: 212-215. [3] Lin Y., et al. 2014. *Meteoritics & Planetary Science* 49: 2201-2219.