VOLATILE ABUNDANCES OF MARTIAN INTERIOR REVEALED BY MARTIAN METEORITE NWA 6162

S. Hu, Y. T. Lin, T. Zhang, J. C. Zhang and J. L. Hao, Institute of Geology and Geophysics, Chinese Academy of Sciences, husen@mail.iggcas.ac.cn, 19 Beituchengxi Road Chaoyang District, Beijing, China.

Introduction: Volitiles play an import role in planet formation and evolution via affecting in melting, viscosity, magma crystallization, volcanic eruption and climate [1, 2]. Although a lot of works were done to constrain the water contents of Maritan interior with hydrous minerals [3-5] and bulk analyses [6-9], rare was done with in-situ analyses on magmatic inclusions which was quenched parent magma entrapped by host olivine or chromite in Martian meteorites [10, 11]. In this work, we will use NanoSIMS 50L to investigate the S, Cl and H_2O contents and hydrogen isotopes of magmatic inclusions in olivine-phyric shergottite NWA 6162.

Experiments: Petrography was carried out using FE-SEM and mineral chemistry was acquired using EPMA at the Insititute of Geology and Geophysics, Chinese Academy of Sciences (IGGCAS). Water contents and hydrogen isotopes of magmatic inclusions were acquired using NanoSIMS 50L at the IGGCAS with multicollection isotope mode[12]. Volatiles (H_2O, S and Cl) of magmatic inclusions were determined using NanoSIMS 50L after the analyses of hydrogen isotopes with multicollection element mode [12]. The absolute volatile contents were calibrated by the glass standards as [13]. Water contents were analyzed in both runs for cross checking.

Results: The water contents and hydrogen isotopes of the magmatic inclusions in NWA 6162 varied from 10-2444 ppm and 16-5057 ‰ in multicollection isotope mode, respectively. S, Cl and water contents of the magmatic inclusions in NWA 6162 varied from 18-239 ppm, 16-967 ppm and 19-3137 ppm, respectively. One magmatic inclusion in NWA 6162 was zoned in water contents and hydrogen isotopes varing from 10-196 ppm and 186-4306 ‰, respectively. Both water and S are heterogeneous distributed in the magmatic inclusions as S in separate sub-micro hot spots and water in separate bands. Significant zoning of Cl was not found within single magmatic inclusion.

Discussions: The water contents and hydrogen isotopes of the magmatic inclusions in NWA 6162 are logarithmicaly positive correlated, similar with that in GRV 020090 [8], indicative of a mixing trend between Martian interior water and crustal meteoric water. The water held in the magmatic inclusions of NWA 6162 is no more prinstine as strong degassing during the parent magma ascending to the subsurface and later meteoric water diffusion, which would be not reliable to estimate the water contents of Martian interior without consideration of degassing and subsurface water diffusion. Whereas, S and Cl of the magmatic inclusion in NWA 6162 would represent the primodial nature with separate sub-micron hot spots during the quenching process and without any degassing profile or subsurface diffusion profile. Although NWA 6162 is a depleted olvine-phyric shergottite [14], its S and Cl contents in the magmatic inclusions are significantly different with the prinstine olivine-phyric shergottite Y 980459 and similar with that of the enriched olivine-phyric shergottite LAR 06319 [11], suggesting S and Cl contents are heterogeneously ditributted nature for Martian interior.

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