NOBLE GASES IN INDIVIDUAL GLASSY SPHERULES FROM THE SAU 290 CH3 CHONDRITE

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Introduction: Numerous glassy spherules (50 - 200 µm) were found in the SaU 290 CH3 chondrite. The spherules are considered to be chondrules. Since SaU290 is the solar-gas bearing meteorite [1], it could be possible that the spherules have been exposed to solar winds and cosmic-rays on the parent body. Here we report the results of noble gas analyses of the individual glassy spherules.

Noble gas analysis: More than 300 of glassy spherules were picked up from the crushed samples of SaU 290 (~1.5 g). Most of them are transparent, some are opaque under an optical microscope. Four opaque spherules and thirteen transparent spherules (100 - 150 µm; 2.6 - 10.4 µg) were selected for noble gas analysis. SEM-EDX shows that the spherules have low-Ca pyroxene like chemical compositions (Fe poor). Noble gases in the individual spherules were extracted by a Nd-YAG laser system, and the purified noble gases were analyzed with the "MS-III" noble gas mass spectrometer at the University of Tokyo.

Results and discussion: Concentrations of ^{4}He and ^{20}Ne are one or two orders of magnitude lower than those of the bulk sample [1]. Isotopic ratios of He and Ne show no clear evidence for solar wind implantation, suggesting that the spherules may have not been exposed to solar winds or may have lost the implanted solar noble gases due to later parent body processes. The ^{3}He concentrations are almost constant ($2.3 \pm 0.4 \times 10^{-8}$cm^{3}/g on average; 2$\sigma$) except for a spherule ($4.8 \pm 0.6 \times 10^{-8}$cm^{3}/g; 2$\sigma$). Assuming that He in the spherules consists of cosmogenic He and radiogenic ^{4}He, the ^{3}He is essentially entirely cosmogenic. Considering the production rate of cosmogenic ^{3}He is independent from the target element chemistry, the cosmogenic ^{3}He excess is indicative of parent body exposure. Since SaU 290 is the solar-gas-bearing meteorite, the constituent materials should have been exposed to solar winds and cosmic rays in various depths on the parent body. The spherule with cosmogenic ^{3}He excess would have been located at the active zone of cosmic rays for longer duration than the other spherules. It could be also possible that the spherules with lower ^{3}He concentrations had experienced partial loss of He during transit to the Earth and/or on the parent body. Since all the spherules we studied are from the small sample (~1.5 g), it is unlikely that the only one spherule with ^{3}He excess avoided the He partial loss during transit to the Earth. The latter case is more likely, which leads to cosmic ray irradiation to the spherules on the parent body.

The most spherules contain lower concentrations of ^{40}Ar than that in the bulk sample (1.0×10^{-5}cm^{3}/g; [1]), which could be attributed to low K contents and/or ^{40}Ar diffusive loss due to later parent body processes. Only two spherules show high concentrations of ^{40}Ar ($2.4 - 3.5 \times 10^{-4}$cm^{3}/g) as well as high ^{40}Ar/^{36}Ar ratios (6000 - 9300). Assuming the gas retention age is 4.5 Ga, the two spherules should contain 0.3 - 0.45 wt% of K.

References: [1] Park J. et al. 2005. *Antarctic Meteorites* 29. p. 69-70.