CONSTRAINTS ON COSMIC-RAY EXPOSURE HISTORY OF THE VACA MUERTA MESOSIDERITE FROM NOBLE GAS ANALYSIS OF NEUTRON IRRADIATED SAMPLES.

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Introduction: Mesosiderites have unique and interesting textures, and their formation mechanism and histories have been investigated from petrological, mineralogical, geochemical, and chronological points of view. Bajo and Nagao [1] proposed a complex cosmic-ray exposure history and extreme depletion of volatile elements such as noble gases and halogens of Vaca Muerta. Here we present halogen and Ba concentrations of Vaca Muerta and discuss on cosmic-ray exposure condition based on noble gas analysis of neutron-irradiated samples。

Experimental: Two samples of different textures, one is metal-silicate mixture (VM-B) and another eucritic pebble (VM-P) [1], were investigated. Measured Ar, Kr, and Xe isotope compositions of neutron irradiated samples were decomposed into each component derived from nuclear reactions of several elements (K, Ca, Cl, Br, I, Ba and U) and intrinsic noble gas components in order to determine the ^{39}Ar–^{40}Ar age and concentrations of the parent elements. The Hb3gr interlaboratory ^{39}Ar–^{40}Ar age standard ([2], [3]) was used to determine conversion factors of Cl, K and Ca to relevant Ar isotopes and neutron fluence. Bromine, I, Ba and U concentrations were determined from concentrations of neutron-produced Kr and Xe isotopes, neutron capture cross sections, and the neutron fluence. The halogen concentrations were calculated from neutron-produced ^{38}Ar, ^{80}Kr, and ^{128}Xe after subtracting cosmogenic and trapped components from measured concentrations of these isotopes.

Results and discussion: Bromine and I concentrations for VM-P were less than 10 ppb and lower than those of VM-B (<5 ppb), which is consistent with volatile depletion in VM-P suggested by [1]. However, the low Cl concentrations and abundant cosmic-ray-produced noble gases allow us to obtain upper limits of Cl concentrations to be 50 ppm. Cosmogenic ^{131}Xe/^{126}Xe ratio determined for the samples suggests the shielding depth (in the parent body) to be 150 g/cm^2. Ba concentration determined for the neutron-irradiated VM-P sample was 2.7 ppb. Adopting the estimated shielding depth and the cosmic-ray exposure age of 140 Myr [1], 2.5×10^{-12} cm^{3}STP/g of cosmogenic ^{131}Xe is estimated under 4π irradiation geometry [4]. This estimation agrees well with the observed value of $(4 \pm 3) \times 10^{-12}$ cm^{3}STP/g [1]. This indicates that the cosmogenic ^{131}Xe was mainly produced in meteoroid during transit from its parent asteroid to the Earth, and the progenitor of Vaca Muerta had been located in deep layer of parent body, to where did not occur frequently.

References: [1] Bajo K. and Nagao K. 2011. *Meteoritics & Planetary Science* 46:556–573. [2] Turner G. et al., 1971. *Earth and Planetary Science Letters* 10:227–234. [3] Roddick J. C. 1983. *Geochimica et Cosmochimica Acta* 47:887–898. [4] Hohenberg C. M. et al. 1978. *Proceedings of the 9th Lunar and Planetary Science Conference*. pp. 2311–2344.