PRIMITIVE TERRESTRIAL XENON: A RELATION TO REFINED COMPOSITION OF SOLAR WIND.

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To explain the isotopic structure of terrestrial Xe, a hypothetical U-Xe (unrelated to uranium) was mathematically constructed using multidimensional correlation diagrams of stepwise heating data of carbonaceous chondrites [1]. The composition of U-Xe was derived without any references to solar Xe. Nevertheless U-Xe turned out to be almost identical to Solar Wind (SW) except for two heaviest isotopes ^{136}Xe and ^{134}Xe, in which U-Xe was depleted. The mismatch in these two heaviest Xe isotopes was attributed to either the presence of nearly pure Xe-H (heavy branch of Xe-HL) in the Sun or to deficit of Xe-H in the carbonaceous chondrites from which U-Xe composition has been derived. There are two difficulties in this approach: U-Xe has never been reproducibly observed and Xe-H and Xe-L are apparently inseparable.

Recent refined analyses of SW delivered by Genesis Mission [2] revealed that in addition to ^{136}Xe and ^{134}Xe, U-Xe is also depleted in ^{132}Xe and ^{131}Xe relative to fractionated SW, suggesting some fission rather than a Xe-H contribution. Xe isotopes apparently missing from U-Xe are related as ^{136}Xe/^{134}Xe/^{132}Xe/^{131}Xe = = 1/0.71/0.13/0.08.

U-Xe was derived under the assumption of canonical ^{244}Pu fission spectra. Primordial Earth Xe derived by Igarashi [3] without this assumption turned out to be much more closer to solar than U-Xe, but required an isotopically unusual fission contribution, matching neither ^{244}Pu nor ^{238}U fission spectra [3]. The Igarashi's Xe is complimentary to Xe apparently missing from U-Xe. Combining them together produces almost pure ^{244}Pu fission Xe. This suggested that the Igarashi's Xe could be a result of Chemically Fractionated Fission of ^{244}Pu (CFF, the effect caused by migration of Xe radioactive precursors in fission chains changing the apparent fission yields for Xe). However CFF-Xe has been reliably observed only for ^{235}U neutron-induced fission [4–6]. Therefore we conducted an experiment to check if CFF-Xe could be produced during spontaneous fission of ^{238}U occurred at relatively small and uniform neutron flux.

Comparing to ^{238}U fission, Xe released at low temperature from the leached uranium-rich ore sample was depleted in heavy isotopes in nearly same proportions as terrestrial fission Xe proposed by Igarashi. Our experiment clearly demonstrated CFF process for ^{238}U fission, and it should affect ^{244}Pu as well since all fissile heavy nuclei form the same fission chains, in spite of different yields of individual chains.

CFF-process is much more pronounced for Xe since it has higher than Kr fission yield and lower abundance. This naturally explains why no U-Kr is needed for modelling of terrestrial noble gases.

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