Re-Os Systematics Of the Nonmagmatic Iron Meteories

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Introduction: Re-Os system is a particularly valuable tool for understanding the origin and crystallization sequence of asteroidal cores(e.g. [1]), and the evolution of HSE in other planetary cores and their possible effects on associated mantle systems(e.g. [2-3]). In the past several decades, numerous Re-Os data of magmatic iron meteorites have been published, but seldom for nonmagmatic iron meteorites. The nonmagmatic iron meteorites experienced incomplete melt, therefore they cannot represent the asteroidal core samples. It is ambiguous question for the origin and crystallization process of nonmagmatic iron meteorites. In this study, 10 iron meteorites have been analyzed by the high-precision NTIMS (TRITON) Faraday cup static measurement through using isotopic dilution method. Among 10 iron meteorites studied here, 3 samples of group IIIAB and one sample of group IIIE belong to magmatic iron meteorites. Another 3 samples of group I AB and 3 samples of group IIICD are nonmagmatic iron meteorites. The precision is ≤ 20 ppm 2σ for $^{187}Os/^{188}Os$ and ≤ 100 ppm 2σ for $^{187}Re/^{188}Os$. The total blank of Re and Os is lower than 80 pg respectively.

Results and Discussions:

In the $^{187}Os/^{188}Os$, $^{187}Re/^{188}Os$ isochron diagram, the 3 IIIAB and a IIIE samples define a straight best-fit line corresponding to a slope of 0.07917±0.00062 and an intercept with the vertical axis of 0.09575±0.00038. The rang of $^{187}Re/^{188}Os$ ratios is from 0.460391 to 0.691148. Application of a λ for $^{187}Re=1.666\times10^{-11}$ yr^{-1}[4] yields an age of 4590±37 Ma. In error rang, this age is consistent with reported Re-Os isochron age of 4558±12 Ma[4]. The large uncertainty likely result from small number data.

3 samples of group I AB in this study produce a slope of 0.07904±0.00011, and initial $^{187}Os/^{188}Os$ of 0.09663±0.00005, corresponding to T=4582.6±6.4Ma, which is older than the published data for the I A, 4529±23Ma [5], and 4537±21 Ma [6]. Another 3 samples of group IIICD also defined a slop of 0.07315±0.00073, and initial $^{187}Os/^{188}Os$ of 0.09873±0.00038, the age calculation is 4253±44 Ma. $^{187}Os/^{188}Os$ ratios vary rather narrow (the biggest difference is 0.087) in the 6 nonmagmatic iron meteorites, which lead to increase the uncertainty of the ages. But one thing can be known that the crystallization of I AB is earlier than IIICD. The distribution of Re and Os concentration also shows same compositional feature. More Re-Os data of nonmagmatic iron are required in order to better understand their precision isochron and evolution history in future study.

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References:

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