Hf-W dating of main-group pallasites

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Classically, pallasites have been thought to represent the core-mantle boundary of their parent body (e.g. [1]). Yet, some recent studies suggest that pallasites formed at a shallower region rather than the core-mantle boundary likely by impact mixing (e.g. [2]). Chronological knowledge of pallasites is the key to this debate, considering that iron meteorites of magmatic and impact origins have different ages [3][4] and also that silicate and metal mixed by impact may have distinctive ages. While the model crystallization age of pallasite olivine was determined by the Al-Mg dating [5], that of pallasite metal is still poorly constrained. The previous study on pallasite mertal reported that the W isotopic compositions of pallasites have a large variations, and some of them represent the lower $^{182}W/^{184}W$ values than the CAIs [6]. These variations are possibly caused by non-radiogenic effects on pallasites, such as nucleosynthetic anomaly and neutron capture effect. In this study, we considered the non-radiogenic effects and determined the Hf-W ages of pallasite metals.

We measured W isotopes and Pt isotopes of four main-group pallasites: Brahin, Esquel, Imilac and Seymchan. $^{183}W/^{184}W$ ratio was used to evaluate the possible nucleosynthetic anomaly, whereas $^{196}Pt/^{195}Pt$ was used to correct the neutron capture effect on ^{182}W. All the samples show no anomaly in $\varepsilon^{183}W$, indicating that there are no nucleosynthetic anomaly in the pallasites. The $\varepsilon^{196}Pt$ values of the samples are positive up to 0.18 (± 0.09) ε, representing that there are the neutron capture effects on the pallasite metal. The $\varepsilon^{182}W$ values corrected for the neutron capture effects range from -3.53 to -3.44 ε, which correspond to the model Hf-W ages of -0.3 to 0.3 Myrs after the CAI formation. The obtained model Hf-W ages of pallasites are consistent with the model Hf-W ages of magmatic irons [3] and the model Al-Mg age of pallasite olivine [5], suggesting magmatic origin rather than impact origin for the formation of pallasites.

[1] Scott (1977) *Mineral Mag.*, **41**, 265-272. [2] Yang et al. (2010) *GCA*, **74**, 4471-4492. [3] Kruijer et al. (2013) *EPSL*, **361**, 162-172. [4] Markowski et al. (2006) *EPSL*, **242**, 1-15. [5] Baker et al. (2012) *GCA*, **77**, 415-431. [6] Quitté et al. (2005) *GCA*, **69**, 1321-1332.