A tungsten and molybdenum isotopic study of lodranite GRA95209 and acapulcoite NWA725, and their implications to the early evolution history in the parent body of lodranites and acapulcoites

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Lodranites and acapulcoites have similar oxygen isotopic compositions, and are generally regarded to have come from the same parent body, but with different petrogenetic history [1]. An acapulcoite, NWA725, and the metal portion of lodranite, GRA95209, are selected to study with the short-lived ^{182}Hf-^{182}W chronometer and Mo isotopes to better constrain the earliest evolution history in their parent body.

Bulk rock samples for both meteorites exhibit deficits in ^{182}W, with ε_w of -2.6 and -3.3 for NWA725 and GRA95209, respectively, suggesting an early metal-silicate segregation in their parent body. The sub-chondritic ε_w are consistent with the observed sub-chondritic ^{180}Hf/^{184}W of 0.59 and 0.007 for NWA725 and GRA95209, respectively. Despite that these two samples along with the CHUR show a general positive correlation in an isochron plot, other evidence, e.g., petrology and oxygen isotopes, seems to suggest that they may not have formed in a single event [1]. Although, the ε_w of the metal portion of GRA95209 alone indicates that the formation of lodranites should be no later than 5 myrs since the start of the solar system, an internal isochron study is needed to better constrain the formation age of NWA725.

In addition to W, Mo isotopic compositions for these two primitive achondrites are also measured in order to further constrain the possibility of a heterogeneous distribution of Mo isotopes in the accretion disk of the solar system [2-4]. Within the analytical errors, the preliminary results for both samples exhibit identical Mo isotopic compositions to the terrestrial Mo standard, with the exception of a slight deficit in ^{96}Mo and an excess in ^{100}Mo for the acapulcoite NWA725, although both anomalies are less than 1ε. If the preliminary results are correct, they seem to suggest a smaller scale of Mo isotopic heterogeneity than previously proposed [2-3] might be present in the parent body of lodranites and acapulcoites. However, more works are needed to verify these results.

References

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