REE and Nd isotopic composition of martian crust

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The shergottite, nakhlite and chassignite (SNC) meteorites have been studied extensively in relation to chemical evolution of Mars [1]. It has been suggested that the early differentiation process of Mars accompanyed global magma ocean and produced chemically distinct portions (geochemical reservoirs) in Mars [2-6]. However, little constraint has been given to the chemical composition of these reservoirs. Although the chemical characteristics of a depleted mantle reservoir has been revealed [4], additional enriched reservoir (martian crust) is required to explain the chemical variation in SNC meteorites.

The chemical composition of martian crust could provide important information about the early differentiation processes of Mars. Due to this importance, many studies were conducted on the chemical composition of the martian crust and provided plausible martian crust compositions [e.g., 7]. However, question is whether the reported crustal compositions represent global chemical reservoir in Mars. Therefore we conducte two types of modeling for martian crust composition: geochemical and petrological modeling that are focusing on rare earth elements (REE) composition.

The geochemical modeling suggests that Shergotty was contaminated by martian crust of which εNd is -12 ~ -20, and CI chondrite normalized La and Lu concentrations are 35 ~ 120 and 15 ~ 35, respectively. The petrological modeling suggests that the martian crust could have -18 of εNd, and 92 and 15 of CI normalized La and Lu concentrations, respectively. The martian crust compositions determined with the geochemical and petrological modeling are in good agreement, suggesting that the depth of martian magma ocean could be ca. 250 km.

References

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