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題目(和文)	玄武岩質ユークライトの地球化学的及び年代学的研究：地球型天体ベスタにおける熱的歴史の解明に向けて
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Abstract

HED (Howardite–Eucrite–Diogenite) meteorites are considered to be originated from the smallest terrestrial planet in the Solar System, Vesta, which was explored by the spacecraft Dawn (NASA) extensively. The connection between geochemical and petrological data obtained from HED meteorites and the exploration data obtained by the Dawn mission allow us to elucidate the evolutionary process of Vesta more in detail. Basaltic eucrites, which quenched at the surface of the parent body's crust, are divided into main-group, Nuevo Laredo-group, Stannern-group, and residual eucrites depending on diverse chemical compositions. Of these groups, the formation process of the Stannern-group eucrites is still controversial partly because the number of the Stannern group is smaller than that of the main group. In addition, the thermal history of the Stannern-group eucrites has not been discussed, whereas that of the main group has been extensively investigated. The thermal history of the main group so far proposed is as follows: 1) igneous crystallization, 2) initial global metamorphism by internal heat source, and 3) later reheating events by impacts. Our main object of this thesis is to understand the thermal and evolutionary history of the Stannern-group eucrites. To this end, we have conducted chemical and isotopic analyses and multiple radiometric dating for some Stannern-group eucrites.

First, we have developed the analytical technique for the concentration determination of Sm and Nd and the chemical separation of Nd from rock samples aimed for the application of the Sm–Nd radiometric dating. This method enables simultaneous determination of Sm and Nd concentrations and effective isolation of Nd with high recovery yield (Ce/Nd < 1.2×10^{-5}, Sm/Nd < 5.2×10^{-6}, and Nd recovery > 91%). Second, we developed a technique for simultaneous determination of 27 elemental abundances in meteorites that can be used to classify basaltic eucrites. This method enables to reduce the requisite sample amount by 50% and thus useful for the analysis of precious samples including meteorites and returned samples that will be brought to the Earth by future sample-return missions.

We applied the developed methods to the geochemical and Sm–Nd chronological studies on a basaltic eucrite, NWA 7188. We found that this meteorite is the ninth monomict Stannern-group eucrite and has the oldest ^{146}Sm–^{142}Nd age (4554 $^{+17}/_{-19}$ Ma) among basaltic eucrites. Next, we measured isotopic compositions of noble gases in four Stannern-group eucrites, which provide (U–Th)/He, ^{40}K–^{40}Ar, ^{244}Pu–Xe, and cosmic-ray exposure ages. The obtained ages show a wide variation in all of the chronometers, suggesting that the Stannern group has formed in various regions on the parent body and has experienced complex thermal history as well as the main group. Finally, in the last chapter "Synthesis", we performed a model calculation for decoding the origin of Stannern-group eucrites and summarized the thermal history of the EPB based on the chronological data.