Natural zinc isotope variations in mammals

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In a previous study [1], we have found that the Zn isotope composition varies up the Kruger Park food chain, with a trophic ^{66}Zn enrichment of about 1‰ between plants and the bones of herbivores. However, no enrichment was observed between the bones of carnivores and herbivores suggesting that, (1) the zinc uptake by carnivores is quantitative or, (2) the edible part of the organisms is ^{66}Zn-depleted relative to bones.

In order to better understand Zn isotope pathways in higher organisms, we have measured the Zn isotope composition of the organs of sheeps raised under controlled conditions. The organs include blood (red blood cell and serum), muscle, liver, kidney and bone. Diet, urine and feces were also analyzed.

The results show that the δ^{66}Zn range within a particular specimen can exceed 1‰. Bone, muscle, serum and urine are ^{66}Zn-enriched by about 0.25‰ relative to diet, whereas feces, red blood cell, kidney and liver are ^{66}Zn-depleted by about 0.25, 0.35, 0.45 and 0.65‰, respectively, relative to diet.

The similarity between bone and muscle zinc isotope abundances in the test sheep explains the absence of ^{66}Zn enrichment between bones of carnivores and herbivores, and strongly suggests that only the uptake of zinc bounded to protein (carnivore diet) is quantitative. However, the discrepancy between the ^{66}Zn enrichment observed under natural and experimental conditions remains to be elucidated. These preliminary data open up perspectives on the utilization of the variations of natural abundances of Zn stable isotopes as a tracer of metabolic activity in higher organisms.

[1] Balter *et al*. (2008). *Geochim. Cosmochim. Acta* **72**, A50.

Temporal change of magma feeding system beneath the Gassan volcano, NE Japan

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Gassan volcano (0.5 to 0.3 Ma) is one of representative Quaternary stratovolcanoes in back-arc side of the northeast Japan arc. The eruptive products can be divided into eight units. Rocks are medium-K andesite to dacite. Cognate mafic inclusions, observed in all units, are basalt to basaltic andesite.

All rocks possess petrographic and mineralogic features suggesting magma mixing/mingling, and whole rock compositions of host rocks and mafic inclusions from a geologic unit show linear trends in variation diagrams, which suggest two (mafic and felsic) end-members mixing. The mixing trends can be classified to high-type, observed in middle units, and low-Cr type, observed in lower and upper units. The differences of these two trends are distinct only in the basalt to andesite. The former are depicted in higher Cr, Ni, MgO and lower FeO, TiO_2 parts in variation diagrams. Silica contents of the mafic end-members of high- and low-Cr types are estimated to be ca. 50% and 51-52%, respectively. On the other hand, the estimated felsic end-members have ca. 65% in SiO_2 for every geologic unit.

The Sr isotopic data for the Gassan volcano are rather constant (0.7033-0.7035) in basalt to dacite, which is indicating the estimated three end-members are cogenetic. The fractional crystallization of high-Cr type mafic end-member can explain the trace element compositions of the low-Cr type mafic end-member, but can not explain those of the felsic end-member. Instead, the trace element model calculations show that the felsic end-member magmas can be produced by the partial melting of solidified mafic end-member magma leaving gabbroic residue.

The felsic end-member magma would be formed by the remelting process at lower crustal level, and ascended to form the shallow crustal magma chamber. In the dawning and waning periods of the Gassan activity, the high-Cr type mafic magmas would differentiate to the low-Cr one at depth before they mixed with the felsic magma. In contrast, the high-Cr type mafic magma directly injected to the crustal felsic magma chamber and mixed with the felsic end-member in the flourish period.