Processes involved in iron isotope fractionation during magmatic differentiation : The Kerguelen Archipelago case

S. RABIN[1], F. POITRASSON[1], M. GREGOIRE[1], P. SOSSI[2]

[1]Laboratoire Géosciences Environnement Toulouse, CNRS-UPS-IRD, 14-16, av. E. Belin, 31400 Toulouse, France (segolene.rabin@get.omp.eu)
[2] IPGP - 1 rue Jussieu - 75238 Paris cedex 05, France (sossi@ipgp.fr)

Iron isotope fractionation during magmatic differentiation has been studied in a variety of geodynamic settings [1-3], but the processes that generate such fractionation remain debated. Bimodal volcanism on the Kerguelen Archipelago allows us to study, for the first time, a silica-saturated and a silica-undersaturated magmatic series in the same geologic context.

The silica-saturated magmatic series displays no significant δ^{57}Fe increase during differentiation. The δ^{57}Fe ranges from 0.132 ± 0.098‰ in basalts to 0.250 ± 0.159‰ in the trachyte. However, the trachytes with the highest SiO_2 contents show a lower δ^{57}Fe that might be due to the post-magmatic crystallization of nontronite, in an open O_2 system.

The silica undersaturated magmatic series displays an increase of the δ^{57}Fe during differentiation up to 0.321 ± 0.041‰ at 57 wt% of SiO_2, with a subsequent decrease of δ^{57}Fe down to 0.153 ± 0.037‰ in the phonolites. This decrease of δ^{57}Fe might be due to the substitution of clinopyroxene by magnetite as the predominant iron-bearing phase in the lavas, in a closed system for oxygen.

For both the silica-saturated and silica-undersaturated series, a fractional crystallization model based on the Rayleigh equation and detailed petrological observations has been used. Fractional crystallization can explain the major isotopic variation for both series, excluding the samples with nontronites.

[1] Sossi, P. A. et al. (2012). *CMP*, **164**(5), 757-772.
[2] Zambardi, T. et al. (2014). *EPSL*, **405**, 169-179.
[3] Williams, H. M. et al. (2018). *GCA*, **226**, 224-243.