High-accuracy determination of Iron in Antarctic waters by isotope dilution MC-ICP-MS using nitrilotriacetic acid chelating resin for preconcentration and matrix separation

J.T.M. DE JONG[1]*, V. SCHOEMANN[2], D. LANNUZEL[1,3], J.-L. TISON[1] AND N. MATTIELLI[1]

[1]Université Libre de Bruxelles, DSTE CP160, Avenue F.D. Roosevelt 50, B-1050, Brussels, Belgium (*correspondence: jdejong@ulb.ac.be)
[2]Université Libre de Bruxelles, ESA CP221, Avenue F.D. Roosevelt 50, B-1050, Brussels, Belgium
[3]University of Tasmania, ACE-CRC, 80 Private Bag, Hobart, Tasmania 7005, Australia

In the present study, we propose a robust and simple method to measure dissolved iron (DFe) concentrations in seawater down to <0.1 nM level, by Isotope Dilution Multiple Collector Inductively Coupled Plasma Mass Spectrometry (ID-MC-ICP-MS) using a ^{54}Fe spike and measuring the ^{57}Fe/^{54}Fe ratio. The method consists of a pre-concentration step (100:1) on micro-columns with the resin NTA Superflow, of 50 mL seawater samples acidified to pH 1.9, at which pH the resin is demonstrated to quantitatively extract Fe. Blanks are low: grand mean 0.047 ± 0.020 nM (n = 18), detection limit (3SD) per session 0.020 – 0.069 nM range, because no buffer is required to adjust the sample pH for optimal extraction, and only ultrapure nitric acid, dilute H_2O_2, and acidified milli-Q water are needed. We measure SAFe reference seawater samples Surface-1 (0.121±0.029 nM, n=6) and Deep-2 (0.925±0.059 nM, n=8) and confirm their assigned consensus values. To demonstrate the feasibility of the method we present vertical DFe profiles from the western Weddell Sea and from the western Bellingshausen Sea, collected respectively during the ISPOL (2004/5) and SIMBA (2007) ice drift time series. At SIMBA, profiles exhibit variability in the upper mixed layer between 0.2 nM and 1 nM in the vicinity of melting icebergs, nutrient type behavior with deep water concentrations of 0.6-1.2 nM and bottom water enrichment up to 1.6 nM. At ISPOL, DFe in the upper mixed layer was 0.6 nM, in deep water 2 nM, with close to the bottom 23 nM. Bottom water enrichment arises from diagenetic Fe diffusion or sediment resuspension.

Origin of the 26-25 Ma flood basalts from Mont Havergal, northermost Kerguelen (South Indian Ocean)

G. DELPECH[1], F. NAURET[2], M. MOULIN[2], F. DESCHAMPS[3] AND J.Y. COTTIN[4]

[1]UMR IDES 8148 “Interaction et Dynamique des Environnements de Surface”, Univeristé Paris Sud-XI, 91405 ORSAY (guillaume.delpech@u-psud.fr)
[2]IPGP, Laboratoire de Géochimie-Cosmochimie and Laboratoire de Paléomagnétisme , 4, place Jussieu, 75252 PARIS Cedex 5 (nauret@ipgp.jussieu.fr, moulin@ipgp.jussieu.fr)
[3]LGCA, Université Joseph Fourier, 1381, rue de la piscine, 38400 Saint Martin d’Hères, France
[4]UMR 6524 “Magmas et Volcans”, Université Jean Monnet, 23, rue du Dr. Paul Michelon, 42023 SAINT-ETIENNE, France (jean.yves.cottin@univ-st-etienne.fr)

Mont Havergal is a 550 m section of flood basalts situated at the northernmost part of the Kerguelen Archipelago (South Indian Ocean). Available Ar/Ar dating of flood basalt sections in the northern part of the Kerguelen Archipelago range between 30 and 28 Ma. K/Ar dating using the Cassignol-Gillot technique indicate that the Mont Havergal flood basalts erupted between 26.4±0.4 Ma and 25.2±0.4 Ma and are therefore significantly younger. The 22 flows analysed are basalts of transitional affinity, except for the occurrence of a more evolved lava flow in the middle of the section with a trachy-andesitic composition. These flows display a wide range of trace element contents and trace element ratios such as for La/Sm or Dy/Yb. Some have trace element contents and ratios that are close to those of Indian MORBS, whereas others have ratios typical of OIB magmas from the Kerguelen plume. Other flood basalts that erupted at the same time on the Archipelago, located mostly in the central part of the main island, reflect the contribution of plume melts (^{87}Sr/^{86}Sr=0.7046-0.7052 and ^{143}Nd/^{144}Nd=0.51272-0.51258). Contrarily, the Mont Havergal basalts are much more variable in terms of trace elements and Sr-Nd isotopic compositions (0.7042-0.7056 and 0.51282-0.51246). Some isotopic compositions reflect a strong contribution from a depleted mantle source (Indian MORB) while others an enriched mantle source with a more extreme composition than that inferred for the Kerguelen plume. The data suggest that the plume may have been zoned or that plume-ridge interactions were still taking place, although the SEIR was about 700 km away from the plume.