Geochemical stratigraphy and correlation within the Faroe Islands Basalt Group: Temporal and Spatial Evolution of Mantle Sources during Continental Rupture

MILLETT, J. M[1]*., HOLE, M. J[1]., JOLLEY, D. W[1]. AND PASSEY, S. R.[2]

[1]Department of Geology & Petroleum Geology, Meston Building, Kings College, University of Aberdeen, Aberdeen, AB24 3UE UK (*correspondence: j.millett@abdn.ac.uk)

[2]*CASP, West Building, 181A Huntingdon Road, Cambridge CB3 0DH, UK*

The geochemical signatures recorded during periods of Large Igneous Province (LIP) volcanism provide important evidence as to mantle sources and magmatic evolution through time. Our understanding of the temporal development of these provinces relies on both accurate stratigraphical sampling constraints of flood basalt sequences along with the integration of available age-dating methods. In this contribution we present new major, trace and mineralogical element data for the Faroe Islands Basalt Group (FIBG), NE Atlantic. The FIBG records a near continuous ~6.6km composite eruptive succession of the Palaeogene aged North Atlantic Igneous Province. All the data is stratigraphically constrained within a GIS database and has been compared to biostratigraphic and sedimentary inter-bed geochemical data which allows high resolution inference into the timing of eruption events during continental rupture. Distinct mantle source variations occur at a number of intervals through the stratigraphy including N-MORB-like and enriched 'Icelandic' sources. The integration of the new flow by flow data for the lower Beinisvørð and upper Enni Formations helps constrain the timing and the nature of these transitions. A distinct transition from Nb-depleted N-MORB-like to a Nb-enriched 'Icelandic' source is recorded in the last few flows of the first major phase of FIBG volcanism. This transition immediately precedes the regional hiatus recorded by the Prestfjall Formation before renewed N-MORB-like source volcanism. The timing of this hiatus, directly after the short lived onset of 'Icelandic' source volcanism implies a potential link between magma plumbing and tectonic reorganisation at the time. The Enni Formation at the top of the FIBG encompasses at least two inter-digitating flow fields sourcing separate high-TiO2 enriched sources and a low-TiO2 MORB-like source. The distribution of distinct geochemical lava groups on the Faroe Islands are demonstrated to overlap both in space and time. The present results have important implications to correlation attempts involving lava geochemistry on both the local and regional scale.

Lithium isotopes in surficial waters: examples from rivers and peatlands

ROMAIN MILLOT[1]*, PHILIPPE NÉGREL[1], ANNE-MARIE DESAULTY[1] AND AGNÈS BRENOT[2]

[1] BRGM, Laboratory Division, Orléans, France (* correspondence : r.millot@brgm.fr)

[2] BRGM, Territorial Activities Division, Lyon, France

In the present work, we report data for lithium and its isotopes in two different hydrosystems in France: the Loire River basin and the Sauvetat peatland system within the Massif Central (part of the Loire catchment).

Assessing the behaviour of lithium and the distribution of Li isotopes during weathering is of major importance for studying water/rock interactions at the surface of the Earth. This is because lithium (^{6}Li ~ 7.5% and ^{7}Li ~ 92.5%) is a fluid-mobile element and, due to the large relative mass difference between its two stable isotopes, it is subject to significant low temperature mass fractionation which provides key information on the nature of weathering processes.

The Loire River in central France is approximately 1010 km long and drains an area of 117 800 km^2. Lithium concentrations in river waters of the Loire River main stream and the main tributaries span a wide range from 3.4 to 46.5 μg/L, whereas δ^7Li are between +5.0 and +13.3‰. There is a clear contrast between the headwaters upstream and rivers located downstream in the lowlands, with a siginificant decrease of the δ^7Li with the distance from the source. In addition, one of the major tributaries in the Massif Central (the Allier River) is clearly influenced by inputs from mineralized waters resulting of hydrothermal activities having lower δ^7Li values.

Concerning the peatland system in the Sauvetat area, we explore the use of Li and its isotopes as a proxy of ground-to-surface water exchanges in a peatland from a mire-lake complex in the French Massif Central, with the aim to investigate the capability of Li isotopes as hydrogeological tracers. Variations in δ^7Li values can be used to distinguish between precipitation, groundwater and anthropogenic inputs (significantly enriched in ^{7}Li) in peat lands, providing a unique perspective on the hydrologic dynamics of the system.

These two examples reveal important information about lithium and its isotopes but, considered together, provide a more integrated understanding of the factors controling lithium isotopic distribution in surficial waters.

www.minersoc.org
DOI:10.1180/minmag.2013.077.5.13