

Argon isotope ratio measurements using different detector strategies

M. KRUMMEN, D.G. BURGESS, E. WAPELHORST,
D. HAMILTON AND J.B. SCHWIETERS

Thermo Fisher Scientific, Bremen, Germany
(Doug. Hamilton@thermofisher.com)

Argon isotope abundances are spread over a large dynamic range which, for Argon isotope ratio measurements, means a special challenge for the mass spectrometer and the detector configuration in particular. In case of a static noble gas mass spectrometer the sensitivity is directly proportional to the internal volume of the mass spectrometer, therefore a small volume is essential. For large sample sizes using a Faraday cup array employing standard 10^{11} Ohm amplifiers is the method of choice. Analysing medium sized sample the Faraday cups used to detect the minor isotopes can be equipped with a higher gain 10^{12} Ohm amplifier. Given the higher gain the signal to noise of these Faraday detectors is improved giving excellent precision. At small sample sizes it becomes necessary to measure the minor isotopes on an ion counting detector while the major ^{40}Ar beam still is best measured on a Faraday cup detector. Finally for the smallest sample sizes sequential single collector peak jumping measurements on an ion counting channel is the method of choice. It eliminates all cross calibration and gain drift issues since all intensities are measured on the same ion counting collector and the actual gains issues are cancelled out.

The Thermo Scientific ARGUS VI noble gas mass spectrometer has exceptional sensitivity given its small internal volume of ~650 cc coupled to its high sensitivity ion source. It has 5 Faraday collectors to simultaneously measure all the Argon isotopes on either 10^{11} Ohm or 10^{12} Ohm electronically cross calibrated amplifiers. The dynamic range of the Faraday detection system is further extended given the capability of the amplifiers to measure up to 50 V intensities. Finally the number VI collector, a discrete dynode multiplier, is used for uncompromised single collector peak jumping measurements of smallest sample sizes. The performance of ARGUS VI will be demonstrated for different sample sizes using multiple air shot analysis.

Os isotope variation in basaltic glasses of the SW Indian Ridge

R.SH. KRYMSKY^{1*}, N.M. SUSHCHEVSKAYA²,
B.V. BELYATSKY³ AND S.A. SERGEEV¹

¹VSEGEI, Centre of Isotopic Research, St.Petersburg, Russia

(*correspondence: robert_krymsky@yahoo.com)

²Vernadsky Institute of Geochemistry, Moscow, Russia

³VNIOkeangeologia, St.Petersburg, Russia

We are presenting Re-Os isotope data for tholeiitic basalts dredged at the western end of the Southwest Indian Ridge (SWIR) within Bouvet junction: the Spiess ridge and a segment in front of Bouvet Island. Re (600-2000 ppt) and Os (6-380 ppt) contents are not much different from MORB (Schiano e.a., 1997; Gannoun e.a., 2007). Clear difference in Os content for basaltic glasses of Spiess ridge (6-8 ppt) and Bouvet segment (60-380 ppt), which doesn't correlate with other geochemical features, may suggest either Os loss (up to 90%) due to degassing of Spiess magma during flowing to the oceanic floor, or enrichment of Bouvet segment basalts by sulfides. Anyway, Os exchange between basaltic melts and oceanic water was negligible, that is proved by similarity of isotope composition in the glasses of two segments: $^{187}\text{Os}/^{188}\text{Os}$ ratio varies from 0.15582 to 0.24914. We are excluding lab contamination factor in measured radiogenic Os composition for basaltic glasses because blank isotope composition was less than 0.12941 and input of Os blank in analysis was about 5-10%. Acid leaching procedure (Gannoun *et al.*, 2007) applied to the basalt samples, allowed to reduce variations in Os isotope composition (0.14758-0.16675), maintaining its generally radiogenic nature and the difference in Os content between the glasses from Spiess ridge (1-2 ppt) and Bouvet segment (50-60 ppt). Possible accumulation of radiogenic Os due to *in situ* decay of parental Re isotope at high Re/Os ratios (5-450) in the basaltic glasses suggests their formation from 3 to 130 Ma ago, age of the Spiess ridge basalts of 3-9 Ma and the age of tholeiitic glasses of Bouvet segment of 50-130 Ma. Modeling of the basalt's source composition indicates the melting of complex mantle substance (depleted mantle plus 45-75% of ca 1.5 Ga old oceanic crust and 1.5-6% of pelagic sediments), which makes isotope-enriched characteristics of the studied tholeiites. These model values are close to those obtained for the basaltic glasses from the southern MAR (Escrig *et al.*, 2005). It cannot be excluded that the variation in isotope characteristics of basaltic glasses is the result of heterogeneity of upper depleted mantle with input of old oceanic lithosphere different in age in two SWIR segments, where the Spiess ridge is younger.