# Monitoring the 40Ar/39Ar irradiation parameter 'J' without using geological age standards

DANIEL RUTTE*[1], SEPP UNTERRICKER[2], JÖRG A. PFÄNDER[1] AND RAYMOND JONCKHEERE[1]

[1]Institut für Geologie, TU Bergakademie Freiberg, Germany, [*daniel.rutte@geo.tu-freiberg.de]

[2]Institut für Angewandte Physik, TU Bergakademie Freiberg, Germany

One of the major error components in $^{40}Ar/^{39}Ar$ geochronology is the irradiation parameter J. Its associated error is based on the accuracy of the independent age of the geological age standard and the inhomogeneity of the neutron fluence in the irradiation channel. To tackle both problems, we included independent fluence monitors (Ni and Co foil) in two of our irradiation containers, one irradiated under Cd-shielding in the research reactor Geesthacht FRG1 (Germany), the other without Cd-shielding in the research reactor Řez LVR-15 (Czech Republic). The irradiation containers were placed in rotating positions. Based on the activation reaction $^{58}Ni(n,p)^{58}Co$, gamma-spectroscopy of the resulting decay of $^{58}Co$ to $^{58}Fe$ provided the means to calculate absolute fast neutron fluences. The relative variation of the calculated fast neutron fluence at different points in the irradiation container is in agreement with the J-values measured from geological age standards within 1 sigma errors. For the irradiation in the research reactor LVR-15, the calculated neutron fluence varied systematically by 2.5% over an axial distance of 6 cm and by 1.9% over a radial distance of 3 cm. From the calculated absolute fast neutron fluences we calculated J-values, independent of geological age standards. In a first approach, the calculated J-values are about 12% higher than the J-values determined using geological age standards. The relative 1 sigma errors of the calculated J-values are on average 0.15%, as determined by a Monte Carlo method, which takes into account the weighing error of the Ni- and Co-monitors, as well as counting statistics of the gamma-spectrometer.

# Halogen Systematics of the Manus Spreading Center.

L. RUZIÉ[1,*], D. CHAVRIT [1], R. BURGESS [1], P. CLAY[1], B. JOACHIM[1], D. R. HILTON[2] , J. M. SINTON[3] AND C.J. BALLENTINE [1]

[1]University of Manchester, UK (*lorraine.ruzie@manchester.ac.uk)

[2]Scripps Institution of Oceanography, California, USA

[3]University of Hawaii, Honolulu, USA

The incompatibility of the heavy halogens (Cl, Br, I) combined with relatively high concentrations and distinct elemental compositions in surface reservoirs makes the halogens good tracers to detect the recycling processes in the different mantle sources. However, the halogen systematics in mantle reservoirs remains poorly constrained mainly because of their very low abundance in materials of interest. An innovative analytical technique, involving neutron irradiation of samples to convert halogens to noble gases then measured using conventional noble gas mass-spectrometry, provides detection limits unmatched by any other technique [1].

We focus on the halogen contents in the glassy margins of basalts erupted along the Manus Spreading Center (MSC), which lies in a back-arc basin setting. Samples consist of both MORB-type lavas and back-arc basin basalts (BABB) [3]. The major and trace elements, as well as $^{3}He/^{4}He$ ratios, water concentrations and δD have already been determined [2].

The halogen concentration range is between 160 and 1500 ppm Cl, 600 and 5700 ppb Br and 10 and 60 ppb I. The lower concentrations found in MORB-type samples are similar to E-MORB contents from Central Indian Ridge [4]. The higher concentrations are found in BABB samples. A strong negative correlation is apparent between I/Cl and both $H_2O$/Ce and δD: (1) the lower I/Cl wt. ratios measured in BABB ($4.1 \pm 1.4 \times 10^{-5}$) are associated with the higher $H_2O$/Ce ratios (2,150 ±580) and δD (-52 ±15‰), (2) the higher I/Cl wt. ratios measured in MORB-type lava ($7.2 \pm 2.5 \times 10^{-5}$) are associated with lower $H_2O$/Ce ratios (750 ±130) and δD (-94 ±11‰). From these results, we infer that our suite of samples from MSC are explained by mixing a seawater-derived component of the actual slab and the Manus underlying mantle. Considering both the MSC distance to the arc (240 km) and the slab slope, we conclude that a seawater-derived component can be preserved below 100 km depth.

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