# Reaction cell ICP-MS to facilitate Rb-Sr age determination

L. MOENS, F. VANHAECKE AND L. BALCAEN

Ghent University, Laboratory of Analytical chemistry, Proeftuinstraat 86, B-9000 Gent, Belgium (luc.moens@rug.ac.be)

### Measuring isotope ratios with quadrupole ICP-MS

Quadrupole ICP-MS instruments are widely used for the determination of trace element concentrations. Its precision in isotope ratio determination, in most cases will be insufficient to be useful for age determination. Considering the Rb-Sr system, the spectroscopic interferences between $^{87}$Rb and $^{87}$Sr necessitates chemical separation prior to the measurement, as is the case when using TIMS or multi-collector ICP-MS, the methods of choice for this kind of work.

### Advantages of dynamic reaction cell technology.

Inserting a dynamic reaction cell (DRC) in front of the quadrupole allows specific ion-molecule reactions to be used to eliminate the $^{87}$Rb/$^{87}$Sr isobaric interference. Thus precise and accurate Sr isotope ratios can be derived from the measurement of the corresponding molecular ions produced in the cell. For instance $SrF^+$ ion beams are produced after selective reaction, Rb will not react at all, of Sr with $CH_3F$ in the cell. Moreover Sr isotope ratios can be determined more precisely when, next to the reaction gas, a collision gas is introduced into the cell to reduce the width of the energy distribution of the ions. It will be shown that with Ne as a collision gas Sr isotope ratios can be measured with a precision (RSD on 5 replicate measurements of) of 0.03 %.

### Rb-Sr age determination

The technique was used for the Rb-Sr age determination of magmatic rocks, without any sample pre-treatment except for the dissolution of the samples. Sr isotope ratios can thus be measured with a precision that is very near to counting statistics and the measured age and initial $^{87}$Sr/$^{86}$Sr ratio of the rocks fully agrees with reference values of thermal ionisation mass spectrometry (TIMS). The precision of the age is only slightly worse than that of the TIMS results. Further improvement lies in making the technique even less time consuming by directly sampling solid minerals using laser ablation (LA), thus eliminating the need to dissolve the material while also reducing the required sample size.

### Conclusion

ICP-DRC-MS is a most useful tool for fast and comparatively inexpensive age determination of large sets of samples. Only when the ultimate accuracy and precision are required, one may want to analyse a selected number of samples with the other methods mentioned.

### References

Tanner S.D. and Baranov V.I., (1999), *At. Spectrosc.*, 20, 45.

# Nitrogen in the OIB-mantle

R.K. MOHAPATRA[1], D. HARRISON[2] AND U. OTT[1]

[1]Abt. Kosmochemie, Max-Planck-Institut für Chemie, D55020 Mainz, Germany (ratan@mpch-mainz.mpg.de)

[2]Dept. of Earth Sciences, Univ. of Manchester, Manchester M13 9PL, U.K. (dharrison@fs1.ge.man.ac.uk)

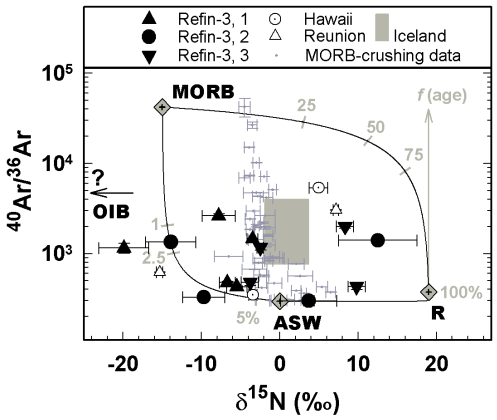
### Introduction

As part of our on-going study of volatile evolution of OIB-mantle, we have analysed different aliquots of an ultramafic nodule (Refin-3) collected from Piton de la Fournaise, Reunion Islands, for the isotopes of nitrogen and noble gases simultaneously by vacuum pyrolysis (Mohapatra et al. 2001), and of He and Ar by vacuum crushing (Harrison et al. 1999).

### Results

Nitrogen in the pyrolysis data varies (in three aliquots) between 1.4 to 4 ppm in concentration. $^{36}$Ar measured in pyrolysis is consistent (within 10%) with a concentration of $2.4\times10^{-10}$ ccSTP/g, while that in crushing is ~65 % lower. Nitrogen isotopic composition (_$^{15}$N) varies between –20 and +13 ‰, compared to the variation in $^{40}$Ar/$^{36}$Ar ratio: 295.5 (Air) up to 2600 (highest measured by step-crushing = 1530). Our preferred explanation (Fig. 1) considers variable contributions from recycled materials (R) and air-saturated-water (ASW) mixed with a mantle component different from that found in MORBs. Our preliminary data suggest a _$^{15}$N ≤–20 ‰ for OIB-mantle under Reunion.

**Figure 1: Plot between $^{40}$Ar/$^{36}$Ar and _$^{15}$N** (after Mohapatra




et al. 2000), literature data: Hawaii and Reunion (Mohapatra and Murty 2000), crushing data for MORBs (Marty and Humbert 1997) and Iceland (Marty and Dauphas 2000). The arrow on R shows that its $^{40}$Ar/$^{36}$Ar is a function of the age of recycled materials.

### References

Mohapatra R.K. et al., (2001), *MAPS* 36, A139.

Harrison D. et al., (1999), *EPSL* 171, 199-207.

Mohapatra R.K. and Murty S.V.S., (2000), *GRL* 27, 1583-1586.

Marty B. and Humbert F., (1997), *EPSL* 152,101-112.

Marty B. and Dauphas N., (2000), *J. Conf. Abs.* 5(2), 672-673.