Along-arc geochemical and isotopic variations in Javanese volcanic rocks: 'Crustal' versus 'source' contamination at the Sunda arc, Indonesia

HEATHER HANDLEY[1], JANNE BLICHERT-TOFT[2], SIMON TURNER[1], COLIN MACPHERSON[3], RALF GERTISSER[4]

[1]GEMOC, Department of Earth and Planetary Sciences, Macquarie University, Sydney, NSW 2109, Australia. (heather.handley@mq.edu.au; simon.turner@mq.edu.au)
[2]Laboratoire de Géologie de Lyon, Ecole Normale Superieure de Lyon, 69007 Lyon, France. (jblicher@ens-lyon.fr)
[3]Department of Earth Sciences, University of Durham, Durham, UK. (colin.macpherson@durham.ac.uk)
[4]School of Physical and Geographical Sciences, Keele University, Keele, ST5 5BG, UK. (r.gertisser@keele.ac.uk)

Through detailed studies of individual magmatic systems it is possible to identify and establish the relative importance and contributions of the various potential source components and differentiation processes that modify magmatic composition, such as crustal contamination. Along-arc changes in lava geochemistry have long been recognised on Java in the Sunda arc, Indonesia, but debate still prevails over the cause of such variations and the relative importance of shallow (crustal) versus deep (subduction) contamination. We present new Pb isotope data for Javanese volcanoes, which, when combined with our recently published geochemical and radiogenic isotopic data of Javanese volcanic rocks and results from other detailed geochemical and isotopic studies, elucidate the potential changing nature of the arc crust and its control on lava chemistry. In $^{207}Pb/^{204}Pb$-$^{206}Pb/^{204}Pb$ space the Javanese volcanic data reveal two distinct trends which can be related to either a strong control by crustal assimilation processes or source contamination by local sedimentary material on the down-going plate. Sr isotope ratios of volcanic rocks generally increase from West to Central Java, showing a wide range within individual volcanic centres and broad correlation with inferred crustal thickness, implying a strong, shallow-level control on isotopic composition. However, East Javanese volcanic rocks show significantly lower Sr and Pb isotopic ratios and extremely restricted isotopic variation at individual volcanoes. Key trace element ratios combined with radiogenic isotopic data of Javanese volcanoes reveal three distinct trends, which roughly equate with the geographical boundaries West, Central and East Java. These results provide evidence for major transitions in the crustal architecture of Java.

Oxygen fugacity in the Kaapvaal cratonic lithosphere – Evidence from Fe XANES measurements of Fe^{3+} in garnet from the Kimberley pipe

BRENDAN J. HANGER[1]*, GREGORY M. YAXLEY[1], ANDREW J. BERRY[1], VADIM S. KAMENETSKY[2], DAVID PATERSON[3] AND DARYL L. HOWARD[3]

[1]Research School of Earth Sciences, The Australian National University, Canberra, ACT, 0200, Australia (*correspondence: brendan.hanger@anu.edu.au)
[2] ARC Centre of Excellence in Ore Deposits, University of Tasmania, Hobart TAS 7001, Australia
[3]Australian Synchrotron, Clayton VIC 3168, Australia

Oxygen fugacity is important in understanding the evolution of the cratonic lithosphere, but is more difficult to determine than other variables (e.g. temperature and pressure). It requires precise measurement of $Fe^{3+}/\sum Fe$ in garnet in peridotite xenoliths which until recently has been practically limited to the bulk technique Mössbauer spectroscopy. However, new highly spatially resolved, *in situ* techniques such as synchrotron-based Fe K-edge XANES [1] or the microprobe-based flank method [2] are enabling precise and rapid determination of garnet $Fe^{3+}/\sum Fe$. We have combined XANES measurements with experimental calibrations of oxybarometers applicable to peridotite [3] to determine the oxygen fugacities recorded in suites of garnet peridotite xenoliths from the Kimberley kimberlite, which sampled the Kaapvaal cratonic lithosphere.

The xenoliths examined are relatively fresh. Most contain lherzolitic garnet based upon the CaO-Cr_2O_3 systematics [4], although two contain harzburgitic garnet. Thermobarometry reveals a pressure range of 2.5-4.5 GPa and a temperature range of 880 – 1100 °C. Fe XANES gave garnet $Fe^{3+}/\sum Fe$ values from 0.04 and 0.07. $\Delta \log fO_2^{[FMQ]}$ varies between -0.46 and -2.40, with most samples falling between -2.0 and -2.4 at pressures from 3.5 to 4.2 GPa. The xenoliths show a general trend of decreasing $\Delta \log fO_2^{[FMQ]}$ with depth, in broad agreement with previous studies [5,6].

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