

New insights into simultaneous determination of mass-dependent isotopic fractionation and radiogenic isotope variations of strontium by multi-collector ICPMS

HOWIE D. SCHER¹, ELIZABETH M. GRIFFITH²
AND WAYNE P. BUCKLEY JR.¹

¹Department of Earth and Ocean Sciences, University of South Carolina, hscher@geol.sc.edu

²Department of Earth and Environmental Sciences, University of Texas at Arlington, lgriff@uta.edu

Variability of Sr isotope ratios are due to radioactive decay and mass dependent fractionation through various physiochemical reactions. Radiogenic Sr ratios are used for geochronology and provenance while stable isotope ratios of Sr reveal mechanisms of sample formation and resolve mass balance in geochemical systems.

Accurate and precise measurements of stable Sr isotope ratios (e.g., ⁸⁸Sr/⁸⁶Sr) are possible if the ratio can be corrected for mass-discrimination effects during analysis. Ohno and Hirata (2007) developed a method where Sr solutions were doped with Zr, and measured ⁸⁸Sr/⁸⁶Sr ratios were normalized to ⁹¹Zr/⁹⁰Zr=0.2181, while simultaneously measuring ⁸⁷Sr/⁸⁶Sr. Using standard sample bracketing combined with a Zr correction, we tested three variables that influence the mass-discrimination effect on the multi-collector ICPMS. All stable isotope ratios are reported relative to SRM987.

First, solutions of 500 ppb SRM987 with Ba/Sr from 0.002 to 200 were analyzed by bracketing against a SRM987 solution with no Ba. Deviations from $\delta^{88}\text{Sr}=0\text{‰}$ occur above Ba/Sr ratios of 10. Deviations from our long term ⁸⁷Sr/⁸⁶Sr value also occur above this level of Ba.

Second, seawater was processed through standard microcolumn extraction with SrSpec resin (Eichrom). Eluted Sr was adjusted to 250 ppb and Zr was added so that Sr/Zr was ~1. We repeated the Ba doping experiment using the Zr correction. When Ba/Sr<10 the measured $\delta^{88}\text{Sr}$ is $0.37\pm 0.05\text{‰}$ (2σ , n=28) which is within analytical precision of published values for seawater (0.35 to 0.39). Deviations occur above Ba/Sr = 10.

Lastly we tested the Zr/Sr ratio on the measurements of $\delta^{88}\text{Sr}$ in seawater. We determined that the ideal Zr/Sr ratio is slightly lower than unity, and that high Zr/Sr ratios result in inaccurate $\delta^{88}\text{Sr}$ determinations.

[1] Ohno T., and Hirata T. (2007) *Analytical Sciences*, **23**, 1275-1280

Dahomeyan Neoproterozoic imprint on Eburnean Palaeoproterozoic rocks in southeast Ghana – Rubust Ar, flimsy Pb

ANDERS SCHERSTÉN¹, LAURENCE PAGE¹, PER KALVIG²,
ANDREAS PETERSSON¹ AND SOLOMON ANUM³,

¹Department of Geology, Lund University, Sölvegatan 12, SE-223 62 Lund, Sweden. anders.schersten@geol.lu.se; laurence.page@geol.lu.se; andreas.petersson@geol.lu.se;

²Geological Survey of Denmark and Greenland, Øster Voldgade 10 DK-1350, København, Denmark. pka@geus.dk

³Geological Survey Department, Ghana, P.O. Box M 80 Accra, Ghana. anumsolo@yahoo.com

The Dahomeyan belt formed during Pan-African suture between juvenile island arcs rocks that were amalgamated to the >2.0 Ga West African craton (WAC). Arc accretion and subsequent continent collision is manifested through eclogites and mafic to felsic granulites. Pre-collisional passive margin sediments were thrust westward over the WAC. A combined zircon U-Pb and hornblende/mica ⁴⁰Ar/³⁹Ar profile across the Eburnean-Dahomeyan orogens was made to constrain Dahomeyan imprint on the Eburnean rocks in the WAC. Hornblende ages are 2.06 Ga, while micas yield 2.0 Ga. Zircon U-Pb ages yield igneous crystallisation ages >2.1 Ga, however some samples display significant Pb-loss with lower intercept ages that are consistent with a 0.6 Ga Dahomeyan imprint. This probably reflect fluid induced variable resetting of the zircon U-Pb system, while mica and hornblende remained below their blocking temperatures and where inert to the fluids that affected the zircon. A granulite and a zoned plagioclase porphyritic metavolcanic rock from within the Dahomeyan belt, yield 0.614 and 0.577 Ga zircon ages respectively. The 0.577 Ga population represent igneous crystallisation as represented by prismatic zoned crystals. The 0.614 Ga population is represented by rounded featureless zircon, and date granulite facies metamorphism. Hornblende from the granulite yield 0.59 Ga ⁴⁰Ar/³⁹Ar plateaux, dating post granulite facies cooling through ~525 °C, correspond to a cooling rate of at least 10 °C/Myr.

These result highlights the imprint of the Dahomeyan orogen on the >2 Ga Eburnean rocks of the WAC in southeast Ghana. No resetting of Ar-ages is noted in mica or hornblende in the Eburnean rocks, while zircon is variably reset.