

In search of a common reference material for cadmium isotope studies

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Research into natural mass-dependent stable isotope fractionation of cadmium (Cd) has taken off in the past few years. Methodologies are quite diverse with MC-ICPMS favoured by all but one lab (the latter uses TIMS); some labs are using double-spike techniques and the rest either bracketing or doping to quantify the isotope fractionation. However, easy comparison of datasets collected in different labs is being hampered by the lack of a suitable, common isotopic reference material (RM) for Cd. Each lab is using its own shelf standard as 'zero delta' and, while attempts at cross-calibrating the offsets have been made (e.g. Wombacher and Rehkämper, 2004; Schmitt *et al.* 2009), the situation remains unsatisfactory in the long term. Here, we have undertaken a comprehensive round-robin assay of the Cd isotope offsets between commonly-used shelf standards.

A Cd isotope RM needs to fulfil three criteria: (1) there should be ensured a long-term supply from a large, homogeneous batch, (2) elemental impurities should be minimal and not impede the isotope measurement, and (3) the isotopic composition should be as close as possible to that of the bulk silicate Earth (BSE; cf., Wombacher *et al.* 2008; Schmitt *et al.* 2009). Candidates such as BAM-I012 and 'Münster Cd' have extremely fractionated Cd and are therefore unsuitable. Variation among shelf standards -mostly JMC plasma solutions- is up to 60 ppm/amu between batches. The Cd isotopic composition of NIST SRM 3108, assayed independently in several labs, lies within ca. 10 ppm/u of current best-estimates for that of the BSE. The purity of the standard was evaluated for possible interferences during MC-ICPMS analyses and, while small amounts of Se, As, Sn and In were detected, their levels are not significant. Thus, the NIST SRM 3108 Cd solution appears to be the best candidate RM available, and we strongly encourage its adoption as a Cd isotope 'zero delta' reference material in future studies.

Detailed mechanisms of melting and crystal growth during crustal anatexis at El Hoyazo (SE Spain)

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Crustal anatexis constitutes the most important mechanism of crustal differentiation. We have investigated the nature of anatexis in crustal anatectic enclaves included in Neogene peraluminous dacites from SE Spain. Garnet-Bt-Sil enclaves are made of Pl+Bt+Sil+Grt+glass±Kfs±Crd+Gr. They represent fragments of a (semi)pelitic continental crust partially melted and equilibrated at 850±50°C and 5-7 kbar in a regional metamorphic setting, that were quenched upon extrusion within the dacite. Peraluminous leucogranitic glass is present as MI within most of the mineral phases and in rock matrix. Glasses in MI represent the remains of the first melts produced during anatexis via Ms melting reactions at ≈700-750°C, starting at H₂O-saturated but evolving rapidly to H₂O-undersaturated conditions. Matrix glasses record the production of melt during the onset of Bt melting at ≈800-850°C. Melt and residual major phases (Pl, Kfs, Bt, Crd) were close to equilibrium (except for Grt) during generation of both MI and matrix glass. However, and regarding the compatible elements, MI show disequilibrium trace element distributions with respect to their host, likely due to enrichment of trace elements in the surface layers of the rapidly growing crystals. Considering the present residual mineral assemblage at T of 800-850°C, matrix glasses show equilibrium concentrations with respect to LILE (except Li and Cs, undersaturated up to 40% rel), but disequilibrium concentrations in HFSE, LREE, Eu, HREE and most FRTE (variably undersaturated in the melt). New experimental data on equilibrium partition coefficients is required, however, to determine precisely the extent of equilibration between the mineral residuum and melt during particular cases of crustal anatexis.