Apatite from Durango (Mexico) – A potential standard for *in situ* trace element analysis of phosphates

DIRK FREI[1], DAN HARLOV[2], PETER DULSKI[3] AND JØRN RØNSBO[4]

[1]GEUS - Geological Survey of Denmark and Greenland, Denmark (df@geus.dk)
[2]GeoForschungsZentrum Potsdam, Germany (dharlov@gfz-potsdam.de)
[3]GeoForschungsZentrum Potsdam, Germany (dulski@gfz-potsdam.de)
[4]Geological Institute, University of Copenhagen, Denmark (jornr@geol.ku.dk)

The trace element geochemistry of phosphates (e.g. apatite, monazite, and xenotime) determined *in situ* by modern microanalytical techniques (such like SIMS and LA-ICP-MS) is increasingly used for petrogenetic purposes. For example, the trace element signature of phosphates has been employed as a monitor of granite petrogenesis (including changes in porosity and permeability during crystallization), as an indicator for mineral exploration, and for geothermometric and geochronologic purposes. Therefore, the availability of a matrix-matched phosphate standard is highly desireable.

Apatite from Cerro de Mercado, Durango, Mexico, is widely used as an electron microprobe (EMPA) reference standard. A large body of major element data exists demonstrating sufficient homogeneity (1 to 5% RSD) at the 10 µm level. The Durango apatite might therefore have considerable potential as a suitable standard for trace element microanalysis of phosphates.

We will present the results of a detailed geochemical study that investigated the trace element homogeneity of a euhedral, highly transparent, and inclusion-free Durango apatite crystal. After crushing, an aliquot of this crystal has been analysed for the bulk trace element content by solution ICP-MS. The remaining splits have been analysed by various microanalytical techniques (EMPA, LA-ICP-MS, and SIMS) for their trace element homogeneity. Our results indicate that the investigated crytals are sufficiently homogeneous (2 to 8% RSD) on a 20 to 40 µm scale. Therefore, after careful geochemical characterization, individual gem-quality crystals of the Durango apatite might be useful as a much-needed standard for microanalysis of phosphates.

High-precision Sr, Nd, Pb and Hf isotopic characterization of USGS reference materials by MC-ICPMS and TIMS

B. KIEFFER[1], D. WEIS[1], C. MAERSCHALK[2], J. BARLING[1], E. DIETRICH-SAINSAULIEU[1], G. WILLIAMS[1], D. HANANO[1], J.B. MAHONEY[3], R.M. FRIEDMAN[1], W. PRETORIUS[1], J.S. SCOATES[1], N. MATTIELLI[2] AND A.GOOLAERTS[1]

[1]University of British Columbia, Vancouver, BC V6T 1Z4, Canada (dweis@eos.ubc.ca)
[2]Université Libre de Bruxelles (ULB), Brussels, Belgium.
[3]University of Wisconsin, Eau Claire, WI, 54701, USA.

The Pacific Centre for Isotopic and Geochemical Research (PCIGR) at the University of British Columbia has undertaken a systematic analysis of the isotopic compositions (Nd, Sr, Hf, Pb) and concentrations of a broad compositional range of United States Geological Survey reference materials, including basalt (BCR-1, 2; BHVO-1, 2; BIR-1), dunite (DNC-1), andesite (AGV-1, 2), rhyolite (RGM-1, 2), syenite (STM-1, 2) and granite (G-2). USGS reference materials are geochemically well-characterized for trace and major element concentrations, but there is neither a systematic methodology nor a database for radiogenic isotopic analyses, even for the most widely used ones, such as BCR-1 or BHVO. The instrumentation at PCIGR, which includes a Nu MC-ICPMS, a Triton TIMS, and an Element2 HR-ICPMS, permits a rigorous assessment and comparison of precision and accuracy in isotopic analyses.

For each of the reference materials 5 to 10 complete replicate analyses provide very coherent isotopic results, all below 60 ppm (2SD) for Sr, Nd and Hf (27, 24 and 58 ppm respectively). The MC-ICPMS and TIMS Nd isotopic results agree for all composition types to better than 15 ppm. For Pb, the reproducibility is not as good. A careful sequential leaching experiment of three first and second generation reference materials (BCR-1&2, BHVO-1&2, AGV-1&2) indicates that the inhomogeneitiy in Pb isotopic compositions, and concentrations (as measured by both HR-ICPMS and isotope dilution), can be directly related to contamination by steel (mortar/pestle) used to process the materials. Contamination also accounts for the high concentration in some specific trace elements in various USGS reference materials.