

Uranium mobility in the Beiras granite (Central Portugal): Implications for radon exhalation

A.J.S.C. PEREIRA AND L.J.P.F. NEVES

IMAR-CMA, Department of Earth Sciences, University of Coimbra (apereira@dct.uc.pt, luisneves@dct.uc.pt)

The medium to coarse grained porphyritic biotite granite of the Beiras region is the dominant facies of a late Hercynian batholith outcropping in Central Portugal, associated with a large number of secondary uranium mineralizations exploited in the past (*ca.* 60). Geochemical and isotopic data indicates that it is a moderately evolved rock, slightly peraluminous, and likely originated from a heterogeneous portion of the lower crust. It's accessory mineralogy includes uraninite, which is a likely primary source for the thousands of local uranium anomalies detected in the region, usually associated with fault filling materials and metasedimentary rocks of the contact aureole and enclaves.

A total of 18 representative samples from the batholith were collected, 16 of granite and 2 of hornfelses. Granitic samples include fresh rock, some stages of slight and moderate weathering and also specimens showing hydrothermal alteration, characterized by the development of pink/red feldspars and strong chloritization; some of these last samples were collected in the vicinity of the Cunha Baixa old uranium mine. Thin sections coupled with mica detectors were prepared and irradiated with fast neutrons in a nuclear reactor. The study of fission tracks produced by ^{235}U decay and recorded in the mica detectors allowed to study the mineralogical distribution of U. In parallel, ^{226}Ra activity and total U concentration was estimated for all samples using a 3x3" Ortec NaI(Tl) gamma ray spectrometer; radon exhalation rate was determined placing the same samples inside sealed containers of known volume and measuring the radon activity in the air of the container after equilibrium being achieved (*ca.* 4 weeks) with an Alphaguard monitor.

Uranium concentration in the samples shows a wide range of variation, from 6 to 29 ppm, with a median of 13 ppm. Accordingly, exhalation rates are in the range 0.7 up to 7.3 Bq.kg⁻¹.h⁻¹, with a median of 1.4 Bq.kg⁻¹.h⁻¹. Fission-track observations indicate a generalized secondary uranium mobilization, even in fresh samples, with a large proportion of this element related with mineral borders, alteration surfaces and oxi-hydroxide fillings of microfractures; this is in good agreement with the very high exhalation rates measured.

IMS 1280-HR: A versatile SIMS instrument for Geosciences

P. PERES, F. FERNANDES, M. SCHUHMACHER AND P. SALIOT

CAMECA, 29 quai des Grésillons, 92622 Gennevilliers Cedex, France (peres@cameca.com)

SIMS (Secondary Ion Mass Spectrometry) is applied to a variety of applications in Geosciences, because it provides *in situ* measurement of elemental and isotopic composition in selected μm -size areas of the sample.

The CAMECA IMS 1280-HR large geometry SIMS offers outstanding capabilities for a wide range of geological applications, thanks to its very high transmission mass spectrometer combined to a versatile multicollection system. The IMS 1280-HR is also able to map the lateral distribution of major, minor, and trace elements, both in microscope and microprobe mode.

Hundreds of scientific papers have been published covering major application fields in geo- and cosmochemistry, geochronology, environmental studies,....:

- stable isotope ratio measurements on different systems: Hydrogen [1], Lithium [2], Carbon [3-5], Oxygen [6-10], Magnesium [11], Silicon [12], Sulfur [13-14],...
- U-Pb dating in Zircon [10, 15-18],
- trace element analyses [10, 19-20],

A review of recent analytical data obtained with the IMS 1280-HR on different domains will be presented.

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