(U-TH)/HE ANALYSIS OF APATITE

SELFRAG Lab – the first commercial High Voltage (HV) pulsed power laboratory equipment for selective fragmentation. Very short pulsed HV-discharges applied to solids under water cause the material to disaggregate along grain boundaries, inclusions or inhomogeneities. The highly selective fragmentation process of SELFRAG Lab liberates morphologically intact minerals while minimizing the production of undesired fines.

SELFRAG LAB FOR (U-TH)/HE ANALYSIS OF APATITE

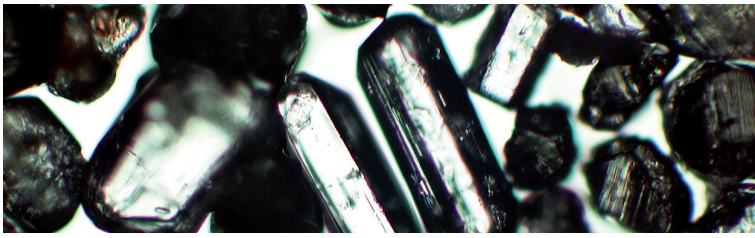
SELFRAG Lab versus conventional preparation (crusher & mills): Applicability for (U-Th)/He analysis of apatite using HV pulsed power disaggregation of rocks.

Stuart, F.M.*, Nägler, T., Eggenberger, U.**, Kurz, D.**, & Ghorbal,B.*****

* Scottish Universities Environmental Research Centre, East Kilbride, UK

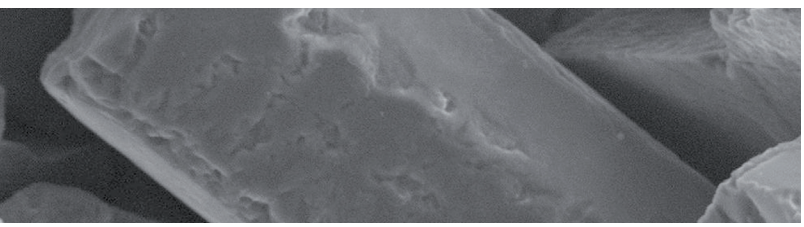
** Geological Institute, University Berne, Switzerland

*** Faculty of Earth and Life Sciences, VU Amsterdam, Netherlands



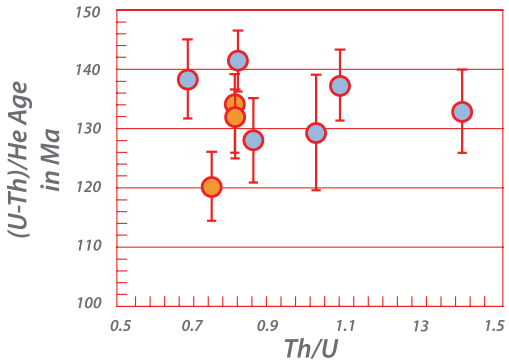
Purpose of study:
Apatite (Ca5(PO4)3) 543is widely used in geoscience to determine rock cooling through very low temperatures. The apatite fission track technique is well-established. Over the last decade (U-Th)/He analysis of apatite has become a powerful chronometer for cooling through 70°C. The diffusion of He from the apatite crystal lattice begins at 30-40°C. Diffusion rates increase exponentially with temperature so that at 1,000°C all He is lost on a timescale of minutes. Because the initial crystal shape is essential for accurate apatite (U-Th)/He age determinations, analysis is usually undertaken on euhedral crystals. Consequently, liberating undamaged, euhedral apatite grains from crystalline rocks is important. SELFRAG Lab uses short pulsed HV-discharges to disaggregate solids. For less than one microsecond a 1-2 µm wide plasma channel is induced along grain boundaries. If significant heating of apatite crystals were to occur during processing, He could be lost and result in erroneously low (U-Th)/He ages. A comparative study of SELFRAG Lab versus conventional preparation (crusher & mills) was conducted to examine the applicability of HV pulsed power disaggregation for (U-Th)/He analysis of apatite.

Sample preparation:
A sample of a two-mica-leucogranite from the Zaer Massif of the Western Meseta, Morocco, was processed in two ways: Conventionally using a jaw crusher followed by a disk mill and by the HV pulsed power process of SELFRAG Lab.



Results/Findings:

- SELFRAG Lab processing gives a higher yield of euhedral apatite than the conventional preparation of typical crystalline rocks.
- The absence of fine particles makes apatite separation faster and easier.
- SELFRAG Lab processing has no influence on apatite (U-Th)/He age. The age concordancy implies that the age distribution of conventional and SELFRAG Lab processed apatites are similar (see figure below). This means that the apatite crystals are not exposed to high temperatures for long enough to cause diffusive loss of He.



(U-Th)/He ages vs. Th/U ratio for single apatite crystals (leucogranite from the Zaer Massif, Morocco). Blue circles are crystals separated by SELFRAG Lab. Yellow circles are crystalsprepared conventionally.

SELFRAG Lab processing is suitable and efficient for mineral separation from crystalline rocks for low temperature thermochronology such as apatite (U-Th)/He and fission track analysis.

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For Customer service contact:
SELFRAG AG • Biberenzelgli 18 • CH-3210 Kerzers • SWITZERLAND
Phone +41 31 750 32 32 • Fax +41 31 750 32 33 • info@selfrag.com • www.selfrag.com