c-axis orientation measurement of apatite for fission track thermochronology using an automated microfabric analyser system

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Apatite fission track analysis is generally carried out on surfaces that contain the crystallographic *c*-axis in order to avoid a counting and measuring bias induced by anisotropic track annealing effects. Grains with the appropriate *c*-axis orientation are traditionally identified by the characteristic shape of polishing scratches and track openings. An automated microfabric analyser system, previously used to analyse the texture of uniaxial minerals in deformed rocks, has been applied to directly measure the *c*-axis orientation of apatites in fission track mounts for the first time.

The data acquisition system uses an array of nine LED light sources and a CCD camera to produce an AVA diagram (Achsenverteilungsanalyse), commonly used in microfabric orientation analysis. In these AVA diagrams, gradational shades of colour represent the three-dimensional orientation of *c*-axes for every pixel. Using the software package INVESTIGATOR, a statistically significant amount of pixel-wide *c*-axis measurements are obtained for each grain. The *c*-axis orientations within the grain are subsequently averaged using statistical methods, resulting in one *c*-axis orientation per grain and eliminating the effects of impurities or grain boundaries. As each *c*-axis is recorded with the XY position of its pixel value, central coordinates for the analysed grains are calculated in order to obtain unambiguous grain – *c*-axis correlations, thus facilitating the inter-calibration between the AVA image and the stage control of a typical fission track microscope.

The microfabric analyser system allows for an automated preselection of grains of a suitable orientation within apatite fission track mounts and is particularly useful in samples with few euhedral grains (e.g. Durango apatite). In addition, the new method provides a precise *c*-axis orientation to which individual fission track orientations can be referred, enabling the potentially useful anisotropy of fission track annealing to be monitored more precisely.