Inter-analyst comparison and reproducibility of apatite fission track analysis

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Abstract

Factors influencing data reproducibility of fission-track (FT) thermochronology can be summarized into three main categories associated with data acquisition steps. (1) Sample preparation involves mineral separation, mounting, polishing and etching; (2) data revelation relates to instrumentation (microscope, LAICPMS, etc.) and software settings; and (3) execution depends on feature selection by the analyst. Previous committee reports and studies (Hurford A.J. 1990; Ketcham et al. 2009; Ketcham et al. 2015; Ketcham et al. 2018) have contributed significant insights into the reproducibility of fission-track data by comparing length and age measurements produced by several laboratories using their own preparation and revelation procedures. A recent attempt to isolate analyst-specific factors in length measurement using an image-based approach (Tamer et al. 2019) found that when two analysts observe the same feature and agree it is a valid track, measurement reproducibility was very good, though impacted by etching. Dispersion of individual length measurements was 0.7-1.0 μm (2?? for weaker etching and 0.5-0.8 μm for stronger etching, but mean lengths were always within 0.1 μm of each other. Where the analysts disagreed more significantly, however, was in finding tracks and evaluating whether they were valid, sufficiently clear, and sufficiently etched for measurement, which led to differences of up to ˜0.8 μm in mean track length. This study builds on the image-based approach to encompass more aspects of the measurement process and increase the number of analysts being compared. We will look at confined track selection in greater detail, and also study analyst decisions behind age determination, including the selection of the region of interest for counting, and identification of grain-surface features as tracks appropriate for counting. Reflected and transmitted light image stacks for 41 grains and graticules are available on a cloud platform Participants will carry out analyses of these images using their preferred approach, e.g. suitable analytical software, manual measurements or AI-based analysis. A limited license for FastTracks (v3.2) will be available for those who would like to participate but do not have measurement software. Analysts are asked to fill out a questionnaire about their fission track experience, conduct track density estimations, confined track length and Dpar measurements, and especially provide comments on all grains being analyzed or skipped. FastTracks users are asked to send the .xml files produced by the software, while other participants are asked to submit the results using a template. The results will be entirely anonymous unless the analyst states otherwise. The deadline for the submission of the results is June 1st, 2022. The results will be shared on 18th International Conference on Thermochronology.

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FastTracks V3 limited license: https://mediaflux.researchsoftware.unimelb.edu.au:443/mflux/share.mfjp?_token=LGT8N3Andqlnu4qx5CBY1128203387&browser=true&filename=FastTracks_3.2.4.zip .

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Submissions to murat@ies.ac.cn

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