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Advantages and challenges in automated apatite fission track counting

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Fission track thermochronometer data are often a core element of modern tectonic and denudation studies. Soon after the development of the fission track methods interest emerged for the developed an automated counting procedure to replace the time consuming labor of counting fission tracks under the microscope. Automated track counting became feasible in recent years with increasing improvements in computer software and hardware. One such example used in this study is the commercial automated fission track counting procedure from Autoscan Systems Pty that has been highlighted through several venues. We conducted experiments that are designed to reliably and consistently test the ability of this fully automated counting system to recognize fission tracks in apatite and a muscovite external detector. Fission tracks were analyzed in samples with a step-wise increase in sample complexity. The first set of experiments used a large (mm-size) slice of Durango apatite cut parallel to the prism plane. Second, samples with 80-200 μm large apatite grains of Fish Canyon Tuff were analyzed. This second sample set is characterized by complexities often found in apatites in different rock types. In addition to the automated counting procedure, the same samples were also analyzed using conventional counting procedures. We found for all samples that the fully automated fission track counting procedure using the Autoscan System yields a larger scatter in the fission track densities measured compared to conventional (manual) track counting. This scatter typically resulted from the false identification of tracks due surface and mineralogical defects, regardless of the image filtering procedure used. Large differences between track densities analyzed with the automated counting persisted between different grains analyzed in one sample as well as between different samples. As a result of these differences a manual correction of the fully automated fission track counts is necessary for each individual surface area and grain counted. This manual correction procedure significantly increases (up to four times) the time required to analyze a sample with the automated counting procedure compared to the conventional approach.