Thermochronology

Methodology, data processing, fields of application and case studies

for master students, 2 hours per week, usually in the winter term
participants receive handouts of ca. 70 pages
exam: written, 45 minutes for 6-8 questions

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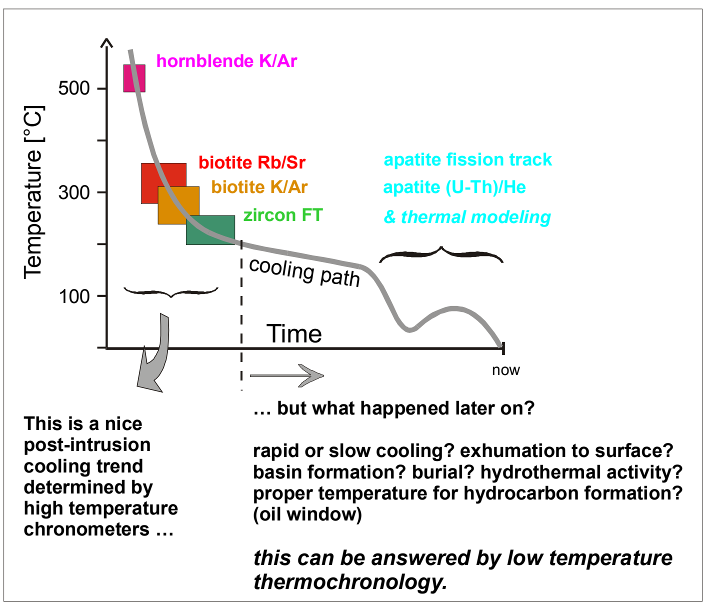
Just some questions as provocation:

- Why to measure the age of detrital grains at all?

- How to evaluate the mixture of single-grain ages?

- How can be measured the age of thermal overprint in the range of diagenesis and oil-window?

- How reliable are the thermal paths (the results of thermal modelling)?



Content of the course:

Introduction

- significance of the low temperature events (<200°C) in the reconstruction of the geological-tectonic evolution

Geotherms

- what controls the position and shape of the geotherms?

Low-T geo-thermomerty

- indicators of the "low T events" (vitrinite reflectance, illite crystallinity, etc.)

Methodology

- physical backgrounds of the fission track and (U-Th)/He methods,
- review of alternative procedures and their evaluation,
- limitations of the methods,
- statistics

Application

- tectonic interpretation of thermochronological results,
- case studies:
    - volcanic rocks -- formation ages,
    - metamorphic & intrusive rocks -- cooling ages, exhumation,
    - sedimentary rocks -- provenance studies,
    - sedimentary basins -- thermal histories,
    - hydrocarbon exploration,

Computation

- demonstration of the most important software (TrackKey, PopShare, BinomFit, ProvSynt, AFTSolve, HeFTY),
- some tricks in modelling of the thermal history

Other methods for dating exposition of rock surfaces and young sediments

Cosmogenic dating methods

Amino acid racemization

Luminescence

Electron spin resonance

Visit in the laboratories

- short demonstration of major instruments and procedures

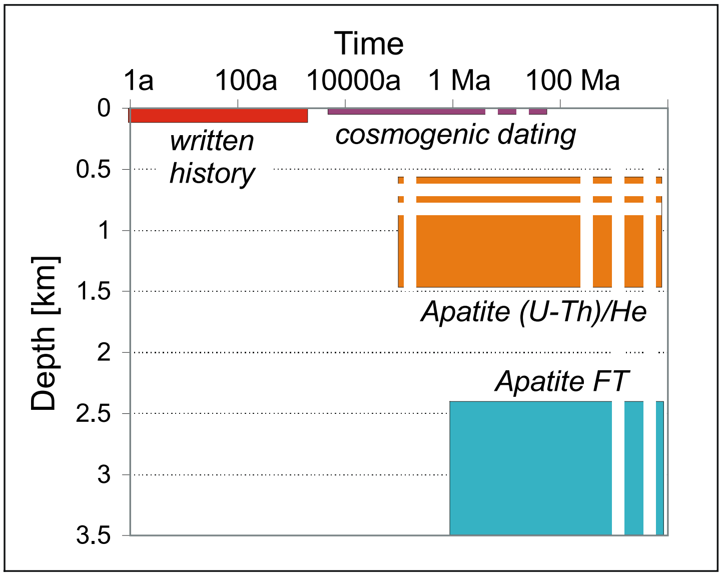


Fig. 1: Ranges of “near-surface” chronological methods. The conversion of temperature to depth is just an estimation, and of course depends on geothermal gradient, but the cartoon describes the possibilities in the chronology of young and shallow events.

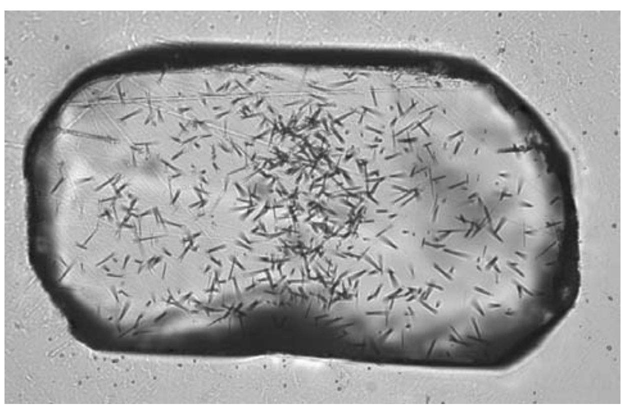


Fig. 2: Fission tracks in an apatite crystal. The age determination is based on the optical counting of crystal damages caused by radioactive decay.

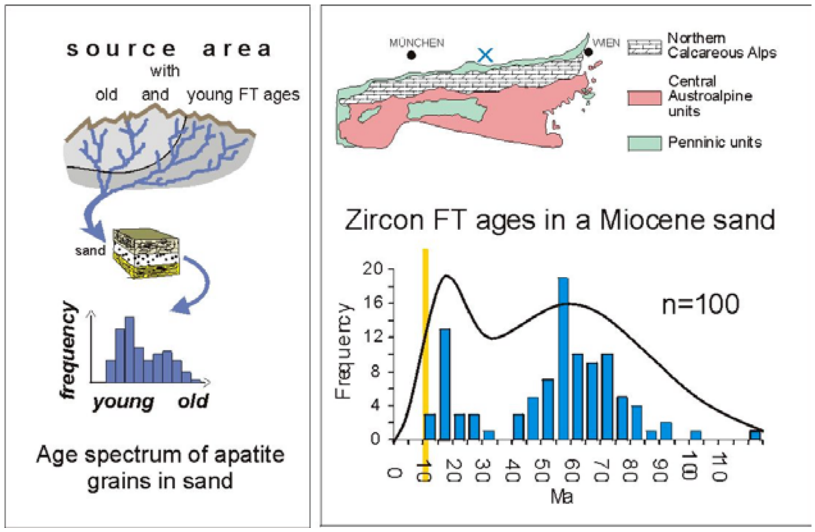


Fig. 3: In case of dating siliciclastic rocks the result is not one age (a given number), but rather a distribution of ages measured in single crystals. This distribution is characteristic for the sediment and describes the cooling ages on the source area of the sediment.