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Towards testing the hypothesis of climatically-induced Pliocene exhumation in the European Alps

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Sediment flux from the Alpine orogen increased dramatically during Pliocene times (Kuhlemann *et al*., 2001); controversy exists, however, over whether this signal was induced by climatic or tectonic forcing. Cederbom *et al*. (2004) showed that a fossil apatite fission-track partial annealing zone (PAZ) exists in boreholes of the Swiss Molasse Basin, well above the present-day PAZ. These data indicate an initiation of $>$1000 m of exhumation at $\sim$5 Ma in the foreland basin. A climatic change (Haug and Tiedemann, 1998) was invoked as a probable cause of increased precipitation and erosion across Europe, and of the resulting isostatic rebound of the Alpine chain and its foreland basin(s).

Predictions of the isostatic component of rock uplift for this $\sim$5 Ma signal in the Alps requires approximately 6 km of exhumation for the regions of the Aar and Mont Blanc Massifs. This project aims to test these predictions using a combination of apatite fission-track and U-Th/He thermochronology from vertical transects in these crystalline massifs. A synthesis of $\sim$900 surface apatite fission-track data from across the Alps demonstrates a range of young ages, some of which from the western French Alps indicating an acceleration in cooling from 3-5 Ma onward (van der Beek *et al*., 2004). If there is a Pliocene erosional signal in the Swiss Alps, then the application of U-Th/He measurements should reveal it.

The fission-track dataset has been analysed with a GIS to determine cooling age vs. elevation trends for particular tectonic units and analyse the exhumation rate they suggest as well as the timing of its inception. Besides analysing the age/elevation relationship in a given area, an alternative approach is now tested by selecting in the large dataset only those data whose elevation and age satisfy a chosen trend. Plotted on a map, the selected set is heterogeneously composed of either scattered samples actually part of very different vertical transects and picked up by chance only, or more clustered samples potentially indicating a location where vertical transects may allow to access the thermal history. This approach constitutes a valuable exploration technique to decide where new vertical transects are expected to yield results on several thermochronometers and to test their consistency.

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Kuhlemann J., Frisch W., Dunkl I. & Szekely B. (2001) – Quantifying tectonic versus erosive denudation by the sediment budget: the Miocene core complexes of the Alps. *Tectonophysics*, 330: 1-23.

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