



## **Steady-state exhumation of the Western Alps constrained by detrital apatite fission track thermochronology**

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There are several lines of evidence for a Late-Neogene increase in exhumation and related erosion in the Western Alps. For instance an Alpine-wide sediment budget implies an approximately doubling of the sediment flux to the foreland since  $\sim 5$  Ma, approximately at the same time the orogen shrank. This was used to argue that the increase in erosion/exhumation is related to a climate change to wetter conditions.

In this study we applied detrital apatite fission track (AFT) thermochronology to Neogene foreland deposits to better resolve the erosion and exhumation history of the Western Alps. For that we sampled Miocene-Pliocene Molasse and modern river sediments in the Chambaran foreland basin remnant located in the French Western Alps. In general 100 grains were counted and resulting age probability density plots decomposed into statistically significant age populations. The lag-time (thermochronological age minus stratigraphic age) of the youngest age population show a distinct pattern: (i) between 17 and 13 Ma the lag-time is  $\sim 2$  Myr, (ii) from 13 to 10 Ma the lag-time increases to a value of  $\sim 6$  Myr and (iii) remains constant since then. The shift in lag-time coincide with a major shift in drainage pattern in the Western Alps. Before 13 Ma the catchment of the paleo-Rhône ranged far east, draining among others the fast exhuming Lepontine dome. Starting at 13 Ma the SW Jura Mountains get uplifted and as a result the paleo-Rhône catchment bisect, draining exclusively the Western Alps and no longer the Lepontine dome. This implies that the decrease in lag-time is not caused by a change in exhumation rate, but most likely is a result of a reorganisation of the drainage pattern. In addition the constant lag-time since 10 Ma suggests a steady exhumation of areas, which have been exhumed most rapidly at that time (external crystalline massifs). In particular the data is not consistent with an increase in exhumation of the Western Alps during the last 5 Myr, as suggested by the sediment budget. Probably the increase in denudation rates reported from the sediment budget is an artifact of overall increasing resolution and conservation of the sediment record. In addition pebble petrography suggests a strong decrease in dissolved load in the Western Alps, whereas the sediment budget was calculated with a constant proportion during Miocene/Pliocene times.