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Post 12 Ma tectonic activity of the Subalpine Molasse resolved by combining thermochronology and critical wedge analysis

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Thermochronological studies in the Northern Alpine Foreland Basin show that the folded and thrusted part of the basin, the Subalpine Molasse (SM), has been tectonically active during the last 12 Ma (Cederbom, C. E. et al., 2011; von Hagke, C. et al., in review). However, the amount of erosion and timing of thrusting is so far only reported from the Swiss Molasse basin. To test whether this is a local signal and whether climate contributed to this thrusting, we report thermochronological data from a profile south of Lake Constance and analyse the results in the framework of critical taper theory.

We selected the Bregenzerach stream as suitable study area because it is one of the few profiles, which provides excellent outcrops in all stratigraphic units of the SM and is located east of the Jura fold and thrust belt, north of the Eastern Alps. We present new apatite (U-Th-Sm)/He (AHe) and apatite fission track (AFT) data.

In contrast to the Central Alps, the new data do not show full resetting of the AFT system. This demonstrates that the eastern SM has experienced less erosion than the central SM. The AHe system in contrast, shows complete resetting also in the eastern SM. We observe age-offsets across the same thrusts which have been reactivated in the central SM. This confirms that the SM of the Eastern Alps must have been tectonically active until at least 5 Ma, as is also known from the central SM. This implies reactivation of thrusts, which formed originally in mid to late Miocene times.

From critical taper analysis, reactivation of thrusting (assuming constant dip of the basal detachment through time) can only be obtained (1) by an increase of basal detachment strength or (2) a decrease of surface slope. An increase of detachment strength through time is either possible due to jumping of the detachment to another stratigraphic level or a change in pore fluid pressure. A decrease in surface slope is either tectonic- or erosion-controlled. We show that today the Eastern Alps are at a stable state whereas the Central Alps are critical. We use these first order constraints in combination with new and old thermochronological data and discuss the influence of climate on foreland deformation.

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CEDERBOM, C.E., SCHLUNEGGER, F., VAN DER BEEK, P.A., SINCLAIR, H.D. & ONCKEN, O. (2011) Rapid, Extensive Erosion of the North Alpine Foreland Basin at 5-4 Ma. Basin Research, 23, 528-550.

VON HAGKE, C., CEDERBOM, C.E., ONCKEN, O., STOCKLI, D.F., RAHN, M. & SCHLUNEGGER, F. (in review) Linking the Northern Alps with Their Foreland: The Latest Uplift and Erosion History Resolved with Low Temperature Thermochronology. submitted to Tectonics.