spatial exhumation. The Seckauer Tauern already cooled to upper crustal levels (2-3 km) during Eocene times, followed by stagnation and very low erosion rates. In contrast, the Niedere Tauern cooled to upper crustal levels during the Middle- and Late Miocene, contemporaneously to the Penninic units within the Tauern Window. Structural investigations suggest that the displacement between these two Austroalpine units occurred along the northern section of the Pöls-Laventtal fault system. We suggest that extrusion became not only lateral in terms of parallel to the trend of the Eastern Alps, but was characterized by a displacement vector at a high angle to the strike of the orogen. This resulted in exhumation of the Niedere Tauern and Pohorje Block that were exhumed within extensional bridges at the northern and southern termination of the Pöls-Lavanttal fault system, respectively.

Thermal modeling of an external Unit of the Eastern Alps - the Helvetic zone of western Austria and Upper Allgäu

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The Helvetic zone of the Eastern Alps is a thin-skinned fold-and-thrust belt comprising Jurassic to Cenozoic shelf deposits. They were detached from their substratum during Cenozoic nappe formation. From the Oligocene onward, they were transported to the north and thrust onto the Alpine Foreland Basin, carrying the Penninic and Austroalpine units piggy-back.

To study the thermal evolution of this external part of the Eastern Alps, maturation of organic matter was measured using vitrinite reflectance. Organic rich dark-colored shales and carbonates build a large part of the Helvetic stratigraphic succession. Fission track dating was done to obtain some time related temperature information on the thermal evolution of the Helvetic nappes. In order to get a more complete image, samples from the Subalpine Molasse in the footwall and from the overlying Penninic Rhenodanubian Flysch were included. Apart from surface outcrops deep wells (Dornbirn 1, Hohenems, V-Au1, Kierwang 1 and Maderhalm 1) were sampled as well. Modeling was done using the PetroMod 2001.1 software by Schlumberger Ltd.

Vitrinite reflectance measurements from the Helvetic zone yielded three different trends: first of all a stratigraphic trend is given – the mean reflectivity (%Rr) decreases for about 0.4% from the Malmian Quinten Limestone to the Late Cretaceous sandstones of the Garschella Fm. Secondly, coalification rises with increasing depth (ca. 0.3%Rr per km). Finally, coalification in general increases from north to south, starting at the high volatile bituminous coal stage and reaching the low volatile bituminous coal- to semi-anthracite stage along the Penninic thrust contact. Measurements deep well samples show a coalification trend that is offset along numerous faults which are known from the drill record. Therefore, a pre- to syntectonic coalification of the Helvetic units has to be claimed.

Preliminary apatite fission track data show that all investigated units were subjected to post-depositional temperatures above the APAZ (i.e. >120°C) since all grains are fully reset. Partially reset zircon samples from few analyzed samples from Helvetic and Rhenodanubian Flysch units argue for maximum temperatures between 180 and 300°C.

By combining results from coalification and fission track analyses a maximum overburden of more than 8 km could be modeled for the Early to Late Oligocene.