Geophysical Research Abstracts
Vol. 13, EGU2011-10128, 2011
EGU General Assembly 2011

Lateral Extrusion in the Eastern Alps: Time constraints and plate tectonic controls during Oligocene to Miocene times

Andreas Wölfler, Walter Kurz, Harald Fritz, and Kurt Stüwe
Graz, Earth Sciences, Graz, Austria (andreas.woelfler@uni-graz.at)

Late-orogenic normal faulting subsequent to the juxtaposition of European and Adriatic continental margins has been documented along the entire length of the Alps and there is a broad consensus that much of the exhumation history of deep seated rocks is related to slip along these normal faults. The structure of the Eastern Alps is characterized by a system of fault zones that developed during late Oligocene to Miocene times. This fault system is related to orogen-parallel escape of Austroalpine units towards east, a process also termed lateral extrusion.

This study comprises a review of the lateral extrusion model for the Eastern Alps, by reassessing the geological evolution, including the evolution of the fault systems within the extruding wedge over space and time. The aim of our study is to evaluate the mechanical processes using recently published geochronological data from the Eastern Alps east of the Tauern Window. In particular, apatite fission track ages as well as sedimentary ages from intramontane basins are used to show that the general process of extrusion can be resolved into distinct tectonic phases. We link these phases to the exhumation history of distinct crustal blocks and demonstrate that extrusion is not exclusively lateral in terms of east-directed displacement of crustal blocks. This interpretation can be used to place constraints on the mechanics of the lateral extrusion process and the configuration of plate boundaries in the Alpine-Carpathian-Mediterranean realm. We demonstrate that, especially for the eastern part of the Eastern Alps, subduction roll back beneath the Carpathians plays a key role for extrusion during Middle Miocene times. Our model is consistent with recent seismic studies that demonstrate opposing subduction polarities within the Alpine-Dinaric-Pannonian junction.

In summary we suggest that lateral extrusion of the Eastern Alps can be sub-divided into distinct stages that closely relate to the plate scale geometry of well known plate boundaries in the Mediterranean realm:

(1) During Oligocene to Middle Miocene times extrusion-related faulting continuously propagated from the western towards the central eastern part of the Eastern Alps. This is confined by oblique convergence between the Adriatic and European plates. We suggest that within this time span the Eastern Alps experienced oblique shortening due to the quickly retreating Apennine subduction zone. The Tauern Window was not fully unroofed and the Eastern Alps did not extent as far as to the approximate position of the Katschberg normal fault system. Accordingly, slab retreat along the Carpathian subduction zone did not substantially contribute to lateral extrusion until Middle Miocene times.
(2) During Middle Miocene times 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 the exhumation of Austroalpine crustal blocks to the east of the Tauern Window (e.g. Niedere Tauern and Pohorje Block). Now, extrusion was controlled by overall extension and the influence of north-directed compression triggered by the northward moving Adriatic plate diminished. Instead, the influence of the retreating Carpathian subduction zone increased. This resulted in the formation of intramontane basins to the east of the Tauern Window as well as widespread calc-alkaline volcanism in the Styrian Basin.