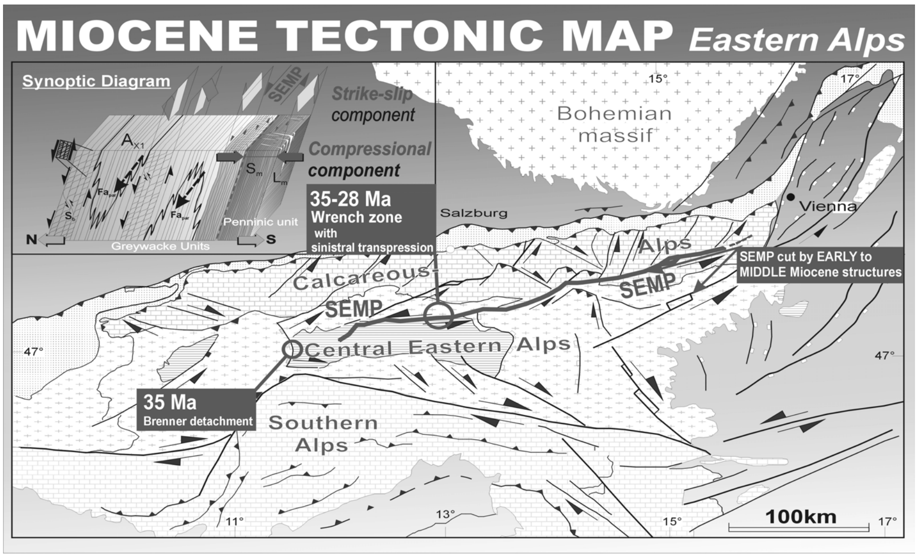

Figure 1. Miocene Tectonic map of the Eastern Alps. $^{40}Ar/^{39}Ar$ data record (28–35 Ma) Late Eocene/Early Oligocene for the beginning of transpressional deformation at the northern border of the Tauern Window.

The Bohemian Massif – from Gondwana to Pangea

J.F. von Raumer[1], G.M. Stampfli[2]

[1] Sciences de la Terre, Université Fribourg, Schweiz; [2] Institut de Géologie, Université de Lausanne, Suisse

In Kossmat's (1927) reconstruction of the European Variscan belt, the Bohemian Massif appears as one of the dominant structures. Among the many results of geological research since that time, we only mention the pioneering work on the southern parts of the Bohemian Massif (Fuchs and Matura 1976), as their geological map is still a valid base for present-day research. Evidently, with growing knowledge, interpretations of structures have changed and it may be interesting to follow the evolution of distinct Variscan massifs in palaeotectonic reconstructions from the Cambrian to the Late Carboniferous, presented recently by Stampfli and Borel (2002). Different stages may be differentiated, the Early Palaeozoic peri-Gondwana evolution, the drift history, and the period of Variscan collision.

During the Cambrian, most parts of the Bohemian massif, like other European basement areas, were located at the Gondwana margin, in the former eastern prolongation of Avalonia and Cadomia, thus having in common relicts of Gondwana-derived Cadomian basement, a Late-Proterozoic active margin setting, the formation of Vendian-Early Palaeozoic detrital sediments on the Gondwana shelf, the sedimentary infill of Cambrian rift systems, and the initial stages of Rheic ocean opening (von Raumer et al. 2002, and references therein).

After separation of Avalonia, around 480 Ma, the plate tectonic evolution of the remaining, more eastern located continental blocks, the Bohemian Massif included, followed a different path. After a short Ordovician orogenic event at the Gondwana border, their evolution was guided, since the Silurian, by the continuing diachronous oblique subduction of Prototethys oceanic ridge under the different remaining segments (Armorica, Alpine domain) accompanied by the opening of the Palaeotethys and the stepwise separation of continental blocks from Gondwana. The Bohemian Massif, consequently, was part of an archipelago-like continental ribbon, which drifted from Gondwana in direction of Laurussia, leaving behind the large space of Palaeotethys.

Since the earliest Devonian, around 380 Ma, parts of this continental ribbon began to collide either with Laurussia-Avalonia-derived continental blocks or with island-arc-structures, accompanied by the high-grade metamorphic transformations as consequence of this first Variscan orogenic event (Stampfli et al. 2003). Subsequently, the amalgamated terranes collided with Eurasia in a second Variscan orogenic event during the Visean, accompanied by large scale lateral escape of major parts of the accreted margin. Final collision between Gondwana and Laurussia took place from the Late Carboniferous onwards, and since the Early Permian, large areas of the resulting Variscan basement underwent postorogenic collapse, accompanied by formation of new rift basins.

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Fault Backstripping: A method to quantifiy synsedimentary dip slip

M. Wagreich[1], H.P. Schmid[2], R. Faber[1]

[1] *Institut für Geologie, Universität Wien, Geozentrum, 1090 Wien;* [2] *OMV AG, 1211 Wien, Austria*

Analysis of deformational histories along faults is commonly based on the dating of cross-cutting relationships using relative ages of offset strata or geochronological ages of syntectonically grown minerals within fault planes. TEN VEEN & KLEINSPEHN (2000) introduced a new approach to reconstruct the vertical component of synsedimentary fault movements by geohistory analysis of sedimentary sections from both the hanging-wall and the footwall blocks adjacent to major normal faults to evaluate timing and sense of dip-slip along these faults.

The backstripping process includes corrections for paleobathymetry and stepwise decompaction of stratigraphic units. Paleobathymetry estimates are based mainly on known depth ranges of sedimentary structures and paleoecological proxies, e.g., benthic foraminiferal assemblages or plankton/benthos ratios. Decompacted thicknesses and paleo-water depths for each stratigraphic unit result in a basement (sediment-loaded) subsidence curve.

The fault backstripping method compares basement subsidence curves from sedimentary successions on two fault blocks adjacent to major synsedimentary normal faults. Segments of convergence or divergence record times of dip-slip activity. Parallel curved segments record either times of inactivity or pure strike-slip motion. Intervals of faulting can be dated according to the established chronostratigraphic resolution. The relative sense of fault movement can be directly determined, with converging or crossing basement subsidence curves indicating reversals in the sense of faulting. Based on this method apparent dip-slip rates, i.e. the vertical component of displacement, can be calculated for individual faults. Assuming similar stratigraphic timing within both sections and the absence of significant erosion, the difference of the basement subsidence values on either side of the fault are calculated stepwise for each stratigraphic unit. These dip-slip values are divided by the time duration to give apparent dip-slip rates for each fault. Results of this fault backstripping method are presented in step plots of the slip rate versus time. Positive or negative values indicate the sense of dip-slip, i.e. which block moved faster; fault inactivity or pure strike slip motion result in zero values.

A case study in the central Vienna Basin demonstrates the applicability of this method to transtensional basins. Major dip slip with rates as high as 3 mm/a is recorded in the central part of the Vienna Basin during the Karpatian. Reversal in the sense of normal faulting during the Karpatian and lowermost Badenian indicates a complex tectonic evolution.

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