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The Alpine nappe stack in western Austria: A crustal-scale cross-section

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A N-S oriented crustal-scale cross-section was constructed east of the Rhine valley in Vorarlberg, western Austria addressing the central Alps-eastern Alps boundary. The construction was based on published data, surface geology, drillings, as well as on reinterpreted seismic lines. The general architecture of the examined area can be described as a typical foreland fold-and-thrust belt, comprising the tectonic units of the Subalpine Molasse, (Ultra-)Helvetic, Penninic, and Austroalpine nappes. These units overthrusted the autochthonous Molasse along the south-dipping listric Alpine basal thrust. The thermotectonic evolution of this nappe stack is adressed by Bertrand et al. (this session). The Subalpine Molasse is multiply stacked, forming a triangle-zone (Müller et al. 1984). The shortening within the Subalpine Molasse in the cross section has been calculated using the Lower Marine Molasse as a reference and amounts to approx. 46 km, (∼70%). Towards east the shortening within the Subalpine Molasse decreases dramatically as shown by Ortner et al. (this session).
A well-defined seismic feature in the research area is the European basement together with its autochthonous cover, with a moderate southward dip from about 3500m BSL to approx. 6500m BSL along the ca. 50km long section. Several seismic sections show fault structures offsetting the top of the European basement as well as autochthonous cover. Another discontinuous double reflector that can be identified in several seismic sections is interpreted as the base of the Helvetic nappe complex (approx. at 5000m BSL in the southernmost parts).
The internal structure of the Helvetic nappe stack could hardly be resolved. The assumed hinterland dipping duplex-structure of the Helvetic nappes results from surface and borehole-data. However, there are at least two Helvetic nappes needed to fill the available space. The deeper one, termed “Hohenemse nappe” (Wyssling, 1985), is overlain by the superficially exposed “Vorarlberg Säntis nappe”. In the southern part of the Vorarlberg Säntis nappe (below the “Bregenzer Wald”) we suspect a Dogger basin (cut across by well V-Au1) which is, at least to the east, bordered by steep lateral ramps, accompanied by tear faults in the hanging wall (Ostergunten fault system).

References

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