THE STRUCTURE OF THE RHENODANUBIAN FLYSCH ZONE IN THE ATTERSEE TO TRAUNSEE REGION (AUSTRIA)

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The structure and the structural development of the Rhenodanubian Flysch Zone (RFZ) in the Attersee to Traunsee region (Upper Austria) have been examined by structural analysis and 3D structural modelling. The structure of this particular sector is complicated due to effects of several superimposed deformation stages. The structure is dominated by thin-skinned tectonics mode of deformation of the infilling of the flysch basin, which took place between the northern front of the Northern Calcareous Alps, which acted as a buttress at the backside of the thrust wedge and the weak Ultrahelvetic successions, which were incorporated into a combined Ultrahelvetic/Rhenodanubian thrust wedge. Several major deformation stages can be distinguished. These include: (i) overthrusting of the Ultrahelvetic continental margin sequences by the Rhenodanubian Flysch Zone during Late Eocene, (ii) subsequent shortening of the combined Ultrahelvetic/Rhenodanubian thrust wedge, likely associated with the emplacement onto the southern margin of the Molasse Zone during Oligocene to Early Neogene, and (iii) disruption of the combined Ultrahelvetic/Rhenodanubian thrust wedge by strike-slip faults during the Neogene.

In detail, the up to 1,400 metres thick turbiditic deposits of the RFZ are organised in a sandwich-like manner and typical structures such as ca. E - W trending, kilometre-scale kink fold anticlines and synclines, blind thrust faults and splay thrusts. Associated outcrop-scale structures have been analysed in, e.g., the Gmunden quarry. Exposure of Ultrahelvetic units is along D2 stage, out-of-sequence thrusts. Palaeostress tensors were deduced using fault-slip data from more than fifty stations. A succession of superimposed palaeostress tensors by means of superimposed fault and striae can be deduced as follows:

1) Top-to-NNE nappe stacking led to the compound of RFZ units above the Ultrahelvetic Buntmergelserie. Mainly bedding plane striae yield reduced palaeostress tensors, which have been calculated from separated, homogeneous data sets with the orientations of the principal kinematic axes of $\mathbf{D_1}$ with σ_1=217/24, σ_2=122/24, σ_3=9/63.
2) Subsequent top-to-N thrusting is documented tectonically by different styles of splay thrusts, kink folds, and blind thrusts - all detectable on both outcrop- and map-scales. Data separation of bedding plane parallel slickensides and of E-trending faults led to a tensor group $\mathbf{D_2}$ with the orientations of principal stress axes σ_1=185/23, σ_2=277/32, and σ_3=12/57.
3) An anticlockwise rotation of the palaeostress field from N-S shortening $\mathbf{D_2}$ to a final top-to-NW thrusting tensor group finished the architecture of the Rhenodanubian fold and thrust belt. The calculation of bedding plane parallel E-W trending fault results in a palaeostress tensor group $\mathbf{D_3}$ with orientations of the main stress axis σ_1=160/31, σ_2=268/27, and σ_3=30/47.
4) Conjugate steep strike-slip, NNW- and ENE-trending, faults formed due to further, ca. N-S contraction respectively left-lateral wrenching. The orientations of the kinematic axes for this event have been calculated with σ_1=153/33, σ_2=357/55, and σ_3=255/12.
5) Dextral reactivation of D4 strike-slip fault patterns under transtensional E-W wrenching conditions ($\mathbf{D_5}$: σ_1=237/11, σ_2=137/42, σ_3=338/46).
6) East and westward directed normal faults (D_6), and reactivated D_4/D_5 fault patterns depict E-W stretching of northern sectors of the Alps even in this northern RFZ zone (σ_1=241/34, σ_3=89/53).
7) Subsequent E-W compression (D_7) due to the geomorphic shape of the basement in this area of the RFZ led to a tensor group with E-W compressional and subvertical extensional directions (σ_1=116/18, σ_3=314/71).
8) Finally, N-S extension (D_8) is related to final collapse of the RFZ during uplift (σ_1=109/69, σ_2=293/21, and σ_3=202/1).

The geological data were put into a 3-D working space with the GEOSEC3D© software in order to create a 3-D structural model. Modelling work focused on the elaboration of geometrically reasonable structures, fault-fold relationships, and evaluating the applicability and methodology of reconstruction of this complicated foreland fold and thrust belt on principle. In this way we obtained results on stratigraphic patterns, kinematics and geometric relationships for this sector of the RFZ, yielding a better understanding of Tertiary kinematic of the Ultrahelvetic/Rhenodanubian Flysch thrust wedge.