Fault-Slip Analysis and their Constraints on Paleostress State Evolution

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We investigate different methods to derive the paleostress fields which controlled the evolution of sedimentary basins. Therefore, field studies are carried out along the south-western margin of the Central European Basin System where Late Palaeozoic and Mesozoic rocks of the basin fill are present in outcrops bearing the imprints of several deformation phases. Structural analysis includes the measurement of fault-slip data and collection of kinematic and chronological indicators. Relating fault kinematics to stress states implies that all faults under consideration have slipped in response to the same deviatoric stress. For this reason, heterogeneous fault-slip data from outcrops documenting polyphase deformation must be separated into homogeneous subsets before stress inversion. We present a new technique facilitating both, data separation and stress inversion, by integrating the results of the PBT-method (Sperner et al., 1993) and the Multiple Inverse Method (Yamaji, 2000). For each homogeneous subset the reduced stress tensor is determined which fulfils both, the criterion of low misfit angles (Wallace-Bott hypothesis) and that of high shear-to-normal-stress ratios (Mohr-Coulomb criterion). Our results indicate that the dominant signals of deformation in the study area are related to different compressive stress regimes in response to the Alpine collision. The reliability of our technique is confirmed by correlating results from outcrops of different rock ages. This consistency regards calculated stress states as well as chronologies locally derived from cross-cutting relationships.