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The role of pre-existing structures for paleostress analysis – a case study from the Central European Basin System (CEBS)

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Since the Permian the CEBS has been an area of recurrent deformation. We investigate the paleostress fields which controlled the post-Variscan evolution of this basin system. Therefore, field studies are carried out along the southern margin of the CEBS where Late Palaeozoic and Mesozoic rocks of the basin fill are present in outcrops bearing the imprints of several deformation phases. The measurement of fault-slip data and careful collection of kinematic indicators provide the data base for this study. In the case of polyphase tectonics, the chronology of successive events is deduced and the total fault population from each site is qualitatively divided into different subsets, each being consistent with one specific stress regime.

Depending on (1) the nature of faults (i.e. neoformed or reactivated), (2) the distribution of fault-slip data and (3) the deformation style, the deviatoric stress tensor is calculated for each subset using either the Numeric Dynamic Analysis (Spang, 1972; Sperner et al., 1993) or the Multiple Inverse Method (Yamaji, 2000). The results are obtained in terms of a reduced stress tensor, consisting of (1) the orientations of the three principal stress axes σ_1, σ_2 and σ_3 with $\sigma_1 \geq \sigma_2 \geq \sigma_3$ and (2) the ratio of principal stress differences, R=$(\sigma_2 - \sigma_3)/(\sigma_1 - \sigma_3)$ with $1 \geq R \geq 0$.

We find that at most sites the direction of principal stress axes shows little variation through time; however, σ_1, σ_2 and σ_3 have interchanged their positions. As a consequence, reactivation of faults is a very common observation which has important implications not only on the choice of the inversion method but also on the ability to infer age constraints.

References

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