Geophysical Research Abstracts, Vol. 8, 04119, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04119

The post-Variscan Paleostress History of the Central European Basin System (CEBS) – first results

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We investigate the paleostress fields which controlled the post-Variscan evolution of the Central European Basin System (CEBS). Therefore, field studies are carried out in the marginal areas of the CEBS where Late Palaeozoic and Mesozoic rocks of the basin fill are present in outcrops bearing the imprints of several deformation phases that affected the basin system since the latest Carboniferous.

Field studies including structural analysis, measurement of fault slip data and careful collection of kinematic indicators provide the data base for this study. Subsequently, the orientation of the principal stress direction is calculated by fault-slip data analysis to evaluate the distribution of the regional paleostress pattern through time. The displacement vector on fault planes recorded by striae is considered to correspond to the direction and sense of the shear stress tensor. Based on this assumption, the deviatoric stress tensor is calculated using quantitative computer-aided methods. The results are obtained in terms of a reduced stress tensor, consisting of (1) orientations of the three principal stresses σ_1, σ_2 and σ_3 with $\sigma_1 \geq \sigma_2 \geq \sigma_3$ and (2) the ratio of principal stress differences, Φ=$(\sigma_2 - \sigma_3)/(\sigma_1 - \sigma_3)$ with $1 \geq \Phi \geq 0$. 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 sub-sets, each being consistent with one specific stress regime. Since the stratigraphy and evolution of the CEBS are well known, temporal and spatial correlations of paleostress orientations are possible.

First field work has been carried out in outcrops of Triassic and Jurassic age in NW Germany along the SW border of the CEBS where outcrops of lithologies with favourable conservation conditions for kinematic indicators are present. Analysis of

Upper Jurassic limestones revealed that post-sedimentary deformation phases led to the formation of NW-SE striking normal faults as well as NE-SW striking dextral faults. Limestones of Middle Triassic age furthermore document a post-sedimentary development of approximately N-S striking normal faults and NNE-SSW striking dextral faults. During a later phase these faults have been reactivated: NW-SE fault systems partly show dextral movements whereas N-S faults exhibit sinistral displacements. We discuss the implications of the changing stress field and the role of the different fault populations.