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Paleostress perturbations and salt tectonics in the Subhercynian Basin, northern Germany

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Paleostress field analysis provide valuable data about deformation phases of a sedimentary basin and are of particular interest to understand modern stress-field patterns. Salt domes commonly represent inhomogeneities in a basin-fill that can cause significant stress pertubations, which can seriously influence the choice of exploration targets and the course of drilling campaigns (Koupriantchik et al., 2007). The Subhercynian Basin, located between the Harz and Flechting basement highs in northern Germany, is an ideal natural laboratory to study the paleostress field in a structurally-complex, salt-dominated basin. The basin-fill is characterized by a set of alternating narrow and broad, NW-SE trending, salt-cored anticlines. We use a multi-scale approach that combines outcrop-scale observations with regional-scale deformation structures to analyse the central and northwestern part of the Subhercynian Basin. We determined paleostress data from the orientation of faults, slickensides, joints and stylolites. On a regional scale, the major normal paleo-stress vector was mainly horizontally NNE-SSW-oriented, which reflects the Late Creatceous inversion phase in Central Europe, but locally the paleostress field shows distinct perturbations that are related to the salt structures. In some cases, the maximum principle normal paleostress vector is deflected by up to 80° from the regional trend. Nevertheless, this deflection is predictable, because our dataset shows that the maximum principle normal paleostress is always perpendicular to the axes of the salt anticlines. Another perturbation occurs at the edges of the salt structures; towards the tips of anticlines, the maximum principle normal paleostress vector tends to rotate towards the trend of the anticline axis.

Reference

Koupriantchik, D., Hunt, S.P., Boult, P.J. & Meyers, A.G. (2007) Geomechanical modelling of salt diapirs: 3D salt structures from the Officer Basin, South Australia. In: Munson, T.J. and Ambrose, G.J. Proceedings of the Central Australian Basins Symposium (CABS), Alice Springs, Northern Territory, 16–18 August, 2005. Northern Territory Geological Survey, Special Publication 2, 388-396