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# Paleostress analysis of the Osning Thrust, Germany

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The Osning Thrust is a 100 km-scale NW-SE fault separating the Lower Saxony Basin to the NE from the Münsterland Basin to the SE. The fault has accommodated a polyphase deformation that started at least when it acted as one of the normal border faults of the Jurassic Lower Saxony Basin. Tectonic inversion of the basin in Late Cretaceous-Early Paleocene times led to the development of the SE-vergent Osning Thrust and to folding of rocks. A paleostress analysis was carried out in order to decipher the polyphase kinematics of the Osning Thrust. The fault slip data were collected in the folded Albian to Turonian stratigraphic units of the Münsterland basin, in the SE vicinity of a 20 km-long steep segment of the Osning Thrust. Fault slip data in sufficient amount to perform paleostress inversion were collected in 10 sites among 23 visited outcrops. Abundant minor faults trend sub-parallel to the NW-SE steep segment of the Osning Thrust but, surprisingly, they are dextral (and not reverse) in type. Another major set of E-W striking minor faults is remarkable. It corresponds to conjugate systems of either reverse or normal faults and to oblique- to strike-slip faults in a less extent. The paleostress tensors reveal a ca. N-S compression recorded in 5 locations under which the NW-SE steep faults were dextral and the E-W striking S- and N-dipping faults were reverse. Six stress tensors fit with a ca. N-S extension. They are calculated from E-W striking S- and N- dipping normal to oblique normal faults. The same N-S trend of minimum stress axis is also recorded with NNE-SSW dextral and E-W sinistral faults. We propose that along the studied segment of the Osning Thrust a N-S compressional stress field led to the inversion of the Lower Saxony Basin and that slip along the Osning Thrust was oblique reverse. At two locations, the N-S compressive stress states affected the rock prior to tilting of the beds (herein, due to folding) and at one site, the normal faults of the N-S extension clearly cut across reverse faults of the N-S compression. These two observations allow to propose a chronology between the reconstructed stress fields. While the N-S compression is presumably linked to the Late Cretaceous-Early Palaeocene inversion of the Lower Saxony Basin, the successive E-W extension is not constrained in age. However, it is known that tensional stresses have largely affected the west European platform in Oligocene times and this N-S extension revealed by the present study might be related to this tectonic event.