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Strain localisation during basin inversion in the North German Basin and the Donbas fold belt

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Basin inversion was and is an interesting feature which is still not fully understood in geodynamic terms. A major step was to recognise that basin inversion is not just a homogeneous process due to compression or uplift but that the deformation frequently is located only in specific regions of the basin area, indicating strain localisation during the deformation phases. The Donbas fold belt and the North East German Basin represent exceptional examples of the inverted intracontinental basins. The Donbas fold belt is the uplifted and compressionally deformed south-eastern part of the Dniepr-Donets paleorift in eastern Ukraine. The North East German Basin is the superimposed Triassic basin on the central part of the Southern Permian Basin. The two basins originated at different times - the Dnieper-Donets paleorift in the Late Devonian, and the Southern Permian Basin in the Late Carboniferous-Early Permian. However, the main phase of inversion almost coincides in the Late Cretaceous-Early Tertiary and is clearly related to far field effects from the Alpine-Carpathian-Caucasian orogeny. In these basins, the geometry and continuity of thrust-related zones can be examined on both the shallow level and the Moho level by use of two deep seismic lines - the DEKORP Basin'96 and the DOBREflection-2000. These lines provide two worldwide examples of successfully performed seismic lines combining good resolution of the sediment fill and very good data about the deeper structures of the crust. In both cases, a high-velocity body has been recognized in the lower crust in the associated wide angle seismic lines, which can also be considered as high density zones and, perhaps, as mechanically strong. It can provide a key issue for strain localisation during basin inversion. The DEKORP Basin'96 line indicates a rather clear Moho uplift, a

bulge just below the Elbe Fault System correlating spatially with an area where maximum erosion of sediments is reported at the shallow level. This localised zone corresponds with major changes in the structure and composition of the crust and in part the upper mantle, as derived from refraction and seismological experiments. A high velocity layer in the lower crust in the north-east obviously caused strain localisation during compression. The DOBREflection-2000 line elucidates the next evolutionary step triggered by inhomogeneities within the crust. Here, the Moho is not simply uplifted, it is broken along a lystric inverse shear zone. A doubling of the Moho is visible in the south-western part of the basin. Once more a high velocity body within the lower crust most probably counteracted the compressive forces and initialized strain localization which finally resulted in failure of the entire crust.