

TECTONIC MODELLING OF RIFT BASINS -STRUCTURE AND RHEOLOGY OF THE LITHOSPHERE VERSUS MODEL DETERMINED RESULTS

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In the NW Dniepr-Donets Basin, a Late Palaeozoic rift basin within the East European Platform in Ukraine, syn- and post-rift basin evolution has been modelled along cross-sections using three different modelling techniques. The basic geological input in each case is the same. This is the present-day geometry of the basin along one of a set of regional seismic reflection profiles, interpreted and depth-converted using abundant borehole data. In the first modelling method, the rheological assumption is one of a continuous, non-faulted, elastic thin plate (with a defined flexural rigidity) that deforms not only from vertical loads associated with sediment, thermal, and isostatic buoyancy loading but also from horizontal loading by tectonic stresses. The nominal parameter set comprises crustal and subcrustal stretching factors and the level of so-called lithosphere necking. In the second method, the basic rheological framework is the same - a thin elastic plate of given strength that flexes - but displacements on pre-defined faults are allowed and these displacements are incorporated into the mechanical equilibrium of the problem. The modelling parameter is the lithosphere stretching factor. In the third method, the governing rheology is also elasticity but the crust is modelled as a block-structured medium rather than as a thin plate. The method incorporates syn-sedimentary and/or erosional faulting of an upper crustal layer. Accumulated strain (displacement) across the defined fault surfaces is the main modelling parameter. Results from the different modelling methods are compared in order to determine whether robust conclusions can be made about lithosphere structure and the actual processes governing rift basin information.