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# Correlation of basement structure and sedimentary basin tectonics - new results from the CORTEC project

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The aim of the CORTEC project is an integrated interpretation of seismic and potential field data to investigate the relation between crystalline basement structures and basin structures of younger epochs up to surface topography. The results presented here were elaborated under the umbrella of the German Priority program “Dynamics of sedimentary systems under varying stress conditions by example of the Central European Basin System".

Our data basis comprises seismic, gravity and borehole data sets covering the German sector of the North Sea, namely, approx. 3500 km high resolution reflection seismic data, a related velocity model with an average grid spacing of 0.2 km, gravity data grids of 2’ x 2’ and 8 km x 8 km spacing, approx. 15000 gravity point along profiles, geological and density profiles of two boreholes in the southern North Sea and bathymetry data.

The interpretational approach is based on the following components:

1. Determination of sedimentary structure and fault zones down to the Rotliegend as imaged by seismic reflection lines,

2. Image processing of potential field data in order to correlate structure between seismic profiles,

3. 3D-gravity stripping based on the seismic model of the upper crust in order to determine the gravity image of the deeper crust,

4. gravity modelling of the deeper crustal structure.

In order to support seismic interpretation we developed a 2D iterative depth migration tool based on the image ray concept and on the Eikonal equation. This tool is used to gain depth consistent seismic reflection images and velocity information. In the seismic data, fault zones and zones of crustal weakness find their expression in salt tectonics, lineaments, (delta) fans, and pathways of fluid or gas migration. We found evidence for recent fluid or gas transport from the Zechstein to near surface layers. Tectonic features were compiled into maps and compared with image-processed potential field maps. In addition, we generated maps of the base Middle Miocene, base Oligocene, base Eocene, base Tertiary, base Upper Cretaceous, Top Zechstein, and base Zechstein. In addition to determining the geometry of these lithological units sediment densities and their spatial variations were estimated on the basis of seismic migration velocities.

The seismic model reaching from the earth surface to the Rotliegend was converted into a 3D density model constrained with the borehole information. By subtracting the gravity effect connected with this model (3D gravity stripping) the effect of sedimentary basin was eliminated. The output of this process is a gravity map of crustal structure below the Zechstein horizon which was interpreted by 3D forward modelling. Results can be compared with a number of 2D deep seismic profiles. The Pre-Permian lower crust was mainly affected by the convergence and collision between the continent of Baltica and the Gondwana derived micro-continent Avalonia. After the accretion of Avalonia, various processes such as magmatism, lithospheric cooling, extension and regional subsidence influenced the composition of the crustal structure. These processes lead to density and related gravity anomalies. We identified a lineament between the Caledonian Deformation Front and the Elbe Lineament which can be correlated with the supposed suture zone between Avalonia and Baltica. 3D gravity modelling shows that the anomaly can be explained by a the change of the dip of the suture zone from steep to flat in the lower crust.

This project overview is complemeted by the presentation of two posters in the same session (Arndt et al. and Hese et al.).

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