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Simulating subsidence and maturation along a 2D section onshore the Netherlands

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This study is part of a larger project in which three seismic sections are examined for their burial and maturation history using forward modelling. Its aim is to implement results from the geological surveys of the involved countries and generate a unified view on the evolution of the Central European Basin System (CEBS). One of the three sections the first crosses the Polish Basin into eastern Germany, the second section runs from the North Danish Basin across the Ringkoebing-Fyn High into the North German Basin and the third section is situated onshore the Netherlands and runs from the Zeeland area in the southwest to the Drenthe area in the east. The involved geologic elements in the third section are from west to east the London-Brabant-Massif, the West Netherlands Basin, the Zandvoort Ridge, the Central Netherlands Basin, the Friesland Platform and the Lower Saxony Basin.

The forward modelling is performed using the PetroMod® Software developed by Integrated Exploration Systems (IES), Aachen. Along the seismic line a total of 31 wells were selected for 1D modelling and calibration. Vitrinite reflectance measurements and Rock-Eval Pyrolysis measurements were performed to calibrate the burial history of the wells. Present-day temperature data and clay compaction values have been derived from well logs.

The 1D modelling data are essential for the calibration of the 2D line. The data provide information about the temperature evolution in their vicinity and the specific rock properties needed for the simulation. Depending on the available database, the amount and timing of erosional events can be estimated from the wells. Estimation of

both sedimentation and erosion is also a key towards a quantitative understanding of extensional and compressional phases in the regional context of Western Europe. The subdivision of the Netherlands into different tectonic elements (highs and lows) brings forth the necessity to look very closely into the burial history of each area in order to determine the timing and reason for the movements and erosions.

One major erosional event occured during the end of Carboniferous and Early Permian. This phase of erosion occurred throughout the Netherlands but with varying intensity. During the Late Permian sedimentation commenced and lasted in the basin areas ("lows") with short interruptions until the Cretaceous. During the inversion phase in the Late Cretaceous the inverted basins were subjected to erosion. The amount differs from area to area. In the Central Netherlands Basin the erosion cut locally as deep as the Triassic. The movements that caused the Late Cretaceous inversion were active until the Late Tertiary, recorded in erosional events at the beginning of the Palaeocene, the Oligocene and the Miocene (de Jager, 2003). The main events on the former "highs" were slightly different. For example the erosional event at the end of the Carboniferous is also recorded on the Friesland Platform. However erosion during the Triassic removed most of the sediments deposited during the Permian and Early Triassic. Another erosional event during the Jurassic that is also present in the basin areas but to a lesser extent, removed the sediments deposited during the Early Jurassic (Geluk et al., 1996). The inversion during the Cretaceous caused the areas to subside and become areas of deposition. This is shown in the thickness of the Cretaceous sediments.

The 2D model will give insights into the structural evolution of the Netherlands and provide information on the different tectonic movements, the temperature and maturity history as well as hydrocarbon generation and provide a large scale view on the western part of the CEBS.

References

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