Geophysical Research Abstracts
Vol. 16, EGU2014-9225, 2014
EGU General Assembly 2014

Permian Basin maturation: proof for pervasive magmatic heat flow in the Netherlands

Damien Bonte (1), Jan Diederik van Wees (2,3), Rader Abdul Fattah (3), Suzanne Nelskamp (3), and Sierd Cloetingh (2)

(1) GeoServ, Ireland (dbonte@geoservsolutions.com, dam.bonte@gmail.com), (2) Utrecht University, Budapestlaan 4, 3584 CD Utrecht, the Netherlands, (3) TNO, Princetonlaan 6, 3584 CB Utrecht, the Netherlands

The area of the Permian Basin is marked by significant Stephanian-Permian magmatism that is related to the Variscanorogenic collapse, resulting in pervasive mantle upwelling. Large extrusive evidence is visible in the North German Basin and in the Central North Sea. Theoretical models for tectonic heat flow and maturity evolution show that mantle upwelling, underplating, and intrusions are likely to have a significant effect on maturity-depth trends.

Tectonic modelling of selected wells shows that tectonic subsidence and exhumation can be reconciled with a significant heat flow pulse at the Stephanian-Permian, and this could well explain the widespread elevated depth gradient of maturity in Carboniferous rocks. The quantitative assessment of heat flow, which is based on a kinematic model of the process of orogenic collapse, shows that the mantle upwelling and underplating at the base of the crust proposed by earlier studies in fact provides insufficient heat flow to explain strongly elevated maturity-depth trends. However, the Southern part of the Texel IJsselmeer High shows unusually high maturation values that cannot be explained by the simple effect of burial alone. This area of high maturation is also associated with evidence of intrusive magmatic rocks. By modelling five wells in the Texel IJsselmeer High, we conclude that the burial of the sediments and a shallow intrusion in the upper crust provide an elevated heat flow mechanism that has a regional impact, consistent with observed high maturity-depth trends. In each well, the model that best matches the elevated maturity data of the Carboniferous demonstrates the impact of a large intrusion emplacement in the upper crust at the time of the collapse of the Variscan orogen. The impact of this magmatic intrusion at such a shallow depth is extremely likely to have brought the maturity to the gas window during the heat pulse, and, based on the tectonic subsidence record, the model allows us to position this pulse at late Carboniferous times.