Geophysical Research Abstracts
Vol. 18, EGU2016-13249, 2016
EGU General Assembly 2016

The structure of the Zechstein 3 stringer in the northern Netherlands, and its implications for salt kinematics and rheology

Frank Strozyk (1), Janos Urai (2), Shiyuan Li (3,2), Joyce Schmatz (4,2), Bianca Biehl (1), Lars Reuning (1), Alexander Raith (2), Steffen Abe (5,2), Heijn van Gent (6,2), Martin de Keijzer (7), and Peter Kukla (1)

(1) RWTH Aachen University, EMR - Energy and Mineral Resources, Geology, Aachen, Germany (frank.strozyk@emr.rwth-aachen.de), (2) RWTH Aachen University, EMR - Energy and Mineral Resources, Structural Geology, Tectonics & Geomechanics, Lochnerstrasse 4-20, 52056 Aachen, Germany, (3) China University of Petroleum, Department of Engineering Mechanics, College of Petroleum Engineering, Beijing, China, (4) RWTH Aachen University, EXIST "Nanoporosity" at Structural Geology, Tectonics and Geomechanics, Lochnerstrasse 4-20, 52056 Aachen, Germany, (5) igem - Institute for geothermal resource management, Berlinstr. 107a, 55411 Bingen, Germany, (6) Shell International Exploration and Production B.V., Carel van Bylandtlaan 5, 2596 HP The Hague, The Netherlands, (7) Nederlandse Aardolie Maatschappij b.v., Postbus 28000, 9400 HH Assen, The Netherlands

The thick, late Permian Zechstein evaporites in the northern Netherlands are exceptionally well imaged in extensive 3D seismic and well datasets. The prominent seismic reflections of the thick, anhydrite-rich Zechstein 3 stringer, which is encased in thick layers of rock salt, provide a basin-scale view of the 3D internal structure of the Zechstein salt. The interpretation of the Z3 stringer was used as a strain marker for the different intra-salt deformation styles and salt flows. Furthermore, models of competing rheologies (pressure solution vs. dislocation creep, Newtonian vs. Power law) were tested in numerical simulations of the gravitational sinking of Z3 stringer fragments through the salt over geologic time in the Tertiary.

The results show that several structural stringer styles can be linked to regional variation in salt kinematics. These mainly comprise local early syn-depositional gravitational movement, passive salt diapirism by differential loading in the Triassic, and reactive diapirism during contractions starting in the Cretaceous. The thickness and deformation degree of the individual salt layers thereby played a major role in the development of regionally distinctive styles of intra-salt structures, which can be linked to breaking and fold patterns in the stringer.

When differential stresses in the salt relaxed across large parts of the northern Netherlands in the Tertiary, stringer fragments physically isolated in the salt did not significantly sink through the salt. The salt surrounding the fragments can not have deformed by Newtonian solution-precipitation creep, because the fragments would have sunk to base salt. Considering also results from geomechanical modelling and analysis of Zechstein salt samples, we conclude that this behaviour can only be explained by strong changes in salt rheology to non-Newtonian.