Geophysical Research Abstracts
Vol. 14, EGU2012-3115, 2012
EGU General Assembly 2012

BASIN ANALYSIS AND PETROLEUM SYSTEM CHARACTERISATION OF WESTERN BREDASDORP BASIN, SOUTHERN OFFSHORE OF SOUTH AFRICA: INSIGHTS FROM A 3D CRUST-SCALE BASIN MODEL - (Phase 1)

W.A. Sonibare (1,2), M. Scheck-Wenderoth (1), J. Sippel (1), and D. Mikeš (2)

(1) Deutsches GeoForschungsZentrum - GFZ, Telegrafenberg, 14473 Potsdam, Germany (wasiu@gfz-potsdam.de, leni@gfz-potsdam.de, sippel@gfz-potsdam.de), (2) Department of Earth Sciences, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa (shoniwas@yahoo.com, mikes@sun.ac.za)

In recent years, construction of 3D geological models and their subsequent upscaling for reservoir simulation has become an important tool within the oil industry for managing hydrocarbon reservoirs and increasing recovery rate. Incorporating petroleum system elements (i.e. source, reservoir and trap) into these models is a relatively new concept that seems very promising to play/prospect risk assessment and reservoir characterisation alike. However, yet to be fully integrated into this multi-disciplinary modelling approach are the qualitative and quantitative impacts of crust-scale basin dynamics on the observed basin-fill architecture and geometries.

The focus of this study i.e. Western Bredasdorp Basin constitutes the extreme western section of the larger Bredasdorp sub-basin, which is the westernmost depocentre of the four southern Africa offshore sub-basins (others being Pletmos, Gamtoos and Algoa). These basins, which appear to be initiated by volcanically influenced continental rifting and break-up related to passive margin evolution (during the Mid-Late Jurassic to latest Valanginian), remain previously unstudied for crust-scale basin margin evolution, and particularly in terms of relating deep crustal processes to depo-system reconstruction and petroleum system evolution. Seismic interpretation of 42 2D seismic-reflection profiles forms the basis for maps of 6 stratigraphic horizons which record the syn-rift to post-rift (i.e. early drift and late drift to present-day seafloor) successions. In addition to this established seismic markers, high quality seismic profiles have shown evidence for a pre-rift sequence (i.e. older than Late Jurassic >130 Ma). The first goal of this study is the construction of a 3D gravity-constrained, crust-scale basin model from integration of seismics, well data and cores. This basin model is constructed using GMS (in-house GFZ Geo-Modelling Software) while testing its consistency with the gravity field is performed using IGMAS+ (Interactive Gravity and Magnetic Assistant System; Götze et al., 2010 and Schmidt et al., 2011). The ensuing model will be applied to predict the present-day deep crustal configuration and thermal field characteristics of the basin. Thereafter, 3D volumetric backstripping analysis will be performed to predict basin subsidence mechanisms (i.e. tectonic, thermal and sediment load) through time as well as to estimate paleo-water depths for paleogeographic reconstruction. The information gathered from crust-scale basin dynamics will be subsequently used at the petroleum system modelling stage to holistically assess the hydrocarbon potential of the basin in terms of source rock maturity and hydrocarbon generation, migration, timing and accumulation.

References

Götze, H.-J. and Schmidt, S. (2010): IGMAS+: A new 3D gravity, FTG and magnetic modelling software tool. In R.J.L. Lane (Ed.), Airborne Gravity 2010 - Expanded abstracts from the ASEG-PESA Airborne Gravity 2010 Workshop: Published jointly by Geoscience Australia and the Geological Survey of New South Wales, Geoscience Australia Record 2010/23 and GSNSW File GS2010/0457, pp. 91-96. ISBN 978-1-921781-17-9.

Schmidt, S., Plonka, C., Götze, H.-J. and Lahmeyer, B. (2011): Hybrid modelling of gravity, gravity gradients and magnetic fields. Geophysical Prospecting. doi: 10.1111/j.1365-2478.2011.00999.x