



3D structural model of the West African continental margin

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The West African continental margin is a passive volcanic margin where the Early Cretaceous continental break-up resulted in the formation of oceanic lithosphere within the Atlantic Ocean as well as several sedimentary basins along the western African coast. In order to understand the present-day structure of the West African margin of South Africa and Namibia, a 3D structural model has been constructed, covering the Walvis, the Luderitz and the Orange basins. This lithospheric-scale 3D model includes eight layers in terms of thickness maps for the following intervals: (1) Sea water, (2) Cenozoic, (3) Upper Cretaceous (base Turonian)-base Cenozoic, (4) Lower Cretaceous (base Aptian)-Upper Cretaceous (base Turonian), (5) basement-Lower Cretaceous (base Aptian), (6) crystalline crust, (7) high-velocity/high-density lower crustal layer and (8) lithospheric mantle.

During the model construction, the structural depth maps from Stewart et al. (2000) have been used for the Walvis and the Luderitz basins. For the Orange Basin and adjacent areas, the main dataset consists of structural depth maps which are provided by Hartwig et al. (2010). Based on these structural databases, four thickness maps (layers 2-5) have been included into our 3D structural model, representing the sedimentary infill of the Namibian and the South African segments of the margin. A 3D lithospheric-scale structural model of the West African continental margin (Hirsch et al., 2009) was the main data source for the crystalline crust and the upper mantle. The input data from this 3D model consist of thickness maps of the crystalline crust, a high velocity/high-density lower crustal layer and the lithospheric mantle.

The thickness of the Cenozoic shows that the study area is characterized by two NW-SE striking zones of thick Cenozoic deposits within the Walvis Basin and the northern part of the Orange Basin, reaching locally more than 3200 m of thickness. The thickness distribution of the Turonian-base Cenozoic interval indicates that the major depocentres are located within the Orange Basin where strong thickening (up to 3000 m) is observed in the central part of the basin. The Orange Basin is also characterized by thick Aptian-Turonian sediments. There, Aptian-Turonian thickness ranges from 2600 to more than 4000 m within a broad area of thickened sediments. The thickness pattern of pre-Aptian sediments is relatively complex, showing several local thickness maxima along the south-west African continental margin.

The crystalline crust of the study area is characterized by strong thinning from more than 44 km beneath the continent to a few km towards the oceanic crustal domain. The high-velocity/high-density lower crustal body has a NW-SE elongated shape restricted to the axial part of the margin. This lower crustal body is locally more than 19 km thick. Thickness of the lithospheric mantle decreases towards the oceanic domain in general with some local variations.

References

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