Geophysical Research Abstracts
Vol. 14, EGU2012-1447, 2012
EGU General Assembly 2012

Crustal structure of the Boreas Basin formed at ultraslow spreading Knipovich Ridge – Northern North Atlantic

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The Boreas Basin is located in Norwegian Greenland Sea bordered by the Greenland Fracture Zone in the south and the Hovgard Ridge in the north, respectively. In the east it adjoins the ultraslow mid-ocean Knipovich Ridge. Previous seismic reflection studies in the Boreas Basin have shown that the basement topography has a roughness, which is typical for ultraslow spreading ridges. This observation supports assumptions that the basin was formed at ultraslow spreading rates during its entire geological history. However, the detailed crustal structure remained unresolved. In summer 2009 new seismic refraction data were acquired in the Boreas Basin during the expedition ARK-XXIV/3 with the research vessel Polarstern. The deep seismic sounding line has a length of 340 km. Forward modelling of the data of 18 ocean bottom seismometers deployed along the NW-SE trending profile reveal an unusual 3.2 km thin oceanic crust. The crustal model is further constrained by S-wave and 2D gravity modelling. The P-wave velocity model shows a layered oceanic crust without oceanic layer 3 and with velocities less than 6.3 km/s except beneath a nearly 2000 m high seamount. Beneath the seamount velocities of up to 6.7 km/s were observed. The mantle velocities range between 7.5 km/s in the uppermost mantle and 8.0 km/s in almost 15 km depth. A serpentinisation of approximately 13% in the uppermost mantle decreasing downwards can explain the low mantle velocities. In summary, the transect confirms earlier models that the entire Boreas Basin was formed at ultraslow spreading rates. Indications for this are the basement roughness and the overall thin oceanic crust. Both observations are typical for ultraslow spreading systems.