Geophysical Research Abstracts, Vol. 7, 02014, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02014

2.5-D seismic modelling based on deep seismic soundings in the northern Svalbard region

1 W. Czuba

Institute of Geophysics, Polish Academy of Sciences, Warsaw, Poland (wojt@igf.edu.pl / Fax: +48 22 6915915 / Phone: +48 22 6915782)

Deep seismic sounding measurements were performed in the continent-ocean transition zone of the northern Svalbard during expeditions in 1985 and 1999. Profile AWI-99200 (Czuba et al. subm.) is 430 km long and runs from the Molloy Deep in the vicinity of an active spreading axis in the Northern Atlantic to Nordaustlandet in north-eastern Svalbard. The data from this profile and from additional crossing profiles (Czuba et al. 1999; Ritzmann & Jokat 2003) were used to model seismic crustal structure of the study area. 2-D trial and error (Seis83 software (Červený & Pšenčík 1983) and 2.5-D (Jive3d software (Hobro et al. 2003)) tomographic inversion methods were used. Seismic energy (airgun and TNT shots) was recorded by land (onshore) seismic stations and ocean bottom seismometers (OBS) and hydrophone systems (OBH). Good quality refracted and reflected P waves were recorded along the profiles providing an excellent data base for a detailed seismic modelling along the profile tracks. Clear seismic records from airgun shots were obtained up to distances of 200 km at land stations and 50 km at OBSs. TNT explosions were recorded even up to distances of 300 km. A minimum depth of about 6 km of the Moho discontinuity was found east of the Molloy Deep. Here, the upper mantle exhibits P-wave velocity of about 7.9 km/s, and the crustal thickness does not exceed 4 km. The continent–ocean transition zone to the east is characterised by a complex seismic structure. The zone is covered by deep sedimentary basins which pinches out northwards. The continental crust, characterised by the P-wave velocities in the range of 5-7 km/s, is narrowing northward. The Moho interface dips down to 28 km beneath the continental crust. The P-wave velocity below the Moho discontinuity increases there up to 8.15 km/s. Ad-

ditionally, along the 99200 profile, two reflectors in the lower lithosphere were found at depths of 14–42 and 40–50 km dipping eastward, with P-wave velocity contrasts of about 0.2 km/s. The evolution of the region appears to be within a shear-rift tectonic setting. The uplifted Moho boundary close to the Molloy Deep can be interpreted as a south-western end of the Molloy Ridge.

References

Červený, V. & Pšenčík, I., 1983. 2-D seismic ray tracing package SEIS83 (software package), Charles University, Prague.

Czuba W., Grad M. & Guterch A., 1999. Crustal structure of north-western Spitsbergen from DSS measurements. Polish Polar Research 20 (2): 131–148.

Czuba W., Ritzmann O., Nishimura Y., Grad M., Mjelde R., Guterch A., Jokat W., subm. Crustal structure of northern Spitsbergen along deep seismic transect between the Molloy Deep and Nordaustlandet. Geophys. J. Int.

Hobro, J. W. D., Singh, S. C., Minshull, T. A., 2003. Three-dimensional tomographic inversion of combined reflection and refraction seismic traveltime data. Geophys. J. Int. 152 (1), 79-93.

Ritzmann O. & Jokat W., 2003. Crustal structure of northwestern Svalbard and the adjacent Yermak Plateau: evidence for Oligocene detachment tectonics and non-volcanic breakup. Geophys. J. Int. 152: 139–159.