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Seismic crustal structure of north-western and southern Spitsbergen

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Deep seismic sounding measurements were performed in the Svalbard region during expeditions in 1985, 1999, and 2005. 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 and off-line providing an excellent data base. 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. The data from 1985 and 1999 projects was used to model seismic crustal structure of north-western Spitsbergen. 2-D trial and error and 2.5-D tomographic inversion methods were used. 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 characterized by a complex seismic structure. The continental crust, characterized 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. During the 2005 expedition on r/v Horyzont II, a seismic profile along Hornsund and crossing Storfjorden and Edgeøya was performed. The 2D seismic model is complicated in the western part which is located near the Knipovich Ridge. This must be connected with active rifting processes in the Knipovich Ridge. The high velocity layer in this part (P-wave velocity of 6.4-7.0 km/s) is connected probably with the rifting, too. The Moho depth in this area shallows up to 13 km, while beneath the Polish Polar Station Hornsund dips down to 30 km. The eastern part of the model is rather simple, with two layers in the upper crust (P-wave velocity in the order of 5.5-6 km/s) and the layer characterized by P-wave velocity 6.10-6.25 km/s in the lower crust. There is no P-wave velocity higher than 6.5 km/s in the crust in the Storfjorden and Edgeøya area. The Moho depth varies between 28 and 30 km, shallowing to the East. There is difficult to find a prolongation of the Billefjorden Fault Zone in this preliminary model.