Geophysical Research Abstracts
Vol. 13, EGU2011-10339, 2011
EGU General Assembly 2011


# Upper mantle structure of southwestern Scandinavia reveals the rim of cratonic Baltica

Christian Weidle (1), Niels Balling (2), Andy Frassetto (3), Bo Holm Jacobsen (2), Andreas Köhler (1), Valérie Maupin (1), Anna Bondo Medhus (2), Joachim Ritter (4), and Britta Wawerzinek (4)

(1) Dept. of Geosciences, University Oslo, Norway (christian.weidle@geo.uio.no, +47 22856678), (2) Dept. of Earth Sciences, University Aarhus, Denmark, (3) Dept. of Geography and Geology, University of Copenhagen, Denmark, (4) Geophysical Institute, Karlsruhe Institute of Technology, Germany

The origin of the Scandinavian mountains, located far away from any presently active plate margin, is still not well understood. In particular, it is not clear if the mountains are sustained isostatically either by crustal thickening or by light upper mantle material. Within the TopoScandiaDeep project (a collaborative research project within the ESF TOPO-EUROPE programme), a major component is therefore the analysis of recently collected passive seismological data in the southern Scandes and surrounding regions. From a previous regional surface wave tomography it became clear that there exists a significant change in upper mantle velocities from southern Norway / northern Denmark (slow) to the Baltic shield (fast) which is detailed in the presented results.

An average depth-velocity profile, based on Rayleigh wave phase velocity measurements, shows that the lithosphere under southern Norway has (on average) characteristics usually found under continental platforms and not, as would have been expected, under cratonic areas.

The Moho under the high topography of southern Norway appears from Receiver Functions as relatively shallow (<= 40 km) with prominent P-to-S conversions beneath most of Norway while the conversions are imaged deeper (>55 km) and with significantly lower amplitudes under central Sweden. The Receiver Function modeling suggests that the differences in the observed Moho response may represent the transition between tectonically reworked Moho under southern Norway and an intact, cratonic crust-mantle boundary beneath the Baltic Shield.

Upper mantle P-wave velocities in southern Sweden and southern Norway east of the Oslo Graben are correspondingly relatively high while lower velocities are observed in the southwestern part of Norway and northern Denmark. The lateral velocity gradient, interpreted as the southwestern boundary of thick Baltic Shield lithosphere, is remarkably sharp and follows the Sorgenfrei-Tornquist-Zone in the southeastern part of the study area, turns northwards through the Oslo Graben area to about 60º N, then turning northwest, approaching the Norwegian west coast at about 65º N. Differences in upper mantle velocities are well defined at depths of 100-300 km and amount to $\pm$ 2-3%.

This model is well matched by S-wave travel time residuals which are up to 2.5s slow underneath the mountains in Southern Norway. S-to-P wave conversions, interpreted to originate from the lithosphere-asthenosphere boundary, are preliminary estimated to 90-120 km depth with a shear wave velocity contrast of -2 to -5% below southern Norway.

Inversion of surface wave phase velocity dispersion curves from observations of ambient noise and earthquake generated surface wavefields yield another independent model of the crust and upper mantle structure below southern Norway. Within the overall slow upper mantle, little additional lateral variations are detected.

All in all, these separate investigations give a very consistent and stable picture of the crust and upper mantle configuration under southwestern Scandinavia. In the next step, these independent results will be integrated in a consistent model.