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Geodynamical aspects of a new 3D geophysical model of the greater Barents Sea region – Linking sedimentary basins to the upper mantle structure

J.I. Faleide (1), O. Ritzmann (1), C. Weidle (1) and A. Levshin (2)

(1) Department of Geosciences, University of Oslo, P.O. Box 1047 Blindern, N-0316 Oslo, Norway, (2) Department of Physics, Campus Box 390, University of Colorado at Boulder, Boulder, CO80309, United States (j.i.faleide@geo.uio.no)

Recently, new 3D geophysical models for the crust and upper mantle of the greater Barents Sea region evolved from collaborations between the University of Oslo, NORSAR, U.S. Geological Survey and the University of Colorado. The internal construction of the crustal model is based on previously published seismic transects. It follows a 5-layer sequence and is organized in predefined geological provinces. The upper mantle model is derived from regional surface wave tomography and improved with respect to previous models by newly assembled surface wave observations from regional station operators. One of the main achievements of both projects is to provide one consistent model of the crust and mantle lithosphere precise enough for further basic geological-geophysical research. The 3D structure of the sedimentary basins can be interpreted with the crystalline crustal units, Moho-topography and upper mantle structure below, and the seismic velocity distribution sheds light on the petrology. Transects through the 3D model reveal regional geological sections through the European Arctic from the Norwegian-Greenland Sea, across the continental margin, the Barents Sea, the Novaya Zemlya Foldbelt into the Kara Sea region. We observe significant lateral velocity and density variations in the mantle, which can be of both compositional and thermal origin. In general, we find an intriguing correlation between the geometries of major crustal units and upper mantle anomalies. The most prominent feature and interesting link between the shallow and deep structure in the regional transects is associated with the deep and wide East Barents Basin that formed by rapid (non-fault-related) subsidence in Late Permian-Early Triassic times. Both the timing and spatial correlation indicates a connection to Uralian collision. The basin is

underlain by an upper mantle body characterized by higher seismic velocity and density. The body continues to the east and dips below Novaya Zemlya and the Kara Sea in a slab-like shape. The western part of the model covering the Norwegian-Greenland Sea, is characterized by slower mantle velocities. These are most likely related to the mantle temperature structure and also underlie the westernmost Barents Sea. Possible geodynamic processes behind the history of differential vertical movements within the Barents Sea region will be discussed in relation to the observed lithosphere structure.