Reviewing the Cenozoic Net Erosion of the Norwegian Barents Sea Shelf

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The circum North Atlantic-Arctic continental margin and adjacent land areas have experienced several episodes of uplift and erosion during the Cenozoic. A series of efforts quantifying this erosion for the Barents Sea shelf, where the Arctic shelf is at its widest and deepest have been done since the early 90's using different methods. As the seismic and well database have expanded considerably, our understanding of the Cenozoic evolution of this climatic sensitive and hydrocarbon prospective area has improved. This review includes a comparison of results from different methods (e.g. the mass balance technique, shale compaction, apatite fission track, sandstone diagenesis, and seismic velocities). The Cenozoic erosion is divided into a pre-glacial and a glacial erosion. The pre-glacial erosion is related to the early Cenozoic tectonics and rift-flank uplift due to the onset of rifting, shear, and compression followed by sea-floor spreading between Norway and Greenland, whereas the glacial erosion occurred during the late Cenozoic Northern Hemisphere Glaciations when grounded ice sheets repeatedly covered the Barents Sea shelf. The different methods generally show the same order of magnitude of erosion for the major source areas in the Barents Sea, i.e. northern Norway, the Loppa High, the Stappen High, Svalbard, and from the northern Barents Sea margin. Furthermore, we compare sediment load and size of drainage area from various settings and different periods. For similar size of drainage area, sediment load for glacial period is generally higher than for the pre-glacial one. Our review shows that the ratio between the Cenozoic pre-glacial and glacial sedimentation along this part of the Arctic margin is ~40%, ~50%, and ~70% for the southwestern, northwestern, and the northern Barents Sea, respectively. Thus, there is a N-S trend of increasing pre-glacial erosion of the Barents Sea shelf, whereas an W-E trend of increasing erosion is inferred for the glacial period. Future directions of research in refining the erosion estimates and better understanding the mechanisms of uplift and erosion will be addressed.