

# Deep, Long-offset Seismic Data Reveals the Complex Structural Development of the NE Greenland Margin

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A new deep long-offset seismic survey was shot in the summer of 2010 on the northern part of the NE Greenland Shelf using specialized new technology for acquiring data in first-year ice covered areas. The new survey adds significantly to our knowledge of the structure and geology of the region and reveals a margin with a long structural history that began with rifting, followed by a period influenced by a major strike-slip plate boundary, and finally into a divergent margin. The new data will have an important impact on the general understanding of the Mesozoic – Cenozoic development of the intra-continental De Geer Megashear region between North Greenland and Eurasia. A revised structural model for the development of the region has been used to develop a new deformable plate model for the area which can be used to interpret palaeogeography and to predict source and reservoir deposits.

The onshore part of the NE Greenland Shelf is dominated by Late Cretaceous to Palaeogene strike-slip faulting of the Wandel Sea Mobile Belt. Evidence for strike slip faulting and inversion interpreted on the seismic data supports earlier model-based interpretations for the area to be affected by strike slip motion related to the offshore extension to the Wandel Sea Mobile Belt. Faulted anticlines, inversion structures, salt diapirism, and complex zones of faulting are interpreted north of the Greenland Fracture Zone and along the outer part of the shelf. The data also provide valuable new information on the deep crustal structure of the margin to the south of the Greenland Fracture Zone. In this area, a high-amplitude deep crustal event is seen at about 15 km along the outer margin which is possibly related to a lower crustal reflector described on the conjugate Norwegian margin, and has been attributed to be associated with crustal underplating.

The new seismic data to the north of the Greenland Fracture Zone is interpreted to be relatively free of volcanics and low angle listric faulting is related to the present-day divergent margin. Seafloor spreading in the Eurasia Basin and the Norwegian– Greenland Sea was established by earliest Eocene times as Greenland and North America separated from Eurasia. The two ocean basins were linked by the right-lateral De Geer Megashear region comprising a NW-SE trending transform zone that includes the northern part of the NE Greenland Shelf. This area is conjugate to the western Svalbard and the sheared Hornsund and Senja margins offset by a rifted segment including the Vestbakken Volcanic Province on the Barents Sea margin. Plate tectonic reconstructions of the Fram Strait region between Svalbard and Greenland show that the relative plate motion between Greenland and Eurasia changed from right-lateral shear to oblique divergence in the Oligocene. The sheared margin was rifted and broken up obliquely as relative plate motions between Greenland and Eurasia changed from transform to divergent.