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Crustal models for the Melville Bay and Northern Baffin Bay

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The Baffin Bay between Greenland and Baffin Island (Canada) opened during the separation of Greenland and Canada in the Palaeocene and Eocene. The Melville Bay is situated in its northeastern part. The crustal composition of Northern and Southern Baffin Bay has been studied in detail: Southern Baffin Bay is underlain by oceanic crust with volcanic margins, while the margins of northern Baffin Bay are characterized by serpentinized mantle material. In contrast, the nature of crust in the deep, central Baffin Bay and the Melville Bay was still unclear due to a lack of deep seismic sounding lines.

In 2010 a joint geophysical experiment in the Greenlandic part of Baffin Bay acquired seismic, magnetic and gravity data. We present three velocity and density models derived from seismic refraction and gravity data. Two of the three profiles are located within the Melville Bay and extend in a SW - NE direction from the deep sea area of central Baffin Bay to the shelf area of the Melville Bay. The third profile crosses the northern profile in the Melville Bay and extends in a N - S direction into the Northern Baffin Bay.

The profiles in the Melville Bay can be divided in three crustal sections. The deep-sea area reveals a 3.5 - 7 km thick, 2-layered oceanic crust with increasing thickness towards the shelf and up to 6 km thick sediments. The crust is underlain by serpentinized upper mantle with velocities of 7.6 - 7.8 kms^{-1}. A transition zone, which is affected by volcanism, connects the oceanic crust with stretched continental crust underneath the Melville Bay. Basement highs and deep sediment basins characterize the stretched and rifted continental crust. The Melville Bay Graben, the deepest rift basin in the Melville Bay, contains up to 10 km thick, possibly metamorphosed sediments with unusually high velocities of up to 4.9 kms^{1}. Well-constrained reflections of the crust-mantle boundary can be found in many seismic sections indicating a maximum crustal thickness of $\sim$ 26 km in the northern profile and $\sim$ 32 km in the southern profile.

In the southern part of the third, N-S extending profile, a 2-layered oceanic crust is covered by up to 5 km thick sediments. Underneath the shelf edge, the crust thickens towards the north in several steps and reaches a maximum thickness of $\sim$ 40 km. The northern part of the profile is characterized by faulted end eroded basement, which crops out at the seafloor.