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Seismic reflection data of the Eirik Drift: A first step to decipher the Neogene development of the Western Boundary Undercurrent (WBUC)

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The Eirik Drift off the southern tip of Greenland contains sedimentary records since the Miocene. This archive of depositional processes has been shaped by the Western Boundary Undercurrent (WBUC), the Greenland ice sheet, and the material input from the Labrador Sea through the Davis Strait. High resolution seismic reflection data collected during RV Maria S. Merian cruise MSM 12/2 were incorporated with geologic information from ODP and IODP sites to deduce information on the development of the WBUC as well as the dimensions and expansion/retreat of the Greenland ice sheet and a much clearer understanding of the evolution of the climate southwest of Greenland.
After correlating synthetic seismograms based on density and P-wave velocity data from ODP Leg 105 Site 646 and IODP Expedition 303 Sites 1305, 1306, and 1307 with the processed seismic reflection data we identified four seismic units and the reflectors R1 (2.5 Ma; onset of ice rafting, weakening of the WBUC), R2 (5.6 Ma; higher carbonate content, increased deep circulation), and R3/R4 (7.5 Ma; change in water mass characteristics, increased sedimentation rate) and an erosional unconformity (4.5 Ma; initiation of strong deep currents, local erosion) as defined by Arthur et al. (1989). Tracking of both reflectors and units leads to information about the redistribution of the WBUC in the vicinity of the Eirik Drift during the Neogene. By means of the reflectors and erosional unconformity defined by Arthur et al. (1989) five phases for the build-up of the Eirik Drift can be distinguished:

Phase 1 (>7.5 Ma):
highest sedimentation underneath the eastern flank of the presently main crest of the drift presumably under the influence of corrosive, southern sourced deep water

Phase 2 (7.5-5.6 Ma):
onset of northern sourced deep water with low sedimentation and weak deep currents; no deposition at todays main crest

Phase 3 (5.6-4.5 Ma):
build-up of a second depot center $\sim$200 km to the west of the main crest suggesting an increase in deep current activity and a separation of the WBUC into two branches

Phase 4 (4.5-2.5 Ma):
build-up of two almost separated lenticular shaped sediment bodies above the Phase 1 and Phase 3 sedimentation centers indicates the preservation of the two branches of the WBUC

Phase 5 (<2.5 Ma):
uniform sedimentation above Phase 3 sedimentation center and deposits on top of todays main crest with low sedimentation at its flanks suggests that the deep current weakened and shifted upslope and that the division into two branches is not persistent anymore

These changes in deposition of sediments are addressed to changes in direction and strength of the WBUC.