



Pleistocene Ice sheets and Ice Shelves on the Chukchi Borderland, Mendeleev Ridge and East Siberian Continental Slope (Arctic Ocean)

Frank Niessen, Tanja Dufek, Anne Hegewald, Rüdiger Stein, Jens Matthiessen, and Wilfried Jokat
Alfred Wegener Institute, Geosciences, Bremerhaven, Germany (frank.niessen@awi.de)

About 10 years ago it was generally accepted that thick Quaternary ice sheets in the Arctic Ocean were restricted largely to continental margins of Eurasia, Greenland and North America, whereas the area from the Laptev Sea across Beringia to the MacKenzie River as well as the central Arctic Ocean remained free of large ice sheets. Since then a growing body of evidence has been found that grounding of ice has occurred in deep-water areas of the Arctic Ocean including the Morris Jesup Rise, Lomonosov Ridge, Yermak Plateau and the Chukchi Plateau. During the last few years, speculations and discussions on large-sized glaciations and ice shelves were initiated by the results of detailed geophysical seafloor mapping in the Arctic Ocean from nuclear submarines and icebreakers, that identified a wide variety of glaciogenic geomorphic features in deep water including iceberg plowmarks, glacial flutes, and Mega-Scale Glacial Lineations (MSG) extending as deep as \sim 1000 m below the present sea level. Recently it has been suggested that thick ice shelves extended north of the Laurentide and Eurasian Ice Sheets as source areas of giant tabular icebergs drifting across the Arctic Ocean during MIS 6. In addition, a newly proposed ice sheet may have developed on the Chukchi Borderland (Jakobsson 2010).

Based on swath bathymetry, sediment echosounding, seismic profiling and sediment coring we present additional results of the RV „Polarstern“ cruise ARK-XIII/3 (2008), which investigated an area between the Chukchi Borderland and the East Siberian Sea up to 81° N. At the southern end of the Mendeleev Ridge, close to the Chukchi and East Siberian shelves, evidence is found suggesting the existence of Pleistocene ice sheets/ice shelves, which have grounded several times in up to 1300 m present water depth. We found MSG associated with deposition of glacial flutes, till fans and stacked debris-flow deposits indicative of sub-glacial erosion and deposition close to the former grounding lines. Glacially lineated areas are associated with large-scale seafloor erosion, accentuated by a conspicuous truncation of pre-glacial strata typically capped with a mostly thin layer of diamicton draped by pelagic sediments. Our tentative age model suggests that the youngest erosional event should be within MIS 5 (stadial MIS 5b, 5d or older). The findings support previous interpretations of a possibly isolated ice sheet on the Chukchi Borderland. According to our results, the ice sheet continued onto the East Siberian Shelf up to about 170°E. It is suggested that the ice sheet extended northward as thick ice shelf, which grounded on the Mendeleev Ridge to an area up to 78°N. From the Chukchi Borderland to the East Siberian Shelf, the entire upper continental slope has been intensively plowed by icebergs possibly indicating the final collapse and disintegration of the last ice shelf in the area which predates the LGM. The results have important implication for the former distribution of thick ice masses in the Arctic and are relevant for both global sea-level variations and freshwater export from the Arctic Ocean.

Reference:

Jakobsson M, Nilsson J, O'Regan M, Backmann J, Löwemark L, Dowdeswell JA, Mayer L, Polyak L, Colleoni F, Anderson LG, Björn G, Darby D, Eriksson B, Hanslik D, Hell B, Marcussen C, Sellén E, Wallin A (2010) An Arctic Ocean ice shelf during MIS 6 constrained by new geophysical and geological data. - *Quat. Sci. Rev.* 29, 3505-3517.