Neogene – Quaternary evolution of the northeastern Fram gateway, European Arctic

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The onset of the Fram Strait's opening through the separation of Eurasian and Greenland plates along the Molloy Fracture Zone, constitutes an important tectonic event in the evolution of the Arctic Ocean, leading to the integration of the Arctic Ocean with the global ocean circulation system. This resulted in an influx of warm water and moisture from North Atlantic waters, spreading west and north of Svalbard. To investigate the nature and consequences of this inflow and its paleoclimatic effects, we have correlated late Miocene to present chronostratigraphic markers from ODP sites 910, 911 and 912 to all available 2D multi-channel seismic surveys covering the southern Yermak Plateau. From this, we have developed a new seismic stratigraphic framework using chronostratigraphic markers of 1.20, 2.78, 3.6 and 5.8 Ma in age, and we have subdivided the sediments into four chronostratigraphic units (U-I to U-IV), aiming to identify important climatic events such as late Miocene-Pliocene transition (~8-3 Ma), the Mid-Pliocene warm period (3.3-3 Ma), and onset of glaciations in the northern Barents Sea (~2.7 Ma). Our sediment thickness maps show that the margin has been draped by contourite drifts that started to accumulate before ~5.8 Ma, indicating an active current system prior to late Miocene. The location of this ocean current along the eastern Fram Strait and into the Arctic Ocean region was controlled by basement highs during the Neogene, later to be influenced by glacigenic deposits sourced from the shelf and upper slope during the Quaternary. This downslope sediment transfer resulted in the buildout of the Sjubrebanken Trough Mouth Fan at ~2.78 Ma, followed by the Kongsfjorden Trough Mouth Fan at ~1.20 Ma. These events likely caused ocean currents to shift further west after ~2.78 Ma, as evidenced by alongslope sediment accumulations.

Our results have the potential to shed more light on the nature and development of the ocean current system in and out of the Arctic Ocean, the onset and development of large-scale glaciations in this part of the Arctic, and their forcing factors including the periods of key climatic events. Continued work will involve expanding our thickness maps further north onto the Yermak Plateau and eastwards to the Woodfjorden Trough Mouth Fan, as well as further studies on this from the integration of preliminary results from the IODP 403 expedition.