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The Decahedrella-event in ODP Hole 909C – Implications for Miocene stratigraphic and paleoclimatic interpretations across the Fram Strait gateway

Michael Schreck (1), Seung-il Nam (1), and Jens Matthiessen (2)

(1) Korea Polar Research Institute, Incheon, Korea (michael.schreck@kopri.re.kr), (2) Alfred Wegener Institute, Geosciences, Bremerhaven, Germany

ODP Hole 909C has been drilled during ODP Leg 151 in 1993 on a small abyssal terrace located immediately to the North of Hovgaard Ridge within the Fram Strait. This major arctic gateway constitutes the only deep-water connection between the Arctic Ocean and the North Atlantic. Moreover, it serves as a pathway for warmer North Atlantic surface waters entering the Central Arctic, and for colder, sea-ice covered waters that are exported to the south. Therefore the Fram Strait is of crucial importance for global ocean circulation and hence climate. Therefore, this deep-water location was designed by ODP to document the timing of the opening of Fram Strait, and to monitor the Cenozoic evolution of water mass exchange as well as the glacial history and climatic variability in a region critical for understanding Miocene climate evolution.

The age model of ODP Hole 909C is primarily based on the interpretation of the magnetic polarity record obtained during the ODP Leg 151 cruise, and provides significant temporal constraints only for the uppermost 40 mbsf, whereas limited recovery and the uncertain occurrence of hiatuses resulted in decreasing reliability of the magnetostratigraphic interpretations downcore and widely divergent hypothesis below 200 mbsf. Two possible correlations of the magnetic signal to the global polarity timescale have been proposed, both neither unique nor definitive, and in the absence of any additional independent age control it is difficult to distinguish between the two models, which in turn seriously hampers reliable paleoenvironmental reconstructions in the Neogene of the gateway region.

A detailed palynological study on a paleoenvironmental transect across Fram Strait comprising IODP Site M2 (Central Arctic Ocean), ODP Site 909 (Fram Strait), and ODP Site 907 (Iceland Sea) revealed the presence of a significant acme of the endemic high-latitude acritarch Decahedrella martinheadii at all three sites. Comparable high abundances of this cold-water acritarch have been reported from several ODP sites in the Norwegian-Greenland Sea and Labrador Sea displaying its supraregional prevalence in the high northern latitudes. This acme, as well as the highest and lowest occurrence of this species, has been independently calibrated to the pristine magnetostratigraphy of ODP Site 907 providing new tie-points for the construction of the ODP Site 909 age model and the interpretation of the paleomagnetic record. Initial results indicate that the existing age models may have to be shifted by roughly 2 Ma towards a younger age within the Middle to Late Miocene interval, resulting in a much younger age for the base of the hole than previously thought. Here we present a revised age model for the late Middle to Late Miocene of ODP Site 909 and discuss resulting implications for previous paleoceanographic and paleoclimatic interpretations, e.g. initiation of deep-water exchange through Fram Strait, establishment and strengthening of the East Greenland current, and the onset of modern like ice drift pattern.