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New insights into late Neogene glacial dynamics, tectonics, and hydrocarbon migrations in the Atlantic-Arctic gateway region.

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Notwithstanding the recent IODP drilling on the Lomonosov Ridge, the Late Cenozoic history of the Arctic Ocean still remains elusive. The tectonic processes leading to the development of the only deep-water connection to the Arctic Ocean via the Fram Strait are still poorly understood. Also, the influence of the gateway region on changes in Arctic–Atlantic ocean circulation, uplift/erosion on the adjacent hinterland, as well as glacial initiation and its consequences for the petroleum systems in the regions, remain unclear. By revisiting Ocean Drilling Program (ODP) Leg 151, holes 911A and 910C and interpreting new multi-channel seismic data, we have now established a new comprehensive chronological framework for the Yermak Plateau and revealed important paleoenvironmental changes for the Atlantic–Arctic gateway during the late Neogene. The improved chronostratigraphic framework is established through continuous paleomagnetic and biostratigraphic data as well as selected intervals with stable [U+F064]18O and [U+F064]13C data derived from benthic foraminifera Cassidulina teretis. Supported by acoustic profiling, the new data indicate a continuous late Miocene/early Pliocene age (∼5-6 Ma) for the base of both holes. The depositional regime north (Yermak Plateau) and south of the Fram Strait (Hovgaard Ridge) was rather shallow during the late Miocene and water mass exchange between the Arctic and Atlantic was restricted. Ice sheets on the Svalbard Platform evolved during the late Miocene, however did not reach the coastline before 3.3 Ma. Migration of gaseous hydrocarbons occurred prior to the intensification of the Northern Hemisphere Glaciations (∼2.7 Ma) as indicated by high-amplitude reflections, corroborating the occurrence of greigite mineralization and stable carbon isotope excursions in planktic/benthic foraminifera. The data indicate that Pleistocene erosion and uplift in the Barents Sea region had probably only minor effects on reservoir leakages than previously thought.