



## **Widespread Pleistocene submarine landslides and erosion on the Lomonosov Ridge (central Arctic Ocean)**

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The Lomonosov Ridge is seen as a relict of continental crust, which drifted from its original Eurasian shelf-edge location into the central Arctic Ocean during the formation of the Eurasian Basin by sea-floor spreading. With a total length of 1800 km, widths between 50 and 220 km and submarine elevations of 3 km above the abyssal plain the Lomonosov Ridge has dimensions of an Alpine mountain chain.

Seismic lines indicate that large areas of the ridge are covered by well-stratified undisturbed Cenozoic sediments of more than 400 m in thickness. This may suggest that the ridge is in a relatively stable tectonic setting and exposed to hemi-pelagic deposition over long time scales. However, there is now a growing number of evidence that the crest and upper slopes of the ridge are characterized by widespread mass wasting. Kristoffersen et al. (2007) described major sediment disruptions on the slopes associated with slide scars on the crest of the Lomonosov Ridge between 87°30' and 88°N as a local phenomenon. Since the expedition of RV "Polarstern" in 2014, which explored the Lomonosov Ridge from near the pole to the Eurasian margin, we now know that similar mass wasting has been common probably along the entire ridge.

Detailed bathymetric mapping between 81° and 84°N exhibit numerous amphitheatre-like slide scars, under which large amounts of Cenozoic sediments were remobilized into mass-wasting features on both the Makarov and Amundsen sides of the ridge. Sub-bottom seismic profiling discovered at least three generations of debris-flow deposits near the ridge, which were generated by the slides. Underneath the slide scars escarpments of up to 400 m in height were formed, which exposed Cenozoic sediments at the sea floor. Sediment cores from these locations recovered unconformities related to the youngest erosional event, which are overlain by undisturbed sediments accumulated during Marine Isotope Stages (MIS) 1 to 6. An age of MIS-6 is also suggested for the uppermost debris flow. Extrapolations of the age models of sediment cores suggest that earlier submarine landslides have occurred during the Middle Pleistocene.

Some areas of the Lomonosov Ridge, where landslides have occurred, are characterized by Mega-Scale Glacial Lineations (MSGL). Typically, several generations of parallel or slightly curved streamlined bedforms are oriented in a SW-NE direction in areas shallower than 1000 m present water depth. They indicate that dynamically flowing ice masses (ice rise within an Arctic Ocean ice shelf) grounded on the Lomonosov Ridge during Pleistocene glaciations and eroded older sediments. MSGL end abruptly at slide scars and were last formed during MIS-6. At the present state of the study we can only speculate on the causes of mass wasting. This includes erosion in the context of glacial loading and seismicity (e.g. earthquakes), as well as slope failure related to gas.

Kristoffersen, Y., Coakley, B.J., Hall, J.K., Edwards, M. (2007) Mass wasting on the submarine Lomonosov Ridge, central Arctic Ocean. *Mar. Geol.* 243, 132-142.