



Age and origin of the Lomonosov Ridge: a key continental fragment in Arctic Ocean reconstructions

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The Lomonosov Ridge is a trans-oceanic seafloor high that separates the Eurasia Basin from the Amerasia Basin. It extends for a distance of almost 1800 km across the Arctic Ocean from the Lincoln Shelf off Greenland and Canada to the East Siberian Shelf. Although known from the ACEX drilling expedition to be a sliver of continental crust, it remains an enigmatic feature and many details of its history are unknown. In the summer of 2012, GEUS recovered dredge samples from two locations along the flank of the ridge facing the Eurasian Basin. The samples comprise 100 kg and 200 kg of rocks and rock pieces ranging in size from 0.1 to 80 kg which were recovered from two different scarps associated with rotated continental fault blocks. A significant quantity of rocks with identical structures and isotopic fingerprints show that they formed at the same time and from the same geological material. This combined with the broken and angular nature of many of the pieces recovered indicates that the material is from in situ bedrock and does not represent dropstones brought to the area by drifting ice. Two main sedimentary rock types were recovered - an arkosic metasedimentary rock, and a quartz rich non-metamorphic sandstone.

The arkosic metasedimentary rock shows compositional layering (primary heterolithic fabric) that is deformed and with a well-developed schistosity. These metasedimentary rocks contain muscovite with textural evidence that shows the muscovite is metamorphic and not detrital, and thus formed at the time the rocks were deformed. The metamorphic fabrics and mineralogy indicate deformation under greenschist facies conditions, indicating that the metamorphism was associated with an orogenic event; the metamorphic muscovite has yielded an Ar/Ar age of around 470 Ma. Thus the rock is interpreted as a Proterozoic to lower Palaeozoic heterolithic sandstone that was involved in an orogenic event during the Ordovician.

This event may be related to the Mid-Ordovician M'Clintock orogeny that affected the Pearya terrane, which forms the northernmost part of Ellesmere Island. The Pearya Terrane has long been considered an exotic terrane in the Canadian Arctic because the Proterozoic and early Paleozoic geological history has much in common with rocks on Svalbard, along East Greenland, and other parts of the Caledonides, but not with the rocks of the Franklinian Basin and other parts of the northern Laurentian margin. The M'Clintock orogeny is interpreted to be related to the earliest phase of the Caledonian orogenic activity and the Pearya terrane is commonly considered as small piece of Baltica that accreted to northern Ellesmere Island, probably sometime in the late Paleozoic during the Ellesmerian orogeny. These results from the Lomonosov Ridge provide an important new constraint on post-Caledonian plate tectonic configurations in the Arctic region, prior to the opening of the Amerasia and Eurasia basins.