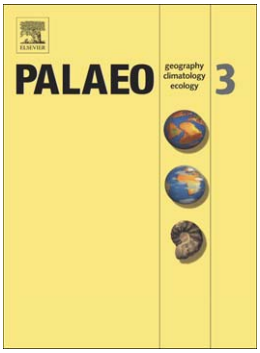

Surface microtextures of ice-rafted quartz grains revealing glacial ice in the Cenozoic Arctic

Ninna Immonen

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Surface microtextures of ice-rafted quartz grains revealing glacial ice in the Cenozoic Arctic

Ninna Immonen *

Thule Institute, PO Box 7300, FIN-90014 University of Oulu, Finland

Department of Geosciences, PO Box 3000, FIN-90014 University of Oulu, Finland

* Tel.: +358 294 487557; fax: +358 8 553 3564.

E-mail address: ninna.immonen@oulu.fi.

Abstract

Ice-rafted grains of the central Arctic Ocean sediments provide a reliable proxy for Arctic paleoenvironments and climatic conditions that prevailed at the time of their deposition. To understand ice involvement and implications for environmental advancement, it has proven necessary to ascertain whether these detrital grains were rafted on glacial ice or sea-ice. Surface microtexture identification allows grain differentiation based on the processes and conditions in its environmental provenance. Here, quartz sand grain surface microtextures are used to detect glacially crushed and reworked grains from the Lomonosov Ridge sediments obtained by the Integrated Ocean Drilling Program Expedition 302 (Arctic Coring Expedition). The data show that the most frequent distributions of glacial grains were deposited at the middle-late Miocene and during the Pliocene and early Pleistocene. Especially, the middle Miocene climatic cooling and the presence of glacial ice are well indicated at ~13.5 Ma sediment grains. Earliest finding of the high frequency occurrence of glacigenic microtextures represents the age of ~56 Ma. This first sedimentological evidence for the late Paleocene glacial ice supports the existing hypothesis of ephemeral polar glaciations during times of marked global warmth. However, due to lack of uninterrupted sediment recovery and non-continuous nature of sampling, the glacially influenced samples recovered here should be treated as an estimate of the minimum frequency of glacier appearance in the Arctic.