

Detrital Zircon Provenance of the Neruokpuk Formation, Northwest Laurentia

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Abstract

The Neruokpuk Formation is a Late Neoproterozoic and Early Cambrian turbiditic succession that is presently located adjacent to the Yukon Stable Block in northwestern Yukon and adjacent northeastern Alaska. It forms part of a Neoproterozoic to Early Devonian slope and basin succession that can be correlated in detail to coeval strata in the Selwyn Basin of the northern Canadian Cordillera. The dominant lithology is quartz to quartz-lithic sandstone, locally containing altered detrital feldspar and muscovite indicating that a metamorphic source contributed detritus to the unit. However, the documented Caledonian-age structural history for the unit associates it more closely with the Arctic Alaska terrane to the west and to northern Ellesmere Island, some 2000 km to the northeast, than to its present position in northwestern Laurentia.

To test whether the Neruokpuk Formation is autochthonous to northwestern Laurentia, two samples of sandstone from the Proterozoic lower part of the unit were processed for detrital zircon analysis. Detrital zircon provenance analysis yields important insights about the age characteristics of the source regions contributing sediment to a depositional basin. To characterize the detrital zircon populations and assess the provenance of the Neruokpuk Formation required analyses of control samples of known northwest Laurentian provenance, in order to account for both cratonic and recycled zircon populations. Two Neoproterozoic control samples from the northernmost Mackenzie Mountains yielded zircon populations that are entirely accounted for by recycling of Mackenzie Mountains Supergroup source rocks. Two Early Cambrian sandstones sourced from the Yukon Stable Block and deposited in the southern Richardson Trough have zircon populations that are essentially identical to those of the upper Wernecke Supergroup, locally exposed across southern Yukon Stable Block.

Detrital zircons in the Neruokpuk Formation are dominated by 1800-2000 Ma grains with subsidiary populations of 1000-1600 Ma, 2300-2500 Ma and 2600-2800 Ma, consistent with a mixed provenance dominated by a Laurentian cratonic source, with contributions from Mackenzie Mountains and possibly Wernecke supergroups. In addition, detrital muscovite yielded disturbed Ar-Ar spectra of 1800-1900 Ma. The interpretation that best fits both the stratigraphic and detrital zircon data is that the Neruokpuk Formation was deposited in its present location; and thus the northeasternmost part of the Arctic Alaska terrane probably is not far-travelled, implying that Arctic Alaska may comprise an assemblage of several Paleozoic terranes. However, a definitive resolution awaits the results of DZ analysis of the Grant Land Formation, a potential correlative of the Neruokpuk Formation on Ellesmere Island.