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Cretaceous magmatism in the High Canadian Arctic: Implications for the nature and age of Alpha Ridge

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Cretaceous magmatism in the High Arctic, best expressed on Axel Heiberg and Ellesmere Island, can provide clues to the nature and age of the adjacent Alpha Ridge, which is in turn a key to understanding the tectonic evolution of the Arctic Ocean. Although the incorporation of some continental crust cannot be excluded, the prevailing view is that Alpha Ridge is dominantly thickened oceanic crust, analogous to oceanic plateaus of the Pacific and Indian Ocean. Together with the on-land volcanic exposures, Alpha Ridge composes the High Arctic Large Igneous Province (LIP), but the physical processes responsible for the magmatism remain unclear. Here we focus on two volcanic formations found on the Canadian Arctic margin. The Strand Fiord Formation is composed of a series of classic continental flood basalt flows, and represents the most voluminous expression of volcanism that has survived erosion. These basalts yield a ^{40}Ar/^{39}Ar age of $\sim$95 Ma (Tarduno et al., Science, 1998) but this comes from the distant edge of the flood basalt exposures. The Hansen Point Volcanics consist of felsic and mafic rocks; previous age assignments range from the Maastrichtian (on the basis of palynomorphs, Falcon-Lang et al., Palaeogeography, Palaeoclimatology, Palaeoecology, 2004) to 80 Ma (Rb/Sr isochron, Estrada and Henjes-Kunst, Z. dt. Geol. Ges, 2004). Here we report new ^{40}Ar/^{39}Ar radioisotopic and paleomagnetic data from the Hansen Point Volcanics. In contrast to the latest Cretaceous/Paleogene dates, we find ages of $\sim$95 Ma and 88-90 Ma. Because of the proximity of the landward extension of Alpha Ridge to Hansen Point, these new ages suggest that volcanism that contributed to the construction of Alpha Ridge may have extended over at least a 7 million interval (although it could have occurred in pulses). We will discuss the implications of these new data for candidate mantle processes that could have been responsible for the emplacement of Alpha Ridge and the High Arctic LIP.