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Contrasting styles of magmatism and rifting in the High Arctic LIP, Sverdrup Basin, Canadian Arctic

Marie-Claude Williamson, Grace E. Shephard, and Dawn A. Kellett
Geological Survey of Canada, Natural Resources Canada, Ottawa, Ontario, Canada (marie-claude.williamson@canada.ca)

Located along the Canadian polar continental margin, the Sverdrup Basin is an elongated, intracontinental sedimentary basin that originated during Carboniferous-Early Permian rifting. Starting in the Early Cretaceous, volcanic complexes (VC) were emplaced throughout the basin, which are associated with the High Arctic Large Igneous Province (HALIP). Geochronological and geochemical data on HALIP rocks exposed on Axel Heiberg Island and northern Ellesmere Island suggest several discrete stages of emplacement; (1) voluminous mafic intrusive activity of tholeiitic character accompanied by minor extrusive volcanism at *ca*. 125-110 Ma (VC1a**);** the eruption of tholeiitic flood basalts on Axel Heiberg Island at *ca*. 100-90 Ma (VC1b); the emplacement of mildly alkaline lava flows, sills and dykes on Ellesmere Island at *ca*. 100-90 Ma (VC2); and the eruption of a suite of alkaline lava flows from central volcanoes at *ca*. 85-75 Ma (VC3). Each magmatic episode is characterized by a distinctive eruptive style and coherent geochemical signature regardless of the mode of emplacement. In this context, onshore manifestations of the HALIP can be viewed as time-markers in the evolution of the adjacent polar continental margin.

We use digital plate tectonic models, constructed via the *GPlates* software, to explore the parallel development of the Sverdrup Basin and proto-Arctic Ocean (Amerasia Basin) during the Early Cretaceous, and the transition from a sedimentary to volcanic Sverdrup Basin. Plate reconstructions of the Amerasia Basin at *ca*. 125 Ma suggest two zones of extension; one within the Canada Basin, which may include seafloor spreading, (Zone 1, more distal to the Sverdrup Basin) and the second further northwards in the Alpha-Mendeleev Ridge and Makarov Basin domains offshore northern Ellesmere Island (Zone 2, proximal to the northeastern portion of the Sverdrup Basin). The potential for enhanced melting caused by mantle flow (possibly related to the arrival of a mantle plume) towards the Sverdrup Basin depocentre could explain widespread magmatism of tholeiitic character from *ca*. 125-90 Ma (VC1). The transition to mildly alkaline (VC2) and alkaline magmatism (VC3) at *ca*. 100 Ma may have signaled the end of extension in Zone 1. The persistence of localized extension in Zone 2 could explain the shift in magmatic style and compositional diversity of igneous rocks emplaced at intrusive complexes (VC2) vs constructional volcanic edifices (VC3). In addition, greater depth to Moho along the northeastern Sverdrup Basin may have contributed to restricted mantle flow in Zone 2. We propose that the spatio-temporal evolution of HALIP magmatism in the Sverdrup Basin during the Cretaceous relates to (1) different styles of tectonic extension (distal vs proximal, protracted vs discrete, widespread vs narrow, seafloor spreading vs hyper-extensional rifting), and (2) the presence of hot, thin lithosphere close

to the basin depocentre vs cold and thick lithosphere in the northeastern part of the basin.