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A model for the development of ultramafic lamprophyre dykes in the Saguenay region, Québec, Canada

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The Ediacaran Saguenay (Quebec, Canada) alkali province comprises the Saint-Honoré syenite-carbonatite intrusion and two dyke swarms. All three components appear to be part of a single magmatic event at around 580 ± 2 Ma. The dykes are 1-500 mm wide and were emplaced with many injections. Dykes range in composition from silicate-dominated (SiO2=30%) to carbonatites, but to emphasize their continuous compositional range they are referred to as ultramafic lamprophyres.

Mineralogically, the dykes are dominated by serpentine, talc and carbonates but in a few dykes high-temperature mineral relicts are preserved, mostly phlogopite, clinopyroxene and olivine. Rare dykes are phoscorites, with cumulus magnetite, phlogopite, apatite and baddeleyite.

Some dykes contain xenoliths derived from the upper crust (Grenville province), but no mantle xenoliths have yet been found. Most dykes crop out close to the Saguenay River/Fjord and dip moderately to the north, towards the Saint- Honoré intrusion. Another swarm occurs nearby in the Baie des Ha! Ha!, where sparse dykes are vertical and strike northwest. These dykes are notably poorer in carbonate.

A model has been developed where partial melting of the mantle produces a range of slightly carbonated ultramafic magmas. These rise into the lower crust where they pause to crystallise. The addition of material causes inflation which is relieved by the development of the radial dykes seen now at Baie des Ha! Ha!. Continuing activity forced magma further into the upper crust where fractionation produced a range in magma compositions, some rich in carbonate. Here, pressure was relieved by formation of cone-sheets, now exposed along the Saguenay River/Fjord. The final stage was the production of the Saint-Honoré syenite-carbonatite intrusion.

