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The Fort à la Corne Kimberlites, Saskatchewan, Canada: Geology, Emplacement and Economics

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Abstract: The Cretaceous Fort à la Corne kimberlite province includes at least seventy well-preserved bodies ranging up to 200 hectares in size. Kimberlite volcanism spanned at least 20 Ma. The main bodies formed by a two stage process: (i) excavation of shallow craters into Cretaceous sediments, and (ii) crater infilling by subaerial magmatic pyroclastic processes, both during regressions of the Western Interior Seaway. Each of the twenty-five bodies investigated is different but dominated by a few volumetrically significant phases of kimberlite. Subsequent eruptions formed nested craters within earlier indurated kimberlites. Eruption styles varied from Hawaiian and Strombolian to a probable kimberlite-specific type of eruption, which formed unique mega-graded beds. Separation of olivine grains from the low viscosity melts was a widespread process that resulted in discrete olivine grains forming approximately half of the pyroclasts across the province. Ash-sized clasts are not common indicating removal by a large scale sorting process. No diatremes, root zones, dykes, hypabyssal or tuffisitic kimberlite or significant amounts of resedimented material were found. The contrast in geology of the Fort à la Corne bodies supports, rather than negates, the 'classic' kimberlite pipe model. The Fort à la Corne mode of emplacement comprises a second style of eruption or model, which is applicable to kimberlites. The new models have been an important foundation of the ongoing economic evaluation of the Fort à la Corne bodies. Applying predictive geology based on knowledge obtained from other kimberlite bodies would have been misleading.

Keywords: Kimberlites, Pyroclastic, Volcanology, Crater, Juvenile lapilli, Olivine, Canada.