Economic Implications of Multidisciplinary Geological Studies on Fort-à-la-Corne Kimberlite Pipe #169

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ABSTRACT

In central Saskatchewan, crater facies kimberlites were emplaced into Cretaceous marine and nonmarine clastic sediments. Core recovered from one drill hole (169/8) that intersects kimberlite was selected for an integrated study involving sedimentology, volcanology, mineralogy, geochemistry, palynology, micropaleontology, and U-Pb geochronology. This work was complemented by multi-parameter borehole geophysical logging. From drill core-based studies, four kimberlite facies were recognized. Fluvial reworked kimberlite occurs at the base of the drill core, and consists of reworked material from the early period of kimberlite volcanism plus delta plain siliciclastic material. These conglomerates are overlain by Cantuar terrestrial siliciclastic sediments. Two distinct facies of pyroclastic kimberlite deposits conformably overlie the Cantuar siltstones, and these kimberlites are interpreted to have been emplaced over a discrete time interval termed the main period of volcanism. Thinly (mm to cm scale) bedded, juvenile kimberlite lapillistone deposits, with a total thickness of 40 m, form the base of the succession, and are interpreted to be the products of violent strombolian volcanism. The kimberlite lapillistones are overlain by 35 m of thickly bedded (1 to 14 m beds), olivine crystal tuff deposits, interpreted to be the products of exceptionally explosive volcanism. A late Albian marine transgression has reworked these kimberlite tephra deposits, producing a distinctive facies consisting of olivine and heavy mineral-rich beach/progradational shoreface/spit deposits. Diamond grade in the Fort-à-la-Corne kimberlites thus can be enhanced by the following mechanisms: 1) aeolian sorting processes associated with volcanism in the deposition of the olivine crystal tuffs; 2) reworking/sorting processes associated with marine transgression in deposition of the olivine-rich shoreface sands; and 3) reworking associated with fluvial processes in deposition of the Cantuar kimberlite conglomerates. The ability to discriminate the four different kimberlite facies is possible utilizing either major/trace element geochemical or multi-parameter borehole geophysical logging methods. These two techniques may be of use in assisting evaluation of the diamond potential of kimberlites in the Fort-à-la-Corne field, regarding changes in diamond grade within a pipe as related to facies variation.