

textural transition zone into HK. The Tesla pipe is intermediate in character between Hearne and Tuzo. A composite model of the four pipes comprises the base of the diatreme zone (TKB; Tuzo) which grades with depth (Hearne, Tesla) into the root zone (HK; 5034). Thus, the kimberlites appear to be partly eroded pipes in which the diatreme zone has developed to different depths from the original surface. The geometry of the main HK to TK textural transition zones in Hearne and Tuzo are different. In Hearne, the transition from TK to HK occurs as a 115m wide zone which dips at ~45deg. down the long axis of the pipe. The Tuzo transition zone appears to be ~70m wide with its upper limit being basin-shaped and coinciding with the lower limit of the massive granite dilution in the overlying TKB. The pipe shapes and infills of the Gahcho Kué kimberlites are similar to the classic South African pipes, particularly those of the Kimberley area. Similar intrusive magmatic emplacement processes are proposed in which the diatreme-zone results from the degassing, after breakthrough, of the intruding magma column. The transition zones represent 'frozen' degassing fronts. The style of emplacement of the Gahcho Kué kimberlites is very different from that of many other pipes in Canada such as at Lac de Gras, Fort a la Corne or Attawapiskat.

1.6 GEOLOGY AND DIAMOND DISTRIBUTION OF THE 140/141 KIMBERLITE, FORT À LA CORNE, CENTRAL SASKATCHEWAN, CANADA

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The Cretaceous Fort à la Corne kimberlite province comprises at least 70 bodies, which were emplaced near the edge of the Western Canadian Interior Seaway during cycles of marine transgression and regression. The bodies formed during a marine regression by a two stage process, firstly the excavation of shallow, but wide craters and subsequent infilling by xenolith-poor, crater-facies, subaerial, primary pyroclastic kimberlite. The bodies range up to 2000m in diameter and are mainly less than 200m thick and thus comprise relatively thin, but high volume, pyroclastic kimberlite deposits. Each body is composed of contrasting types of kimberlite reflecting different volcanic histories and, therefore, must be considered separately for evaluation purposes.

Exploration of this province has been ongoing since 1989. Recently the Fort à la Corne Joint Venture (De Beers Canada Exploration Inc., Kensington Resources Ltd., Cameco Corporation and UEM Inc.) has focussed their attention on the 140/141 kimberlite. Programmes of core drilling, ground geophysics and large diameter drilling have increased the understanding of the internal geology, which in turn assists to explain the diamond distribution within the body.

The 140/141 kimberlite is the largest delineated body in the province, estimated to have an areal extent in excess of 200ha. The infilling of the 140/141 crater is complex, resulting from multiple phases of kimberlite. The central and younger parts of the infill are dominated by several contrasting phases of kimberlite. One of these phases represents a single primary pyroclastic airfall mega-graded bed up to 130m in thickness. The constituents grade in size from very fine to coarse macrocrystic kimberlite, through to a basal breccia. The mega-graded bed is a widespread feature within some parts of the body and at this current stage of evaluation appears to explain the variable diamond distribution within the tested portion of the pipe. A second different phase of kimberlite is interpreted as representing a younger nested crater within the mega-graded bed. Centrally located thicker intersections (>450m) of this younger kimberlite may indicate a vent for the kimberlite crater. The thickness of the mega-graded bed increases with proximity to the younger kimberlite in the study area.

Macrodiamond bulk sample grades from the mega-graded bed have been obtained from nine large diameter drill holes, from an area of ~20ha, which represents approximately 10% of the currently modeled kimberlite area. The trend of diamond grade increases with depth within the mega-graded bed and increases, within the same unit, towards the centre. Macrodiamond sample grades (collected over 12m drill hole intersections to +1mm) vary from low diamond grades at the top of the mega-graded bed, to considerably higher grades near the base. Total sample grade per drill hole varies from moderate grades near the vent feature to lower grades only 200-300m from the vent feature. Macrodiamond stone frequency, measured in stones per tonne (spt) shows a more pronounced relationship with depth and proximity to the vent feature within the mega-graded bed. There is a strong correlation between depth and increased spt, and a similar correlation between spt and proximity to the vent feature. The data supports aspects of the mega-graded bed and in turn, these conclusions are useful in understanding the macrodiamond distribution within this bed.

1.7 SEDIMENTOLOGIC AND STRATIGRAPHIC CONSTRAINTS ON EMPLACEMENT OF THE STAR KIMBERLITE, EAST-CENTRAL SASKATCHEWAN

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Diamond-bearing kimberlites in the Fort à la Corne region, east-central Saskatchewan, consist primarily of pyroclastic deposits which are intratratified with Lower Cretaceous (Albian) marine, marginal marine and continental sediments. Approximately 70 individual kimberlite occurrences have been documented. Of these, the Star Kimberlite, at the southeastern end of the main Fort à la Corne trend, has been identified as being of economic interest, and thus is characterized by an excellent drill core database.

Integration of multi-disciplinary data-sets has helped to refine and resolve models for emplacement of the Star Kimberlite. Detailed core logging has provided the foundation for sedimentological and volcanological studies and in constructing a regionally consistent stratigraphic and architectural framework for the study interval. Micropaleontologic and biostratigraphic analysis of selected sedimentary rocks, and U-Pb perovskite geochronology on kimberlite samples have been integrated to define periods of kimberlite emplacement. High-resolution 2-D and 3-D shallow seismic studies, complemented by multi-parameter borehole geophysics on drill holes within the same body, has aided in determining the 3-D geometry and internal lithologies of the Star Kimberlite.

Radiometric age determination and micropaleontologic evidence support the hypothesis that multiple kimberlite eruptive phases occurred. The oldest kimberlite in the Star body erupted during deposition of the predominantly continental strata of the lower Mannville Group (Cantuar Formation). Kimberlites within the Cantuar Formation include terrestrial airfall deposits as well as fluvially transported kimberlitic sandstone and conglomerate. Successive eruptive events occurred contemporaneous with deposition of the marginal marine upper Mannville Group (Pense Formation). Kimberlites within the Pense Formation consist primarily of terrestrial airfall deposits and associated massive kimberlite vent deposits within the underlying feeder pipe. Fine- to medium-grained cross-stratified kimberlitic (olivine dominated) sandstone in this interval reflects reworking of airfall deposits during a regional marine transgression. The youngest eruptive events associated with the Star Kimberlite occur within the predominantly marine Lower Colorado Group (Joli Fou, Westgate and Belle Fourche formations). Kimberlite beds, which occur at several horizons within these units, consist of marine airfall deposits that commonly exhibit evidence of wave-reworking. Black shale-encased kimberlite beds, deposited as subaqueous debris flows and turbidites are particularly common in the Lower Colorado Group.

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