

GEOLOGY OF THE HEARNE KIMBERLITE PIPE, NORTHWEST TERRITORIES, CANADA: MAGMATIC KIMBERLITE EMPLACEMENT

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Canada is characterised by diverse types of kimberlite pipes with contrasting emplacement processes. Three main types have been identified: (1) saucer to bowl-shaped pipes filled with bedded pyroclastic lapilli tuffs, (2) steep-sided pipes infilled with well-bedded resedimented volcanoclastic kimberlite, and (3) steep-sided pipes containing massive so-called tuffisitic kimberlite (TK). The main example of Group (3) comprises the four eroded <2 ha. Cambrian kimberlite pipes located at Gahcho Kué in the southern Slave Craton. The composite geological model based on the investigation of 243 drillholes shows that the pipes are exceptional examples of the transition from TK-infilled diatremes to the underlying HK-infilled root-zones as seen, and defined, in southern Africa. This paper focuses on this transition in the dominant phase of kimberlite in one pipe, Hearne. This kimberlite displays an igneous textural gradation from TK at surface to HK with depth. The transition zone, defined by the limits of uniform TK and uniform HK, is 115 m wide and characterised by patchy and/or oscillating textures. In situ modification of the magma occurs in patches on all scales varying from millimetres to metres and includes the visible development of pelletal textures until, as the surface is approached, the whole magma has been modified to pelletal TK. This shows that the

diatreme zones are formed by intrusive magmatic processes. Other supporting evidence includes the decrease in groundmass crystallinity and proportion of primary groundmass carbonate, the correlation of textures with variations in the concentration and alteration of the xenoliths, as well as the presence of juxtaposed phases of kimberlites with contrasting textures and diamond grades. All the observed features offer strong support for the interpretation that the TK forms by the depressurisation after breakthrough of a single intrusive magma column with the transition zone representing a “frozen” degassing or fluidisation front.

WORD COUNT: 295