The following examples illustrate how information obtained from the geological studies could directly influence mining method selection, strategy and design.

Pipe emplacement – This is one of the fundamental studies that help to understand the kimberlite pipe geology. Although the importance of the pipe emplacement model is commonly recognized in the resource geology, its importance to the mine design is not always appreciated by the mining engineers. The knowledge of the pipe, character of the contact zones, internal structures and distribution of inclusions could directly influence pit wall stability (thus striping ratio), underground mining method selection, dilution, treatibility, dewatering strategy etc.

Kimberlite geology – Understanding the internal geology of the pipe mainly includes the geometry and character of individual phases and facies, and the orientation and character of internal structures that transect the rock mass. For any mining method it is important to know "where the less and where the more competent rocks are located". On the other hand the detailed facies studies may not be important for the resource and mine design if the rock types have similar physical properties and diamond content.

Kimberlite petrology/mineralogy – Forming a good understanding of the kimberlite petrology and mineralogy could be crucial to the treatability (namely diamond damage and liberation), but also to the pit wall and underground excavation stability, support design, mine safety (mudrush risk assessment) and mine dewatering.

There is no doubt that a better understanding of the geology has a direct impact on the safety and economics of the mining operations. The process of mine design could start right at the beginning of the discovery without necessarily significantly increasing the exploration budget. On the other hand it is important to appreciate fundamental geological research and its impact on the increased confidence in mine design. Such studies must not be viewed as cost items but as an investment.

1.4 GEOLOGY OF THE VICTOR KIMBERLITE, ATTAWAPISKAT, NORTHERN ONTARIO, CANADA: CROSS-CUTTING AND NESTED CRATERS

Webb KJ*, Scott Smith BH, Paul JL and Hetman CH

The kimberlite pipes within the Attawapiskat cluster, including Victor, formed by an overall two-stage process of: (1) pipe excavation without the development of a diatreme (sensu stricto) and (2) subsequent pipe infilling. These pipes, therefore, differ from most of the southern African kimberlite pipes. The Victor kimberlite comprises two adjacent but separate pipes, Victor South and Victor North. The pipes are infilled with two contrasting textural types of kimberlite: pyroclastic and so-called hypabyssal. Victor South and much of Victor North are composed of pyroclastic, spinel carbonate kimberlites, the main features of which are similar: they consist predominantly of clast supported, discrete olivine macrocrysts and phenocrysts and lesser pyroclastic juvenile lapilli, mantle-derived xenocrysts and minor country rock xenoliths. These partly bedded, juvenile lapilli-bearing olivine tuffs appear to have been formed by subaerial fire-fountaining airfall processes. The Victor South pipe has a simple bowl-like shape that flares from just below the basal sandstone of the sediments that overlie the basement. The sandstone is a known aquifer, suggesting that the crater excavation process was possibly phreatomagmatic.

In contrast, the pipe shape and internal geology of Victor North are more complex. The northwestern part of the pipe is dominated by dark competent rocks, which superficially resemble fresh hypabyssal kimberlite, but have unusual textures and are closely associated with pyroclastic juvenile lapilli tuffs and country rock breccias ± volcaniclastic kimberlite. Current evidence suggests that the so-called hypabyssal kimberlite is, in fact, not intrusive and that the northwestern part of Victor North represents an early-formed crater infilled with contrasting extrusive kimberlites and associated breccias. The remaining part of Victor North consists of macroscopically similar, but petrographically distinct, pyroclastic kimberlites that have contrasting macrodiamond sample grades. Only microscopically can the juvenile lapilli of each pyroclastic kimberlite be distinguished. The nature and relative proportion of primary olivine phenocrysts in the juvenile lapilli are different, indicating derivation from different magma pulses, or phases of kimberlite, and thus separate eruptions. The initial excavation of a crater, cross-cutting the earlier northwestern crater, was followed by emplacement of phase (i), a low grade olivine phenocryst-rich pyroclastic kimberlite, and the subsequent eruption of phase (ii), a high grade olivine phenocryst-poor pyroclastic kimberlite, as two separate vents nested within the original phase (i) crater. The second eruption was accompanied by the formation of an intermediate mixed zone with moderate grade. Thus, the final pyroclastic pipe infill of the main part of the Victor North pipe appears to consist of at least three geological/grade zones.

In conclusion, the Victor kimberlite was formed by several eruptive events resulting in adjacent and cross-cutting craters that were infilled with either pyroclastic kimberlite or so-called hypabyssal kimberlite, which is now interpreted to be of probable extrusive origin. Within the pyroclastic kimberlites, there are two nested vents, a feature seldom documented in kimberlites elsewhere. This study highlights the meaningful role of kimberlite petrography in the evaluation of diamond deposits and provides further insight into the emplacement and volcanic processes occurring in kimberlites.

1.5 GEOLOGY OF THE GAHCHO KUÉ KIMBERLITE PIPES, NWT, CANADA: ROOT TO DIATREME TRANSITION ZONES

Hetman CM*, Scott Smith BH, Paul JL and Winter FW

The Cambrian Gahcho Kué kimberlite cluster includes four main pipes which have been emplaced into the Archaean basement granitoids of the Slave Craton. Each of the steep-sided pipes was formed by the intrusion of several distinct phases of kimberlite in which the textures vary from hypabyssal kimberlite (HK) to diatreme-facies tuffisitic kimberlite breccia (TKB). The TKB displays many diagnostic features including abundant unaltered country rock xenoliths, pelletal lapilli, serpentinised olivines and a matrix composed of microlitic clinopyroxene and serpentine without carbonate. The HK contains common fresh olivine set in a groundmass composed of monticellite, phlogopite, perovskite, serpentine and carbonate. A number of separate phases of kimberlite display a magmatic textural gradation from TK to HK which is characterised by a decrease in the proportion of pelletal lapilli and country rock xenoliths and an increase in groundmass crystallinity, proportion of fresh olivine and the degree of xenolith digestion.

The four pipes, 5034, Hearne, Tuzo and Tesla (up to 2 ha. in size), have contrasting shapes, internal geology and dominant kimberlite textures. The 5034 pipe has a very irregular shape comprising four main lobes, one of which is blind. The pipe is composed mainly of HK characterised by extensive xenolith digestion. Some gradational textures to TK are present. In contrast, the Hearne pipe has a more regular elongate shape. The complex internal geology includes approximately equal proportions of TK and HK. The dominant phase of kimberlite includes a complete gradation from TKB through a textural transition zone to HK. The more regularly shaped circular Tuzo pipe has relatively simple internal geology which is dominated by TKB. The main phase of xenolith-rich TKB grades with depth through a

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