Welded/agglutinated intra-crater deposits: an example from the Victor Northwest kimberlite pipe, Northern Ontario, Canada

Bram I. van Straaten[1*], Maya G. Kopylova[1], J. K. Russell[1], Kimberley J. Webb[2], Barbara H. Scott Smith[3,1]

1. Department of Earth and Ocean Sciences, University of British Columbia, Canada, 2. De Beers Canada Inc., Exploration Division, 3. Scott-Smith Petrology Inc., Canada

* Department of Earth and Ocean Sciences, University of British Columbia, 6339 Stores Road, Vancouver, B.C., V6T 1Z4, Canada, e-mail: bvanstraaten@eos.ubc.ca, phone: +1.604.822.0671.

Welding of pyroclastic deposits involves the sintering of hot glassy particles and is greatly facilitated when emplacement temperatures exceed the glass transition temperature (Tg) of the juvenile volcanic material. Welding can occur on various scales as observed in large welded pyroclastic flows, in small-volume agglutinated spatter rims, or as in partly/completely coalesced clastogenic lava flows. The result of welding is to produce dense, massive, coherent pyroclastic deposits. In this abstract, we present evidence for welding of originally clastogenic rocks from the Victor Northwest kimberlite pipe, Canada. Interestingly, unequivocal welded kimberlite deposits have never been described before.

The Victor Northwest pipe forms part of a volcanic complex comprising several adjacent and cross-cutting kimberlite pipes. These steeply dipping (~70°) pipes occur in a ~275m thick Palaeozoic sedimentary succession, unconformably overlying granitoid basement. After kimberlite emplacement in the Middle-Late Jurassic, the upper portions of the pipes (~50-300m) have been eroded.

The infill of the Victor Northwest kimberlite pipe is complex, and comprises: *(i.) Sedimentary Country Rock Breccias (CRB)*, consisting of diverse country rock fragments and minor kimberlite; country rock fragments are mixed and out-of-place with respect to their original stratigraphic position. *(ii.) Volcaniclastic Kimberlite (VK)* is found throughout the pipe, is massive to thickly bedded, and contains variable proportions of juvenile pyroclasts (crystals rimmed by selvages of crystallized melt) and country rock fragments. *(iii.) Apparent Coherent Kimberlite (aCK, the focus of this work)* is generally dark-coloured, massive, competent and macroscopically featureless. This unit has two distinctive textures. Firstly, the unit features evenly distributed, well crystallised groundmass minerals (carbonate laths, spinel, perovskite, phlogopite). Secondly, a prominent feature in certain parts of this unit is the presence of olivine crystals with diffuse fine grained selvages that are gradational to the slightly coarser-grained surrounding matrix.

The textural similarity between diffuse selvages in the aCK and juvenile pyroclasts in the VK, and the many gradational contacts from aCK to VK show that these diffuse selvages are relics of juvenile pyroclasts. This indicates that at least part of the aCK has a welded clastogenic origin. It might prove difficult to determine the origin of the coherent kimberlite with no diffuse selvages, as both densely welded pyroclastic deposits and kimberlite lavas are expected to have a similar appearance. Therefore, we conclude that the most important, as yet unresolved, issue is related to the scale of the eruption(s) forming the pipe-infill. More specifically, is this deposit a proximal record of a fall-back from a large, dense and hot eruption column, or did these rocks form by small-scale fire-fountaining, agglutination and/or effusive activity. This first account of a welded kimberlite deposit has important implications for other coherent-looking rocks in kimberlite pipes, as well as the dynamics and emplacement of kimberlite volcanoes.