



The Geology of the Faraday 3 kimberlite, Kennady Lake, NWT Canada.

Dan Gainer¹, Casey Hetman², Michael Diering³

¹ Aurora Geosciences Ltd., Yellowknife, Canada, dan.gainer@aurorageosciences.com

² SRK Consulting, Vancouver, Canada, chetman@srk.com

³ SRK Consulting, Vancouver, Canada, mdiering@srk.com

Introduction

The diamondiferous Faraday 3 body is one of four pipes identified in the Kelvin- Faraday cluster. It sits three kilometers north of the main Kelvin kimberlite and is 10 km from the recently constructed Gahcho Kué diamond mine within the Archean Slave Craton in northern Canada. Emplaced along the same structural trend as the other kimberlites in the cluster, Faraday 3 intrudes into gneissic basement comprised of metaturbidites of the Yellowknife Supergroup with minor amphibolite and narrow diabase dikes. Archean granitoids occur immediately to the west of the kimberlite cluster. Similar to the other kimberlite bodies in the Kelvin-Faraday cluster, Faraday 3 is described as a tubular, sub-horizontal, inclined pipe dominantly infilled with volcanoclastic kimberlite. It contains multiple kimberlite phases resulting from various emplacement events. Presently it is drill defined as 300 meters long, 30 meters in height and 70 meters wide.

Evaluation

Extensive geophysical surveys, 59 diamond drill holes and 42, 11-inch diameter reverse circulation (RC) drill holes have defined the external shape of the body. Microdiamond sampling of drill core has revealed that the body is significantly diamondiferous. Detailed logging and clast abundance measurements on the drill core have revealed a complex internal geology. This work is reinforced by a petrological investigation of 163 kimberlite thin sections and 44 country rock thin sections from 16 diamond drill holes selected across the body. Following this investigation a 3D model was generated in Leapfrog (Figure 1). A total of 3.16 tonnes of kimberlite recovered by core drilling was processed for microdiamonds by caustic fusion at the Geoanalytical Laboratories Diamond Services of the Saskatchewan Research Council (“SRC”) to return a sample grade of 2.18 carats per tonne. The diamond recoveries are presented in Table 1 below.

Unit	Sample Weight (dry tonnes)	Number of Diamonds According to Sieve Size Fraction (mm)												Total Stones	Total Carats (+0.85 mm)
		+0.106 -0.150	+0.150 0.212	+0.212 -0.300	+0.30 0 -0.425	+0.42 5 -0.600	+0.60 0 -0.850	+0.85 0 -1.180	+1.18 0 -1.700	+1.70 0 -2.360	+2.36 0 -3.350	+3.35 0 -4.750	+4.75 0 -6.700		
KDYKE	0.0512	222	154	80	41	25	17	8	3	-	-	-	-	550	0.1347
KIMB1	0.1965	531	365	212	145	65	39	16	10	8	-	-	-	1,391	1.0764
KIMB2	0.1484	206	165	82	45	24	15	11	6	1	-	-	-	555	0.4009
KIMB3	0.0822	47	31	21	13	8	2	2	-	-	-	-	-	124	0.0243
KIMB4	2.4712	1,456	964	555	332	178	94	51	23	10	9	1	-	3,673	4.6461
MB	0.0885	22	18	11	8	1	1	1	1	-	-	-	-	63	0.0259

Table 1: Diamond results by phase for the main pipe infills. Minor phases are not listed.

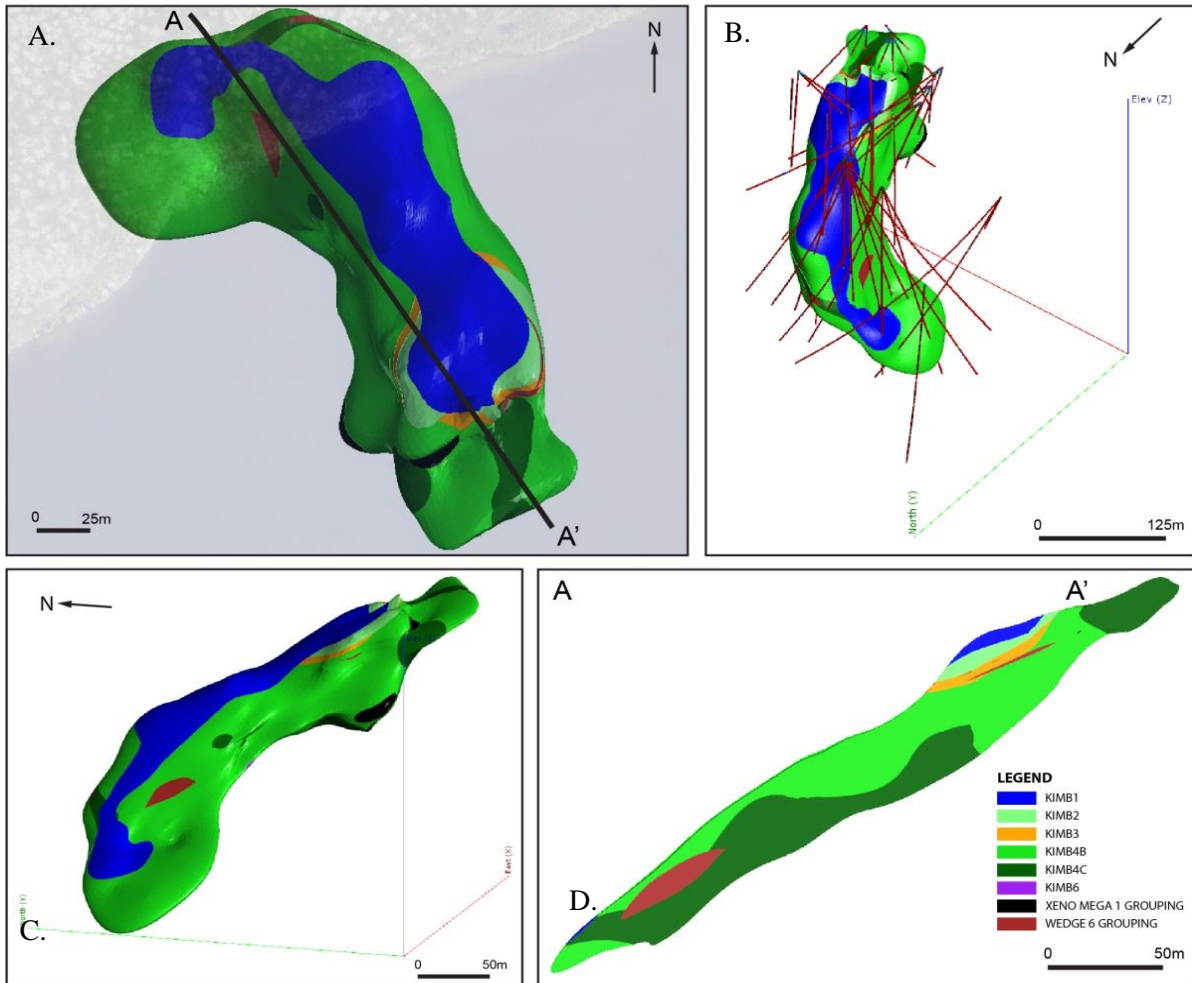


Figure 1: 3D model of the Faraday 3 kimberlite pipe. (A) Plan view; (B) Oblique view of the Faraday 3, looking southeast, with the traces of diamond drill; (C) Detailed geology model of Faraday 3 looking northeast; KIMB1, a hypabyssal kimberlite (HK); KIMB2, a uniform volcanoclastic kimberlite (VK); KIMB3, a well sorted volcanoclastic kimberlite (VK); In-situ gneissic wedges; and KIMB4, a highly variable VK with respect to country rock dilution. KIMB4 has been subdivided into KIMB4A (<25% dilution) not modelled, KIMB4B (25-75% dilution) and KIMB4C (>75% dilution). (D) Long section of Faraday 3 looking northeast.

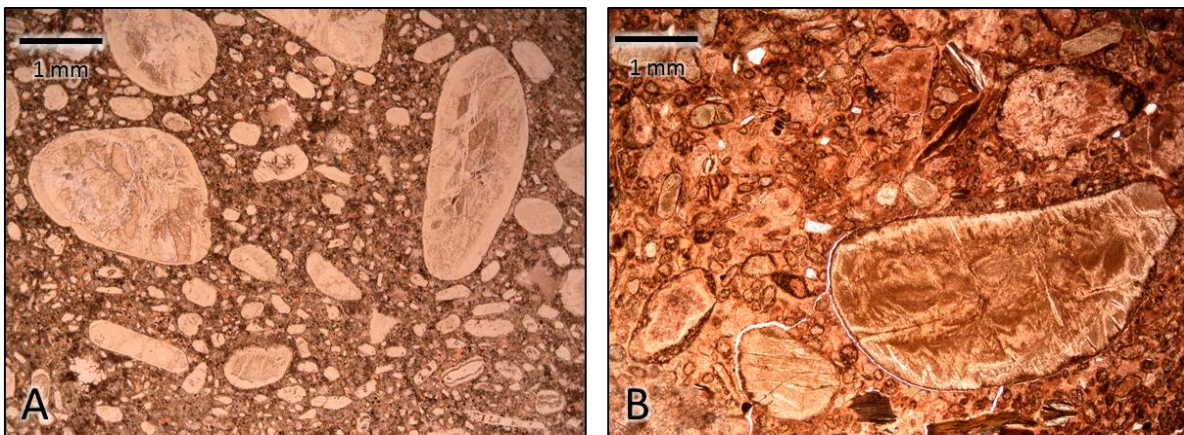


Figure 2: Photomicrographs of the two textural end-members present at Faraday 3. A) Coherent phlogopite kimberlite (KIMB1); note the uniform distribution of olivines altered to serpentine and carbonate set within a groundmass of monticellite > phlogopite > carbonate > spinel > perovskite. B) Volcanoclastic phlogopite kimberlite (KIMB2); olivine rich with thin melt selvages and common fresh country rock xenoliths set within an altered microlitic matrix with abundant serpentine.

Geology

Four kimberlite domains have been modeled in the body: KIMB1, a HK comprised of at least 2 unique phases of kimberlite, one is dominated by a phlogopite groundmass while the other phase contains conspicuous monticellite in the groundmass; KIMB2, a uniform VK; KIMB3, a well sorted VK associated with in-situ gneissic wedges which displays flow features; and KIMB4, a highly variable VK with respect to country rock dilution. KIMB4 has been subdivided into KIMB4A (<25% dilution), KIMB4B (25-75% dilution) and KIMB4C (>75% dilution). The individual phases of kimberlite are related to separate emplacement events and occur in conformable layers. Discrete, unique intervals of volcanoclastic kimberlite, HK sheets and marginal breccias also surround the body. Based on the current drilling, the main pipe infills that occupy the majority of the pipe are KIMB4B, followed by KIMB4C and then KIMB1. The VK infill is characterized by thin skinned pelletal shaped magmaclasts (formally termed pelletal lapilli) set within a serpentine and microlite dominated interclast matrix with common fresh to variably altered locally derived country rock xenoliths and xenocrysts. Mantle derived indicator minerals are rarely encountered within the drill cores and include peridotitic and less common eclogitic garnets and no ilmenite has been identified.

Conclusions

Following detailed petrography, KIMB2 and KIMB4 are further classified as Kimberley type pyroclastic kimberlite (KPK), formerly called tuffisitic kimberlite breccia (TKB) (Smith et al., 2013). KIMB3 has not been classified as such due to the presence of layering. This material is interpreted to represent a zone of flow or a volatile escape feature associated with a contact against in-situ wedges of country rock.

The textures, general geology and preliminary diamond results obtained from Faraday 3 are similar to those published from the Gahcho Kué mine to the south (Hetman et al., 2004). Only the inclined nature of Faraday 3 differs from the emplacement of the Gahcho Kué kimberlites

It is presently unclear if Faraday 1 and 3 volcanoclastic rocks are connected at depth; they share many similarities however further work is required before the relationship (if any) between these rocks can be determined.

Faraday 3 has an average grade of 2.18 carats per tonne based on microdiamond analysis, however in 2017, 42 11-inch large diamond RC drill holes were completed and a 262 tonne bulk sample was collected for the purpose of obtaining a macrodiamond parcel for preliminary grade and diamond value estimates. The macrodiamond results from the 2017 program will be combined with previous data to support a possible resource classification for Faraday 3.

References

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