10th International Kimberlite Conference, Bangalore - 2012

10IKC-300

# SEITAPERÄ GROUP II KIMBERLITE/OLIVINE LAMPROITE: LARGE 1200 MA DIAMONDIFEROUS PIPE IN KUHMO, EASTERN FINLAND

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## Introduction

The Seitaperä kimberlitic pipe in eastern Finland represents a large body, at this stage of exploration drilling, covering as much as 6.9 hectares, in a province containing numerous dikes, stockworks and rare pipes of potassic, ultramafic magmas, many of which are diamond-bearing. The Kuhmo-Lentiira-Kostamuksha (KLK) area of the Karelian craton was fluxed by phlogopite and volatile-rich magmas during 1200 – 1230 Ma extension along nearly N-S structures. The younger age for this magmatism comes from Ar-Ar dating of phlogopite from 2 Seitaperä samples and 2 dikes in the Lentiira region (together 1200 ± 3) while the older age is from Rb-Sr data on Kostamuksha rocks (Belyatskii et al., 1997; Nikitina et al., 1999). Giving a name to this group of KLK rocks has been problematic because they have mineralogical, chemical and isotopic compositions that straddle the border between Group II kimberlites and olivine lamproites.

## Petrology

Petrographically the Seitaperä rock types range from hypabyssal mica kimberlite breccias near contacts with the granitic countryrock, to porphyritic olivine-rich mica kimberlite without significant crustal contamination. Unusual globular segregation-rich sections mapped in drill core are very similar to those found in some Group II/orangeites (e.g., Finsch, SA). Whether these globular structures, many of which are olivine macrocryst or peridotite xenolith-cored, represent coarsened pelletal lapilli (indicating subaerial eruption) or some other magmatic separation process (indicating hypabyssal intrusion), remains as a critical factor to be determined (Fig. 1). Although mica-rich kimberlite types are the most common variety at Seitaperä, those dominated by olivine with abundant perovskite in a rhombohedral primary carbonate, apatite and serpentine (both clear and red-brown Fe-rich types) matrix also occur (Fig. 2A). Fresh samples of the mica-rich variety (Fig 2B) are golden brown in hand samples due to the dominance of phlogopite but more highly serpentinized varieties are thoroughly black in color. The example shown in Fig. 2B displays a well developed carbonate segregation texture with a late carbonate-apatite

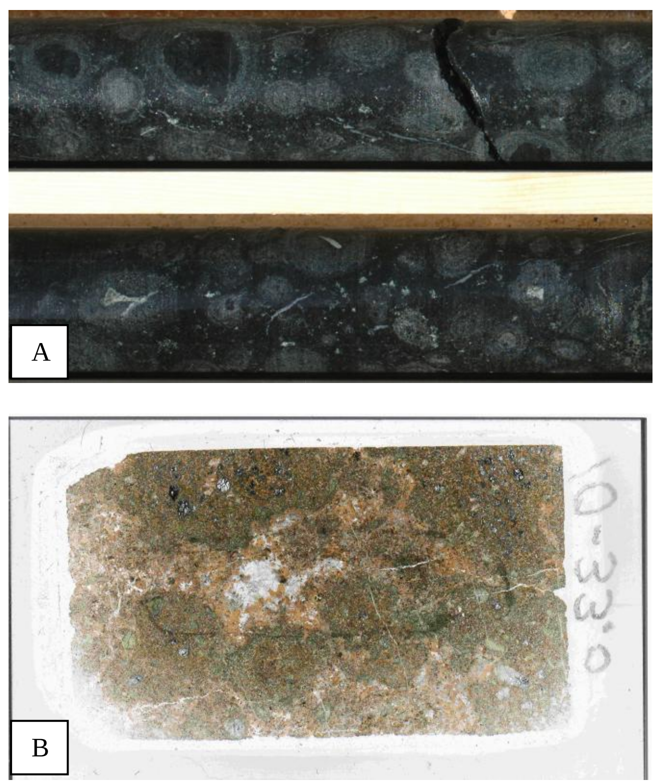


Figure 1. Drill hole SP10 from Seitaperä. (A.) Drill core showing globular structures that were originally considered potential pelletal lapilli. (B.) Thin section of same showing coarse mica-carbonate 'matrix' between globules. It is more likely the latter represent some type of immiscibility texture than recrystallized lapilli. Drill core is 4 cm in diameter and thin section is 4.8 cm, widest dimension (also Figs. 2 & 5).

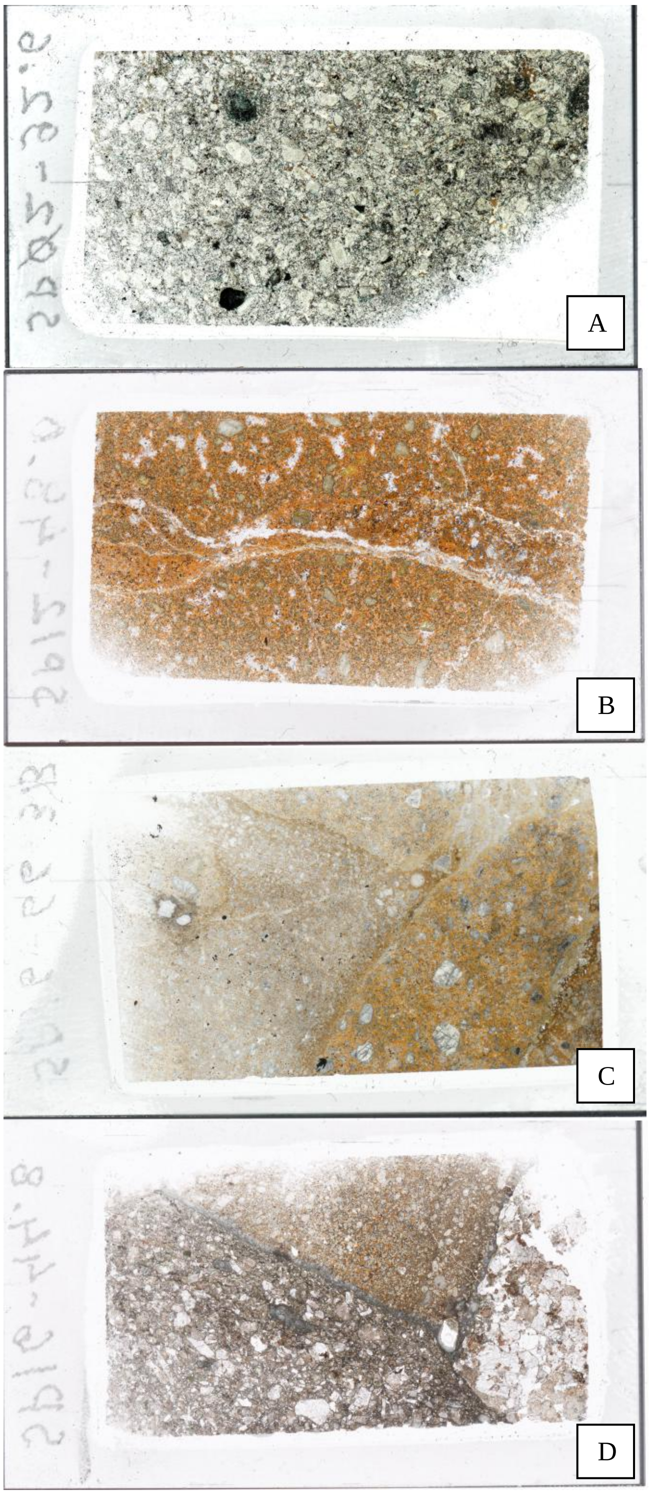


Figure 2. Seitaperä rock types in thin section. (A.) Olivine-rich kimberlite with elongate phlogopite laths in a carbonate-serpentine matrix. (B.) Mica-rich kimberlite with carbonate segregations. (C.) Example of clast in clast of a range of kimberlite textural varieties. (D.) Granite (right), granularized granite (left) and kimberlite (top).

vein cutting across all textures. Determining relative age relationships can be complex, as shown in Fig. 2C, where a coarser grained phlogopite kimberlite clast is contained within 3 other textural varieties of finer-grained kimberlite, with the variety on the left of the thin-section dominated by olivine with tiny microphenocrysts of phlogopite in an unresolved matrix. In addition to this wide range in texture and mineralogy in the purely magmatic rock types, there exists a plethora of breccia types. Fig. 2D is an example showing three rock types: 1. on the right, fractured but otherwise coherent granite that forms the bulk of the country rock for the pipe, 2. lower left, termed granularized granite, wherein angular granite fragments from mm to µm in size form a breccia containing a few percent kimberlite material. It is hypothesized that the pulverizing-fragmentation process occurred by the high velocity passage of kimberlite-related, exsolved fluids during emplacement of the pipe. In some sections of the drill core, spectacular examples of this granularized granite run for tens of meters, attesting to violent, high velocity and high energy emplacement processes.

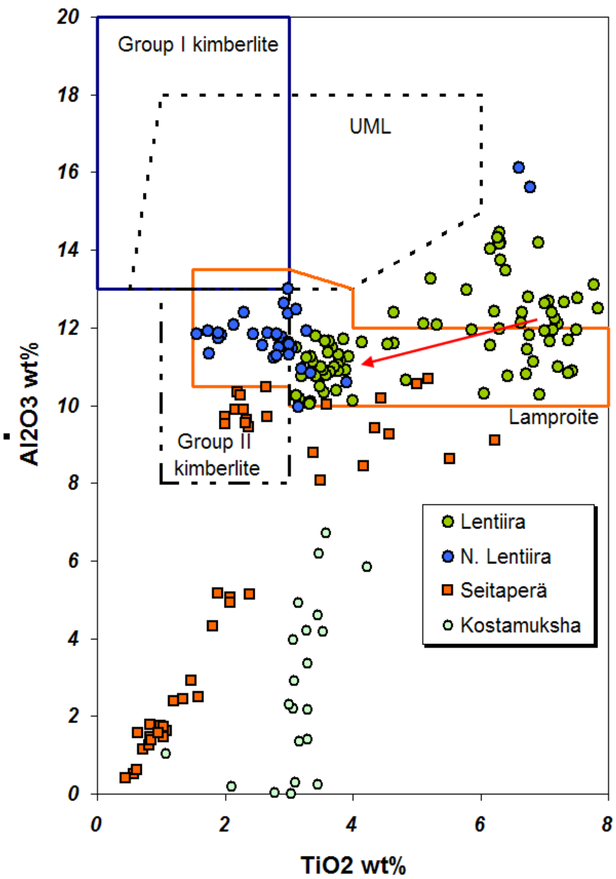


Figure 3. Mica compositions of KLK rocks (see text) plotted in $Al_20_3$ vs $TiO_2$ wt%. Seitaperä micas cover the range from lamproite to Group II kimberlite varieties.

Phlogopite compositions from Seitaperä span nearly the entire compositional range of micas known from the KLK magma suite, starting within the lamproite microphenocryst field yet following the Group II kimberlite mica evolution trend to extremely low $TiO_2$ and $Al_2O_3$ tetraferriphlogopite (Fig. 3). We expect the range of mica compositions to grow when all textural varieties have been analyzed.

Whole rock compositions also show transitional characteristics with major elements ranging from Group II kimberlite to olivine lamproites and some trace elements, such as Zr-Nb even plotting in the Group I kimberlite field of this discriminant diagram (Fig. 3).

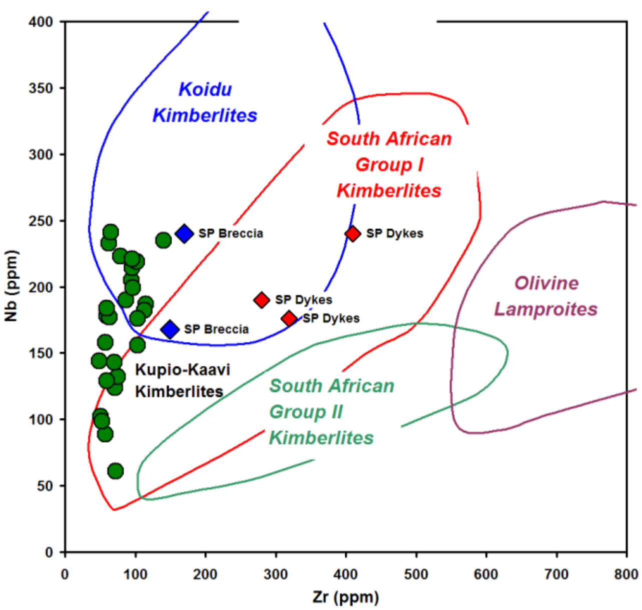


Figure 4. Nb versus Zr for whole rock analyses of various textural varieties from Seitaperä.

### Mantle Xenoliths

Studies of the numerous mantle xenoliths recovered in the Karelian Diamond Resources drilling program over the past three years have provided some extremely mantle xenolith-rich sections; in places the xenoliths are tightly packed with little to no intervening magmatic matrix. Studies of these xenoliths is ongoing, but preliminary results show that most are garnet-bearing, few have any clinopyroxene, and several examples of highly strained porphyroclastic textured peridotites have been obtained. Garnet in these xenoliths has been preferentially targeted by alteration, with little fresh garnet remaining in the peridotites. This goes a long way to explaining the chromite-rich, relatively garnet-depleted mineralogy of the concentrate from this body.

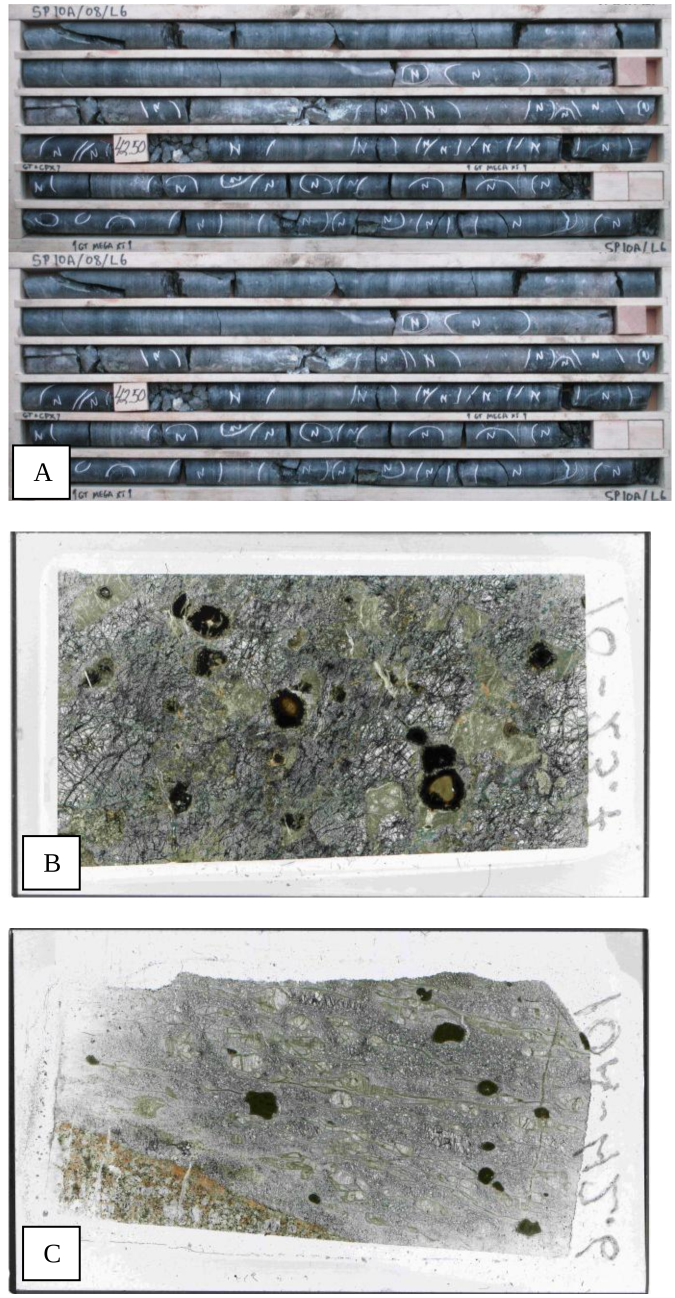


Figure 5. Drill core SP-10A. (A.) Drill core boxes from this drill hole into the center portion of the kimberlite body. Chalk marks on the core demarcated mantle xenoliths and and a few large megacrysts. Xenoliths recovered range from coarse granular peridotites (B.) to rarer highly strained porphyroclastic textured peridotites (C.). Studies of these xenoliths, particularly determining P-T conditions, is ongoing, to be augmented by sampling from similar sections of xenolith kimberlite that have been intersected during the summer 2011 drill program.

**KDR Exploration of Seitaperä**

Over the past three years, Karelian Diamond Resources has drilled 29 drill holes into the body, representing a total length of over 2,400m. During the latest round of drilling in summer 2011, rod size was changed to wide diameter, 61mm core to allow better petrological, geochemical and microdiamond sampling of the body. Previous microdiamond results have proven to be heterogeneous, and the summer 2011 drill program has produced some long intersections of kimberlite that will provide further material for microdiamond studies.

**References**


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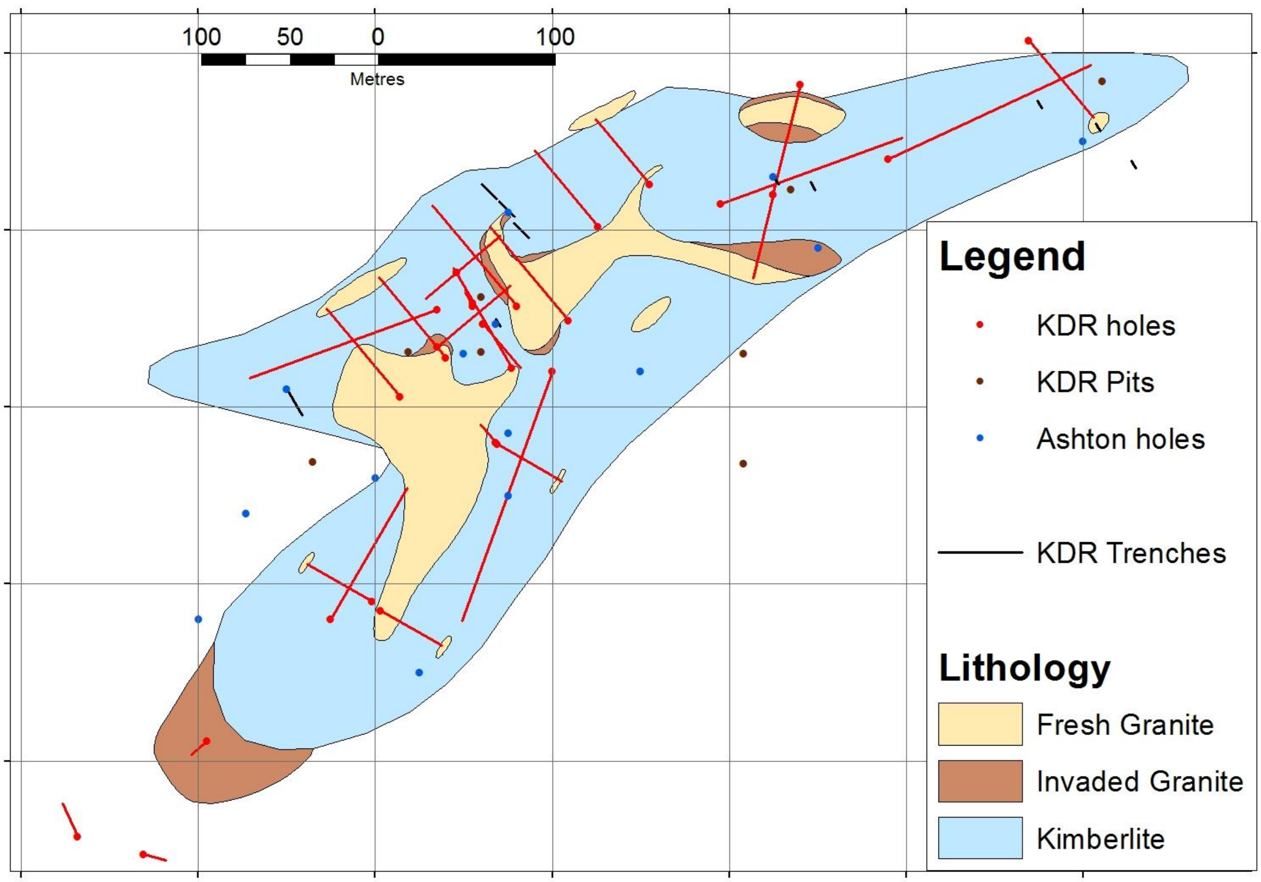


Figure 6. Drill plan of Seitaperä kimberlite, showing previous drill collars of former Ashton Mining, and new prospecting by Karelian Diamond Resources, including drilling and trenching.