The main glimmerite-carbonatite intrusions within the Siilinjärvi complex occurs as a central tabular, up to 900 m wide body of glimmerite and carbonatite running the length of the complex, surrounded by a fayalite margin. Unlike many other ore deposits of the same type, the Siilinjärvi carbonatites and glikernites are intimately mixed, varying from nearly pure glikernites (tetraferrphlogopite) to nearly pure carbonatites, with a well-developed subvertical to vertical lamination. Although not strictly stratified, generally the volume of carbonatite is greatest near the center of the intrusion, which is cut by numerous subvertical carbonatite veins (Fig. 3). Glimmerites near the outer edges of the body can be nearly carbonatite-free, yet still contain ore-grade amounts of apatite. Crossing relationships and textures suggest that, at least at the present level of exposure, some of the fayalities formed early because they occur as megacolumns within the glikernite gneisses.

Age
There have been a number of studies concerning the age of the Siilinjärvi carbonatite complex (Puustinen, 1971; Basu and Puustinen, 1982; Karhu et al., 2001; Rukhlov and Bell, 2010; Tichomirowa et al., 2006; Zozulya et al., 2007). The oldest precise data appear to be from U-Pb analyses of zircons, particularly a concordant zircon 1.57 Ga of age 1670 ± 3 Ma (Fig. 6.1) measured by G. Korsun (GTNM unpublished report, 1984) on a large zircon megacryst. These U-Pb data indicate that the Siilinjärvi complex is one of the oldest carbonatite complexes in the world. However, K-Ar data (Puustinen, 1971) and Rb-Sr isochron data (Tichomirowa et al., 2006) for carbonatite and glikernite samples with ages of 1785–1900 Ma and 1754–1831 Ma, respectively, show a greater concordance of isotopic data identifying any parental magmas in the area. The mantle-normable incompatible trace elements differ for the average glikernite and carbonatite, and the intermediate rock are shown in Figure 6. Several features can be highlighted.

• A negative Zr anomaly in the carbonatite is not seen in the glikernite, although this may be a nugget effect as zircon is generally rare.

• The large negative anomaly in Ti can have a number of origins, but likely candidates include Ti-magnetite or titanitic fractionation. This may also explain the negative Nb-anomaly in the carbonatite.

• The overall REE content of these rocks is not very high considering the apatite and calcite content in the complex. Clearly the primary magmas was not very REE-enriched.

The isotopic composition of Siilinjärvi has been determined by a number of researchers. Tichomirowa et al. (2006) measured the isotopic composition of amphibole, mica, carbonatite, and apatite from a representative suite of the Siilinjärvi core rocks and reported a carbon and oxygen oxygen composition of 8.00±0.04, 8.00±0.04, and 7.4±0.4. This composition is very uniform throughout the complex, and it plots within the field of mantle derived primary igneous carbonatites determined by Taylor et al. (1987) and de Jode et al. (2006) reviewed on a large glikernite sample from Siilinjärvi (Tichomirowa et al., 2005, 2015). The isotopic composition of the Sm-Nd data from a carbonate-apatite-phlogopite whole rock isochnor of Zozulya et al. (2007) with an inferred age of T = 265 ± 30 Ma, providing a well-constrained initial Nd of -0.1+0.2. The isotopic composition of the Siilinjärvi rocks are rather homogenous, and very much in line with the bulk of carbonatites globally.

Summary
1. Siilinjärvi represents the second largest carbonatite complex in Finland, and one of the oldest carbonatites on Earth at 2.6 Ga.

2. Mineral compositions, particularly apatite and phlogopite, do not show any systematic comminutional variation based on rock type. This is consistent with the glikernite carbonatite rocks representing an equilibrium assemblage of cumulate minerals.

3. Comparing the tetraferrphlogopite at Siilinjärvi and Siksali suggests that the parental magmas for the Siilinjärvi glikernite-carbonatite complex was moderately evolved, as evidenced by secondary magmatic alteration.

4. Further work is well likely provide a larger variety of ultramafic dike that may lead to a better understanding of the primary magmatism of this system.

5. Some form of a carbonatite magma system at K-Ar rich fluids, produced through crystallization of the magma chamber, may be the surrounding bedrock. Acting over a significant period of time, the process converted country rock gneisses into a variety of xenolith dependent on the fluid flux, composition, and distance from the fluid source.

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