Appendix 3: Whole-rock geochemistry Method

Samples, analysed by ALS in Sweden, were crushed, split and pulverized (85% > 75µm). Powders were fused using lithium metaborate flux at 1000C for ore grade trace element analyses (ME-MS81h method) to make sure all oxides were dissolved. The resulting melt was chilled and then dissolved in 4% nitric acid.

For method ME-MS61, method designed to analyse a wide range of major and trace elements, powders were digested into four different acids. Details about the methods and standards used during the different runs to obtain a calibration curve are available in Appendix 3 and on the ALS website: <https://www.alsglobal.com/services-and-products/geochemistry>.

Each element is associated with the range of concentration the method is calibrated for (Table 1). ME-MS81h is a method developed for ore grade Rare Earth Element analyse and ME-MS61 is a standard whole-rock trace element analytical method. Only one sample needed to be analysed with the Zn-OG62 method, when the concentration of Zn was above 1%.







*Table 1: Analytical methods used for whole-rock analyses (table provided by ALS)*.

The second method was added to the ore grade REE analyses because carbonatites are for concentrating other trace elements other than REE, such as Barium, Strontium, Copper, Phosphorous, Titanium, Iron and Zirconium ([Verplanck *et al.*, 2014](#_ENREF_1)).

**Reference**

Verplanck, P. L., Van Gosen, B. S., Seal, R. R. & McCafferty, A. E. (2014). A deposit model for carbonatite and peralkaline intrusion-related rare earth element deposits. *U.S. Geological Survey Scientific Investigations Report*: USGS, 58.