

Fast automated mineral analysis of kimberlite xenocrysts for diamond exploration, Lahtojoki kimberlite, Finland

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We present the results of a mineralogical analysis of mantle xenocrysts from the Lahtojoki kimberlite pipe, Kaavi-Kuopio, Finland, at the edge of the Karelian craton. We used fast automated chemical analysis of resin-mounted xenocrysts using an SDD-EDS detector on a Field Emission Gun Scanning Electron Microscope (FEG-SEM) using Oxford Instrument's INCA Feature software. Using this approach, we obtained (semi-)quantitative results of >400 xenocrysts per hour. We use these to:

1) Quantify the proportions of harzburgitic (G10), lherzolitic, wehrlitic and eclogitic and megacrystic garnets, and to identify suitable grains for subsequent laser-ablation ICP-MS analysis Ni-in-garnet thermometry;

2) Identify clinopyroxenes from gt-peridotite lithologies that are suitable for subsequent WDS (electron microprobe) analysis for single pyroxene thermobarometry, to constrain the local lithosphere-scale geotherm;

3) Identify bi-mineralic and polymineralic particles ('mini-xenoliths'), in particular ones obtained from eclogitic lithologies, for further WDS analysis for Fe-Mg exchange gt-cpx thermometry, to better constrain the depth distribution of eclogites.

Using this approach, we were able to further improve the layered model for the subcontinental mantle lithosphere at the edge of the Karelian Craton [1], to better constrain the diamond potential of the Lahtojoki pipe, and to demonstrate the value of fast automated mineralogy in diamond exploration.

[1] Lehtonen, M.L., H.E. O'Brien, P. Peltonen, B.S. Johanson, L.K. Pakkanen, (2004) Layered mantle at the Karelian Craton margin: P-T of mantle xenocrysts and xenoliths from the Kaavi-Kuopio kimberlites, Finland. *Lithos* **77**, 593-608.