Micro drill sampling in *in situ* mineral analysis

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Different types of *in situ* analysis techniques are now routinely able to deliver spatially and texturally controlled mineral chemical information on the evolution of magmas. For example Sr isotope analysis of feldspar by laser ablation ICP-MS analysis has proven its power in resolving sub-mm scale within-crystal variation. However, due to Rb interference on mass 87, LA-ICP-MS-analysis of Sr isotopes is limited to low Rb/Sr phases, which necessitates a different approach when studying for example micas or alkali feldspar. To overcome this problem micro drilling (and milling) techniques, which enable chromatographic chemistry and complementary TIMS and ICP-MS - analysis of the sample material, have been developed.

Micro drill technique is also showing promise in providing high-resolution textural control to U-Pb zircon analysis. Large age differences in zircon populations (*i.e.* Archean vs. Proterozoic) can be deciphered from LAM-ICP-MS and SIMS data on traditionally processed samples. A growing amount of evidence, however, shows that high-precision U-Pb geochronology is riddled with sample heterogeneities on a far more subtle scale, which warrants for better textural control of sample material.

For example the effects of antecrystic zircon entrainment can be studied by micro drill sampling in a wide variety of sample materials. Coupled with SIMS or single crystal CA-ID-TIMS analyses strong textural control can provide important *a priori* evidence for mineral population classification.

Micro drilling approach was utilized to study the potential zircon antecryst entrainment effects on the U-Pb geochronology of the $\sim$1.63 Ga rapakivi granites of the Wiborg batholith in southeastern Finland. Meticulous sampling and SIMS analysis was able to resolve analytically minute ($\sim$1 myr) but petrologically significant age differences between the zircon populations within the rapakivi texture-forming alkali feldspar ovoids and the corresponding groundmass zircon populations. Combined with zircon trace element analyses, this approach is able to provide detailed information about the multiple stages in the magmatic evolution of the Wiborg batholith.