
Analytical Methods -- Overview

1. Major and minor elements: EMP (routine since 1970s)
   Principles
   WDS vs EDS: advantages, drawbacks

2. Trace elements
   Ion Microprobe (since mid-1980s)
   Principles: advantages and disadvantages, COST
   Proton Microprobe (since mid-1980s)
   Principles
   Advantages, limitations, MDL, etc
   Scanning PMP/pixel mapping: fluid inclusions as example

   LAM-ICPMS (since mid-1990s)
   ICPMS principles
   Quadrupole vs sector instruments
   Time-resolved software: essential
   Lasers: types, pros and cons
   Summary- cost-effectiveness, speed, reliability: LAM-ICPMS

3. Isotopic Analysis
   Ion Probe: U/Pb, stable isotopes
   LAM-ICPMS: U/Pb, Pb isotopes
   Compare ion probe re data quality, speed, spatial resolution, COST
   LAM-MC-ICPMS
   Principles
   U-Pb vs quadrupole etc
   Other radiogenic systems: Lu-Hf, Re-Os, Rb-Sr, Sm-Nd
   Brief overview of limitations and possibilities
   Summary: comparisons

Examples of applications -- "indicator mineral" approach

Basics: anything can be an "indicator": must know your system, what to look for, use imagination + technology. Empirical "fingerprints" can work, or not; need to understand your target.
1. Trace element applications: Diamond exploration as example
   G10 discriminant: originally purely empirical, failed in several instances
   Improvement: add information on critical genetic factors
   Ni thermometry on garnets, trace element signatures: understand
   depth distribution of sampling relative to diamond window, redox etc
   \(\rightarrow\) improved discrimination of good and bad targets
   Slave Craton example: best indicator = kyanite-eclogite garnet (from DI
   studies), not G10 garnets (from graphite stability field)

2. Trace elements: Examples of their potential "indicators"
   Zircon: kimberlitic vs crustal; signatures of hydrothermal systems
   Apatite
   Tourmaline
   Cpx: use Ni-related Cr-diopsides as example?

3. Isotopic "indicators"
   Zircon: Age determinations ± Hf isotopes -- looking for specific rock
   types/settings -- cross-reference talk in main conference

   Cu-Fe isotopes in sulfides: vectors toward ore (examples)

   Potential fingerprints: Sr isotopes in apatite, titanite, cpx, feldspar, etc