Efficient search for accessory phases and chemical characterisation of major rock forming minerals for petrologic applications by combining Electron Probe Microanalysis and SEM automated mineralogy

KRAUSE, J.[1], SCHULZ, B.[2]

[1]Helmholtz-Zentrum Dresden-Rossendorf, Helmholtz-Institute Freiberg for Resource Technology, Chemnitzer Straße 40, D-09599 Freiberg, Germany, joachim.krause@hzdr.de

[2]TU Bergakademie Freiberg, Institute of Mineralogy, Brennhausgasse 14, D-09596 Freiberg, Germany

Many applications in modern petrology require the assignment of qualitative and quantitative mineral chemical data to the textural position in thin section samples. We present a novel approach that combines scanning electron microscope (SEM)-based automated mineralogy and electron probe microanalysis (EPMA).

After selection of samples, polished thin sections are prepared. In a first step SEM-based automated mineralogy (Mineral Liberation Analyser, MLA) is used in the grain X-ray mapping (GXMAP) mode which records a back scattered electron (BSE) image of the sample to identify mineral grains with defined BSE grey levels. Then a grid of EDX analyses of the grains provides the microstructural positions of rock forming minerals, in this specific case garnet. Careful classification of the EDX spectra allows a semiquantitative resolution of different zonation pattern of garnets within a sample. The quantitative chemical composition of garnet is then determined by EPMA.

The U-Th-Pb age of monazite is determined by EPMA in order to assess the temporal evolution of the studied samples. The identification of monazite (mostly <100 μm) in typical metamorphic rocks by light microscopy is cumbersome,time-consuming and afflicted with error. Therefore, spare phase search routines of MLA are used to identify and locate monazite grains and to assess their textural position. The U-Th-Pb ages along with the chemical composition of monazites are then determined with EPMA.

Combining SEM-based automated mineralogy with EPMA provides a robust and accurate procedure for localization, identification and quantitative chemical analysis of accessory and rock-forming minerals with many potential applications on petrological problems.