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XMapTools a program for X-ray images processing and thermobarometric studies

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Metamorphic rocks are made up of a mosaic of local thermodynamic equilibria. They frequently involve minerals that grew at different equilibrium conditions of Pressure (P), Temperature (T) and fO_2. The identification of relationships between microstructures and metamorphic conditions can be achieved using continuous P-T estimates in two dimensions. The resulting P-T maps can be derived from standardized X-ray images and superimposed to the observed deformation structures and assemblages at thin section scale.

XMapTools 1.6.5 (Lanari et al. 2014; find out more at http://www.xmaptools.com), is a set of MATLAB©-based graphical user interface programs to process electron microprobe X-ray images. XMapTools provides an efficient method to standardize X-ray images (raw intensities) into maps of oxide weight percent compositions. This analytical standardization is done using Castaing's approach, employing internal standards. The classification function allows to automatically separate the different minerals phases and other parts of the maps such as fractures or mineral boundaries using a K-means clustering approach. A set of $\sim$50 external functions is providing in the XMapTools package (1) to calculate structural formulae for common minerals from the standardized analyses, and (2) to estimate the P-T conditions of growth or equilibration, with the semi-empirical geothermobarometry functions. For chemically heterogeneous samples, local effective bulk (LEB) can be derived by means of standardized X-ray images. In addition, two graphical user interface modules Chem2D and TriPlot3D can be used to plot the mineral compositions into binary and ternary diagrams.

The program XMapTools can easily be coupled with forward (i.e. rock-specific equilibrium phase diagrams) and inverse (i.e. multi-equilibrium) thermodynamics models to estimate the P-T conditions of crystallization at the microscale. This presentation introduces XMapTools and includes typical examples of its functionality using examples from the Himalayas, the Atbashi range and the Western Alps.

Lanari, P. et al. (2014). XMapTools: a MATLAB©-based program for electron microprobe X-ray image processing and geothermobarometry. Computers and Geosciences. 62, 227-240.