Geophysical Research Abstracts
Vol. 20, EGU2018-12880, 2018
EGU General Assembly 2018

Modelling metamorphic reactions and textures along continuous pressure-temperature-time paths

C. T. (Tom) Foster

University of Iowa, Earth and Envrironmental Sciences, United States (tom-foster@uiowa.edu)

The pressure-temperature histories of metamorphic rocks span a broad range of times and P-T conditions. Most modern metamorphic studies extract estimates of P & T at a few points along the P-T path, connect them with lines, and present the resulting plot as the P-T history of the rock. However, the duration of metamorphic events ranges from a few thousand years in shallow contact settings to many millions of years in the deeper parts of orogenic belts and T & P conditions span hundreds of degrees and many kilobars, depending on the P-T path. This means that the environment and processes operating during significant portions of a metamorphic event are not well resolved by traditional approaches. There is still much to be learned about mineral nucleation and growth during metamorphism, but advances in thermodynamic databases, kinetic models, and computing power allows the nucleation, growth, and dissolution of metamorphic crystals to be modelled in rocks following different types of P-T-t paths. Variations in mineral compositions, sizes, and spatial distribution can be followed as a function of time at the scale of a hand-specimen in two dimensional sections or 3-D volumes to gain insight into metamorphic processes that are dependent on parameters such as dP/dT, dT/dt & dP/dt, and the timing of Tmax & Pmax. The procedure uses: a) THERIAK or GIBBS to calculate stable and metastable equilibria as a rock progresses along a P-T path, b) irreversible thermodynamics to calculate local reactions and domains of equilibrium for each time interval, and c) local reaction affinities at each point in the rock to calculate nucleation patterns. The result is a comprehensive view of how a rock develops along a specified P-T-t path with various boundary conditions. The method will be illustrated using pelitic bulk compositions, but it is generally applicable to all compositions.