Simulated microstructure development during prograde metamorphism

P. ÖZFIRAT*, M.J. CADDICK AND A.B. THOMPSON

Institute for Mineralogy and Petrology, ETH Zürich, 8092 Zurich, Switzerland
(*correspondence: pinar.ozfirat@erdw.ethz.ch)

Rocks undergo progressive changes in mineralogy, mineral composition, and microtexture during metamorphism. Changes in mineral assemblage and composition can be readily predicted by equilibrium thermodynamics, but textural maturation is currently not easily predictable. Textures that are common to many rocks that experienced similar *P-T*-time histories, indicate which key internal processes control formation of these textures.

Here we model the porphyroblast and matrix texture, and chemical zoning formed during a prescribed metamorphic path, deducing the ranges of significant external parameters (chiefly temperature range, rate of change of temperature, and metamorphic duration) that produce final textures comparable with natural examples. Petrographic observations to be matched include the range of crystal sizes within a single sample, the spatial distribution of crystals of any specific phase, the chemical zoning of crystals as a function of crystal size, and the lengthscale of chemical equilibrium between multiple grains.

We focus on isobaric prograde metamorphism, analogous to heating of pelitic rocks due to a proximal magmatic intrusion. This allows a large ΔT and easily predictable timescale, without necessarily introducing significant deformation. Diffusion of certain important elements (Mg, Fe, Ca, Mn) within crystals and along grain boundaries has been tracked, and crystal growth due to changing temperature has been permitted. Preliminary results indicate that with simple modifications of ELLE [1] experiments, realistic rock microtextures can be simulated for geologically consistant parameter ranges.

[1] Jessell, M., Bons, P., Evans, L., Barr, T. & Stüwe, K. (2000), *Computers and Geosciences* **27** 17-30.

Genetical modelling of the epithermal Hg deposit of Haliköy, Sb deposit of Emirli and Au deposit of Küre in the rift zone of the Küçük Menderes, Western Anatolia, Turkey

NEVZAT ÖZGÜR

Süleyman Demirel Üniversitesi, Research and Application Centre for Geothermal Energy, Groundwater and Mineral Resources, 32260 Isparta, Turkey
(noezguer@mmf.sdu.edu.tr)

From Early to Middle Miocene, the continental rift zones of the Büyük Menderes, Küçük Menderes and Gediz within the Menderes Massif were formed by extentional tectonic features, which strike E-W generally and are represented by a great number of thermal waters, epithermal mineralizations and volcanos with ages up to 18.000a. The thermal waters and epithermal mineralizations are related to faults which strike preferentially NW-SE and NE-SW and locate diagonal to general strike of the continental rift zones. These faults are probably generated by compressional tectonic stress which leads to deformation of uplift between two extentional rift zones.

The Hg deposit of Halıköy, Sb deposit of Emirli and Au deposit of Küre are located in the eastern part of the continental rift zone of the Küçük Menderes within the Menderes Massif in Western Anatolia, Turkey. The ore mineralizations of these three deposits is associated with Paleozoic altered mica schists. At the surface, the host rocks are intensively altered by interaction with the circulation of geothermal fluids. Therefore, the ore fields can be recognized by a distinct color change of the rocks. The hydrothermal alteration is noticable at the surface which is distinguished by phyllic, argillic and silicic alteration zones.

The isotope ratios of $\delta^{18}O$ and $\delta^{2}H$ in fluid inclusions of quartz samples of Halıköy, Emirli and Küre show a similarity with active geothermal systems. By using geological, geochemical, isotope geochemical, ore and rock microscopical and microthermometric methods these deposits in the rift zone of the Küçük Menderes have been modelled genetically and can be considered as fossile geothermal systems.