

From Garnet to Orogeny: *Seeing a mountain in a mineral grain*

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Abstract

Understanding the physical and chemical properties of minerals and rocks, and their geodynamic implications has been among the primary goals of modern geoscience research. In this presentation, I will discuss selected topics of some interesting minerals and rocks from a metamorphic petrologist's view. Metamorphic petrology is the study of metamorphic rocks and aims to decipher the crustal evolution in terms of pressure, temperature, deformation, and time. A great percentage of metamorphic rocks on the Earth crops out within orogenic belts, which commonly involve processes like subduction and collision in geologic history. Recent petrological work has successfully demonstrated that minerals can be a very robust time-capsule. In many cases, a great portion of the tectono-metamorphic history of a mountain range might have been well preserved within a porphyroblast (e.g. garnet, pyroxene) or an accessory mineral (e.g. zircon). To read such geologic records in minerals or rocks, scientists have to rely on modern techniques (e.g. electron micro-beam analysis) and theories (e.g. phase equilibria). Thanks to the innovations in science and technology for the past two decades, petrologists and mineralogists nowadays can observe the features and characterize the chemical/physical nature of minerals or rocks down to submicron scales. In other words, we can "see" a mountain in a tiny mineral grain. I will introduce some of the optical and electron micro-beam techniques, and their applications to some interesting samples from the Qinling-Dabie orogen in central China and the Tananao basement complex of eastern Taiwan. In a very special case, the microstructures, e.g. precipitates, exsolution lamellae, zoning, and inclusions, of a clinopyroxene from the northern Dabie Mountain indicate that more than four stages of metamorphic transformation can be inferred. However, geochronological constraint on such a complex P-T path remains a great challenge. On the other hand, there appears to be a huge gap between microscopic observation and macroscopic conception. How to bridge such a gap will be one of the major tasks for future work. To conclude this presentation, I will summarize some personal reflections and perspectives on the related issues.