Micro-textural studies of granulite-facies rocks from the Eastern Madurai Domain, Southern India: Evidence for decompression at high temperatures.

T. SARKAR [1], A. DEY [2], S. MUKHERJEE [2]

[1]Department of Earth Sciences, IISER Kolkata, Mohanpur-741246, West Bengal, India
[2]Department of Geological Sciences, Jadavpur University, Kolkata-700032, India

The history and evolution of the granulite terrane of South India with respect Proterozoic supercontinent formations is a matter of ongoing debate. Unraveling the evolutionary history of different rock suites from this high-grade terrane is the key in understanding the geodynamic evolution of the entire terrane. With this aim, we present micro-textural studies from a mafic granulite enclave and the surrounding garnet-orthopyroxene-cordierite gneiss from the western part of Eastern Madurai Domain.

The Madurai domain of the granulite terrane of South India exposes Neoarchean to Paleoproterozoic quartzofeldspathic gneiss with mafic enclaves associated with younger supracrustal rocks. Optical microscopy and high-resolution back scattered electron (BSE) images reveal the peak metamorphic mineral assemblage in the mafic granulite as garnet + clinopyroxene + amphibole + plagioclase + quartz, whereas in the garnet-orthopyroxene-cordierite gneiss as garnet + orthopyroxene + plagioclase + K-feldspar ± biotite. The peak assemblage in the mafic granulite has been replaced by spectacular symplectitic intergrowth of orthopyroxene and clinopyroxene, growing over compositionally zoned plagioclase grains, which are surrounded by intergrowth of orthopyroxene + ilmenite. In the garnet-orthopyroxene-cordierite gneiss, relics of resorbed garnet lie within the orthopyroxene – cordierite ± sillimanite symplectites, pseudomorphing coarse-grained garnet.

Quantitative thermobarometry combined with thermodynamic modeling indicates a near-isothermal decompression P-T path from at least 800ºC at ~11.5 kbar to ~750ºC at ~9 kbar, responsible for formation of the symplectitic assemblage in both rock types. Low geothermal gradient (dt/dz~21ºC/km) during the inferred high-pressure metamorphism followed by rapid decompression presumably reflects a collisional setting during the time of metamorphism.