



## **Electron microscopic evidence for syntectonic transition from pyrite to pyrrhotite in low-grade metapelites from southern Taiwan**

Yi-Syuan Chen and Wei-Teh Jiang

Department of Earth Sciences, National Cheng Kung University, 1 University Road, Tainan 70101, Taiwan

A pyrite-pyrrhotite boundary occurs across the mountain-building Daguanshan fault zone in accordance with an age gap and a grade change from the prehnite-pumpellyite to lower greenschist facies in the Tertiary slate belt of the Backbone Range, southern Taiwan. This study characterized the microstructural and mineralogical changes of metapelites across the boundary utilizing high-resolution scanning electron microscopy, coupled with electron backscatter diffraction and X-ray energy-dispersive spectroscopic techniques.

West of the fault zone, the pyrite zone is characterized by a weak foliation roughly parallel to elongated patches or layers of framboidal and irregular aggregates of fine-grained pyrite that show partial recrystallization and overgrowth features in association with neof ormation of chlorite, chalcopyrite and Fe-bearing sphalerite and local crystallization of coarser grained euhedral pyrite crystals. In the pyrite-pyrrhotite borderland across the fault zone, a strong S1 foliation is present due to strongly recrystallized phyllosilicates, quartz and carbonates and the proportion of fine-grained pyrite including framboidal pyrite diminishes in part due to pseudomorphic replacement by quartz and pyrrhotite. Sphalerite, chalcopyrite and selenium-bearing galena are present in the interstices among or in the vicinity of pyrite microcrystals, and form inclusions within or intimate intergrowths with pyrrhotite. In addition, nickel- and iron-rich cobaltite was found to be in close contact with pyrrhotite. The neoformed pyrrhotite ( $\text{Fe}_7\text{S}_8$ ) occurs in forms of bands of disseminated submicron-sized crystals and elongated aggregates of coarse-grained crystals with irregular outlines confined mainly by recrystallized silicates, more or less parallel to the S1 foliation. Complete or partial pseudomorphic replacement of framboidal pyrite microcrystals by pyrrhotite was evidenced by coalescing octahedral grains of pyrrhotite having a single crystallographic orientation and a framboidal texture. Additional pyrrhotite growth over such pseudomorphs often forms aggregates of coarser grains accompanying rutile, locally associated with calcite or allanite. In the pyrrhotite zone east of the fault zone, pyrrhotite occurs as larger subhedral to euhedral crystals invariably intergrown with rutile and is associated with the S1 foliation in the absence of allanite, pyrite and other sulfide minerals.

The result indicates that the pyrite-pyrrhotite boundary marks a syntectonic metamorphic reaction from pyrite to pyrrhotite in the Taiwan orogeny. The transition initially occurred via progressive dissolution and crystallization at microscale and was coeval with intense silicate recrystallization and mobilization of Cu, Zn, Pb, Se, As, Ni, Co, Ti and REE.