

White mica domain formation: A model for paragonite, margarite, and muscovite formation during prograde metamorphism

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ABSTRACT

Scanning transmission electron microscopy images of the 00 l white mica planes in crystals from central Switzerland and Crete, Greece, reveal that domains of paragonite, margarite, and muscovite are ordered within the basal plane. Energy dispersive X-ray analyses show that both cations in the interlayer and in the 2:1 layer have ordered on the scale of tens to hundreds of nanometers. Domain boundaries can be both sharp and crystallographically controlled or diffuse and irregular. A model outlining the domain formation process is presented that is consistent with X-ray powder diffraction and transmission electron microscopy data. The domain model incorporates aspects of a mixed-layered and a disordered compositionally intermediate phase models. The main feature of the model is the formation of mica species that segregate within the basal plane and contradict the notion of homogeneous layers within mixed-layer phases. Implications for the formation of all diagenetic and very low-grade metamorphic 2:1 sheet silicates are discussed.

Keywords: Muscovite, paragonite, margarite, TEM, STEM, low-grade metamorphism, white mica formation