
The Transformation of Illite to Muscovite in Pelitic Rocks: Constraints from X-ray Diffraction

M. Gharrabi¹, B. Velde¹ and J.-P. Sagon²

¹ Laboratoire de Géologie, Ecole Normale Supérieure, CNRS 1316, 24 rue Lhomond, 75231 Paris, France

² Laboratoire de Pétrologie, Université de Paris VI, 4 pl. Jussieu, 75000, Paris, France

Abstract: The boundary between diagenesis and metamorphism most likely involves the change of illite into mica. Observations of this change can be made using decomposed X-ray diffraction (XRD) spectra of illitic clay mineral assemblages in pelitic sedimentary rocks.

XRD analysis of the (003) diffraction peak of diagenetic illites indicates that there are 2 components, one of small coherent diffraction domains and another of larger domain size. Peak width, shape and position define these fractions. The smaller domain size material in diagenetic rocks is highly illitic (>95%) but contains some smectite layers and can be best described by Gaussian shapes. The grains with larger diffracting domains show no expanding layers.

Metamorphic illites (probably muscovites) show no smectite interlayers in any fraction. In the transition from sedimentary and diagenetic to metamorphic illites, new grains of smectite-free illite are formed at the expense of the older minerals. This suggests that the new metamorphic minerals are recrystallized phases. Metamorphism of illites then produces new mica phases.

Key Words: Decomposition • Diagenesis • Illite • Metamorphism

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