Chlorite as an indicator of grade in incipient metamorphic conditions: an X-ray diffractometric approach

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On the basis of the analogies between diagenetic and low-grade metamorphic reaction progresses of illite-muscovite and chlorite, X-ray diffraction (XRD) chlorite crystallinity index (ChC) was suggested to apply as a complementary tool for metapelites. The applicability of ChC for monitoring metamorphic grade of fine-clastic metasedimentary rocks was also demonstrated by statistical evaluation of a large data set.

ChC, apparent mean crystallite size and lattice strain, and composition of chlorite from coexisting metapelites and basic meta-igneous rocks was determined by XRD and EMP methods. The samples originated from Paleozoic and Mesozoic formations of the Bükkium (innermost Western Carpathians, Hungary) that suffered Alpine (Cretaceous) orogenic metamorphism. Metapelites range from late diagenesis to epizone, whereas metabasic rocks vary from prehnite-pumpellyite through pumpellyite-actinolite to greenschist facies. ChC and mean crystallite size increase, the proportion of mixed-layers in chlorite decreases, whereas the calculated lattice strain does not change significantly with increasing metamorphic grade. The apparent increase in calculated Al^{IV} content of chlorite with increasing grade is mainly related to the decrease of contaminants (mixed-layered or discrete intergrown phases of mostly smectitic composition). Thus, the chlorite crystallinity method may complement the correlation of the illite crystallinity-based zonal classification of meta-sediments and the mineral facies classification of metabasic rocks.