
Statistical Analysis of Clay Mineral Assemblages in Fault Gouges

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Abstract: The clay mineral distributions in fault gouges from shear zones in several slates, phyllites, mica schists, and gneisses of the Eastern Alps were statistically analyzed for consistencies in their occurrence. Discriminant analyses suggested significant groupings of the most common minerals: illite, smectite, kaolinite, and chlorite. The clay mineral distributions in the fault gouges appeared to be related to regional geological units. No relationship, however, was found with the piles of nappes of the Alps. The influence of the mineralogical composition of the parent rock on the clay mineral assemblages appeared to be minor, but the shear behavior of the parent rocks, which is mainly a function of rock strength, was found to control the formation of the clay minerals. In hard rocks (e.g., gneisses), solution transfer at an early stage of the shear process was apparently extensive enough to favor kaolinite formation. As shearing continued, the rate of solution transfer gradually decreased and favored the formation of smectite. In softer rocks (e.g., phyllites), the extent of solution transfer during the shear process was less than in the gneisses and generated an environment that favored smectite formation, even during the early stages of shearing.

Key Words: Chlorite • Discriminant analysis • Fault gouge • Illite • Kaolinite • Shearing • Smectite • Solution transfer

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