
Burial and Contact Metamorphism in the Mancos Shale

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Abstract: Clay samples from shales and bentonites in the Mancos Shale (Cretaceous) and its stratigraphic equivalents in the southern Rocky Mountain and Colorado Plateau have been analyzed by X-ray powder diffraction methods. The major clay in the shales is mixed layered illite/smectite, with 20– 60% illite layers. The regional distribution of ordered vs. random interstratification in the illite/smectite is consistent with the concept of burial metamorphism in which smectite interlayers are converted to illite, resulting finally in ordered interstratification. The interstratification data correlate with other geologic information, including rank of coal and Laramide tectonic activity. In addition, contact metamorphism of the shale by Tertiary igneous intrusions produced a similar clay suite. Chemical variation within these shales (particularly the presence or absence of carbonate) affected the clay conversion reactions in the interbedded bentonites and the shale itself during the early stages of transformation. In extreme cases, shales and bentonites from a single outcrop may contain clays that range from pure smectite (calcareous shales) to ordered illite/smectite containing $\geq 50\%$ illite layers (noncalcareous shales). The use of mixed-layered illite/smectite compositions to infer thermal regimes, therefore, may be misleading unless allowance is made for local chemical controls.

Key Words: Bentonite • Burial metamorphism • Illite • Interstratification • Shale • Smectite • X-ray powder • diffraction

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