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# Role of Iron Reduction in the Conversion of Smectite to Illite in Bentonites in the Disturbed Belt, Montana

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**Abstract:** Cretaceous bentonites were collected in outcrop from the Sweetgrass Arch and the Disturbed Belt in Montana. The mixed-layer illite-smectite (I/S) components of the bentonites from the Sweetgrass Arch have from 0 to 25% illite layers and no detectable structural Fe<sup>2+</sup>, whereas the samples from the Disturbed Belt have from about 25 to 90% illite layers, and all contain Fe<sup>2+</sup>. A positive correlation ( $r = 0.89$ ) exists between the percentage of structural iron that is Fe<sup>2+</sup> and the amount of fixed interlayer K in the I/S.

The higher percentage of illite layers in the samples from the Disturbed Belt is attributed to reactions related to elevated temperatures caused by burial beneath thrust sheets. The increase in Fe<sup>2+</sup>/Fe<sup>3+</sup> with increasing percentages of illite layers is tentatively attributed to a redox reaction involving the oxidation of organic matter. Although there is no statistical evidence for an increase in octahedral charge with an increase in illite layers when all the samples are considered together, iron reduction may have contributed as much as 10 to 30% of the increase in total structural-charge that occurred in any given sample during metamorphism. The remaining structural charge increase can be attributed to the substitution of Al<sup>3+</sup> for Si<sup>4+</sup> in the tetrahedral sites.

**Key Words:** Bentonite • Illite • Iron reduction • Mixed layer • Montana • Smectite

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