
Smectite-to-Illite Conversion in a Geothermally and Lithologically Complex Permian Sedimentary Sequence

C. Bühmann

Soil and Irrigation Research Institute, Private Bag X79 Pretoria 0001, Republic of South Africa

Abstract: The <0.5- μm fraction of 120 samples from a lithologically complex Permian sedimentary sequence, underlying dolerite intrusive sheets, has been characterized by means of X-ray diffraction to establish I/S compositions as a function of temperature, lithology and time duration. Illitization has been active over the entire 210 m depth range and the clay data reflect both the local pattern of contact metamorphism and the more regional trend of heat flow during burial. A continuum exists in the illite proportions of the illite/smectite interstratifications with increasing distance from the intrusive sheet ranging from R = 3 with less than 5% smectite via R = 2 and R = 1 to R = 0 with up to 70% smectite. In the mixed-lithology section, individual component layers in the I/S within similar distance levels, but between contrasting lithologies, appear to vary only within a very restricted compositional range. In the massive mudstone strata, however, more silty parts contain I/S of a higher degree of ordering and lower expandability. Calcite contents are reflected in a higher rate of chlorite formation, but not in the I/S composition. A satisfactory inverse correlation was found between percent smectite in I/S and vitrinite reflectance in the lithologically complex section. R = 1 interstratifications are associated with a maximum vitrinite reflectance of 1.07– 1.29 and R > 1 phases with 1.93– 2.7, indicating that time duration is not a controlling factor in the illitization process in this facies. R = 0 interstratifications are present in a massive mudstone/siltstone sequence situated furthest from the igneous intrusives, and display vitrinite reflectance values of 1.42– 1.52. No satisfactory explanations for this finding can be offered.

Key Words: Burial diagenesis • Contact metamorphism • Lithology • Paleotemperature • Vitrinite reflectance

Clays and Clay Minerals; February 1992 v. 40; no. 1; p. 53-64; DOI: [10.1346/CCMN.1992.0400107](https://doi.org/10.1346/CCMN.1992.0400107)

© 1992, The Clay Minerals Society

Clay Minerals Society (www.clays.org)
