Comparison of Clay and Zeolite Mineral Occurrences in Neogene Age Sediments from Several Deep Wells

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Abstract: Clay and zeolite mineral assemblages were determined for five deep wells in volcano-clastic sediments (Japan) and for one well in mudstones (California). The clay mineral suites in these wells showed a gradual change with depth of illite/smectite (I/S) composition, which increases in smectite content in the upper portion towards a fully expandable mineral (2-3 -- 3 -- km -- depth) and then decreases in smectite content with depth (2-5 -- km). The temperature of transformation or recrystallization to a fully expandable smectite mineral is about $60^\circ - 70^\circ$ C in non-zeolite bearing rocks and $70^\circ - 90^\circ$ C in zeolite-bearing rocks, with no apparent dependence on time. Comparison is made between the I/S smectite content in the lower part of the wells (i.e., below the occurrence of the fully expandable mineral) and the zeolite mineral zone boundaries. The 60% smectite composition was found at $108^\circ - 118^\circ$ C maximum burial temperatures. The zeolite II/III zone boundary, i.e., the onset of the analcime zone, occurs between 85° and 95° C and may be slightly time-related in the span of 1-15 Ma. The clay and zeolite minerals can be used as temperature indicators in the range of the Neogene age.

Key Words: Analcime • Geothermal temperature • Illite • Diagenesis • Smectite • Zeolite

Clays and Clay Minerals; August 1988 v. 36; no. 4; p. 337-342; DOI: <u>10.1346/CCMN.1988.0360407</u> © 1988, The Clay Minerals Society Clay Minerals Society (<u>www.clays.org</u>)