
Hydration States of Smectite in NaCl Brines at Elevated Pressures and Temperatures

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Abstract: A high-pressure, high-temperature cell was used to monitor the basal X-ray powder diffraction spacing of Na-saturated Cheto montmorillonite in contact with NaCl solutions at temperatures as high as 200° C and hydraulic pressures as high as 6700 psi (456 bar). The 003 and 005 reflections were used to determine d(001) of the smectite. The montmorillonite, in 1 molal NaCl, exhibited a d(001) of 15.4 Å at room temperature and pressure and a d(001) of 15.6– 15.7 Å under 500– 2200 psi hydraulic pressure. The basal spacing of the clay in 5 molal NaCl was 15.2 Å and 15.33– 15.45 Å at 1 bar and 750– 6700 psi (53– 456 bar), respectively. Because no changes in the basal spacing with increasing temperature to 200° C were detected in any of the experiments, this Na-smectite probably exists as a two-water-layer complex under diagenetic conditions.

Key Words: Brine • Diagenesis • Hydration • Pressure • Smectite • Temperature

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