The Gypsum-Anhydrite Equilibrium at 1 Atmosphere Pressure[1]

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ABSTRACT

The equilibrium temperature for the reaction $CaSO_4 \cdot 2H_2O = CaSO_4 + 2H_2O$ (liq., in soln) has been determined as a function of activity of H_2O (^aH_2O) of the solution. Synthetic gypsum and anhydrite or 1 : 1 mixtures were stirred in solutions of known ^aH_2O at constant temperature for periods up to 12 months. Direction of reaction was established by the disappearance of one solid and growth of the other. Conversion of gypsum to anhydrite and of anhydrite to gypsum was often complete. Identification was based on optics and X-rays. Activity of H_2O was varied from 0.960 to 0.770. The reversible equilibrium was approached from both sides and is defined by

^aH_2O	$T°C$
0.960	55°
0.845	39°
0.770	23°

Activity of H_2O of the solution was varied by adding Na_2SO_4 or H_2SO_4. Provided the solids do not change in composition, the equilibrium is a function of ^aH_2O only; $K_{p,t} = {}^aH_2O$; and is independent of the constituents in solution. ^aH_2O values were calculated from vapor pressure data. Extrapolation to solutions in the system $CaSO_4$-H_2O (^aH_2O = 1.000) yields 58° ± 2°C. This is within values predicted from thermodynamic calculations (46° ± 21°C) but higher than that based on solubility measurements (38° to 42° C). The new data indicate that in sea-water saturated with halite, gypsum will dehydrate above 18°C. The scarcity of anhydrite in modern evaporite deposits is predicted by the present results. The available data on the temperature-salinity conditions under which anhydrite and gypsum exist in the lagoons of the Trucial Coast, Persian Gulf, are completely compatible with the present experimental data.

[1] No paper available for publication.