

A thermodynamic and mineralogical study of the (Ba,Sr)SO₄ solid solution: application to the calculation of the saturation state of the world's ocean with respect to substituted barites

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The mode of formation of barite in the marine environment is still under debate, although there is ample evidence of the essential role of living organisms. Its stability in the marine environment has been investigated through the calculation of the saturation indices of the world's ocean waters with respect to pure barium sulfate. It appears that the vast majority of the oceans are undersaturated with respect to pure barium sulfate. It is paradoxical to find barite everywhere in a globally undersaturated ocean.

In order to investigate the role of Sr substitution on barite stability, we have constructed Lippmann diagrams for the (Ba,Sr)SO₄ system to analyze the GEOSECS data (49 stations, 1289 data points) for the world's ocean. We report results for the ideal and regular solid solution models. We find that the conclusions previously obtained for the pure barite case are not changed: the saturation state of ocean waters with respect to a regular solid solution is close to that for pure barite. At equilibrium with seawater, the solid solutions contain a few percent in Sr, in agreement with what has been observed in marine barites recovered from sediment cores. Equilibrium values of the Sr content of the solid solutions in the intermediate (0.2-0.8) range are found for surface waters where the Ba/Sr ratio is low, but these waters are undersaturated.

We will also present results from a SEM study of composition zoning in barite and celestine.