

The solubilities of the quaternary system $\text{Li}_2\text{CO}_3 + \text{Na}_2\text{CO}_3 + \text{K}_2\text{CO}_3 + \text{H}_2\text{O}$ at 273 K

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The salt-water system phase diagram is the direction for the comprehensive and utilization of saline brines. System $\text{Li}_2\text{CO}_3 + \text{Na}_2\text{CO}_3 + \text{K}_2\text{CO}_3 + \text{H}_2\text{O}$ is one of the basic systems for carbonate alkaline brines.

Experimental Method

The isothermal evaporation method was used [1]. The experiments were done at (273.15 ± 0.1) K, and a thermostatic evaporator was used for evaporation. The composition of solution was determined by analytical method. The crystals were analyzed by X-ray diffraction.

The densities of solution were also determined by specific gravity bottle method [1] and used for the mass fraction calculation of components.

Discussion of Results

The phase diagram consists of five univariant curves, two invariant points and four crystallization fields corresponding to single salt Li_2CO_3 , $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$, $\text{K}_2\text{CO}_3 \cdot 3/2\text{H}_2\text{O}$ and double salt $\text{KNaCO}_3 \cdot 6\text{H}_2\text{O}$. Double salt $\text{KNaCO}_3 \cdot 6\text{H}_2\text{O}$ is formed in this system, which was also founded in the Harvie's study at 298 K [2]. Whereas, $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ is the only crystal form for sodium carbonate, the heptahydrate and unhydrate sodium carbonate are not found.

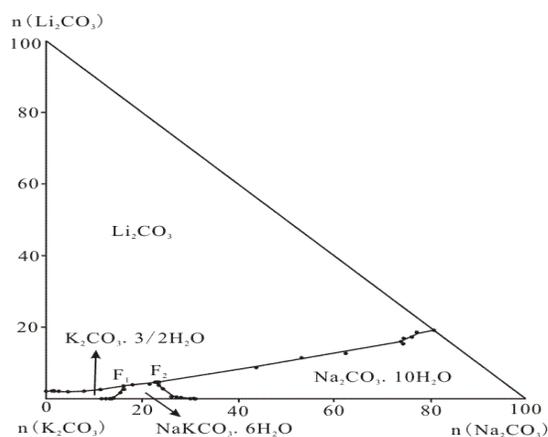


Figure 1: The phase diagram of the system $\text{K}_2\text{CO}_3 + \text{Na}_2\text{CO}_3 + \text{Li}_2\text{CO}_3 + \text{H}_2\text{O}$ at 273 K.

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- [1] Zeng *et al.* (2005) *J. Chem. Eng. Data*, **50**, 928-931.
[2] Harvie *et al.* (1984) *Geochim. Cosmochim. Acta*, **48**, 723-751.

Fractionation of multiple sulfur isotopes during phototrophic S oxidation

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Here we report multiple sulfur isotope measurements (^{33}S , ^{34}S , and ^{36}S) of sulfur compounds associated with the oxidation of H_2S and S^0 by the anoxygenic phototrophic S-oxidizing bacterium, *Chlorobium tepidum*. We measure small inverse isotope effects during H_2S oxidation, and slightly larger normal isotope effects during S^0 oxidation, resulting in the net production of sulfate that is slightly depleted in heavy isotopes from the starting sulfide. Utilizing the fractionation factors for phototrophic S oxidation processes that we calculated from these experiments, we present a steady-state box model of the isotopic composition of ocean sulfur reservoirs. Our model indicates that, although the isotopic effects associated with phototrophic S oxidation are small, this process can significantly alter the overall isotopic composition of the system through the redistribution of mass. The trends produced in our models suggest that phototrophic S oxidation has the potential to mask the isotopic signal of sulfur compound disproportionation if greater than 33% of elemental sulfur in the system is re-oxidized to sulfate. This result has important consequences for interpretation of ancient S isotope records during periods of widespread photic zone euxinia, such as proposed for the mid-Proterozoic.