

Formation and solubility of hydrous carbonates formed in alkaline lakes under freezing condition

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Alkaline lakes have functions of absorption of atmospheric CO₂ to natural water and fixation of dissolved carbonate by mineralization. Therefore, it has been considered that alkaline lakes located in arid area inside the continents play important roles in carbon cycle on the earth surface (Finley et al., 2015; Fukushi and Matsumiya, 2018).

The common carbonate minerals are calcite and aragonite in natural environment. On the other hand, monohydrocalcite (MHC) is formed in alkaline lakes as most common carbonate minerals (Fukushi et al. 2012). MHC (CaCO₃ · H₂O) is metastable carbonate mineral with respect to calcite or aragonite (Munemoto and Fukushi, 2008). The formation of MHC requires the paragenesis of amorphous magnesium carbonate (AMC) (Nishiyama et al., 2013; Fukushi et al., 2017).

Fukushi and Matsumiya, (2018) measured the solubilities of MHC and AMC under the atmosphere at 25 °C and reported that MHC and AMC control the water chemistry of alkaline lakes. However, the most of surrounding environment of alkaline lakes are semiarid and cold. The lakes are covered with ice in most of the year.

During the ice forming ice, the lake water must be isolated from the atmosphere, which may lead to the decrease of low partial pressure of CO₂ in lakes. Low temperature may affect the formed mineral species and physicochemical properties of the minerals. Therefore, we can't discuss the water chemistry of alkaline lakes only from the knowledge obtained from the ambient condition atmosphere CO₂ pressure and 25 °C. The purposes of this study are (1) investigation of the carbonate mineral formation from the solution simulated the alkaline lakes under low partial pressure of CO₂ at 5-50 °C and (2) measurements of solubilities of these carbonate minerals to estimate of water chemistry of alkaline lakes.