Calcium carbonate is classified into six types: anhydrous calcium carbonate calcite, aragonite, and vaterite; monohydrocalcite (MHC, CaCO$_3$·H$_2$O); ikaite (CaCO$_3$·6H$_2$O); and amorphous calcium carbonate (ACC). In addition to these, calcium carbonate hemihydrate (CCHH, CaCO$_3$·1/2H$_2$O) was recently synthesized by Zou et al. Although CCHH is still undiscovered in the natural environment, investigating its possible existence and predicting its role will contribute to our understanding of the global carbon cycle. According to Zou et al. (2019), CCHH is produced from high concentration Ca-Mg-CO$_3$ solutions, while our previous study confirmed that CCHH is universally produced under conditions of high Ca$^{2+}$ and CO$_{3}^{2-}$ concentrations even when Mg is not present in the solution (Suyama et al., JpGU2021). Therefore, CCHH is considered to exist in water environments with high component concentrations in the natural environment. In examining the possibility of the existence of CCHH in nature, "solubility" is used as an index to compare the relationship between the aqueous environment and CCHH. Solubility is the limit amount of a solute that can be dissolved in a certain amount of solvent, and is an index of solubility. By comparing a substance's intrinsic solubility product with the ionic activity product of its natural environment, we can examine the controlling substance in a given water quality environment. Fukushi and Matsumiya (2018) reviewed the ionic activity product for calcium carbonate in an alkaline lake in the interior of a continent, and found that the water quality was controlled by the dissolution and precipitation reactions of MHC. The lower limit of the ion activity product of alkaline lakes shown by them is certainly consistent with the solubility of MHC, but another series of data with slightly higher solubility than MHC can be found at the upper limit of the ion activity product. However, at the upper limit of the ion activity product, there is another series of data that is slightly more soluble than the MHC. Therefore, we propose that the ionic activity product of alkaline lakes may be controlled by the solubility product of CCHH. In order to test this hypothesis, the solubility of CCHH was experimentally determined in this study. The results show that the solubility of CCHH is consistent with the upper limit of ionic activity product for calcium carbonate found in alkaline salt lakes in the continental interior.

Keywords: Calcium carbonate hemihydrate, solubility, ion activity product, alkaline lake