CHEMICAL CONTROLS ON IKAITE FORMATION

ELIN TOLLEFSEN[1*], GABRIELLE STOCKMANN[1], ALASDAIR SKELTON[1], CARL-MAGNUS MÖRTH[1], CHRISTOPHE DUPRAZ[1] AND ERIK STURKELL[2]

[1] Department of Geological Sciences, Stockholm University, 106 91 Stockholm, Sweden ([*]elin.tollefsen@geo.su.se)
[2] Deparment of Earth Sciences, University of Gothenburg, 405 30 Gothenburg, Sweden

In a narrow fjord in southwest Greenland, impressive columns composed of the rare mineral ikaite ($CaCO_3 \cdot 6H_2O$) are forming and can grow up to 0.5 m/year. They form from a mixture of seawater and carbonate rich spring water high in pH emanating from underlying alkaline magmatic rocks at the bottom of the fjord. Why metastable ikaite forms instead of the more stable phase calcite remains unknown. However it has been suggested that calcite formation is inhibited by Mg and SO_4 in the seawater [1] and also that high pH [2] and that the cold temperature (<6°C) in the fjord promotes ikaite formation.

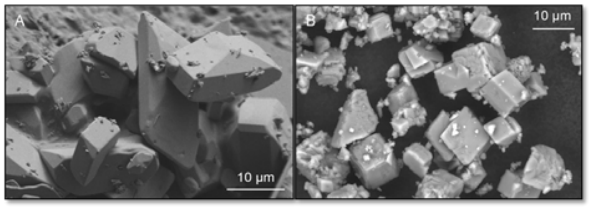

Figure 1: A) Ikaite crystals from an experiment with natural sewater. B) Calcite crystals from an experiment with synthetic seawater with removed Mg.

Here we show that pH and Mg control ikaite formation in the fjord. We simulated Ikka Fjord conditions in a series of laboratory experiments to test the effect of SO_4 and Mg in seawater and pH of the spring water on ikaite formation. In our experiments ikaite precipitated with natural and synthetic seawater and also with synthetic seawater from which SO_4 had been removed. Calcite precipitated instead of ikaite in experiments with synthetic seawater from which Mg had been removed. Furthermore we varied the Mg concentration in the synthetic seawater and the pH of the spring water. Our results show that both Mg concentration in seawater and pH of the spring water control ikaite formation.

[1] Nielsen et al. (2016) Crystal Growth & Design, v. 16, p. 6199-6207. [2] Hu et al. (2014a) Marine Chemistry, 162, 10-18.