

Synthetic ikaite precipitation simulating conditions in Ikka Fjord, SW Greenland

G.J STOCKMANN^{1*}, E. TOLLEFSEN¹, T. BALIC-ZUNIC²,

J. LANGHOF³, H. SKOGBY³

¹*Department of Geological Sciences, Stockholm University, 106 91 Stockholm, SWEDEN*

*(*correspondence: gabrielle.stockmann@geo.su.se)*

²*Natural History Museum, University of Copenhagen, 1350 Copenhagen K, DENMARK*

³*Department of Geosciences, Swedish Museum of Natural History, Box 50 007, 104 05 Stockholm, SWEDEN*

Two series of experiments precipitating synthetic ikaite were carried out, one using a 5°C cooling room at the University of Copenhagen, and one using cooling baths at Stockholm University to keep the temperature low. Ikaite is a hydrated calcium carbonate mineral ($\text{CaCO}_3 \cdot 6\text{H}_2\text{O}$) and is generally assumed to be unstable above 6°C. The aim of the experiments was to test if the presence of PO_4 (aq) is a key factor to form ikaite over calcite in a system simulating Ikka Fjord in Greenland, where ikaite forms naturally. In addition, experiments at 5, 10, 15 and 20°C were performed to test the upper temperature limit for ikaite precipitation.

In Ikka Fjord, ikaite forms hundreds of columns over sodium carbonate springs issuing at the bottom of the fjord. When mixed with seawater, ikaite precipitates – not calcite. A combination of low water temperature (<6°C) and the presence of PO_4 ions (9-25 ppm) in the spring water has been suggested as the main reason for the formation of ikaite (Buchardt et al., 2001), as phosphate is a well known inhibitor of calcite growth.

Our results, using XRD analysis, show that ikaite precipitates readily at 5°C when mixing sodium carbonate solutions with natural seawater from Ikka Fjord, Skagerak, and Øresund, and artificial seawater. Phosphate had no effect on the ikaite precipitation. It formed equally well PO_4 -free as with 5-25 ppm PO_4 . When using a CaCl_2 solution in place of seawater, calcite was the main precipitate. Hence, seawater chemistry is the key factor controlling ikaite precipitation in Ikka Fjord. In our experiments, ikaite precipitates easily at 10°C over a 6h period. At 20°C an amorphous (CaCO_3 ?) phase is formed as judged from XRD results, but no calcite.

References:

Buchardt, B., Israelson, C., Seaman, P. and Stockmann, G., (2001). Ikaite Tufa Towers in Ikka Fjord, Southwest Greenland: Their formation by mixing of seawater and alkaline spring water. *J. Sed. Res.* 71, 176-189.