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Interactive comment on “Ikaite crystals in melting sea ice – implications for $\vec{p}CO_2$ and pH levels in Arctic surface waters” by S. Rysgaard et al.

Anonymous Referee #2

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Review of "Ikaite crystals in melting sea ice leads to low pCO_2 levels and high pH in Arctic surface waters." by Rysgaard S. et al..

The manuscript represents a diverse set of observations and measurements, but does not represent anything which is really new. The “Methods and Results” section describes isotope measurements for O and H but nothing about it can be found further in the Discussion (one wonders why these measurements were done and why they are needed in the manuscript). The description of the crystals is very weak and terms without a clear meaning in crystallography are used (e.g. “... crystallized simple single crystals ...” a crystal is by definition crystallized and what does simple mean in this context?, or “One high quality crystal ...”, what is a high quality crystal?). Then the authors describe the crystals as “simple uniform” but say that they show layered

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structures. This makes no sense. What I have my problems with is that the authors investigated crystals by polarized light microscopy and then did x-ray studies on it, but only 4 out of 14 are identified as ikaite. How do we know that the crystals used to describe the morphology were ikaite? How do the authors explain that the largest amount of crystals within the ice is not ikaite. However, the biggest problem is that all conclusions are based on only one ice core and that this core was stored for some time at -18 °C. How do the authors know, that the low temperature polymorph ikaite did not form during the ice core was stored at -18 °C. Furthermore, if crystals, other than ikaite are found throughout the ice, how do they know that their location within the ice represents the location of formation (for sure minerals like feldspar and quartz do not form within the ice)? I have strong doubts that the crystals first disintegrate and then dissolve. For me what we see is typical transformation (most likely into calcite), causing the crystal to disintegrate. That the authors identified one $\sim 20 \mu\text{m}$ fragment as ikaite was coincidence (it would have been necessary to measure all fragments to draw a clear conclusion). The fact that ikaite is very unstable is well known, and represents nothing new.

Interactive comment on The Cryosphere Discuss., 6, 1015, 2012.

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