Response to Anonymous Referee #2

We find this review not to be very constructive. However, we will try to answer it to the best of our ability.

The Referee states that he/she is not convinced that ikaite abundance in sea ice has the impact anywhere close to what former senior author claims it to be (ln 55-65). First, this paragraph is included to explain how the presence of ikaite (formation and dissolution) can affect the carbonate system. This will naturally have an effect on the exchange of CO_2 between the ocean and the atmosphere and the pH of surface waters. This background information is needed to understand the dynamics of ikaite in sea ice and how it can modify the exchange between the atmosphere and ocean. Thus, it is important to keep this section in the manuscript. Second, this manuscript is not dealing with the global implications of ikaite, but it presents a new and novel technique that will allow for more measurements of ikaite from different regions. So far, there have been few measurements of ikaite from few geographical regions. Third, we find that sea ice algal communities seem to stimulate ikaite formation, something never before reported. Finally, we do not agree that we 'overhype' the implications of ikaite. Throughout the manuscript the wording we use is "may play a significant role" (e.g., ln 61). A few years ago we did not know ikaite existed in sea ice. Since then we have been investigating the details of ikaite formation and dissolution in sea ice, as well as the potential effects of ikaite on the atmosphere-ocean exchange of CO_2 at local, regional and global scales. Locally and regionally we have found that ikaite can explain a large part of the atmosphere-ocean CO_2 flux (e.g. Rysgaard et al., 2009), which matches regional outputs from global simulations (Grimm et al., 2016). Our recent model results show that the flux on a global scale is minor as the CO_2 taken up by the Arctic seas is released again to the atmosphere further south. As the uptake of this ikaite mediated CO_2 flux in the global model is fully linked to brine formation and the spatial resolution of the global models (both resulting in a poorly constrained brine dynamic in these models) there is still room for new discoveries to be made. The new method we report here will contribute to such discoveries and to quantitatively examine their significance.

The final comment by the referee that he/she will not further comment on the technical details of the paper because he/she does not want the graduate student to feel overly disheartened is noted. It would have been more appropriate and perhaps productive to contact the senior author directly by email or phone and discuss his/her frustrations rather than providing an anonymous comment in a public forum. Perhaps we could have had a scientific discussion on the matter that could have benefitted the scientific community. Disagreement is often a way to learn new things☺.

References:

Grimm, R., Notz, D., Glud, R.N., Rysgaard, S., and Six, K.D.: Assessment of the sea–ice carbon pump: Insights from a three–dimensional ocean–sea–ice biogeochemical model (MPIOM/HAMOCC), Elementa: Science of the Anthropocene, 4, doi:10.12952/journal.elementa.000136, 2016.

Rysgaard, S., Bendtsen, J., Pedersen, L.T., Ramløv, H., and Glud, R.N.: Increased CO2 uptake due to sea ice growth and decay in the Nordic Seas, J. Geophys. Res., 114, C09011, doi:10.1029/2008JC005088. 2009.