



Mesozoic authigenic carbonate deposition in the Arctic: Do glendonites record gas hydrate destabilization during the Jurassic?

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Glendonites are calcite pseudomorphs after ikaite, an unstable hydrated calcium carbonate mineral. Because present-day ikaite occurs predominantly in sub-polar environments and is unstable at warm temperatures, glendonites have been used as an indicator of near-freezing conditions throughout Earth history. Ikaite has also been observed in cold deep-sea environments like the Gulf of Mexico, the Japan Trench, and the Zaire Fan where their formation is possibly governed by other parameters. The description of glendonites in Paleocene-Eocene sediments of Svalbard, and Early Jurassic (Pliensbachian) deposits of northern Germany, however questions the role of temperature on ikaite precipitation (Spielhagen and Tripathi, 2009; Teichert and Luppold, 2013). Anomalously low carbon isotope values of Jurassic glendonites point to the involvement of methane as a possible carbon source for ikaite/glendonite formation. Terrestrial organic matter degradation is also frequently evoked as a potential source of carbon. The involved bio- and geochemical processes remains thus not well constrained. Here we present new geochemical data of a large number of glendonites specimens from the Lower and Middle Jurassic of northern Siberia and the Lena river middle flows (Bajocian, Bathonian, Pliensbachian). Carbon and oxygen isotopic values show comparable trends between the different sections. Bulk glendonites $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values vary from 0.0 to -44.5‰ and -15.0 to -0.8 respectively and show a negative correlation. Some samples display similar low $\delta^{13}\text{C}$ values as the Pliensbachian glendonites of Germany (Teichert and Luppold, 2013), suggesting thermogenic and/or biogenic methane sources. The range of carbon isotope values is comparable to those observed at other methane seeps deposits. Further investigations are needed to better constrain the carbon cycle in these particular environmental conditions. The role of microbial communities into ikaite/glendonite formation equally needs to be considered. These results however caution the use of glendonites as a proxy for near-freezing conditions.

References:

Spielhagen, R.F., Tripathi, A., 2009. Evidence from Svalbard for near-freezing temperatures and climate oscillations in the Arctic during the Paleocene and Eocene. *Palaeogeography, Palaeoclimatology, Palaeoecology* 278, 48-56.
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