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An assessment of Mesozoic polar environments and climate change based on glendonites from Svalbard and Siberia

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The Mesozoic was a globally ice-free world with high pCO_2 levels and reduced temperature gradients between high and low latitudes, presumably leading to an equable greenhouse climate mode. However, sedimentological, paleontological, and geochemical data indicate that Cretaceous climates were relatively variable. Hyperthermal episodes linked to massive pCO_2 release during major volcanic eruptions led to the spread of anoxic conditions in oceanic basins ("OAEs"). Periods of brief cooling ("cold snaps") have also been debated, mainly based on the occurrences of glendonites in Arctic successions. Glendonites are pseudomorphs after ikaite ($CaCO_3$•$6H_2O$), which precipitates under conditions of low temperature and high carbonate alkalinity, the latter being attributed to organoclastic sulfate reduction and/or the anaerobic oxidation of methane. Because natural occurrences of ikaite are mainly restricted to polar latitudes and deep ocean settings, their fossil form, glendonites, have been interpreted to reflect glacial conditions. The usefulness of glendonites as a glacial proxy is, however, increasingly debated. The precipitation of ikaite at temperatures of 15°C in hyperalkaline and Mg-rich solutions has been shown under laboratory conditions (Purgstaller et al., 2017; Stockmann et al., 2017). In addition, glendonites have been found in supposedly warm environments, i.e. in hemipelagic series of Germany during the Pliensbachian, or in shallow-marine deposits in Denmark during the Early Eocene. This suggests that other parameters than temperature play an overriding control on glendonite formation. There is therefore a crucial need to investigate the environmental conditions leading to glendonite in order to reconstruct past high-latitude climates and environments. Here we explore and compare the conditions that led to glendonite formation in Siberia during the Jurassic and in Svalbard during the Early Cretaceous. The sections of Cape Kystatym (NE Siberia) and Festningen (Geotope of Svalbard) provide well-exposed and stratigraphically-constrained archives of high-latitude conditions during the Jurassic and the Cretaceous respectively. Glendonites from the Bajocian, Valanginian, Hauterivian, Aptian and Albian are investigated. The relative impact of early and burial diagenesis is disentangled. The relative role of temperature, organic carbon remineralization, and methane oxidation in glendonite formation is examined.

References:

Purgstaller, B., Dietzel, M., Baldermann, A., and Mavromatis, V., 2017, Control of temperature and aqueous Mg2+/Ca2+ ratio on the (trans-)formation of ikaite: Geochimica et Cosmochimica Acta, v. 217, p. 128-143.
Stockmann, G., Tollefsen, E., Skelton, A., Brüchert, V., Balic-Zunic, T., Langhof, J., and Skogby, H., What controls ikaite ($CaCO_3.6H_2O$) formation in Ikka Fjord, Greenland?, in Proceedings Goldschmidt, Paris, 2017.