Evaluating $\delta^{238/235}U$ records in mudrocks as a proxy for ocean oxygenation during the Early Eocene

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It is generally established that Early Eocene climate was characterised by persistent warmth punctuated by abrupt global warming events that were associated with perturbations in the global carbon cycle. The distribution of O_2 in the oceans would have been profoundly affected but the timing and extent of any fluctuations in global ocean oxygenation during these events are still poorly constrained.

Records of seawater Mo isotope compositions derived from marine sediments from the Arctic Ocean suggest that euxinic areas were slightly more widespread in the Early Eocene ocean than they are at present [1,2]. Here, we present $\delta^{238/235}U$ data from the same location. By comparing these new U isotope data with complementary $\delta^{98/95}Mo$ data, we assess their capacity to provide additional constraints on the variations of global ocean oxygenation during this period. The residence times of Mo and U in the oceans differ from one another, and their isotope fractionations display different sensitivities to dissolved oxygen concentrations. By combining information from both isotope systems, we should therefore be able to better constrain the onset and the severity of the episodes of seawater anoxia during the Eocene, and to improve our understanding of the processes that control ocean oxygenation.

Our analyses of Arctic Ocean mudrocks show that where $\delta^{98/95}Mo$ likely records a global redox signal, $\delta^{238/235}U$ has more complicated variations that appear to be related to changes in the nature and/or the flux of detrital material. Our observations highlight the importance of quantifying continental inputs and local sedimentation rates, as well as understanding the processes controlling U isotope fractionation, before $\delta^{238/235}U$ data can be used reliably for paleo-environmental reconstructions.

[1] Dickson, Cohen & Coe (2012), *Geology* **40-7**, 639-642. [2] Dickson & Cohen (2012), *Paleoceanography* **27**, PA3230.