Geophysical Research Abstracts
Vol. 17, EGU2015-2297, 2015
EGU General Assembly 2015

Entrapment of ancient and modern organic carbon by iron on the Eurasian Arctic Shelf

Joan A. Salvado (1), Tommaso Tesi (1), Igor P. Semiletov (2,3,4), Oleg V. Dudarev (2), and Örjan Gustafsson (1)

(1) Department of Applied Environmental Science and Bolin Centre for Climate Research, Stockholm University, Sweden (joananton.salvado@itm.su.se), (2) Pacific Oceanological Institute, Far Eastern Branch, Russian Academy of Sciences, Vladivostok, Russia, (3) International Arctic Research Center, University of Alaska Fairbanks, Fairbank, USA, (4) National Research Tomsk Polytechnic University, Tomsk, Russia

Given the potential for climate-carbon feedbacks in the Siberian-Arctic land-ocean system, there is a need for improved understanding of carbon cycle processes (Vonk et al., 2012). The entrapment of organic carbon in sediments is a key factor to attenuate the outgassing of greenhouse gases to the atmosphere. In this context, there is a pressing need to understand the mechanisms that control preservation and accumulations of organic carbon in marine sediments. Recently, the role of iron oxides in the preservation of organic matter globally has been outlined (Lalonde et al., 2012).

In the present study, the composition of organic carbon associated to reactive iron (OC-Fe) on the Eurasian Arctic Shelf is evaluated. For this purpose, sediment cores and grab samples were collected in the shelves of the Kara Sea, Laptev Sea and East Siberian Sea from 9 to 69 m water depth. Experiments were conducted to extract the OC-Fe from the sediments by applying a citrate-dithionite iron reduction method –accurately control corrected- and analyze the δ13C, % OC and Δ14C of the bulk and iron-associated fractions.

The results show that $11.0 \pm 5.5\%$ of organic carbon in surface-sediments of the Siberian Arctic Shelf is attached to reactive iron. The Δ14C and δ13C signatures presented sharply contrasting offsets between the sedimentary bulk and the OC-Fe. The OC-Fe is much younger than the OC-bulk in the eastern East Siberian Sea and older in the Laptev Sea. The same offsets were observed using a dual-carbon endmember mixing model showing that the iron fraction is mainly composed by young marine plankton organic carbon in the eastern East Siberian Sea and pre-aged thawing permafrost in the Laptev Sea. Overall, it seems that (i) some of this pre-aged organic carbon still remains bound to iron oxides after permafrost thawing and (ii) the iron oxides are transferring dissolved organic carbon to the sediment. This study presents the first analyses of Δ14C ever done in the OC-Fe fraction to start progressing on what organic matter components are prone to entrapment by iron oxides.

References

Vonk, J.E., Sánchez-García L., van Dongen B.E., Alling V., Kosmach D., Charkin A., Semiletov I.P., Dudarev O.V., Shakhova N., Roos P., Eglinton T.I., Andersson A., Gustafsson Ö. Activation of old carbon by erosion of coastal and subsea permafrost in Arctic Siberia. Nature 489, 137–140 (2012).

Lalonde K., Mucci A., Ouellet A., Gélinas Y. Preservation of organic matter in sediments promoted by iron. Nature 483, 198-200 (2012).