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Interactive comment on “Organomineral nanocomposite carbon burial during Oceanic Anoxic Event 2” by S. C. Löhner and M. J. Kennedy

Anonymous Referee #2

Received and published: 22 July 2014

The manuscript entitled 'Organomineral nanocomposite carbon burial during Oceanic Anoxic Event 2' by S.C. Löhner and M.J. Kennedy, proposes that mineral surfaces of clay such as smectite plays a key role on preserving organic matter in anoxic marine sediments. This could be an important piece of contribution for understanding processes of organic carbon-rich marine sediments that characterize Oceanic Anoxic Events in the geological pasts.

Based on the conventional geochemical and mineralogical analyses they show a clear positive correlation of mineral surface area and organic carbon content of sediments. They also provide a series of geochemical data by electron microscopy, x-ray dispersive and synchrotron infrared microanalyses that imply a close association of organic matter and clay minerals. The lines of evidence led the authors conclude that the

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high TOC in the marine sediment from Demerara Rise is attributed to mineral surfaces which physically encapsulate organic matter on it. Publication of this work might be recommended in order for this journal to gain a broader attention from the relevant geoscience community. However, the evaluation of the data is not clearly presented such that the discussion and conclusions are not readily interpretable. I request the authors to provide further evidence, or re-write their discussions by rationalizing their data presented. The following are comments regarding this manuscript.

- In the manuscript they point out that 'OC is preserved mainly as sub- μm organic matter in close association with clays, rather than as discrete, μm -scale organic particles' and 'the great majority of OC is quantitatively associated with and stabilized by clay mineral surfaces' (p. 6822). However, I cannot find any discussion about quantitative estimation of their relative abundances. Thus, it is difficult to agree with the authors claim. Isn't it possible to quantitatively estimate their ratios? In Fig. 6D, some areas (few to 10 μm in size) with high carbon content are seen. They look like discrete OM. I feel that the manuscript needs careful discussion on relative abundances of μm -size discrete OM and sub- μm size OM associated with clay minerals.

- I am not fully convinced by the FTIR spectroscopic maps of aliphatic carbon and clay (Figs 6B and 6C) that were used to exemplify the close association between organic matter and clay minerals. In my view, the distribution of aliphatic carbon significantly differs from that of clay.

- The analytical position of electron microprobe analysis with EDAX (Fig. 5D) should be given in Fig. 5C. In general, electron beam expands about 3 μm in the sample surface. Because of the limit of spatial resolution of electron beam, I think that the EDAX data is not good enough to demonstrate the co-existence of organic matter and clay minerals on the sub-micrometer scale.

- The regression lines shown in Fig. 2 do not run near the zero point, but they have intercepts around 200 m^2/g . What does the intercept mean? Attention must be paid

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to compare their results with their previous data (Kennedy et al., 2002, 2014; Kennedy and Wagner, 2011). For example, the 'laminated anoxic' sediments of late Cretaceous interval from the deep Ivorian Basin, Site 959 (Fig. 2B in Kennedy and Wagner, 2011), are plotted in a different field with a different slope ($\sim 0.7 \text{ mg-OC/m}^2$) compared with the data presented in this paper (Fig. 2). What does this mean? Does this indicate that mechanism governing the OM preservation is not as simple as the authors consider, and that we should think other mechanisms to explain the preservation of OM?

- How are the slopes and intercepts of the MSA-OM crossplots (Fig. 2) sensitive to mineral compositions? Don't those slopes change in response to relative abundance of smectite (e.g., smectite / total clay minerals) during OAE2, when relative abundance of smectite increased?

Interactive comment on Biogeosciences Discuss., 11, 6815, 2014.

BGD

11, C3653–C3655, 2014

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