Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2017-509-AC2, 2018
© Author(s) 2018. This work is distributed under
the Creative Commons Attribution 4.0 License.

Interactive comment on "Mineral physical protection and carbon stabilization in-situ evidence revealed by nano scale 3-D tomography" *by* Yi-Tse Weng et al.

Yi-Tse Weng et al.

betacau07@gmail.com

Received and published: 14 February 2018

Reply to Reviewer#2:

We thank Reviewer#2 for recognizing our work in methodology development and contribution to the understanding of C stabilization. In-situ evidence reveals abundant mineral nano particles, in dense thin layers or nano-aggregates/clusters, instead of crystalline/micron/clay-size mineral on or near OC surfaces, the key working minerals for C stabilization are essentially SRO minerals and/or poorly crystalline submicron size clay minerals. We have other sets of unpublished 3-D tomography data for samples from various mineralogy background, and the minerals found associated with OC

surface are coincidentally in line with nano particles/poorly crystalline minerals.

Inspired by the reviewer's suggestions, efforts have been taken to identify micro assemblage features which likely reflect the differentiation of adsorption and co-precipitation in our natural OC-mineral consortium using TXM images. In the all-depth 2-D X-ray absorption-contrast image (Fig. 1r), sheet-like mineral coating is observed on OC surface, which is a dense and thin layer, pointing to likely high level of physical protection. We propose such texture originate from absorption. Another distinct texture is recognized as OC-mineral cluster, with either minerals in the core and organic matter around (Fig. 1r), or vice versa (Fig. 2r). This type of texture indicates possible microsite of mineral co-precipitation with relatively free OC. Many clusters of various shapes are observed (Fig. 2r). However, to fully explore this long-standing question on the structural development of OC-Fe mineral assemblages attributed by absorption vs co-precipitation, we suggest future work with carefully planned lab-made OC-Fe consortiums and thorough 3-D tomography observation are needed for reliable evidence and answers.

Revised manuscript is attached (shown as a supplement file).

Please also note the supplement to this comment:
https://www.biogeosciences-discuss.net/bg-2017-509/bg-2017-509-AC2-supplement.pdf

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2017-509, 2017.

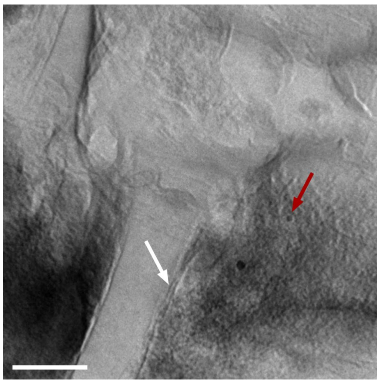

Fig 1r. The 2-D X-ray absorption-contrast composite image in focus depth for OC-mineral consortium from Mt. Nanhua. The grey scale is inverse proportional to X-ray attenuation coefficient of different materials. The dark laminal texture pointed by the white arrow reveals sheet-like mineral coating on OC surface, which is a dense and thin layer, pointing to likely high level of physical protection. We propose such texture originate from absorption. On the other hand, the red arrow points to the other distinct texture of OC-mineral cluster, with dark minerals in the core and light organic matter surrounding, which is not necessary on the rim. This texture indicates possible microsite of OC-mineral co-precipitation. It should be noted that the light region surrounding dark region (minerals) could be either organic matter or air/cavity, as their attenuation coefficient is very difficult to distinguish in X-ray image. There are numerous such OC-mineral clusters in the image, a large round-shape one was chosen for illustration. However, in reality, the OC-mineral cluster could be of any shape. The scale bar is 3 microns.

Fig. 1.

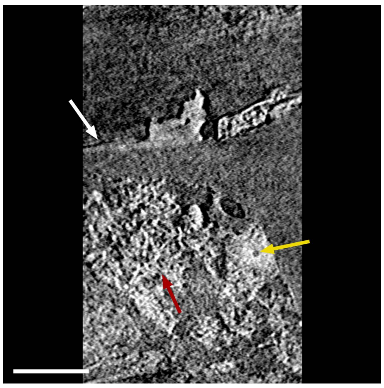

Fig 2r. A Cross-section view of the reconstructed 3-D tomography, under absorption contrast mode for the OC-mineral consortium from Mt. Nanhua, along the X-Z plane. The grey scale is proportional to X-ray attenuation coefficient of different materials. The white and the red arrows point to the mineral layer and OC-mineral cluster respectively. The yellow arrow points to a potential nucleus for mineral clusters development, it could be light material such organic C. On the other hand, this microsite may just be a cavity. The scale bar is 3 microns.

Fig. 2.