

## ***Interactive comment on “Biogeochemical properties and diagenetic changes during the past 3.6 Ma recorded by FTIR spectroscopy in the sediment record of Lake El’gygytgyn, Far East Russian Arctic” by C. Meyer-Jacob et al.***

**Anonymous Referee #2**

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This paper presents biogeochemical properties (BSi, TOC and TIC) measured by FTIRS in a Lake El’gygytgyn sediment core from Russian Arctic. The aims of this paper are "1. development of the quantitative method of the properties using FTIRS", "2. estimation of biological activities", and "3. diagenetic changes" during the past 3.6 Ma. Because FTIRS is very effective tool (rapid, convenient and simple method) for climate reconstruction using long sediment cores, the development of calibration models is necessary for the works. However, I am not able to find new insight in this paper because of the following reason. Therefore the paper in this version is not suitable for

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CPD, in my opinion.

1. This paper is limited to an application of statistics in method. The FTIRS quantitative method for biogeochemical properties in sediment cores have been already established by Vogel et al. (2008), Rosen et al. (2010), Rosen et al. (2011), Melles et al. (2012).

2. The authors said that the FTIRS is rapid and cost-effective method. However, time resolution of the dataset in this paper is much lower than previous study (Melles et al., 2012). Moreover, the biogeochemical properties in Lake El’gygytgyn sediment cores during 2.8 Ma by FTIRS method have been also reported (Melles et al., 2012). I strongly recommend that the authors try to focus on high-time resolution analyses during Pliocene compared with the reported values from Quaternary. Then, I believe that the authors can discuss about climate and environmental changes in Far East Russian Arctic from 3.6 Ma to 2.8 Ma.

3. In this paper (Figure 5), the error of FTIRS inferred burial depth is very large in the lower part of the core. The FTIRS inferred values at ~300m measured depth actually varied from ~200 to ~400 m. The authors should compare the values with other proxy for diagenetic changes.

Other minor comments are as follows:

Fig 1. The authors should not use the same figure as published one (Melles et al., 2012). It is just a copy, and it’s completely same as previous study (Melles et al., 2012).

Fig 2. What is the meaning of comparison between Fig 2c and Fig 2d ? If the authors discuss it based on literatures (Rosen et al., 2011; 1012) , it could be just a repetition. If a 7-component TIC model is original way in this paper, the authors should show the detailed processes (How they can select the component?).

Fig 3. Fig 4. Please clarify the collected depth, age and sampling location of the BSi.

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Did they take the BSi samples from same core sediments (5011-1)?

Fig 5. It is difficult to see Figure 5 in this paper. What is "Burial depth" on the top of figures ? The authors can express as "measured burial depth (m)" just below the horizontal axis. Anyway, it is not necessary to show the information on the top of figure, because the authors have already described it in the figure legend.

Page 2492 line7 and Page 2493 line25. In this paper, the authors should clearly show the age model for core 5011-1. The authors refer to Nowaczyk et al ("in preparation") for the age model. I believe that nobody can refer to the manuscript "in preparation".

Page 2496 lines4-14 and Page 2498 lines8-20. The information has been reported (Vogel et al., 2008; Rosen et al., 2010; 2011), so it should be shown in Introduction section. The authors should try to show original novel results in CPD.

Page 2500 lines19-20. In my opinion, the authors should show the XRD results in this paper. It is not original data for your research? If it is only citations from others, they should show it in the Introduction section.

Page 2501 lines3-6. Why the TIC values increased at ~223 ka ? Please make discussion about it.

Page 2501 lines15-19. The authors concluded that "biological activity was strongly impaired..." However, AR values of "TOC" during the initial sedimentation period (<3.54 Ma) are higher than those in Quaternary (Figure 6). Please clarify the source of TOC in the period (<3.54 Ma).

Page 2501 line 20-Page 2502 line 10. Although the AR values varied largely during 3.6-3.3 Ma, the authors explain it by only warming. How can the authors explain these fluctuations ?

Page 2502 lines15-17. I guess this sentence is a speculation without any proof. Please show the large scale cycles in the figure.

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Page 2502 lines21-22. The authors comment is right. Please try to show the age model and make high-time resolution dataset for climate changes during the period.

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