

## ***Interactive comment on “Dynamic diatom response to changing climate 0–1.2 Ma at Lake El’gygytgyn, far east Russian Arctic” by J. A. Snyder et al.***

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General comment This paper is a mostly descriptive work on an Arctic diatom record representing the last 1.2 M years. The diatom record is coupled with the standard MIS curve and interpreted in the light of changing temperature, lake ice and nutrient conditions. Although there is nothing wrong with that, this approach partly fails as the relationship between the observed diatom patterns and suggested climatic/environmental implications is often not consistent within the record. For example, high total diatom concentration is not only observed in assumed warm intervals but also in cold intervals, excluding diatom concentration as a good direct climate (temperature) proxy. The

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planktonic genera diversity and periphyton concentration show similar patterns. To me these inconsistencies indicate that it is critical to interpret the diatom record only as a (direct) response to climate change. Diatoms mainly react on habitat changes and conditions which are triggered by many different processes, only one of which is climate. This diatom record is very unique in terms of represented geological time and setting. It should definitely be published. However, the authors missed the chance in this paper to study/present some fundamental questions related to e.g., long-term diatom evolution, taxa changes and diversity.

The following specific comments may help the authors to improve the paper. 1. Figs 4, 5 and 6 should be omitted from the paper. They are enlarged sections of Fig 2, and do not offer any additional information that is not visible in Fig 2. 2. Several times in the paper the authors write that the diatom record correlates to climate conditions inferred from other proxies. A few of those other proxies should be added to Fig 2 to underpin this. This would also emphasize the value of diatoms as climate/environmental proxies. 3. On Fig 2 the axes of diatom and species concentrations should be scaled the same way (all to  $10^{10}$ ), this makes comparisons between taxa easier and more obvious. 4. If sediment density data are available (are they?) diatom accumulation rates should be preferred because they take sediment compaction into account. May be that the patterns would not change much as the authors assume, but prove it instead of just assume this. 5. The authors should provide a table listing the genera/species that are counted for the plankton diversity index. From Fig 2 I assume that *Fragilaria* is also included: all taxa of this genus or selected taxa? *Fragilaria* is a heterogeneous genus in terms of life form, including planktic and periphytic taxa, and those being able to live both planktic and periphytic. 6. For the taxonomists and biogeographers: where is an updated taxa list available or can one be added as digital supplement? 7. Page 4606, lines 15–20; Page 4610, lines 3–9: I really would like to read more about cell size and thus, biovolume variations of genera/species and links to environmental/climatic changes. This is an interesting phenomenon not well documented in the literature and the authors would have the chance here to study such phenomena in detail over

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longer periods. What's the reason for these observations? How are those changes induced, is it an adaptation on changed climate, habitat, water chemistry, physiology etc and what are advantages/disadvantages of the single species? Obviously the authors have put some effort on these questions, so please present and discuss these data in more detail (add figure, table). 8. Is there any conclusive reason that the authors chose MIS 5e, 11 and 31 as examples? There are more warm modes with absolutely similar diatom signatures which are not considered. In this sense, MIS 11 and 31 are not more exceptional than other events; at least this is not obvious from Fig 2. 9. Page 4610, lines 22-28; Page 4611, lines 15-20: good statement, absence/presence of genera and specifically species is complex and for sure not easy to explain. Therefore, I would like to see a discussion on this summarizing some general thoughts about this issue (hidden taxa, how is absence/re-development triggered?) and possible implications for L. El'gygytgyn. There is, although limited, literature available. 10. Page 4611, Lines 1-11: Why is high biogenic silica and diatom concentration unexpected in MIS2? The recent strong growth and deposition of biogenic silica/diatoms observed in polar regions, particularly the Antarctic, shows that diatoms do grow and bloom in cold conditions. The fact that assumed cold and warm modes show partly a similar diatom signature point to other triggers than only temperature being responsible for the observed pattern. The authors should also present and discuss alternatives triggers and scenarios in the broadest sense. 11. Page 4612, lines 21-24. What means apparently unique El'gygytgyn-adapted species? How unique are conditions in L. El'gygytgyn? Or do you mean that many of your species are unique to L. El'gygytgyn? Again, include a paragraph dealing with general ideas on occurrence/recurrence of taxa over longer time scales (see point #9). 12. 4.3 Sparse plankton events: the offered reasons for these events are rather speculative, and all related to assumed climate change. First of all, carefully define what sparse in this context means. Is there a threshold of planktic diatom concentration below which you consider a sparse plankton event? Sparse does not mean that there is no plankton, so in fact planktic diatoms grew and were deposited in these periods. Could this be simply a dilution effect, so that, for some reason, more

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non-planktic diatoms did accumulate at the site? 13. Conclusions: omit this piece from the paper, it is a collection of statements and results presented in the sections before. This is no conclusion. Future work (page 4613, lines 20-24) can be addressed under a header 'Future studies' but then it should be clearly said what the added value would be of putting more money and time in diatom studies of L. El'gygytgyn.

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