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Climate of the Past Discussions

Interactive comment on "Lack of marine entry into Marmara and Black Sea-lakes indicate low relative sea level during MIS 3 in the northeastern Mediterranean" *by* Anastasia G. Yanchilina et al.

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Response to first peer review:

Response to (1) paleosalinity and seismic profiles not usually considered regional sea level proxies. First of all, just because the methods and conclusions drawn from non-traditional methods are not considered traditional and usual is not a justified reason for not considering the conclusions drawn. We see that the concept presented is very simple.

Before we continue with our response, however, we would like to note that saline in-

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trusion in and out of basins, that are marginally connected to the global ocean, have been used to give an idea for regional and eustatic sea level in the past. We think that including more of this discussion will help explain how our method will additionally contribute to reconstruction of paleo sea level.

The first example is from the work of Van Daele et al. (2011). Here, the authors look at infills in the Gulf of Cariaco, a marginal basin, that is connected to the Caribbean Sea via a shallow 58-m-deep sill. The authors use a similar idea to ours, changes in regional sea level, to infer when the regional sea level was higher than the sill versus lower. When the regional sea level is higher, saline water intrudes into the Gulf of Cariaco, creating sedimentary infills. When the regional sea level is lower, saline water does not intrude and sedimentary infills related to saline water intrusions do not occur.

The second example is from the work of Pico et al. (2016). The authors use sedimentary core analyses from a Yellow River Delta in the Bohai Sea of China to make inferences about a migrating paleoshoreline. Pico et al. (2016) use information from cores taken from the delta, to observe changes in inundation of the delta associated with first changes in regional sea level and second, make further to make conclusions about eustatic sea level after applying glacio-isostatic corrections.

The third example is using changes in the δ18O record of the eastern Mediterranean Sea (Grant et al. 2012) and the Red Sea (Siddall et al. 2003) using a basin isolation concept to infer changes in regional sea level. The basin isolation concept features reduction of intrusion of saline water into a basin that is marginally connected to the global ocean; in the Red Sea from the description of Siddall et al. (2003), "Reduction of the strait profile by sea-level lowering decreases the exchange transport of water masses through the strait. This results in increased residence times of the water within the Red Sea, enhancing the effect of the high rate of evaporation (2.06 m yr-1) on properties in the Red Sea. The basin though amplifies the signal of sea level change, which are recorded in d18O values of foraminifera in Red Sea sediment cores."

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These above all give examples of non traditional methods that do not include uplifted coral terraces that have been used to reconstruct past regional and global sea levels.

For our manuscript, we want to make conclusions from a simple concept. The Black and Marmara Seas are connected to the Mediterranean by two shallow sills, both approximately shown to have been 80 meters below sea level during MIS 2 and 3 (the sill level connecting Marmara and Black Seas, Bosporus, is now 30 mbsl but during MIS 2 and 3 it was lower, at 80 mbsl). Now, marine water enters through these sills and these seas are saline because the regional sea level (from the Mediterranean side) is higher than the sills, hence, saline water has no option than to flow into both of these basins and make them seas as opposed to freshwater lakes. A good visual schematic is filling water in a bathtub. The water flows and if its higher than the level of the bathtub, it will overflow over the edges of the bath tub onto the floor. Same concept almost for the water inflowing into the Marmara and Black Seas, when the level of the Mediterranean is lower, no salt water flows in and when the level of the Mediterranean is higher, salt water flows in. This is what we are trying to conclude from the data presented. The paper is not about making conclusions about lake/sea level in the Black Sea and the Marmara Seas, although it alludes to them, the paper is about the regional sea on the Mediterranean Side of the Marmara and Black Seas.

We agree that it would be great to have detailed regional and global sea level data from uplifted coral terraces but such information is largely absent and is mostly available for the glacial and postglacial and the Eemian. One of the reasons we are making and drawing these conclusions is because of the lack of regional and global sea level data that currently exists during MIS 3. We believe that knowing a constraint for regional sea level and an overall understanding that it was low, is a very important contribution for the paleo sea level community.

If there was any marine intrusion into the Marmara and Black Seas, there would have been a rise in salinity, during Marine Isotope Stage 3. There is not recorded a change in paleosalinity from all proxies available to date, most strongly the lack of change in the δ18O of the Sofular Cave in the Black Sea, shown to reflect δ18O of surface Black Sea water. Porewater Cl- from both Marmara and Black Seas adds to this conclusion. Second (2), new results. We have a section that indicates all new results, we do not understand how this not clear to the reviewers. We have sections 3.1 and 3.2. In section 3.1, we detail the new data that we are presenting and adding from the geochemistry side, which are 87Sr/86Sr from the Sea of Marmara that go into MIS 3 and in section 3.2, we add data for a chirp profile of a perched lake in the Sea of Marmara that does not is there to present no entry of water from external sources, such as the Mediterranean Sea/ global ocean, during MIS 3, supporting what is seen from geochemistry. We agree that discussion of the time scales necessary for salinities of the Black and Marmara Seas to have responded to marine incursions would make this a stronger paper and hope to make these changes in the revised manuscript, including the observation of changes in eustatic sea level on time scales of 1-2 years by 10-15 m as shown by work of Chappell (2002).

Regarding the seismic profiles, while it is true there is a seismic unconformity related to sea level fall during MIS 2, and prior sediment, if it was present, would have been removed, our point is that no such prior sediment existed. This is largely seen from the Figure 5 and Supplementary Material Figures 1-5. The main clear point we are trying to make with these figures can be seen From Supplementary Figure 4. Core C9 dates the cut off sedimentary layers at the modern depth of 80-90 mbsl to 24.9 14C thousand years. This indicates, that those layers that were outcropping towards Southeast (SE), (in this figure to the right of the 14C date), must be younger than 24.9 14C years. In calendar years, 24.9 14C thousand years is the end of MIS 3 / beginning of MIS 2 so all of the sediments belonging to those cut off to the right, must all be MIS 3, by logic of sediment accumulation, indicating the local lake level in the Sea of Marmara was low and lower than 80 mbsl, regionally. If the regional sea level on the Mediterranean side, was higher, it would have overfilled the Marmara Sea and the deposits that would have formed, would be like those indicated in the red above the blue (that date to the post connection of the Marmara Sea with the Mediterranean). It doesn't matter that there is an unconformity during MIS 2, the sediments that were deposited during MIS 3 are still there. This is the same pattern observed all over the Sea of Marmara and the Black Sea (Figure 5, Supplementary Figures 1-3, 5).

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