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Interactive comment on "Early–mid Miocene erosion rates measured in pre-Dead Sea rift Hazeva River using cosmogenic ^{21}Ne in fluvial chert pebbles" *by* Michal Ben-Israel et al.

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In this discussion paper, Ben-Israel et al. present new neon isotope measurements from quartz sand and chert pebbles deposited by the Hazeva River, which drained the Arabian Peninsula during Miocene times, as well as from modern eroding outcrops where the chert pebbles were likely sourced. The authors compare apparent erosion rates calculated from cosmogenic 21Ne concentrations at both sites, and conclude that the erosion rates recorded by the Miocene fluvial deposits are higher than those in the modern. They attribute higher Miocene erosion rates to higher uplift rates and a wetter climate of the Arabian Peninsula at that time.

Major comments:

In general, I think the approach taken in this paper to quantify paleo-erosion rates is exciting. However, I am concerned that the uncertainties in the paleo-erosion rates the authors calculate are underestimated, and that therefore the conclusions about higher erosion rates during the Miocene are overstated. Specifically, the authors assume that the elevation during Miocene production of cosmogenic 21Ne was 1000 km. It is unclear to me if this is the assumed elevation of the source of the chert pebbles, and that the authors then assume that the majority of cosmogenic 21Ne production occurs prior to sediment transport? Or is 1000 km accounting for sediment transport and meant to be representative of some catchment-integrated value between where the pebbles were sourced and deposited? Furthermore, it appears that the authors do not give this paleo-elevation any uncertainty in their calculation of exposure times or minimum erosion rates. I suspect that if the authors incorporate a reasonable elevation uncertainty of something like ïĆś 500 m, that their paleo-erosion rates will overlap entirely with their modern erosion rates. Because the choice of a paleo-elevation has such a large effect on the calculated paleo-erosion rates, there needs to be (1) a more detailed explanation of what the paleo-elevation the authors use represents, and (2) an uncertainty associated with this paleo-elevation incorporated into the calculated paleo-erosion rates.

I am also wondering if the authors need to be worried about neon diffusion with their analysis chert pebbles. They cite a neon closure temperature for quartz reported by Shuster and Farley (2005), but this was calculated for a 500 micron quartz grain. What is controlling the diffusion lengthscale in these chert pebbles, and what is the typical grain size in the chert pebbles analyzed? If you look at Figure 4 from Shuster and Farley (2005), for a 200 micron-diameter quartz grain (e.g., log radius of -1), you would expect significant diffusive loss of neon on 100 ka timescales and at temperatures of 60-70 °C. These seem like high temperatures, but in the Arabian Peninsula air temperatures regularly exceed 40 °C in the summer months and rock temperatures can certainly be in the range of 60-70 °C (e.g., McFadden et al., 2005). Additionally, the fact that the authors observe lower degassing temperatures in the laboratory for the chert samples than they do for the quartz samples suggest that the chert has a lower thermal sensitivity. Altogether, this makes me think that diffusion might be contributing to the observation that the chert pebbles have lower cosmogenic 21Ne concentrations than the quartz sands. Given this, I think a discussion of the potential role of neon diffusion needs to be added to the text.

Minor comments:

Figure 1 should have a box indicating the location of figure 2A.

Figure 2 should also include field photos of the modern in situ sampling sites of chert nodules.

Lines 204-206: This sentence is awkwardly worded, and I'm not sure I fully understand I follow the logic.

Lines 255-268: The calculated paleo-erosion rates overlap with the upper end of the modern erosion rates, even without my concerns about the paleo-elevation uncertainty being addressed. This sentence (and similar statements elsewhere) overstates the significance of the authors findings. I think it would be more appropriate to say that the calculated paleo-erosion rates allow for the possibility of higher erosion rates in the Miocene.

Lines 281-283: Here and elsewhere, do you mean rock uplift or surface uplift?

Supplement: There needs to be some text explaining what is provided in each of the Excel spreadsheet tabs as well as a caption provide for each of the supplemental figures. It's not obvious to me why you need all of the different neon three isotope plots and why they are in the order that they are presented in. This could be cleaned up by having one three isotope plot for the Miocene samples and one for the modern samples, and using different symbol shapes to represent the different temperature steps.

Sincerely,

Marissa Tremblay Purdue University November 17, 2019

New references cited: McFadden, L.D., Eppes, M.C., Gillespie, A.R., and Hallet, B., 2005, Physical weathering in arid landscapes due to diurnal variation in the direction of solar heating: Geological Society of America Bulletin, v. 117, p. 161, doi:10.1130/B25508.1.

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