Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2019-54-AC2, 2019

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.

Michal Ben-Israel et al.

michal.benisrael@mail.huji.ac.il

Received and published: 21 November 2019

We thank reviewer #2 for her/his time and for the constructive and helpful comments. We will incorporate many of the suggested changes and modify the manuscript to address the concerns raised. Generally, there were three major comments made, some of which were similarly made by the first reviewer (Taylor Schildgen) and we include our responses to these concerns below.

The first comment is regarding the small number of modern samples analyzed. As the first reviewer made a similar point, I include here the answer given there. Unfortunately, the source area for chert nodules is very difficult to currently access and therefore

Printer-friendly version

Discussion paper

we can only use the few samples collected there previously. However, we will now include in the manuscript data from several previous studies of modern erosion rates from locations across the Negev Desert, demonstrating the reported erosion rates are representative of this region (e.g., Boroda et al., 2014; Fruchter et al., 2011; Matmon et al., 2009; Matmon and Zilberman, 2016; Matmon et al., 2016).

The second main comment is concerning the interpretation of the measured data and the uncertainty regarding the elevation of the samples during the Miocene, as well as a suggestion to use 'banana plots' to investigate the slowly eroding samples. The first reviewer also brought up the concerns about the elevation during the Miocene and I include here the answer given. While we somewhat address this issue in the manuscript, the references cited do not provide clear evidence to constrain the timing of uplifting of the western half of the Arabian Peninsula and can only determine that it was uplifted to its current elevation over the last 30 Myr (see Feinstein et al., 2013; Willson et al., 2014). We now include an additional calculation based on a 0.5% moderate gradient westward from a base level at the Mediterranean margin and over a ~200 km distance to the location of the currently exposed source rock. This simple calculation supports an elevation of ~1 km above sea level. Additionally, based on a comment made by the third reviewer (Marissa Tremblay), we now consider a range of possible elevations between 500-1000 m and the ensuing production and erosion rates. We will alter the discussion, conclusions, and abstract accordingly in the revised manuscript.

Regarding the suggestion made to include a more familiar tool for presenting burial time at different erosion rates, unfortunately applying this type of diagram will not help to better explain the reported data. When examining samples that have been buried for extensive periods, the measured concentrations of cosmogenic 26Al and 10Be do not represent burial time, as the samples have reached a steady-state determined by post-burial (muonic) production. We did include a figure that presents changes in steady-state concentration with time (see fig. 4). Furthermore, when comparing the cosmogenic 21Ne concentration between the two samples, this is also not a straightforward comparison due to the different sedimentary histories of the different types of samples. While the currently eroding chert nodules have only undergone exposure and weathering from the source rock. In contrast, the Miocene samples were eroded, transported in the fluvial system, and deposited all the while exposed/partially exposed to cosmic rays. Therefore, a 'simple comparison' cannot be made. Nevertheless, we will do our best to explain this point more clearly in the revised manuscript.

Regarding the final major comment, regarding possible Ne diffusion during sample preparation, as the manuscript suggests, 80-90°C is the closure temperature of Ne in quartz over geological timescales. The fractional loss of Ne due to diffusion over a 1.5-hour timeframe is insignificant (<0.1%). We realize that cosmogenic Ne experts are few and far between and we will rephrase this part in the manuscript to clear up any confusion.

Lastly, regarding the detailed minor comments, edits, and questions. We will address each one in the revised manuscript.

——————————— Boroda, R., Matmon, A., Amit, R., Haviv, I., Arnold, M., Aumaître, G., Bourlès, D.L., Keddadouche, K., Eyal, Y., and Enzel, Y., 2014, Evolution and degradation of flat-top mesas in the hyper-arid Negev, Israel revealed from 10 Be cosmogenic nuclides: Earth Surface Processes and Landforms, v. 1621, p. 1611-1621, doi: 10.1002/esp.3551. Feinstein, S., Eyal, M., Kohn, B.P., Steckler, M.S., Ibrahim, K.M., Moh'd, B.K., and Tian, Y., 2013, Uplift and denudation history of the eastern Dead Sea rift flank, SW Jordan: Evidence from apatite fission track thermochronometry: Tectonics, v. 32, p. 1513–1528. Fruchter, N., Matmon, A., Avni, Y., and Fink, D., 2011, Revealing sediment sources, mixing, and transport during erosional crater evolution in the hyperarid Negev Desert, Israel: Geomorphology, v. 134, p. 363–377, doi: 10.1016/J.GEOMORPH.2011.07.011. Matmon, A., Simhai, O., Amit, R., Haviv, I., Porat, N., McDonald, E., Benedetti, L., and Finkel, R., 2009, Desert pavement-coated surfaces in extreme deserts present the longest-lived landforms on Earth: Geological Society of America Bulletin, v. 121, p. 688–697, doi:

10.1130/B26422.1. Matmon, A., and Zilberman, E., 2016, Landscape Evolution Along the Dead Sea Fault and Its Margins, in Enzel, Y. and Bar-Yosef, O. eds., Quaternary of the Levant, Cambridge University Press, p. 771. Matmon, A., Elfassi, S., Hidy, A., Geller, Y., and Porat, N., 2016, Controls on aggradation and incision in the NE Negev, Israel, since the middle Pleistocene: Geomorphology, v. 261, p. 132–146, doi: 10.1016/j.geomorph.2016.02.020. Morag, N., Haviv, I., Eyal, M., Kohn, B.P., and Feinstein, S., 2019, Early flank uplift along the Suez Rift: Implications for the role of mantle plumes and the onset of the Dead Sea Transform: Earth and Planetary Science Letters, v. 516, p. 56–65, doi: 10.1016/j.epsl.2019.03.002. Wilson, J.W.P., Roberts, G.G., Hoggard, M.J., and White, N.J., 2014, Cenozoic epeirogeny of the Arabian Peninsula from drainage modeling: Geochemistry, Geophysics, Geosystems, v. 15, p. 3723–3761, doi: 10.1002/2014GC005283.

Interactive comment on Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2019-54, 2019.