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Solid Earth Discussions

Interactive comment on "The thermal structure of Israel" *by* E. Shalev et al.

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Dear Dr. Mareschal,

Thank you for taking the time and effort to review our paper. We appreciate your constructive comments. We have addressed all of the points you raised and we think that our paper has been significantly improved by taking these comments into account. Please see our answers to your questions below. Sincerely,

Eyal, Vladimir, Yishai, and Zvi.

1. Unfortunately, it is absolutely impossible for readers who do not know extremely well the geology of the region and who have not memorized the tectonic map of a much wider region including the Sinai and the Red sea to appreciate the tectonic significance of the data and to understand the proposed interpretation. I am unable to precisely link

many of the important geological features mentioned in the paper to the heat flux and temperature maps that are shown. This paper must not be published without a tectonic map of the region. A map showing the total sediment thickness over the study area would also be useful. Answer: We added a new figure 1 that includes the main tectonic elements in the area and locations of the xenoliths. The total sediment thickness is shown in figure 2.

2. I have very strong reservations about the approach used by the authors for calculating temperature at depth (as explained in section 4.2). The authors rely on a model with heat generation exponentially decreasing with depth, which is normally based on a linear heat flow heat production relationship q = qr + A $\times$ D. In this relationship, qr and D are usually constant for a given province and surface heat production A is variable. The authors have used a fixed (and very high) value of heat production (3.7μW m$-$3) and varied qr. This makes little sense if qr is the mantle heat flux as they state. Incidentally, it has been understood for a long time that qr is not the mantle heat flux and it is now referred to as the reduced heat flow (heat flux at the base of the enriched upper crustal layer). With the parameters used by the authors (A=3.7μW m$-$3and D=10km), the total crustal heat production will be 37mW m$-$2, i.e. it is higher than the surface heat flux in some regions shown on Figure 3, which would then require a negative reduced heat flux! I do not think that the heat flow heat production relationship and the exponential model for heat genaration are good approximations (see the discussion in chapter 7 of Jaupart and Mareschal, 2011), but if they are used, they should be used consistently. Also, I assume that the temperature measurements were made in the sediments. Then I do not know why the authors use equation (2) to fit the temperature profile to the data if they assume that heat production is zero in the sediment . On the same note, equation 2 is not correct for a layered medium. If thermal conductivity varies between layers, one must calculate the temperature through each layer with a different conductivity. With no heat production, the equation would be: T(z) = T(zi) + q0(z $-$ zi)/Ki with T(zi) temperature at the top of the layer and q0 surface heat flux. Answer: Indeed, this paragraph was not written well. We were trying to write this

paragraph succinctly, but as the reviewer noted this resulted in errors. We have now corrected equation 2. The equation suggested by the reviewer was used for the sedimentary cover and an equation that takes into account the radiogenic heat was used for the basement. We have used radiogenic heat generation of 0.37μW m$-$3 and not what was incorrectly written before (sorry for typo).

3. Were the values given by Eckstein and Simmons measured on samples from the region? In that case, it would be useful to give the range of values and the number of samples measured for each lithology. Yes, the values were measured on samples from the region. We added two columns of number of samples and standard deviation in table 1.

4. The authors could provide a table with all the heat flux estimates and relevant information (geographical coordinates, average temperature gradient and thermal conductivity assumed, depth interval). Answer: We append a table with this information.

5. What is the coordinate system used for the maps? Answer: we have changed the coordinated to Lat, Long in all maps.

6. Heat production is not 0 in the sediments, although it is smaller than the value used by the authors for the basement. For some of lithologies (shales) it could be as high as 1.5μW m$-$3. Answer: We neglected radiogenic heat production in the sediments and used a linear temperature profile as suggested by the reviewer before. In the sedimentary cover, borehole data is abundant and temperatures are constrained throughout the sedimentary layers.

7. Where are the xenoliths found? Maybe their locations could be shown on the tectonic map. Or another map could be provided with xenoliths locations and T and P estimates. Answer: Locations of the xenoliths are shown in figure 1.

Interactive comment on Solid Earth Discuss., 3, 431, 2011.