Interactive comment on “The thermal structure of Israel” by E. Shalev et al.

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Received and published: 25 May 2011

This manuscript could make a very interesting paper relating the tectonic framework and heat flux of the region around Israel. 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 This paper must not be published without a tectonic map of the region.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.

Secondly, 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 nor-
mally based on a linear heat flow heat production relationship \( q = q_r + A \times D \) (or
\( q = q_m + \rho_c H_0 h_r \) in their notation). In this relationship, \( q_r \) and \( D \) are usually constant for
a given province and surface heat production \( A (\rho_c H_0) \) is variable. The authors have
used a fixed (and very high) value of heat production (3.7 \( \mu \text{W m}^{-3} \)) and varied \( q_r \). This
makes little sense if \( q_r \) is the mantle heat flux as they state. Incidentally, it has been
understood for a long time that \( q_r \) 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 (\( A=3.7 \mu \text{W m}^{-3} \) and \( D=10\text{km} \)), the total crustal heat
production will be 37\( m\text{W m}^{-2} \), 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
generation 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 \((z_i < z < z_{i+1})\) with a different
conductivity. With no heat production, the equation would be:

\[
T(z) = T(z_i) + q_0(z - z_i)/K_i
\]

with \( T(z_i) \) temperature at the top of the layer and \( q_0 \) surface heat flux.

There are a few less important points.

Some more details are needed concerning thermal conductivity values. Were the val-
ues 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 mea-
sured for each lithology.
Also, 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).

What is the coordinate system used for the maps?

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 $1.5 \mu \text{W m}^{-3}$.

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. Incidentally, there is no need to provide so many temperature maps.

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