

שפיעות חום והיסטוריה תרמלית בדרום רמת הגולן

ד"ר איתי רזניק - המכון הגיאולוגי

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Thermal History of the Southern Golan Heights

Ghareb



Lithology: Chalk
Kerogen: Type IIS
TOC_{ave} = 7 wt%
Organic maturity
(Transformation ratio) <30%

Mishash



Lithology: Chalk, Silicified Chalk,
Phosphorite, Chert.

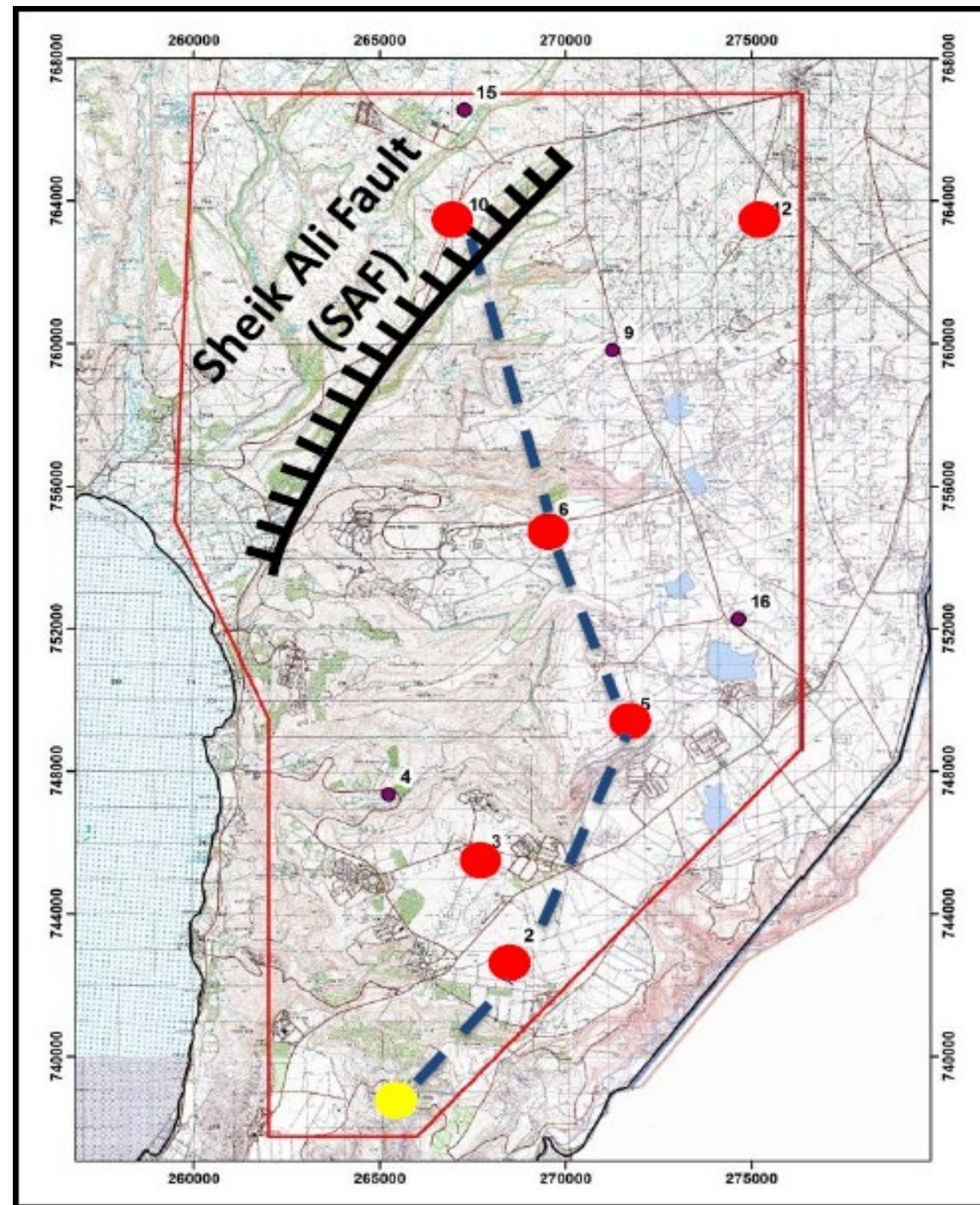
Kerogen: Type IIS

TOC_{ave} = 3.5 wt%

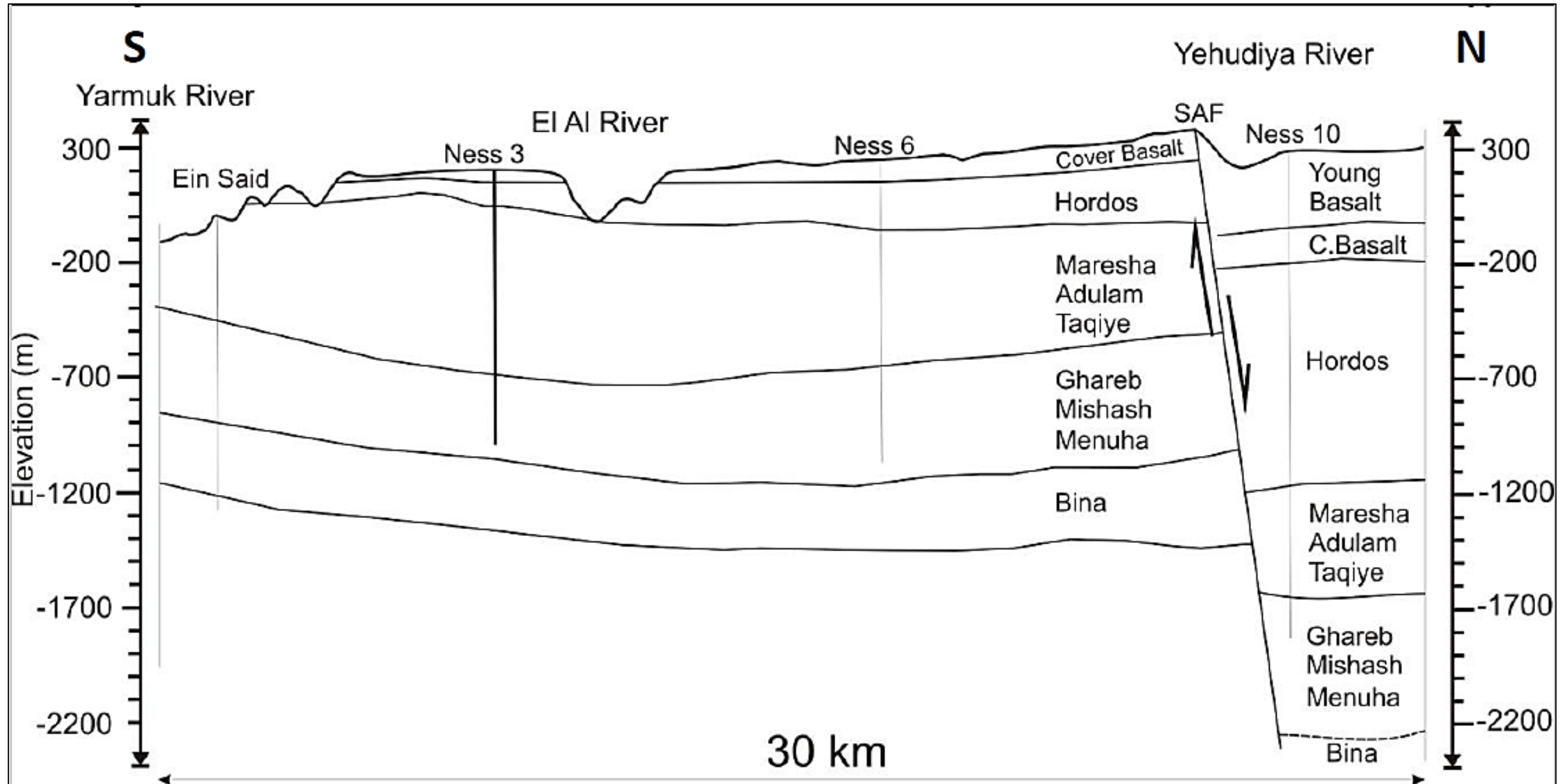
Organic maturity
(Transformation ratio) <45%

Reznik I. J., & Bartov, Y. (2021). Present heat flow and paleo-geothermal anomalies in the southern Golan Heights, Israel. *Earth and Space Science*.

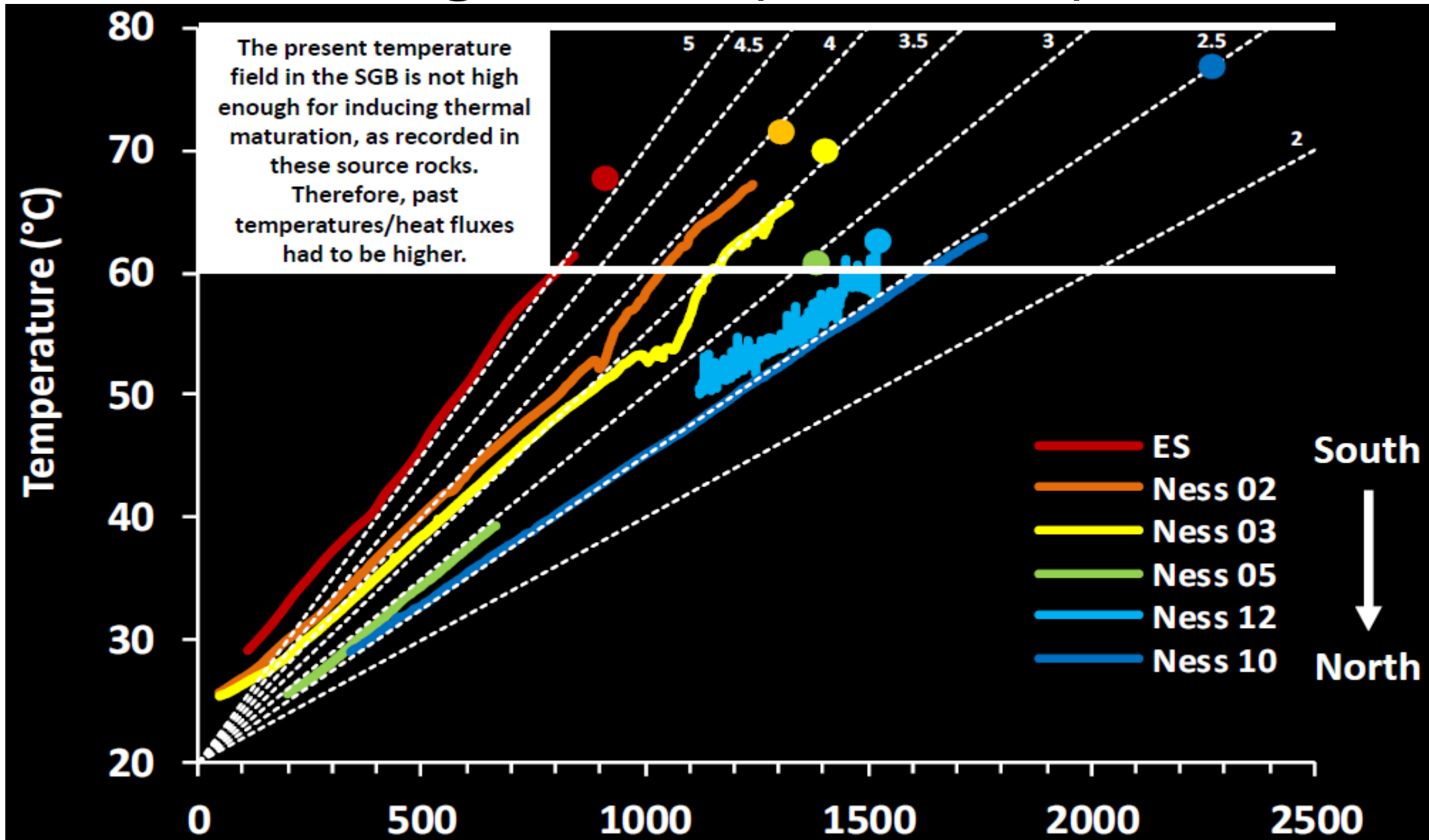
Borehole locations



S-N cross section

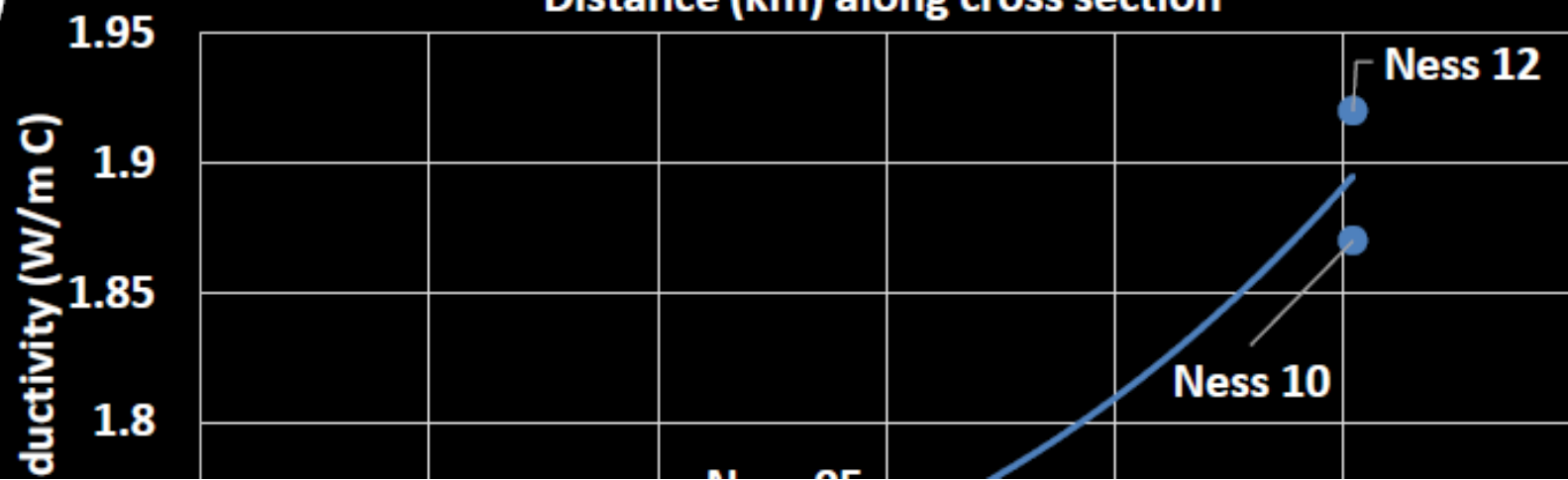
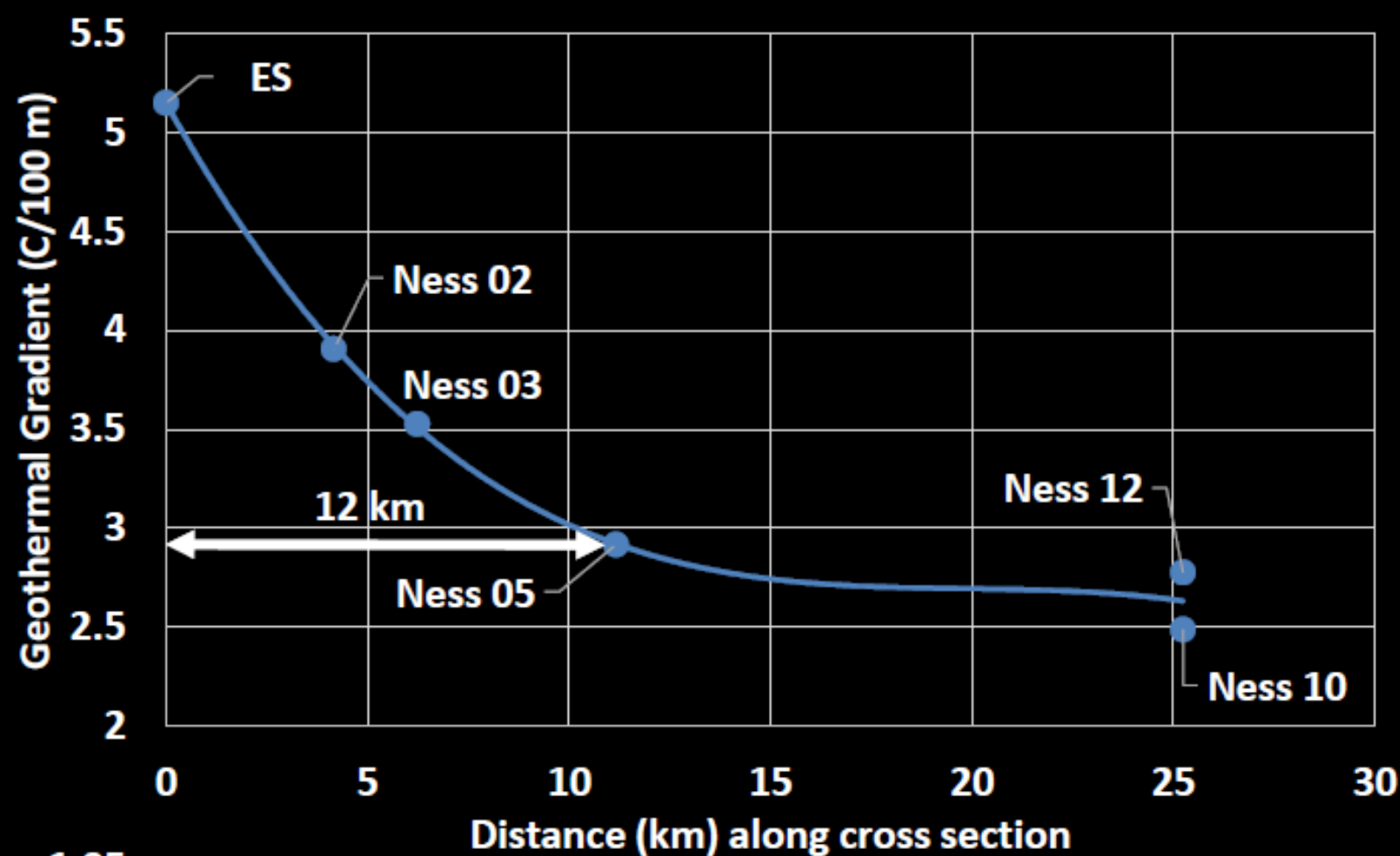


Geothermal gradients ($^{\circ}\text{C}/100\text{ m}$)



Present heat flux (mW/m²)

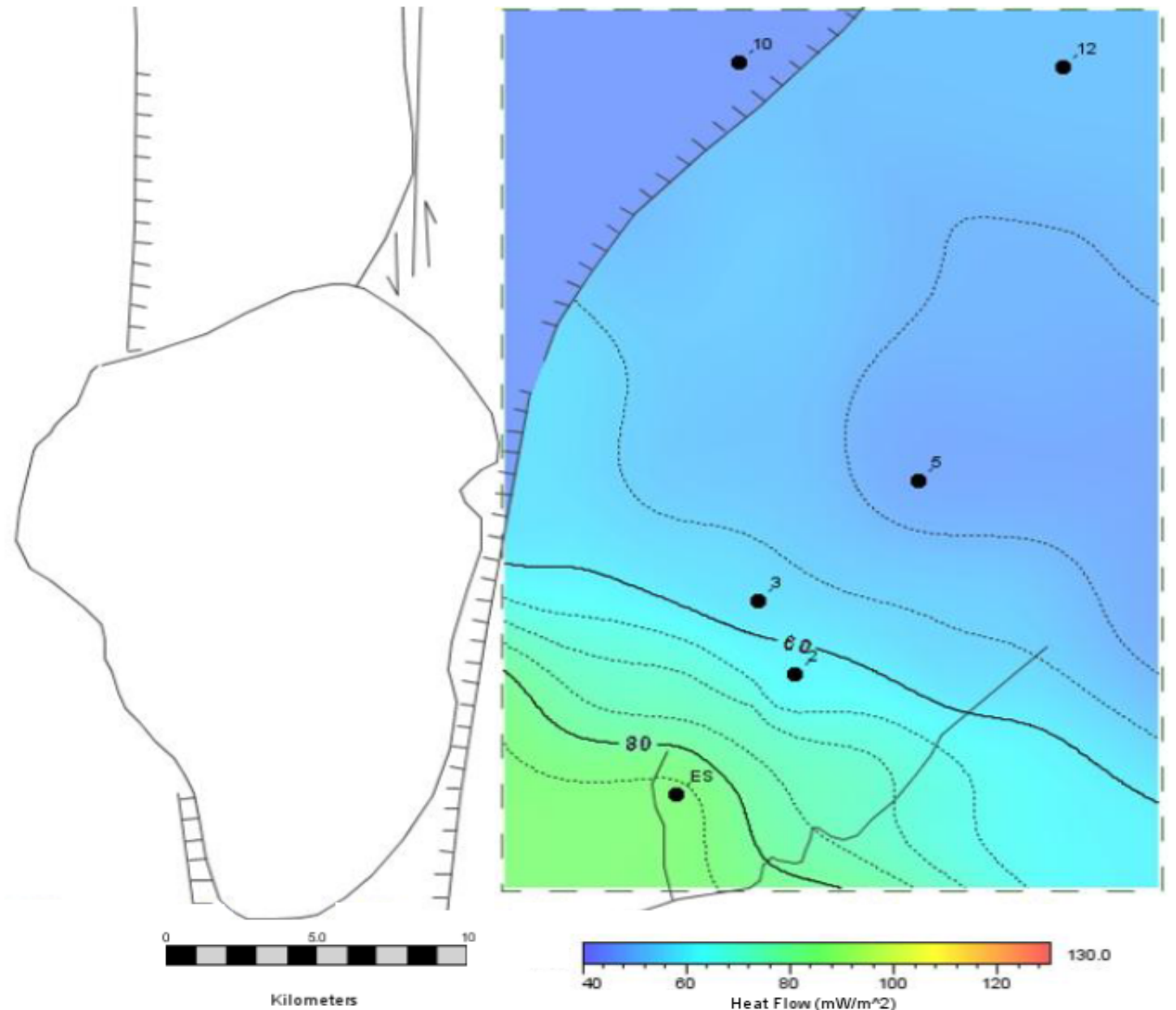
$$\text{Heat Flux} \left(\frac{\text{mW}}{\text{m}^2} \right) = \text{Geothermal Gradient} \left(\frac{\text{C}}{100\text{m}} \right) * \text{Thermal Conductivity} \left(\frac{\text{W}}{\text{m} * \text{C}} \right) * 10$$



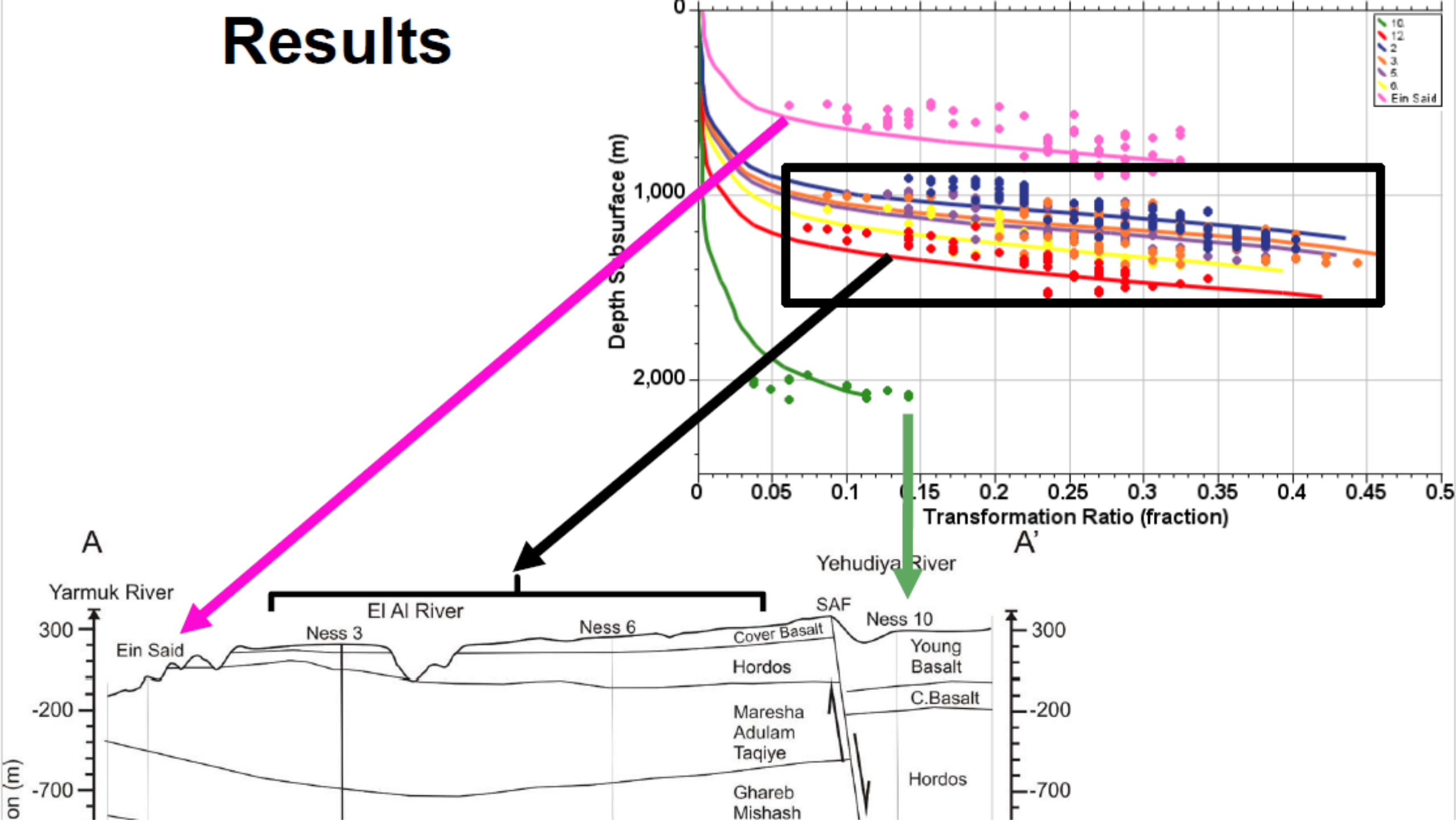
Present heat flux (mW/m²)

The thermal anomaly in the Yarmouk area is significantly more widespread than previously known.

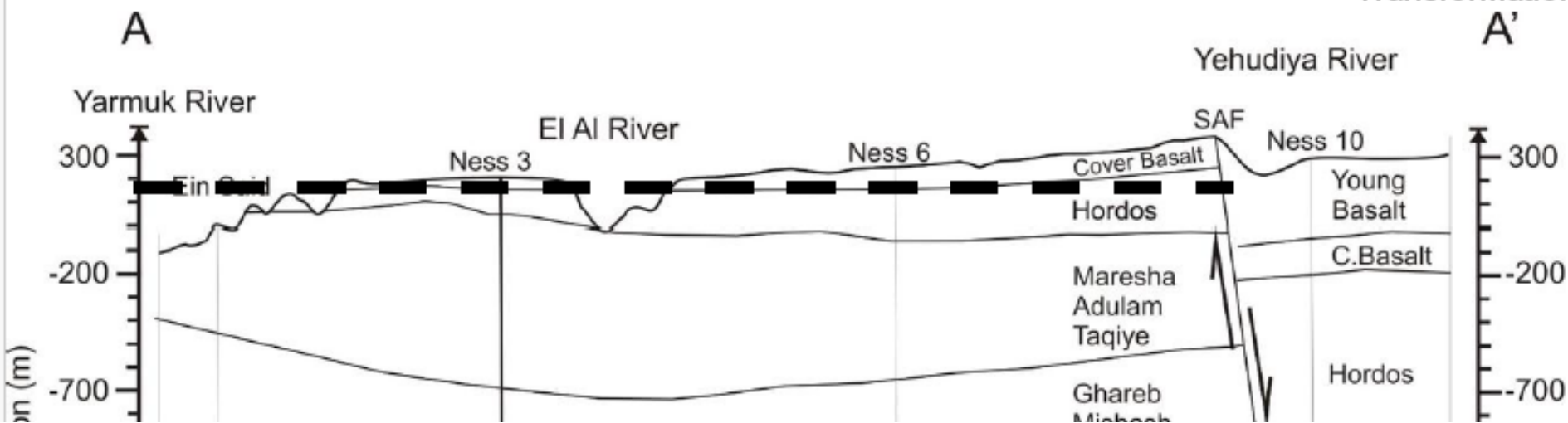
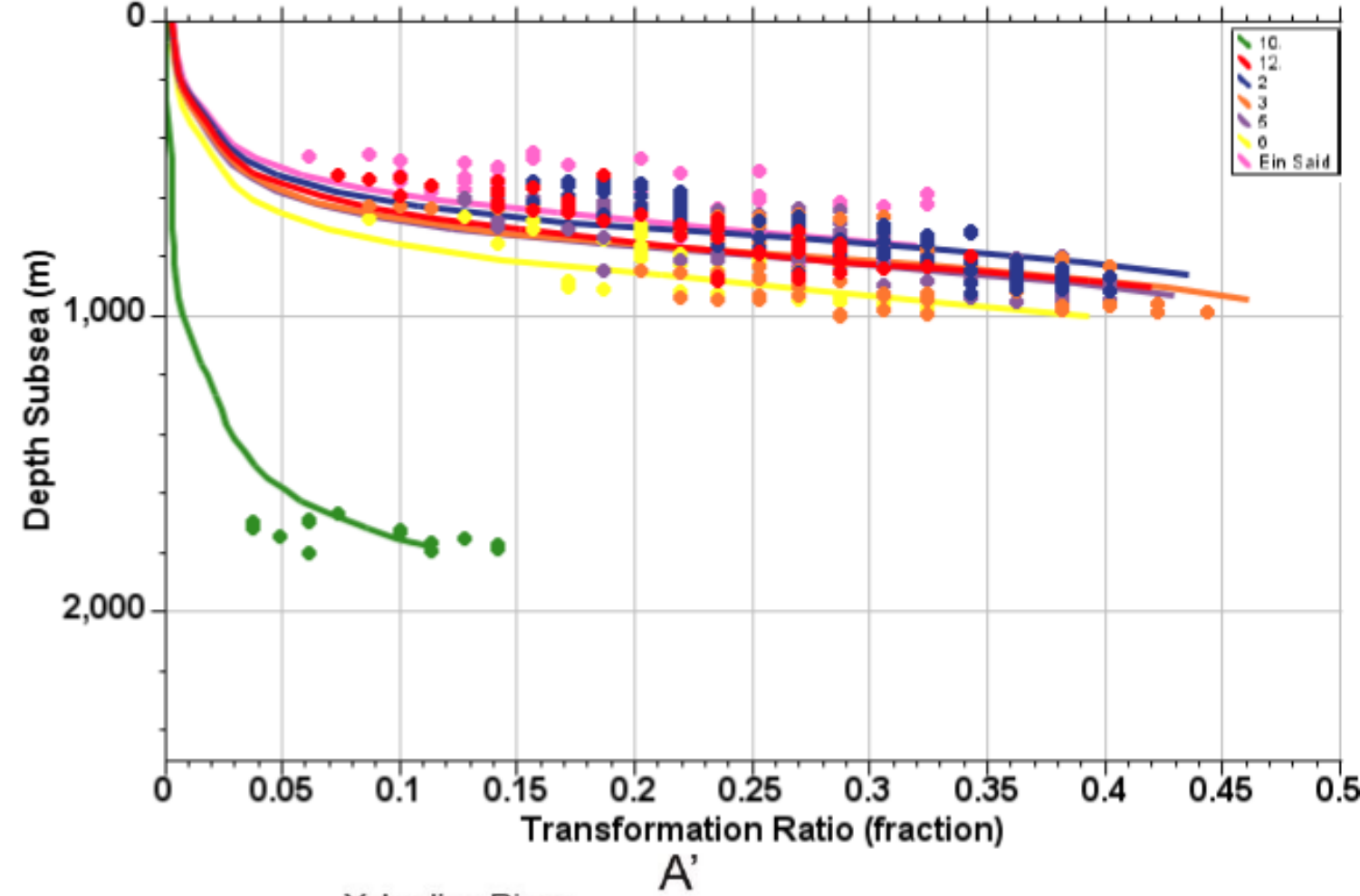
This anomaly is therefore likely to be attributed to crustal heating via a shallow (lithospheric) magmatic chamber (in contrast with groundwater flow from depths) along the Yarmouk fault.



Results

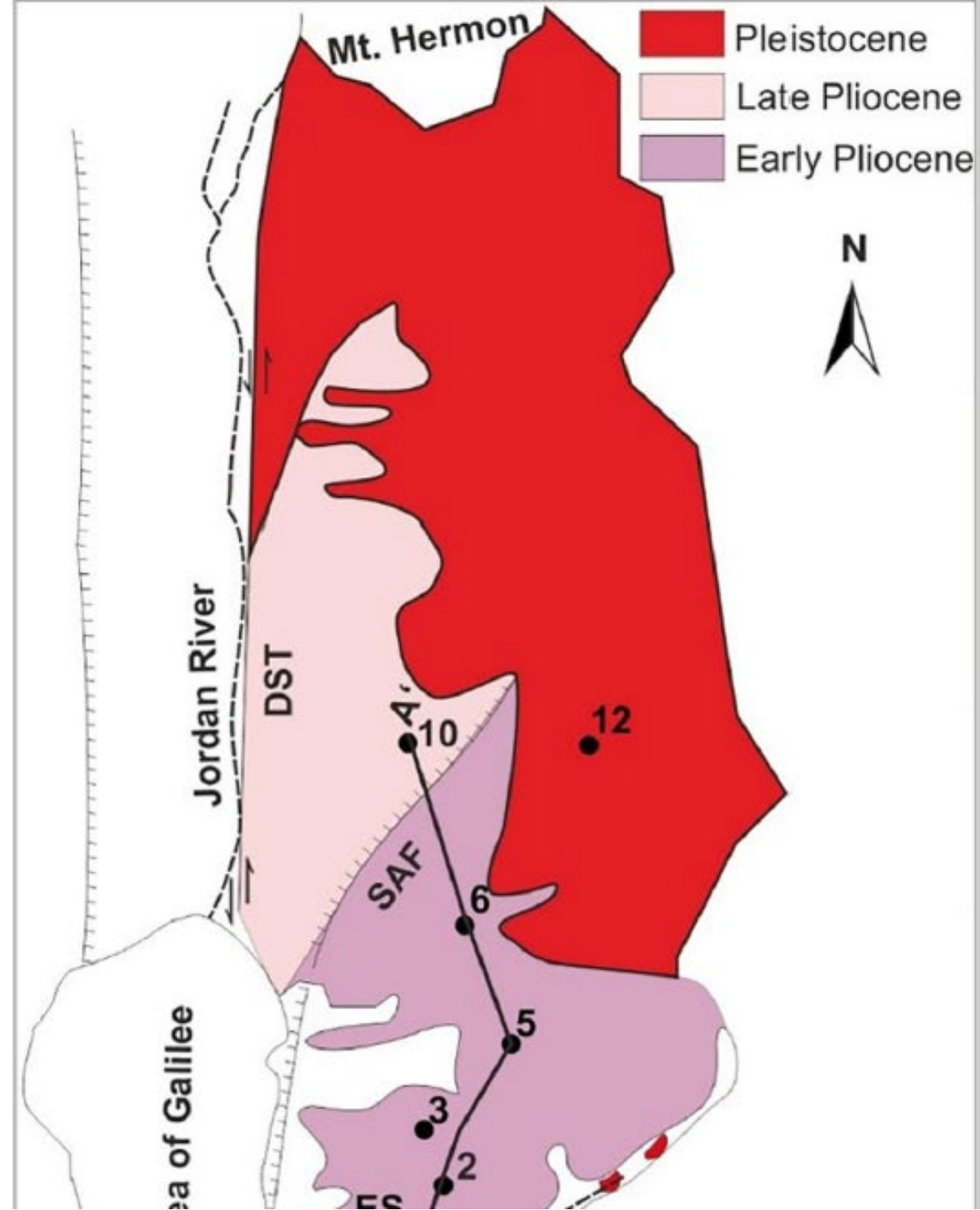


Results



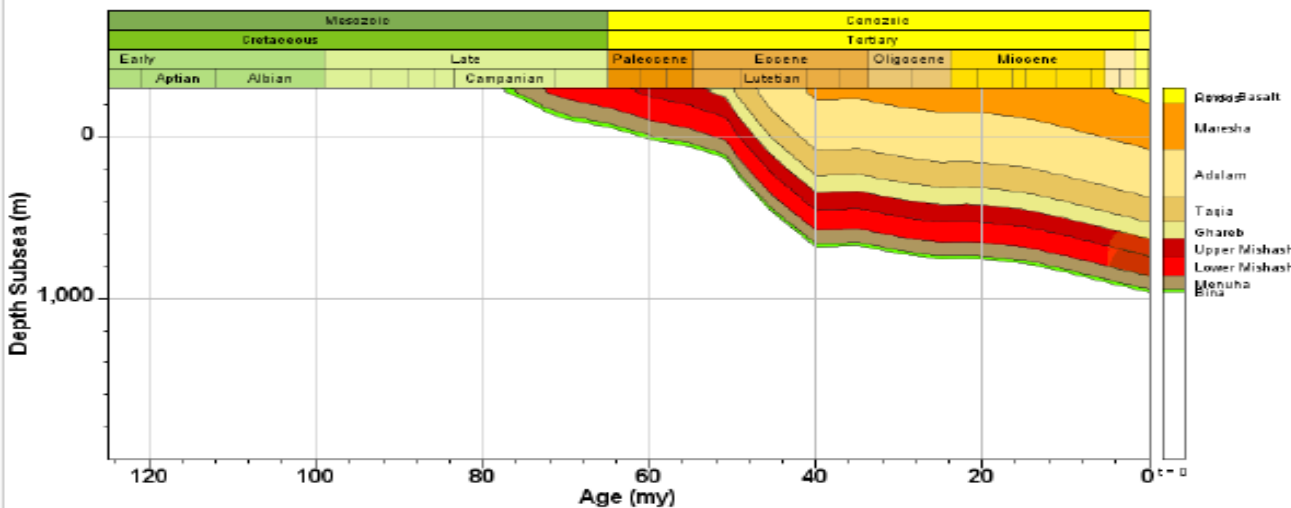
Pliocene (5.3-3.5 Ma) thermal event

- 1) Pleistocene (young) basalts do not occur in all the areas that have matured.
- 2) Late Pliocene basalts (north of SAF).
- 3) Early Pliocene (cover) basalts appear in all the matured areas.

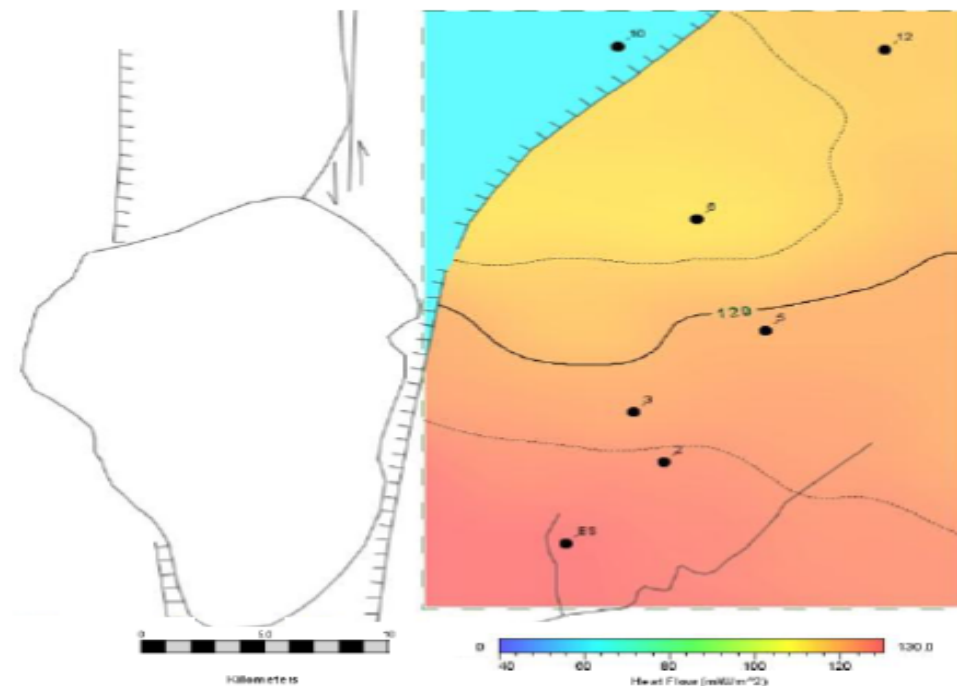
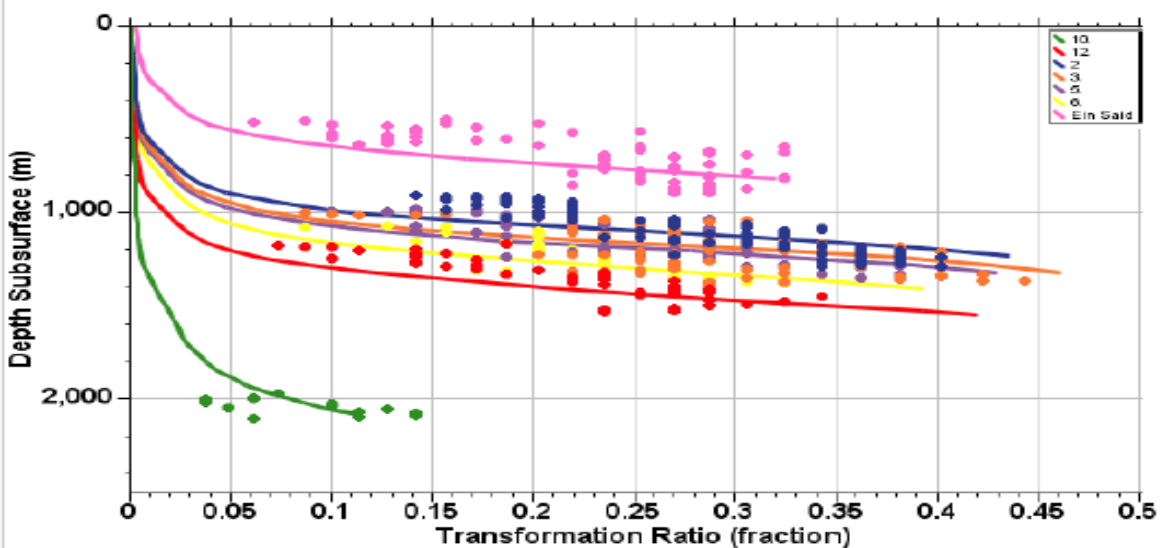
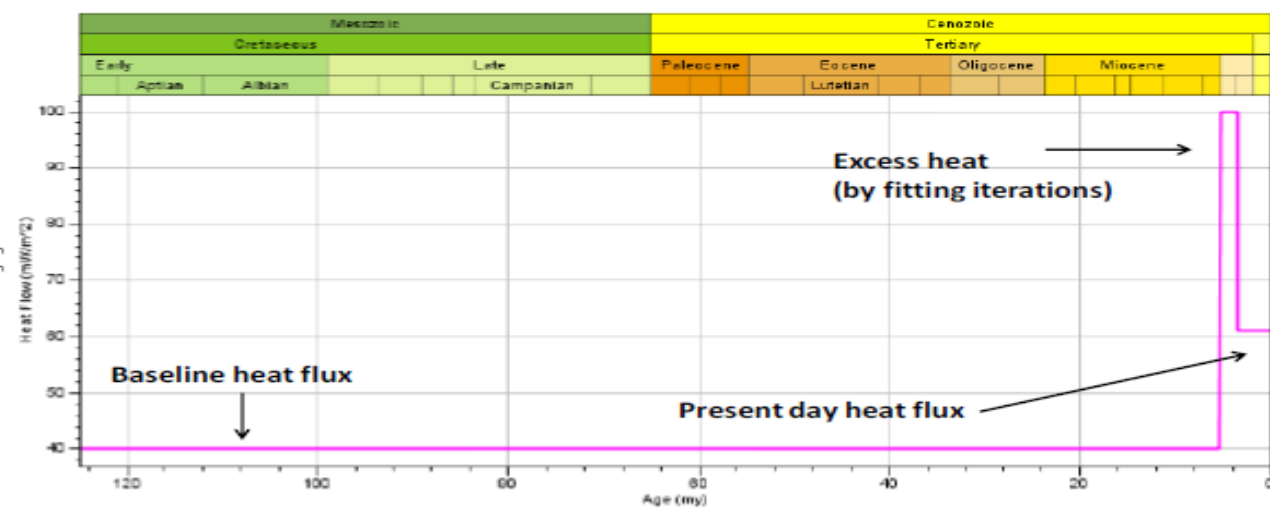


BasinMod modelling workflow

2

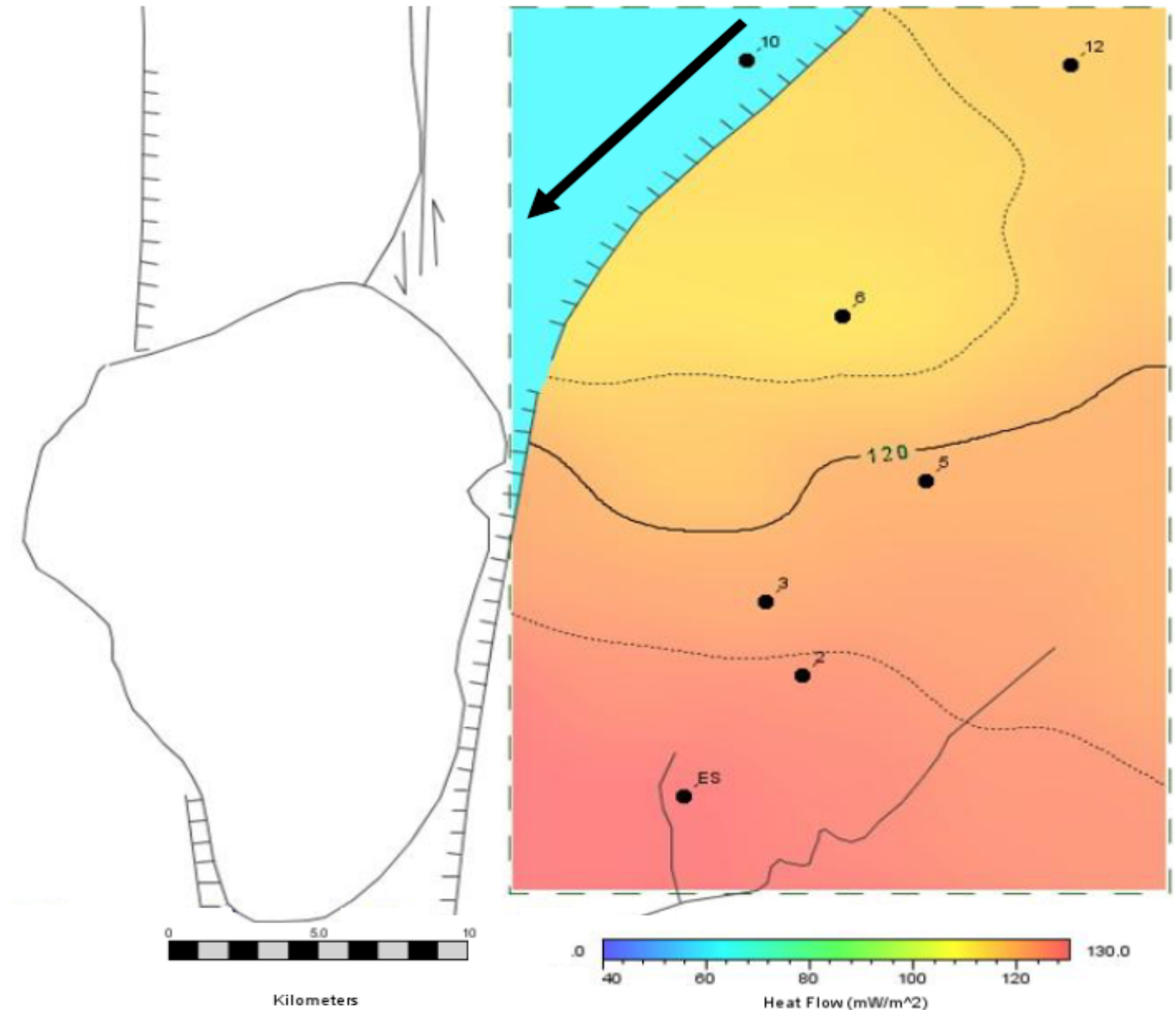


2B



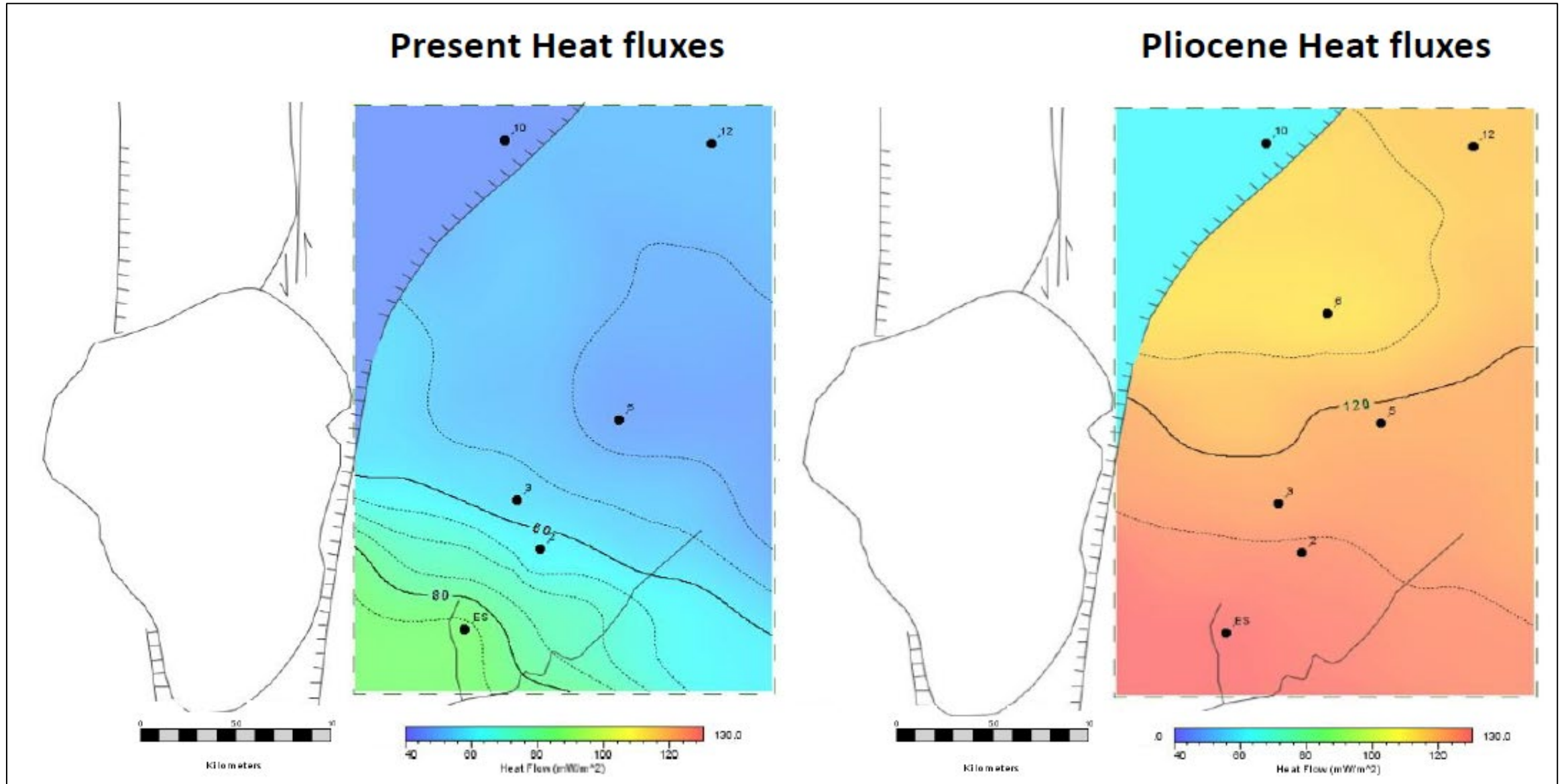
Paleo heat flux (mW/m²)

- 1) Uniform maturation levels, almost uniform columnar sections, similar derived heat fluxes south to the SAF.
- 2) However, north to the SAF, there was no thermal anomaly. Why?
 - a) Hydrological barrier
 - b) Tectonics
 - c) Edge of thermal anomaly



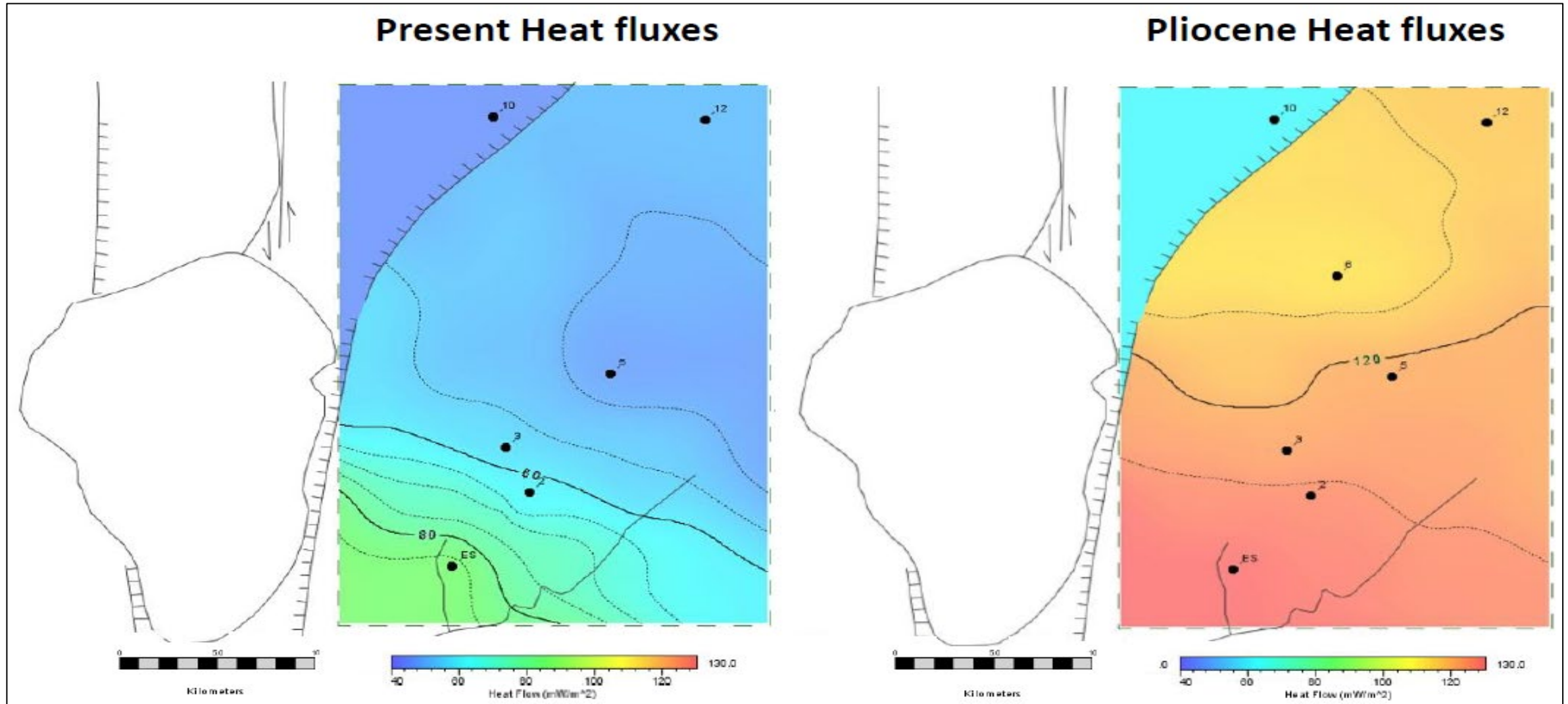
Present vs. Pliocene anomalies:

Option 1 –hydrological heat removal



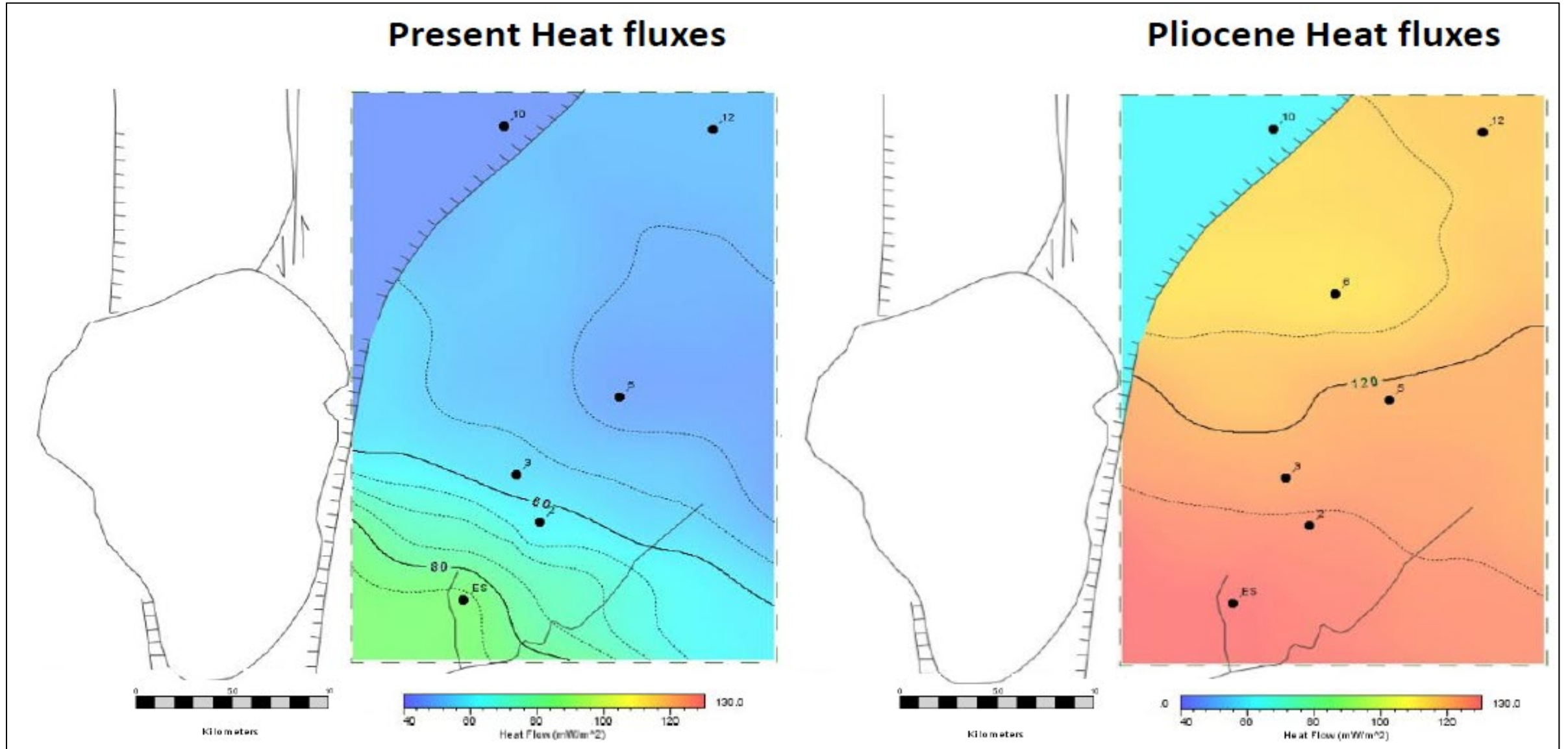
Present vs. Pliocene anomalies:

Option 2 – Present magmatic chamber is a relic of the Pliocene magmatic chamber



Present vs. Pliocene anomalies:

Option 3 – Two separate magma chambers



Conclusions

- The present temperature field, as measured in the new boreholes, indicates that the thermal anomaly around the Yarmuk is wider than previously thought
- The present temperature field points to local heat sources (magmatic chamber or magmatic intrusions) or a regional (crustal) basal heat source, which is modulated by deep groundwater flow.
- During the Pliocene, a regional (crustal) scale thermal source has led to strikingly similar degrees of maturation of Late Cretaceous source rocks across the basin.
- Further study is needed in order to determine whether the present and paleo thermal anomalies can be considered separate and discrete events with potentially different heat sources or whether these events are genetically tied