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# Neogene evolution of Transylvania basin: insights derived from (2D steady-state) thermal modeling

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Formation and evolution of back-arc basins are directly related to the dynamics of a subduction area. While the main subduction area is characterized by regional convergent movements and a depressed thermal regime, a back-arc basin is dominated by extension and increased heat flow due to lithospheric stretching.

Transylvania Basin stands out as a back-arc basin developed in the central-eastern part of the Carpathians system. A special feature of this basin is the thick Neogene (Badenian – Pannonian) sedimentary fill, with an average thickness of 3 km, deposited during the Middle-Late Miocene collision stages of the external Carpathians. In addition, the basin shows no significant extensional deformation and is characterized by low heat flow (in average $\sim$45 mW/sq.m). The evolution of the basin ended with the final docking of the Carpathians on top of the East-European-Moesian Platforms, when the entire basin became subject to uplift and erosion. The basin is characterized by a lithospheric thickness of $\sim$100 km, with a Moho depth around $\sim$34 km. The heat flow increase from 35 W/sq.m in the central part of the basin to 50-60 mW/sq.m on the margins.

First, the cooling effect of the Neogene sedimentation was assessed by 1D non steady-state calculations. In the central area, where the thickness of sediments is the highest, the sedimentation decreases the heat flow by 20%. Thus, the corrected heat flow increases to 45 mW/sq.m. This is still low value, but not extremely low. In the peripheral areas, where late stage erosion occurred, the erosion increases the heat flow by 5-10%. Thus, the corrected values are $\sim$50-55 mW/sq.m. Groundwater flow in the basin can

be neglected. Therefore, the heat is transported by conduction.

In the second step, we modeled the 2D temperature field in the lithosphere along three sections. Our aim was to investigate if the low heat flow can be modeled assuming a steady-state and using realistic thermal parameters. Results show that the low heat flow in the central area can be achieved, if the heat production in the crust is considerably lower than in general, or assuming that the temperature at the bottom of the lithosphere is less than 1000 $^{o}$C. Low crustal heat production might be derived from the thick ophiolitic sequence present in the basin basement. On the other hand, low lithospheric temperatures might be caused by the long lasting subduction along the East-Carpathians. Both assumptions are realistic.

The thermal modeling can not offer the entire solution for the depressed heat flow in the Transylvania basin, but provide answers for a large part of questions.