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Eastern Mediterranean geothermal resources and subduction dynamics

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The Aegean-Anatolian retreating subduction and collision zones have been investigated through 3D numerical geodynamic models involving slab rollback/tearing/breakoff constrained by, for instance, seismic tomography or anisotropy and geochemical proxies. Here, we integrate these investigations by using the well documented geothermal anomalies geothermal anomalies. First, we use 3D high-resolution thermo-mechanical numerical models to quantify the potential contribution of the past Aegean-Anatolian subduction dynamics to such present-day measured thermal anomalies. Results suggest an efficient control of subduction-related asthenospheric return flow on the regional distribution of thermal anomalies. Our quantification shows that the slab-induced shear heating at the base of the crust could partly explain the high heat flow values above the slab tear (i.e. in the Menderes Massif, Western Turkey). Second, the associated thermal signature at the base of the continental crust is used as basal thermal boundary condition for 2D crustal-scale models dedicated to the understanding of heat transfer from the abnormally hot mantle to the shallow geothermal reservoir. These models couple heat transfer and fluid flow equations with appropriate fluid and rock physical properties. Results suggest that permeable low-angle normal faults (detachments) in the back-arc region can control the bulk of the heat transport and fluid circulation patterns. We suggest that detachments can drain crustal and/or mantellic fluids up to several kilometers depths. At the basin-scale, we show that the permeability of detachments may control the reservoirs location. Temperatures at the base of detachments may be subject to protracted increase (due to anomalously high basal heat flow) through time, thereby generating dome-shaped thermal structures. These structures, usually with $\sim$20km characteristic wavelength, may reach the Moho involving lateral rheological contrasts and possibly crustal-scale boudinage, thereby driving the formation of new crustal detachments.