Geophysical Research Abstracts,
Vol. 11, EGU2009-8304-1, 2009
EGU General Assembly 2009

The steady-state thermal structure of the Arabian Shield prior to the Read Sea rifting

H.-J. Förster (1), A. Förster (2), R. Oberhänsli (1), and D. Stromeyer (2)

(1) Institute of Earth Sciences, University of Potsdam, Potsdam, Germany, (2) GFZ German Research Centre for Geosciences, Potsdam, Germany

Several lines of evidence exists indicating that since the Oligocene, large portions of the Arabian Shield (AS) are experiencing significant heating associated with mantle upwelling, lithosphere thinning, rifting, and associated voluminous basaltic volcanism. In contrast, little is known about the thermal state prior to the onset of these thermal perturbations and respectively, of those areas of the shield that remained tectonically stable. To address this issue, a unique set of samples from the uppermost crust down to the lithospheric mantle of Jordan is analyzed for chemical composition and petrophysical properties (density, thermal conductivity, radiogenic heat production). These data, covering a vertical section of almost 65 km, are used in conjunction with surface heat flow (F
örster et al. 2007) to elaborate a detailed and comprehensive lithospheric thermal model that reflects the pre-Oligocene conditions of the AS, which consolidated in the late Proterozoic/early Cambrian. Steady-state model geotherms, calculated on the basis of conductive surface heat flows of 55 and 60 mW m^{-2}, appear to best describe the thermal structure, because they (a) meetthe range of lithosphere–asthenosphere boundary depths of 110–160 km deduced from seismology and inferred from xenolith thermobarometry, (b) are in accordance with typical, xenolith-derived geotherms for terranes of similar age and lithospheric thickness, and (c) conform to results of thermomechanical models on the origin of the Dead Sea basin that started in Miocene time. Accordingly, pre-Oligocene Moho temperatures (at depths between 35 and 40 km) of the AS should have been in the order of 530–650 ^{o}C, with mantle heat flows averaging between 24 and 29 mW m^{-2}.The results of this study are opposed to previous models assuming that the AS constitutes a cold continental lithosphere, thermally similar to many terranes consolidated in the Archean. Such a “cold´´ thermal structure, inferred from previously measured low surface heat flows (generally
le45 mW m^{-2}) is inconsistent with the thickness, composition, and petrophysical properties of the stable lithosphere of the shield.

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örster, A., F
örster, H.-J., Masarweh, R., Masri, A., Tarawneh, K., DESERT Group (2007) The surface heat flow of the Arabian Shield in Jordan.
textitJ. Asian Earth Sci.,
textbf30, 271–284.