The rise of the asthenospheric mantle beneath the Arabian lithosphere

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Twenty-five years passed since the introduction of the MOMO model by Stein and Hofmann[1]. The model proposes that continental crust evolved through several **M**ajor **O**rogenic cycles that were associated with large **M**antle **O**verturning events. The model describes large plume heads that enrich the shallowest mantle by incompatible trace element, change its isotopic composition, form oceanic plateaus (e.g., the Mesozoic Ontong Java plateau) and produce source material for juvenile arc magmas constructing the major juvenile additions of continental crust. The magmatic suites comprising these juvenile orogens are characterized by Nd-Sr-Hf isotope ratios that lie between the enriched plume compositions (the MOMO plume heads) and depleted MORB mantle (DMM). On the isotope–evolution diagram the enriched juvenile orogens form growth trend whose slope reflects a time–integrated (past 4Ga) $^{147}Sm/^{144}Nd$ ~ 0.205 that is consistent with values derived from the excess in $^{142}Nd/^{144}Nd$ in mantle magmas including young PREMA-type basalts[2,3]. The MOMO model suggests that the DMM represents a transient reservoir, which evolves after major overturn events during crust formation. Recent tomographic mapping indicates a large-scale rise of the asthenosphere mantle beneath the Arabian lithosphere [4], consistent with the scenario proposed by Stein and Hofmann that the upper mantle transforms from MOMO orogeny to Wilsonian tectonics.

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