Lucassen, F., Franz, G., Romer, R. L., Pudlo, D., Dulski, P. (2007): Nd, Pb, and Sr isotope composition of Late Mesozoic to Quaternary intra - plate magmatism in NE - Africa (Sudan, Egypt): implications for the mantle sources
Jahrestagung der Afrikagruppe deutscher Geowissenschaftler (Potsdam 2007), 24 p.

Nd, Pb, and Sr isotope composition of Late Mesozoic to Quaternary intra-plate magmatism in NE-Africa (Sudan, Egypt): implications for the mantle sources

Friedrich Lucassen*,** Gerhard Franz**, Rolf L. Romer*, Dieter Pudlo***
& Peter Dulski*

* GeoForschungsZentrum Potsdam, Telegrafenberg, 14473 Potsdam, Germany; Email: *lucassen@gfz-potsdam.de*
** Institut für Mineralogie-Petrologie, TU Berlin, Sekr. ACK9, Ackerstr. 71-76, D-13355 Berlin, Germany;
*** Faculty of Chemistry and Earth Sciences, Institute of Earth Sciences, Friedrich-Schiller-Universität Jena, Burgweg 11, 07749 Jena, Germany

Isotopic compositions of mafic small volume intra-plate magmatism have the potential to identify the compositions of the contributing sub-continental mantle sources. The Nd-Pb-Sr isotope signatures of the widespread intra-plate magmatism in NE Africa (Sudan, Egypt), which was active at least from the late Mesozoic to Quaternary, are surprisingly uniform and indicate the existence of a high-μ (μ=238U/204Pb) mantle source. This mantle source is characterized by small ranges of initial isotope compositions 143Nd/144Nd ca. 0.5127 – 0.5129, 206Pb/204Pb ca. 19.5 – 20.5, 207Pb/204Pb ca. 15.65-15.75, 208Pb/204Pb ca. 39 – 40 and 87Sr/86Sr ca. 0.7030 – 0.7032. Such isotope signatures are commonly attributed to deep seated mantle sources, which are activated by uprising mantle plumes. In contrast, the age range and spatial distribution of the intra-plate magmatism and its compositional relation to the Afar flood basalts (convective mantle 'plume related') and Red Sea and Gulf of Aden basalts from the spreading centers (convective mantle 'Mid Ocean Ridge Basalt (MORB) - type' = common depleted mantle) suggest a source in the lithospheric mantle. This mantle formed during the Pan-African beneath orogens and magmatic arcs from asthenospheric (convective) mantle and was enriched in trace elements (U, Th, and light REE = Rare Earth elements) during the Pan-African. Combining our new data set with published data of intra-plate magmatic rocks from the Arabian plate indicates two compositionally different domains of lithospheric mantle in NE-Africa - Arabia. The two domains are spatially related to the subdivision of the Pan-African orogen into a western section dominated by reworked cratonic basement (NE-Africa; high-μ lithospheric mantle) and an eastern section dominated by juvenile Pan-African basement (easternmost NE-Africa and Arabia; moderate high-μ lithospheric mantle). The compositions of the Pan-African lithospheric mantle and the MORB-type mantle of the Red Sea and Gulf of Aden spreading centres could explain the Nd-Pb-Sr isotopic compositions (after subtraction of crustal contamination) of the Afar flood basalts in Yemen and Ethiopia by mixtures of the isotopic composition of regional lithospheric and asthenospheric sources. Nd-Pb-Sr isotope compositions do not allow discerning a plume component in the magmatic rocks of this region.