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New data on mantle xenoliths from Cenozoic lavas of the Upper Rhine Graben: Nidda (Vogelsberg) case study

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Vogelsberg (central Germany) is one of the largest (ca. 2500 km2) volcanic fields of the Cenozoic Central European Volcanic Province. It is situated at the northern prolongation of the Upper Rhine Graben and spreads towards the Hessian Depression. The volcanism was active from Early to Middle Miocene (19-10 Ma), with maximum at ca. 16 Ma, with lavas of composition ranging from alkali-olivine basalt to basanite, and subordinate tholeiites. Mantle-derived xenoliths are abundant in several lava flows. NW part of Vogelsberg is underlain by the Rheno-Hercynian Variscan basement, whereas the SE part by that of Mid-German Crystalline High.

Witt-Eickschen (1993) studied the xenoliths from major occurrences and concluded that lithospheric mantle beneath the Vogelsberg was subjected to moderate melting, followed by metasomatic changes, including the Fe-Ti metasomatism. We decided to study the xenolith suites from the region in order to get data sets based on larger xenolith populations and with extensive use of LA-ICP-MS technique. In this abstract the preliminary major element mineral chemical data on the Nidda basanite (SW of the Vogelsberg volcanic field; Ehrenberg et al. 1982) xenoliths are presented.

The Nidda xenoliths are not abundant, they are typically oval or elongated in shape, varying in size between 3 and 8 cm. They have the composition of clinopyroxene-poor spinel lherzolite or spinel harzburgite. As elsewhere in the European Variscan orogen, the olivine composition defines two groups of xenoliths: A (Fo 90.4-91.5 %) and B (Fo ∼89.5 %).

Orthopyroxene in group A is characterized by Mg# from 0.907 to 0.920 and Al content from 0.13 to 0.17 atoms p.f.u. (per formula unit); Ca content is 0.015-0.045 atoms p.f.u. and is positively correlated with Mg#. Clinopyroxene has Mg# similar to that of orthopyroxene and is rich in Al (0.18-0.22 atoms p.f.u.). Cpx-opx geothermometry shows temperatures of ca. 950 – 970 ºC. Spinel is characterized by Mg# 0.75-0.78, Cr# varies from 0.30 to 0.38. Amoeboidal spinel occurring in one of the xenoliths is rich in Al (Cr# 0.14-0.16) and slightly richer in Mg (0.79-0.81), probably being of metasomatic origin (Cpx-Opx thermometry showing ca. 760-790 ºC).

The xenoliths of group B contain Al-rich (0.18-0.20 atoms p.f.u.) orthopyroxene of Mg# ∼0.90 and Ca content between 0.035 and 0.040 atoms p.f.u. Clinopyroxene (Mg# ∼0.895) is Al-rich (∼0.26 atoms p.f.u.). Spinel is characterized by Cr# 0.21-0.22 and Mg# 0.78-0.79.

In terms of Fo content in olivine and Mg# and Al content in pyroxenes, the Nidda xenoliths are similar to those from the Northern Hessian Depression (Ćwiek et al., 2017). More data on are needed for better characterization of mantle beneath the Vogelsberg.

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