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Rifting of buckled European lithosphere in combination with lithosphere-penetrating lineaments determine the composition of mafic igneous rocks in the northern CECIP

M. Abratis, L. Viereck-Goette

Institut fuer Geowissenschaften, Friedrich-Schiller-Universitaet Jena, Germany

The intraplate volcanic fields between the Eifel (Germany) and Silesia (Poland) form the northern E – W oriented zone of the Central European Cenozoic Igneous Province (CECIP). The compositions of the mafic magmas show systematic regional trends in geochemistry and mineralogy that require variations of the melting processes in the lithosphere-asthenosphere boundary (LAB) zone. From the Eifel to NW Bohemia the magmas exhibit increasing Si-saturation and decreasing $(La/Yb)_N$ ratios approaching the volcanic field of the Vogelsberg from both sides. The chemical variations require an (1) increasing degree of partial melting and (2) shallower equilibration depths of melt segregation indicated by increasing melt proportions from the spinell instead of garnet lherzolite mantle. The data argue against a plume model underneath the Eifel or NW-Bohemia, which are both marked by magma compositions derived from lower degress of partial melting. A correlation is rather obvious with the decreasing depth of the LAB from 100 to 60 km towards the Vogelsberg. Both characteristics can thus be explained by assuming (1) a "background" potential for (melilite) nephelinitic melt formation along the volcanic zone due to slight buckling of the European lithosphere induced by the alpine deformation front and (2) an overprint of increasing energy supply due to increasing amounts of lithospheric uplift (or more unlikely temperature supply) towards the Vogelsberg, who marks the crossing of the northern extension of the Rhine Graben with the E-W running buckled zone.

Within the Bohemian Massif towards Silesia the chemical variations indicate an additional overprint by lithosphere penetrating NNW-running tectonic structures paralleling the Tornquist-Teisseyre-Lineament, the Elbe zone as well as the zone of earthquake swarms crossing the Cheb Basin). Approaching these structures from both sides the necessary amount of partial mantle melting decreases as well as the volumes of erupted magma, an observation similar to oceanic fracture zones. This may be explained by the cooling effect of these tectonic elements on the melting zone at the LAB or by metasomatically induced linear lithospheric mantle heterogeneities (e.g. MgCa-carbonates).