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GEOCHEMICAL RESPONSE OF MAGMAS TO NEOGENE-QUATERNARY CONTINENTAL COLLISION IN THE CARPATHIAN-PANNONIAN REGION: A REVIEW

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The Carpathian-Pannonian Region contains Neogene to Quaternary magmatic rocks of highly diverse composition (calc-alkaline, shoshonitic and mafic alkalic) that were generated in response to complex microplate tectonics including subduction followed by roll-back, collision, subducted slab break-off, rotations and extension. Major element, trace element and isotopic geochemical data of representative parental lavas and mantle xenoliths suggests that subduction components were preserved in the mantle following the cessation of subduction, and were reactivated by asthenosphere uprise via subduction roll-back, slab detachment, slab-break-off or slab-tearing. Changes in the composition of the mantle through time are evident in the geochemistry, supporting established geodynamic models:

(1) Magmatism occurred in a back-arc setting in the Western Carpathians and Pan-

nonian Basin (Western Segment), producing felsic volcaniclastic rocks between 21 to 18 Ma ago, followed by younger felsic and intermediate calc-alkaline lavas (18 - 8 Ma) and finished with alkalic-mafic basaltic volcanism (10-0.1 Ma). Volcanic rocks become younger in this segment towards the north. Geochemical data for the felsic and calc-alkaline rocks suggest a decrease in the subduction component through time and a change in source from a crustal one, through a mixed crustal/mantle source to a mantle source. Block rotation, subducted roll-back and continental collision triggered partial melting by either delamination and/or asthenosphere upwelling that also generated the younger alkalic-mafic magmatism;

(2) In the westernmost East Carpathians (Central Segment) calc-alkaline volcanism was simultaneously spread across ca. 100 km in several lineaments, parallel or perpendicular to the plane of continental collision, from 15 to 9 Ma. Geochemical studies indicate a heterogeneous mantle toward the back-arc with a larger degree of fluid-induced metasomatism, source enrichment and assimilation on moving north-eastward toward the presumed trench. Subduction-related roll-back may have triggered melting, although there may have been a role for back-arc extension and asthenosphere uprise related to slab break-off.

(3) Calc-alkaline and adakite-like magmas were erupted in the Apuseni Mountains volcanic area (Interior Segment) from15-9 Ma, without any apparent relationship with the coeval roll-back processes in the front of the orogen. Magmatic activity ended with OIB-like alkali basaltic (2.5 Ma) and shoshonitic magmatism (1.6 Ma). Lithosphere breakup may have been an important process during extreme block rotations ($\sim$60 degree) between 14 and 12 Ma, leading to decompressional melting of the lithospheric and asthenospheric sources. Eruption of alkali basalts suggests decompressional melting of an OIB-source asthenosphere. Mixing of asthenospheric melts with melts from the metasomatized lithosphere along an east-west reactivated fault-system could be responsible for the generation of shoshonitic magmas during transtension and attenuation of the lithosphere.

(4) Voluminous calc-alkaline magmatism occurred in the Călimani-Gurghiu-Harghita volcanic area (South-eastern Segment) between 10 and 3.5 Ma. Activity continued south-eastwards into the South Harghita area, in which activity started (ca. 3.0 – 0.03 Ma, with contemporaneous eruption of calc-alkaline (some with adakite-like characteristics), shoshonitic and alkali basaltic magmas from 2 to 0.3 Ma. Along arc magma generation was related to progressive break-off of the subducted slab and asthenosphere uprise. For South Harghita, decompressional melting of an OIB-like asthenospheric mantle (producing alkali basalt magmas) coupled with fluid-dominated melting close to the subducted slab (generating adakite-like magmas) and mixing between slab-derived melts and asthenospheric melts (generating shoshonites) is suggested.

Break-off and tearing of the subducted slab at shallow levels required explaining this situation