Geochemistry and Significance of Dyke Swarms in the Central Bohemian Plutonic Complex

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The Central Bohemian Plutonic Complex (CBPC) is the most voluminous igneous body within a zone of calc-alkaline (CA) and high-K calc-alkaline to shoshonitic (HK) intrusive activity of Lower Carboniferous age transecting the Bohemian Massif from SW to NE. The CBPC is situated at the boundary between the relatively cold Barrandian block in the NW and the hot, rapidly exhumed metamorphic rocks of the Moldanubian block in the SE. Both the granitoids and less voluminous mafic rocks bear geochemical features similar to those from magmatic arcs related to subduction zones (Holub et al. 1997a). The plutonic intrusive activity took place within a narrow time span between about 355 Ma and 345 Ma (Holub et al. 1997b) with the relatively younger rocks being progressively more potassic. This trend culminates in the ultrapotassic rocks (UK) of the durbachite series and related KMg-rich granites. These younger plutonic bodies are aligned in a NNE-SSW-trending zone which is shifted from the Central Bohemian suture to E into the Moldanubian block.

The area of the CBPC with adjacent parts of the Barrandian and Moldanubian blocks are intruded by abundant dyke swarms. Although geochemically much more variable, they can be subdivided into the same compositional groups as the plutonic rocks; moreover, tholeiitic (TH) dykes are present. The N-S-trending tholeiitic diabases in the marginal part of the Barrandian block are clearly older than the CBPC and are absent from other parts of the area studied. A great majority of dykes within the CBPC trend mostly E-W to ESE-WNW and were formed by multiple injections of highly diverse magmas. Mafic dyke rocks are represented by diabases (both CA and TH, the latter being much higher in Ti, Fe and P), spessartites (CA, HK), kersantites (HK and strongly shoshonitic) and abundant minettes (UK). Minettes are the youngest and most widespread, occurring in an area between the N vicinity of Prague and the Šumava Mts. in the S. One subgroup of minettes corresponds geochemically to durbachites. Intermediate to acidic rocks comprise diorite to granodiorite porphyrites (CA, HK), melasyenite to melagranite porphyries (UK) and several types of granite porphyries. Those of CA affinity seem to be restricted to the N part of the CBPC built of CA granitoids. The HK and especially UK groups are much more widespread but absent among the youngest UK and KMg plutonic bodies. Besides the typical dyke rocks of subvolcanic appearance, several generations of leucogranites or aplitic granites occur. Most abundant are tourmaline-bearing leucogranite dykes intruding the "peri-Moldanubian zone" of the CBPC inclusive of the durbachitic rocks and the Moldanubian complex itself. They are much less regularly oriented and should be younger than almost all the "typical" dyke rocks, perhaps except some varieties of minette and the absolutely youngest, N-S-striking dyke swarms of highly evolved subvolcanic granite porphyries (rhyolites).

Multiple intrusive pulses forming the dyke swarms should be derived from distinct mantle and crustal sources. The mantle sources were heterogeneously depleted and subsequently enriched in hygromagmatophile elements. High LILE/HFSE ratios of magmas are indicative for enrichment by hydrous fluids released from a subducted slab due to its metamorphism and dehydration. The strongest depletion and most pronounced enrichment are characteristic for the mantle sources of UK magmas. The highly variable geochemistry of primitive mafic dykes with variable LILE/LILE (e.g., K/Rb, Rb/Sr, Cs/Rb) and HFSE/HFSE ratios reflects a strongly heterogeneous nature of the Hercynian lithospheric mantle. Only the Ti-rich "amygdaloidal diabases" could be derived from a mixed asthenospheric plus enriched lithospheric source.

More acidic magmas could originate by fractionation, contamination and/or hybridization with crustal melts. Purely crustal origin is assumed for the tourmaline-bearing leucogranites. The ultimate source of subvolcanic N-S trending felsitic porphyries whose composition corresponds to highly evolved granitic magma is unknown; existence of fractionated granite bodies younger than the rather primitive granitoids of the CBPC and dykes should be presumed below the SE and S parts of the CBPC.

It is clear that small batches of diverse mantle-derived magmas were able to pass through the crust of the Barrandian block and even predominant parts of the CBPC repeatedly. It means that the upper lithosphere was brittle enough to support propagating dykes both before and after intrusions of major plutonic bodies of CBPC. In contrast with the Barrandian block, the Moldanubian area is devoid of mafic dykes except for minettes accompanied by melagranite porphyries in the restricted area S of the CBPC. Perhaps all the older small magma batches were unable to penetrate the hot, low-viscosity and anatectic Moldanubian crust which could be passed by voluminous and often hybrid magma portions (e.g., the durbachites) and crustal melts.

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References

HOLUB F.V., MACHART J. and MANOVÁ M. 1997a. The Central Bohemian Plutonic Complex: Geology, chemical composition and genetic interpretation. *J. Geol. Sci., Econ. Geol. Mineral.* 31, 27-51.

HOLUB F.V., ROSSI Ph. and COCHERIE A. 1997b. Radiometric dating of granitic rocks from the Central Bohemian Plutonic Complex (Czech Republic): constraints on the chronology of thermal and tectonic events along the Moldanubian-Barrandian boundary. *C. R. Acad. Sci. Paris, Sci. terre planet.*, 325, 19-26.