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Stratified Magma Chambers Versus Granitization in the Central Bohemian Plutonic Complex (CBPC)

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It is well known from gravimetric data that the NW and N parts of CBPC of Lower Carboniferous age (Holub et al. 1997) comprise some great volumes of mafic rocks in some depth. On the surface, there are isolated bodies of gabbroic to dioritic rocks and enclave swarms surrounded by prevailing granitoids of the calc-alkaline (the Sázava type) and the high-K calc-alkaline to shoshonitic series (the Kozárovice, Blatná and "marginal" types).

In the Příbram area in NW margin of CBPC, Vlašímský has found that volumes of mafic rocks increase with depth. From investigation of many mining works he was able to draw a profile with some subhorizontal or gently dipping enclave-rich layers, forming a "shallow synclinal structure", and some subvertical mafic bodies within the granitoid complex. Such a structure has been interpreted in terms of "relict stratigraphy" and granitisation hypothesis (Vlašímský et al. 1992; Vlašímský 1993). Accordingly, the mafic enclaves (referred to as "amphibole hornfelses" by Vlašímský or "granitised basic xenoliths" by Patočka) represent strata of Cambrian volcanic and pyroclastic rocks interbedded with sediments (now granitoids) and intruded by pre-granitisation subvolcanic mafic stocks and dikes (now the subvertical gabbroic to dioritic masses). The major process responsible for changing the volcanic and sedimentary rocks to granitoids and mafic plutonites is called the "isochemical granitisation in situ" (see Palivcová et al. 1989; Vlašímský et al. 1992).

Recently, extensive mining works for the artificial reservoir of gas in NW marginal part of CBPC near Příbram, about 1 km below the present surface, enabled us to evaluate the granitisation hypothesis and to suggest a new explanation of the geological structure.

This part of CBPC is built of two granitoid groups: (1) the so-called "marginal type" of medium to coarse-grained, often porphyritic biotite to amphibole-biotite granite, containing abundant pink to reddish K-feldspar, (2) the group of variable grey-coloured amphibole-biotite to biotite granodiorites, corresponding to the Kozárovice and Blatná types, and grading into heterogeneous granodiorite to tonalite without any special local name.

Many parts of these granitoids contain huge amounts of mafic enclaves, which could be pillow-shaped or irregular and often tabular with subparallel alignment. Enclaves correspond petrographically to typical mafic microgranular enclaves (MME) with well-developed magmatic textures and no signs of metamorphic recrystallisation. Some MME are ocellar and/or display an increasing grain size from chilled margin to inner parts.

More voluminous mafic masses within the grey granitoids also occur, often surrounded by and passing to, an extreme accumulation of MME. At their contacts we may observe diverse interaction phenomena linked with various stages of granitoid and mafic magma solidification. Early contacts are lobate or crenulate with chilled margins of the mafic magma bodies, pillows and blobs, whereas some later stages of interaction are characterised by mechanical disruption of mafic masses and veining by granitoids with development of enclave swarms. Such enclaves are typically angular and of a block shape without the chilled margin, or with it only along one side of the inclusion.

The most important for our interpretation are those parts of the complex where the mafic and granitoid rocks are interlayered with preserved original shapes and interfaces. Gently dipping to subhorizontal mafic layers are chilled against and separated by much thinner layers of granitoid, which often display textures typical for cumulitic rocks. Basal contacts of the mafic masses are lobate with crests filled by a mobilised granitoid which sometimes form also small pipes and veins extending upward and injecting the mafic layer.

Such phenomena are fully comparable to the stratified mafic-silicic magma chambers, which have been recognised in calc-alkaline plutonic complexes in various part of the world, e.g. in Maine, USA (see Wiebe 1996 and references therein). It can be stated that similar chambers periodically injected by mafic magmas existed also in CBPC. Early mafic intrusions

could disperse on a temporal floor of the chamber, whereas later mafic magma portions were injected into and supported by the more consolidated granitoid rocks. Although local convective motions of the mingled masses, increased intrusive activity of the re-heated granitoids, and emplacement of relatively late mafic intrusions partially disturbed the original geological relations, the gross structure of the dynamically evolving magma chamber near Příbram is still preserved.

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Geology of Multi-generation Intrusive Rocks in the Příbram Area, NW Border of the Central Bohemian Plutonic Complex

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The Central Bohemian Plutonic Complex (CBPC) is built of variable plutonic rocks ranging in composition from gabbro to prevailing granodiorite to granite plus ultrapotassic melasyenitic to melagranitic rocks. Numerous rock dikes of even more variable composition crosscut the plutonic rocks as well as their roof (the "Islet Zone") and adjacent parts of the Barrandian in the NW, and the Moldanubian metamorphic complex in the S.

Our investigation was focused on the SE vicinity of Příbram, namely on the artificial gas reservoir, which has been mined on the 21st level of the Shaft No. 16, about 1000 m below the present surface. Two groups of granitoid rocks can be distinguished in this area:

(1) The "marginal" type comprising predominantly pink- to reddish-coloured medium- to coarse-grained, often porphyritic biotite to hornblende-biotite granites rich in K-feldspar. Mafic microgranular enclaves are scarce in some parts but extremely abundant in others.

(2) The group of grey-coloured, medium- to fine-grained hornblende-biotite to biotite granodiorites. Some parts are built of highly heterogeneous granodiorite to tonalite, more homogeneous parts correspond petrographically to the Kozárovice and Blatná types. Mafic microgranular enclaves are ubiquitous, often being concentrated into roughly tabular zones. Some more voluminous mafic masses of hornblende gabbro to quartz diorite or quartz monzodiorite occur in close association with these granitoids (see Holub, this volume).

In contrast with current opinions (e.g., Vlašímský 1993), the marginal granite behaves as relatively older in respect to the grey granitoids, being intruded by their dikes and included in the grey granitoids as xenoliths and rafts. As both the granitoid groups are closely associated with roughly coeval mafic microgranular enclaves and mafic masses, there should be present at least two major generations of the mafic rocks, too.

Dike rocks are abundant and highly variable. Some dikes are of a plutonic appearance whereas the typical dike rocks resemble the subvolcanic ones. Of the plutonic types, granodiorite dikes containing mafic enclaves and intruding the marginal granite are contemporaneous with emplacement of the grey granitoids. Also some pegmatitic veinlets and small dikes are closely associated with the grey granitoids and sometimes may evolve from their late apophyses into already consolidated mafic rocks. Fine-grained leucogranites (aplitic granites) seem to be only slightly younger and penetrate all the grey granitoids and the mafic bodies. Locally, they may grade to pegmatites. Many leucogranitic bodies occur as subhorizontal to steeply dipping sheets, 5 cm to about 1 m in width.

As a phenomenon still unknown in the area of CBPC we have found composite dikes of microgranodiorite mingled with dark microdioritic pillows. These unusual dikes display an uncommon strike N50-70°E with a variable dip to NW. Their shape is indicative of intrusion into the already brittle "grey granitoids", probably from some deeper-seated magma reservoir of granitoid magma injected by the mafic one.

Typical dike rocks comprise kersantite, granite to diorite porphyries, dolerites (diabases) and abundant minettes. Kersantite has been found as a single dike system striking N-S to SE-NW, steeply E-dipping, which cuts the marginal granite only. Although its shape suggests an intrusion into brittle fractures, the kersantite itself is injected by small granitic to pegmatitic veinlets and its texture is affected by partial recrystallisation (perhaps due to the thermal effect of the grey granitoids?).

Other dikes are clearly post-dating the grey granitoids. Scarce injections of a light granite porphyry form gently dipping intrusive sheets and thin dikes crosscutting the aplitic to pegmatitic veins. Dark hornblende diorite- to tonalite-porphyries with fine-grained margins of spessartitic appearance occur as gently to steeply dipping irregular dikes.

The numerous E-W to ESE-WNW trending dikes of diabases and minettes are forming a conspicuous subswarm of the regional dike swarm which is typical for predominant parts of CBPC. Diabases and some minettes usually dip about 50-65 to S, but many minettes are more or less vertical. Margins of all these dikes are straight and often stepped with bayonet