Two Genetic Types of Ocelli in Some Mafic Rocks from the Central Bohemian Plutonic Complex: No Room for Transformistic Speculations

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Some varieties of mafic plutonic rocks corresponding to quartz diorites to gabbros from the Central Bohemian Plutonic Complex contain felsic clots dominated by quartz and feldspars, sometimes with rims of mafic minerals. Excellent descriptions and figures of these textural features have been presented by M. Palivcová and her co-workers in many papers (Hanuš and Palivcová 1968, 1969, 1970, 1971a,b, Palivcová 1978, Palivcová and Ledvinková 1997, Palivcová et al. 1989, 1992, 1995, 1996). They interpreted these phenomena as relict volcanic textures like quartz pseudomorphs after olivine, amygdules, ocelli and variolae. In their hypothesis these textures have survived processes of granitization or transformation of older volcanic rocks and, more recently, even pyroclastic and volcanoclastic rocks, into rocks of plutonic appearance.

In order of evaluation of that hypothesis we have studied these and many other occurrences of spheroidal textures in plutonic, dyke and also subvolcanic and volcanic rocks. The rocks studied vary in composition from calc-alkaline and alkaline to ultrapotassic.

The comparative research of textures combined with an extensive literature exploration came to conclusion that there are two genetic types of the so-called "ocelli" present in our rocks.

(1) Segregation vesicles (ocelli): Their origin involves exsolution of an immiscible fluid phase (water-rich in the case of the gabbro-diorite suite and potassic plutonic rocks, CO_2-rich in alkaline rocks and some lamprophyres) and vesiculation due to decompression of the rising magma portion or due to its cooling and crystallization. During some advanced stages of crystallization, origin of early microcracks enables the fluid to release gradually and it leads to fall of internal pressure in the vesicles. At this stage vesicles are partly or completely refilled with felsic residual melt infiltrating from the surrounding intergranular spaces. Origin of segregation vesicles under plutonic conditions is possible in the case of relatively volatile-rich magma composition and relatively rapid cooling, e.g., in marginal parts of mafic enclaves or larger magma blobs chilled against host granitoid magma of lower temperature. The process is quite common in mafic dykes.

(2) Felsic, predominantly quartz xenocrysts: Presence of quartz xenocrysts, often with spectacular reaction rims, is very frequent in mafic rocks. Quartz is apparently more resistant to dissolution in mafic melts compared to alkali feldspars. However, small grains of quartz (0.X to about 1 mm) are heavily reacted and often totally dissolved even in subvolcanic rocks. Possibility of preservation of quartz xenocrysts in plutonic rocks depends not only on temperatures and compositions of mafic magmas but also on the original size of quartz grains and the relative volume of xenocrysts incorporated into the magma portion. When the local ratio "xenocrysts/magma" was sufficiently high, any apparent reaction rims of xenocrystic quartz may be absent. In such a case the feldspar xenocrysts of comparable size could be also well preserved.

In volcanic, subvolcanic and dyke rocks the two genetic types of felsic eyes can be readily distinguished. The same may be true for some chilled margins of small mafic masses against granitoids. In more slowly cooled plutonic rocks, however, the originally distinct textural features may converge in their appearance or gradually disappear due to readjustment of grain boundaries.

Both the xenocrysts and the non-xenocrystic (true) ocelli in volcanic, dyke and some plutonic rocks are clearly the same things under various conditions and we can observe their typical features despite of the large compositional variability of the host rocks. There is no reason for interpreting ocellar textures in mafic plutonic rocks in terms of "relict textures" like amygdules or varioles that were preserved from hypothetical pre-existing volcanic "precursors" or even as features resulted from "mingling" of mafic and felsic pyroclastic material as was proposed in papers by members of the Czech transformistic school.

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