Petrology of the Plutonic Rocks in the Polička and Zábřeh Crystalline Units (NE Bohemian Massif)

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The Polička crystalline complex (PCC) and Zábřeh crystalline complex (ZCC) are situated in the NE part of the Bohemian Massif. They are composed of similar metamomorphosed volcanosedimentary sequence intruded by elongate sills of granodiorite - tonalite composition. They are likely of Variscan age according to radiometric data by Parry et al (1997) obtained for very similar rocks of the Staré Město belt.

The basic, tonalite and granite suites were distinguished in the PCC and ZCC based on their petrology and geochemistry. The basic suite (a primitive chemical composition) is represented by metagabbros and ussually serpentinized ultrabasic bodies. These rocks form oval bodies, several tens of metres to several kilometres in size, enclosed in metamorphic rocks or in rocks of the tonalite suite in the PCC. They are spatially related to the amphibolite bodies in the ZCC. These rocks were subjected to metamorphism under conditions of lower amphibolite facies. Based on the mineral association (Atg+Tr+Chl+Ol), the temperature of metamorphism of the PCC ultrabasic rocks was estimated at 535 to 565 °C and pressure of 5 kbar (Buriánek, 2001); the temperature obtained from the amphibole–plagioclase thermometer (Holland and Blundy, 1994) for amphibole and amphibole-biotite gabbros ranges between 603 and 685 °C.

Tonalite suite in the PCC is represented by tonalites and granodiorites, whereas granodiorite composition prevails in the ZCC. The Budislav massif the largest body in the PCC area is composed of amphibole-biotite tonalites and granodiorites, less commonly by biotite tonalites and granodiorites. The proportion of acid plutonic rocks in the PCC decreases, and the proportion of gabbros and ultrabasic rocks increases to the SE. The only significant body of tonalites in SE part of the PCC is that one near Jedlová, formed by amphibole-biotite tonalites locally containing pyroxene and garnet; compositionally tend to quartz gabbros. In the ZCC, these rocks are mostly arranged in several parallelly oriented elongate intrusions in N part of the complex. Small intrusion is exposed in S part of the unit. Plutonic rocks are represented by amphibole-biotite tonalites to granodiorites, locally containing pyroxene. Rocks of the tonalite suite are metaluminous and mature continental crust is believed to be the likely source material according to the trace elements signature. Chemical composition of rocks of tonalite suites of the ZCC and Staré Město belt is very similar. However, rocks of the tonalite suite in both complexes differ in the fO2. The presence of ilmenite indicates a higher fO2 in the PCC, predominance of sphene (Stein and Dietl, 2001) indicates lower fO2 in the ZCC. Clinopyroxenes were produced by the reaction of tonalite magma with marbles in the roof pendant and proved contamination by crustal rocks.

Rocks of the tonalite suite from the PCC yielded zircon saturation temperatures (Watson and Harrison ,1983) of 730–766 °C. The obtained data from amphibole–plagioclase thermometer (Holland and Blundy, 1994) and amphibole barometer (Anderson and Smith, 1995) are considered solidus temperatures of the studied rocks. The values for tonalites to granodiorites are 655–751 °C and 2.5–6.3 kbar, garnet-bearing amphibole-biotite quartz gabbros indicate 659–785 °C and 6.1–8.8 kbar in the PCC.

Rocks of the tonalite suite ZCC yielded zircon saturation temperatures of 717–770 °C. In amphibole-biotite tonalites 706–795 °C using the amphibole–plagioclase thermometer, and the pressures of 2.9–4.3 kbar using the amphibole barometer.

Granite suite is minor, fine-grained muscovite-biotite to biotite granites to granodiorites evolved from the mature source. The different magmatic pulses explain their quite different trends in variation diagrams compared with spatially and temporally-related tonalite suite. The zircon saturation temperatures yielded 741–765 °C in granite suite PCC and 673 °C in granite suite ZCC.

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