The Gneissic Complex of the Staré Hory Mts. – Its Hercynian and Alpine History

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Tectonic significance of the Staré Hory Mountains for the evolution of the Central Western Carpathians has been recognized for a long time. However, the crystalline rocks from this area were not studied in detail for more than thirty years. Because of its enclosing by sedimentary rocks – verrucano and Mesozoic carbonates, this crystalline complex is commonly denoted as the Staré Hory window. The geological structure and tectonic evolution of the mentioned area was a matter of long lasting discussion between advocates of “fixism” – all crystalline basement is only autochthonous (Hynie 1923; Hynie and Kettner 1924; Kubiny 1954–1965) and advocates of “mobilism” – part of crystalline basement is autochthonous (granites) and parts of crystalline (gneissic complex) are in tectonic – allochthonous (nappe) position (Koutek 1937; Andrusov 1958; Jaroslav 1965, 1971; Vozárová and Vozár 1988). However, gneissic complex was described as an Early Paleozoic “para-crystalline” – sedimentary in origin complex, dominated by muscovite-biotite paragneisses, mica shists and metaqartzites, partly injected by “orthogneissic material” having thus character of banded and augen migmatites (Jaroš 1965, 1971). Although orthogneisses were identified in the Staré Hory Mts. already by Hynie (1923) and Koutek (1937), hypothesis of sedimentary and/or magmatitic origin of gneissic complex was preferred. On the basis of petrography, the granitic rocks of the Staré Hory Mts. are generally compared with the Nizke Tatry Mts. (Tatricum) granites while the gneissic complex is compared either with the identical rocks on the southern slopes of the Nizke Tatry Mts., or with those of the Northern Veporicum. The penetrative brittle-ductile overprint of the Staré Hory Mts. gneissic complex is considered to be Alpine in age in analogy to strongly sheared Vepor basement (Jaroslav 1965, 1971).

According to the proposed strike-slip depositional model of the Bohemian Cretaceous Basin (Uličný 1997) and the above results, it is assumed that the main structures controlling the basin evolution were NW-NNW–oriented fault zones active in a dextral strike-slip regime. The study area behaved structurally as a pull-apart sub-basin formed between overlapping segments of the principal displacement zone. The intrabasinal high which emerged during the deposition of unit D is probably related to similar phenomena described from pull-apart basins formed at overlapping fault segments by Dooley and Mc Clay (1997).

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References
biotite PA from identical samples yielding ages 332.1 ± 5.6 Ma and 332.4 ± 3.2 Ma (Kohút and Frank unpublished data). These data, indicate cooling rate of 16 °C/Ma and suggest that during the Hercynian collisional orogeny exhumation of these rocks occurred not only by erosion, but was driven mainly by tectonic processes. These data show that penetrative foliation of these rocks is Hercynian in age even if the allochthonous position within nappe structure developed during Alpine orogeny. The Cretaceous tectonics in this area is linked only with development of narrow brittle shear zones within gneissic complex not exceeding lower greenschist facies conditions.

References

From Collision through Delamination to Post-Orogenic Uplift: Three Stages of the Hercynian Granite Magmatism in the Veľká Fatra Mts. (Slovakia)

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The distribution of various types of granitic and associated mafic magmatic rocks within the European Hercynian belt is related with distinct thermal and tectonic environments. The granitic plutons well mirror the whole Paleozoic history of this orogenic realm divided into three geodynamic stages. The Eo-Hercynian period (Cambrian–Silurian) corresponds to the pre-collision history, reflecting fragmentation of the northern Gondwana immature crust due to formation of small oceanic basins and followed by final subduction and amalgamation of oceanic lithosphere. The Meso-Hercynian stage (Devonian–Lower Carboniferous) corresponds to the proper collision tectonics marked by lithospheric thickening with the formation of crustal-scale nappe structures and the intrusions of collision-related peraluminous S-type granites. The Neo-Hercynian period (Upper Carboniferous–Permian) correspond to the final collision with concomitant lithospheric delamination (slab breakoff) which resulted in high heat flows, induced melting of lower crust calc-alkaline I-type granites and granulitization of lower crust, accompanied by large transient faults. This period was characterized by a shift from compressional tectonics towards extensional tectonics, generally interpreted as recording the post thickening collapse of collisional belt. Rapid post-collisional uplift was associated with small intrusions of A/S-type granites and/or explosive volcanism.

The Veľká Fatra Mountains typify the Core Mountains of the Tatinicum, a major tectonic unit in the Western Carpathians. The crystalline basement represented by the Lubochňa granitoid massif, shows stratigraphic and/or local tectonic boundary with the Mesozoic autochthonous or paraautochthonous Šipruň envelope sequence. The Upper Mesozoic nappe structure is represented by the Križna and Choč nappes. The crystalline complex includes four Hercynian granitoid rock types that comprise a normally zoned pluton and/or composite massif, consisting of Smrekovica tonalites (ST) with xenolithes and wall rocks of paragneisses and orthogneisses. Other components of the body in a vertical sequence (Kohút 1992) include the Kornietov granodiorites (KGD), the Lipová granites (LG) and youngest Lubochňa leucogranites (LLG). The Hercynian age of a granite magmatism was determined by Rh/Sr WR isochron with an age of 342 ± 4 Ma (Kohút et al. 1996). This is in accordance with estimation K/Ar isochron from muscovites and/or biotites showing an age of 338 ± 9 Ma, and/or Ar/Ar mineral PA and TGA determinations of 338 ± 2 Ma (Kohút et al. 1998). The first U-Pb zircon data (356 ± 25 Ma) from two micas granite – LG and monazite data (340 ± 2 Ma) from biotite granodiorites – KGD (Kohút et al., 1997) showed a good compatibility with previous age determinations. Extensive dating of the Velká Fatra granites using cathodoluminescence controlled single-grain (CLC) method by TIMS, as well as ion-Microprobe (Poller et al., 2000a) confirmed Lower Carboniferous age – 337 ± 9 Ma for the biotite tonalites (ST). Partly marvellous was indeed the identification of Permian granite dykes within Veľká Fatra composite pluton (Poller et al., 2001), showing an age from 283 ± 15 Ma to 254 ± 13 Ma. Geochemical studies proved the relative independence of three granite types already by Kohút (1992). Due to observed gradual contact and changes in mineral and chemical compositions within granite types as well as lack