biotite PA from identical samples yielding ages 332.1 ± 5.6 Ma and 332.4 ± 3.2 Ma (Kohút and Frank unpublished data).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.

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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 Palaeozoic 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 crustal calc-alkaline I-type granites and granulitization of lower crust, accompanied by large transcurrent 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 Tatricum, a major tectonic unit in the Western Carpathians. The crystalline basement represented by the Ľubochňa 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 Krížna 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 Ľubochňa leucogranites (LLG). The Hercynian age of a granite magmatism was determined by Rb/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 Veľká 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 LG, and exhibited younger granite forming event with age of 304 ± 2 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 of isotope age dating, the situation in pluton was interpreted (l.c.) as an imperfect mixing of distinct sources and/or pulse character with AFC mechanism.

Voluminous granite magmatism dominated the Hercynian orogeny across the entireEuropean realm over the time interval of 150 million years (400–250 Ma). Indeed, for the Western Carpathians belonging to the Alpine Neoeurope, four granite-forming events have been recognized within the Hercynian basement (Petrík and Kohút 1997). The oldest event reflecting initial collision of Meso-Hercynian stage is represented by intrusion of peraluminous S-type granites (405–380 Ma), subsequently sheared onto orthogneisses during the main collision period (Poller et al. 2000b) in the Tatra Mountains. The hypercollision – peak stadium of orogeny is broadly connected with melting of muscovite-rich peraluminous S-type granites, terminated around 340 Ma. The Neo-Hercynian stage is characterized by delamination involving high heat flows from mantle induced melting of lower crustal calk-alkaline I-type, causing the intrusion of MME-bearing granites 310–300 Ma ago. The collapse of the Hercynian orogeny connected with post-orogenic uplift and lithospheric thinning was associated with small intrusions of A/S-type granites. It is noteworthy that except for the S-type orthogneisses, all three principal granite-forming stages were identified in the Veľká Fatra composite granite massif.

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Evolution of the Horst-Graben Structure in the Central Slovakia Volcanic Field

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Konečný et al. (1975, 1978) demonstrated that volcanic rocks of the Central Slovakian Volcanic Field (CSVF) cover a spectacular system of horsts and grabens with relative displacement amplitudes of up to 3000 m. The most prominent features of this system there are (Fig. 2): (a) dominant N-S trending horsts and grabens at the central part of the system, (b) mostly NE-SW trending horsts and grabens elsewhere, (c) obscured NW-SE trending structural elements, (d) volcano-tectonic features including Kremnica graben, Štiavnica caldera and resurgent horst, Javorie graben, Poľana depression and (e) a frequent occurrence of asymmetric horsts and grabens, including halfgrabens. Related tilting of tectonic blocks shows at the North a N-S trending axis of symmetry (Nemčok and Lexa 1990).

Evolution of the horsts and grabens took place during Badenian to Early Pannonian times (16.5–9 Ma), and since its beginning to the end was accompanied by an extensive, mostly andesitic volcanic activity giving rise to a number of andesite stratovolcanoes (Fig. 3). Relationship of their marginal faults to dated volcanic formations gives us a clue to details of their history.

The oldest grabens are those trending NW-SE, which localized major volcanic centres and controlled the extent and thickness of Early Badenian sediments and volcanics. With the exception of grabens between Prievidza and Strháre they are mostly obscured by younger N-S and NE-SW trending horsts and grabens. The present structural pattern is mostly a result of the strong Late Badenian (to Early Sarmatian ?) extension giving rise to N-S and NE-SW trending grabens. The most intensive subsidence was accompanied by effusions of mafic lavas, perhaps as a response to related crustal thinning. Structural evolution during the Late Badenian time included also evolution of volcanotectonic depressions and/or calderas in central zones of major andesite stratovolcanoes, accompanied by eruptions of differentiated rocks. During the Sarmatian time an active horst and graben evolution was restricted to the western half of the CSVF, especially to the surroundings of the Žiar basin. A related uplift of the Kremnica and Hodruša – Štiavnica resurgent horsts was accompanied by extensive rhyolite volcanism. The youngest subsidence took place during the Early Pannonian in the Žiar