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Geological structure and tectonic evolution of the Southern Veporicum

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Abstract: Area of the Southern Veporicum is built up by superposed tectonic units and tectonic duplexes, which have a sandvich-like character. The compression stage was connected with closing of the Meliata oceanic domain. The compression and overthrusting, generally from SE to NW, took place during the Late Kimmerian stage of the Alpine orogeny. Extensional unroofing was presumably connected with the uplift of the crystaline basement. During the Late Cretaceous and the Paleogene, deformation along the sinistral SW–NE and dextral SE–NW brittle fault zones occurred. The youngest brittle deformation structures are NNE–SSW oriented faults, which controlled distribution of the Neogene volcanic rocks.

Key words: Central Western Carpathians, Southern Veporicum, nappe tectonics, extension tectonics, brittle tectonic regime.

Geological framework

Area of the Southern Veporicum is built up by superposed tectonic units and tectonic duplexes, which have a sandvich-like character (Fig. 1). The tectonic history was different in individual tectonic subunits with typical structural features, metamorphism, character of deformation, age and lithological composition. In the Southern Veporicum realm, two different areas have been investigated which contain a complete tectonic set (detailed subdivision see in Fig.2 and Fig. 3).

The Southern Veporic Unit comprise a crystalline basement represented predominantly of granitic rocks and the Foderata unit. The Foederata unit is a subautochtonous sedimentary sequence with stratigraphic range from the Carboniferous to the Late Triassic. The substratum of the Foederata unit and the Foederata duplex was the crystalline basement of the Southern Veporicum (Plašienka, 1993, Madarás et al., 1995). Substratum of the Markuška duplex (Fig.4) is unknown.

The Gemericum is represented mainly by the Early and Late Paleozoic metasediments tectonicaly overlying the Southern Veporic Units.

The Meliaticum s. l. consists of a tectonic melange of sedimentary rocks (Permian – Jurassic). Age of the tectonic melange is most probably Late Jurassic. The Meliaticum s. l. forms lenses and slices betwen the Gemeric and the Turnaic tectonic units. These tectonic units underwent low – grade metamorphism, recrystalization and ductile deformation.

The highest tectonic unit is the Silicicum (the Muráň nappe) containing mainly carbonatic rocks (Middle Triassic – Middle Jurassic) (Vojtko, 1999, 2000).

The nappe units were covered by post-nappe Paleogene sedimentary formations and the Neogene volcanoplutonic complexes (Bacsó, 1964). The post nappe formations were deformed only under the brittle conditions (Kováč & Hók, 1993).

Tectono-deformational evolution

Compression

The compression stage is connected with closing of the Meliata oceanic domain and successive displacement of the Gemericum, Meliaticum, Turnaicum and Silicicum nappes (Hók et al., 1995, Marko et al., 1995). The stacking of the nappes has wedge shaped form with thickness decreasing northward (Fig.5). The compression and overthrusting, generally from SE to NW, took place during the Late Kimerian stage of the Alpine orogeny (Late Jurassic – Early Cretaceous). The duplex structures are presented mainly at the contact zone of the Southern Veporicum and the Gemericum (Hók et al., 1993, Madarás et al., 1995).

Extension

After the compression stage and the crustal thickening, an inversion tectonic regime took place and exhumation of the crystalline basement followed (Fig. 6). An uplift of the crystalline basement occurred which resulted to an extensional unroofing of the overlying tectonic units (Foederata, Markuška, Gemericum, Meliaticum etc.) and emplacement of the Rochovce granitic body (Hók et al., 1993, Madarás et al., 1996). The Middle Cretaceous age of the extension was evidenced by Ar–Ar, K–Ar and FT

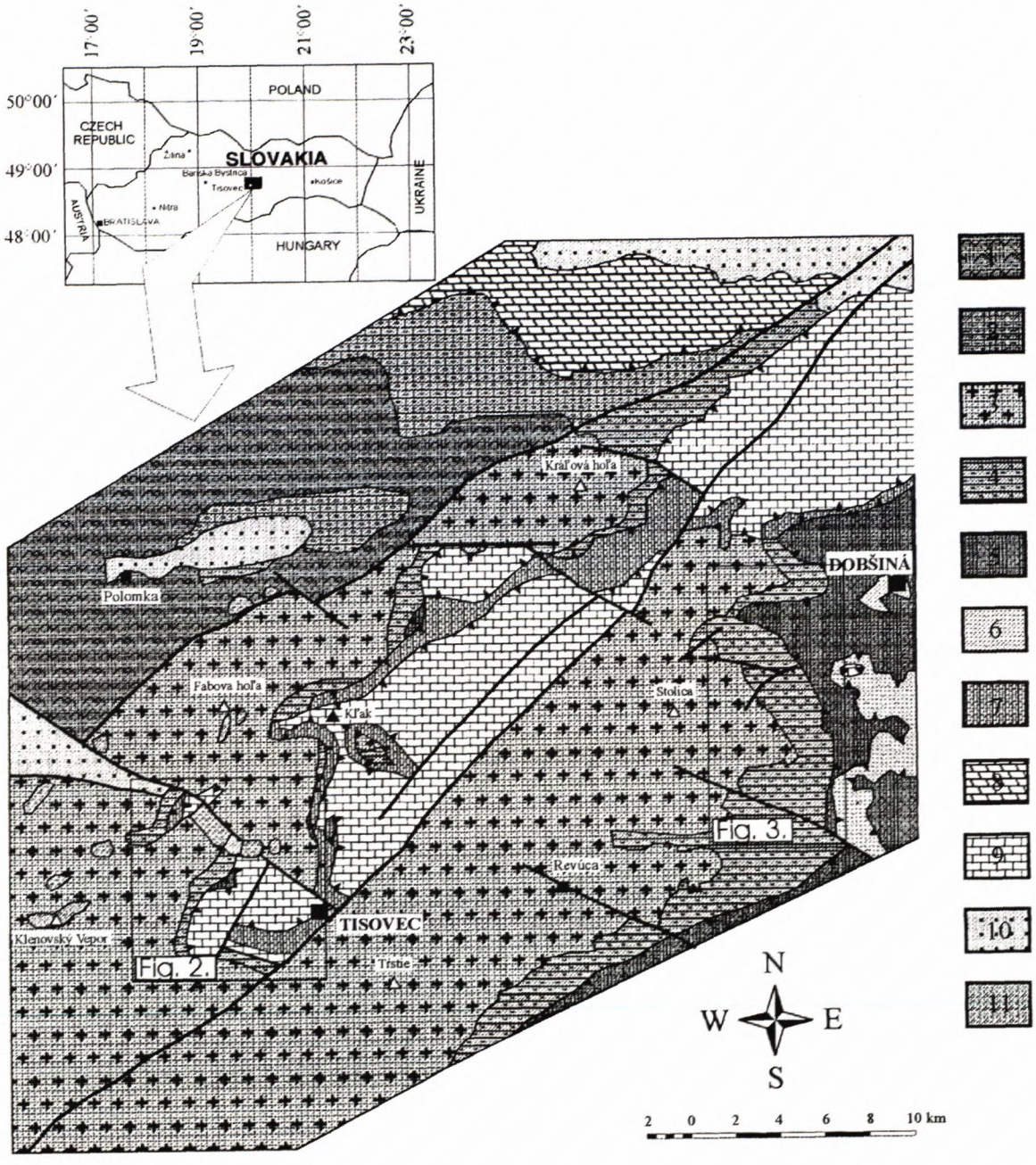

Fig. 1 Simplified tectonic map (Vojtko, original figure): 1– North Veporic crystalline basement, 2 – North Veporic subautochthonous unit (Veľký Bok unit), 3 – South Veporic crystalline basement, 4 – South Veporic subautochthonous unit (Foederata unit), 5 – Gemericum, 6 – Meliaticum, 7 – Turnaicum, 8 – Hronicum, 9 – Silicicum, 10 – Sub-Tatra Group (the Central Carpathian Paleogene), 11 – Neogene volcanites

datings (C. F. Kráľ, 1977; Burchart et al., 1987; Maluski et al., 1993; Kováč et al., 1994; Hraško et al., 1995).

Brittle deformation

During the Late Cretaceous period in higher structural levels, a dextral movement along the NW-SE oriented dislocations started (Plašienka, 1993). The N–S compression during the Late Cretaceous and the Paleogene caused deformation within the sinistral SW–NE (Muráň fault; Marko, 1993A) and dextral SE–NW (Mýto-Tisovec fault zone; Marko, 1993B) brittle fault zones.

The youngest brittle deformation structures are NNE–SSW oriented faults. The faults controlled also distribution of the Neogene volcanic rocks (Vojtko, 1999, 2000). Probable Badenian–Sarmathian age of volcanic rocks and normal character of the NNE–SSW faults correspond with the WNW–ESE orientation of principal extension.

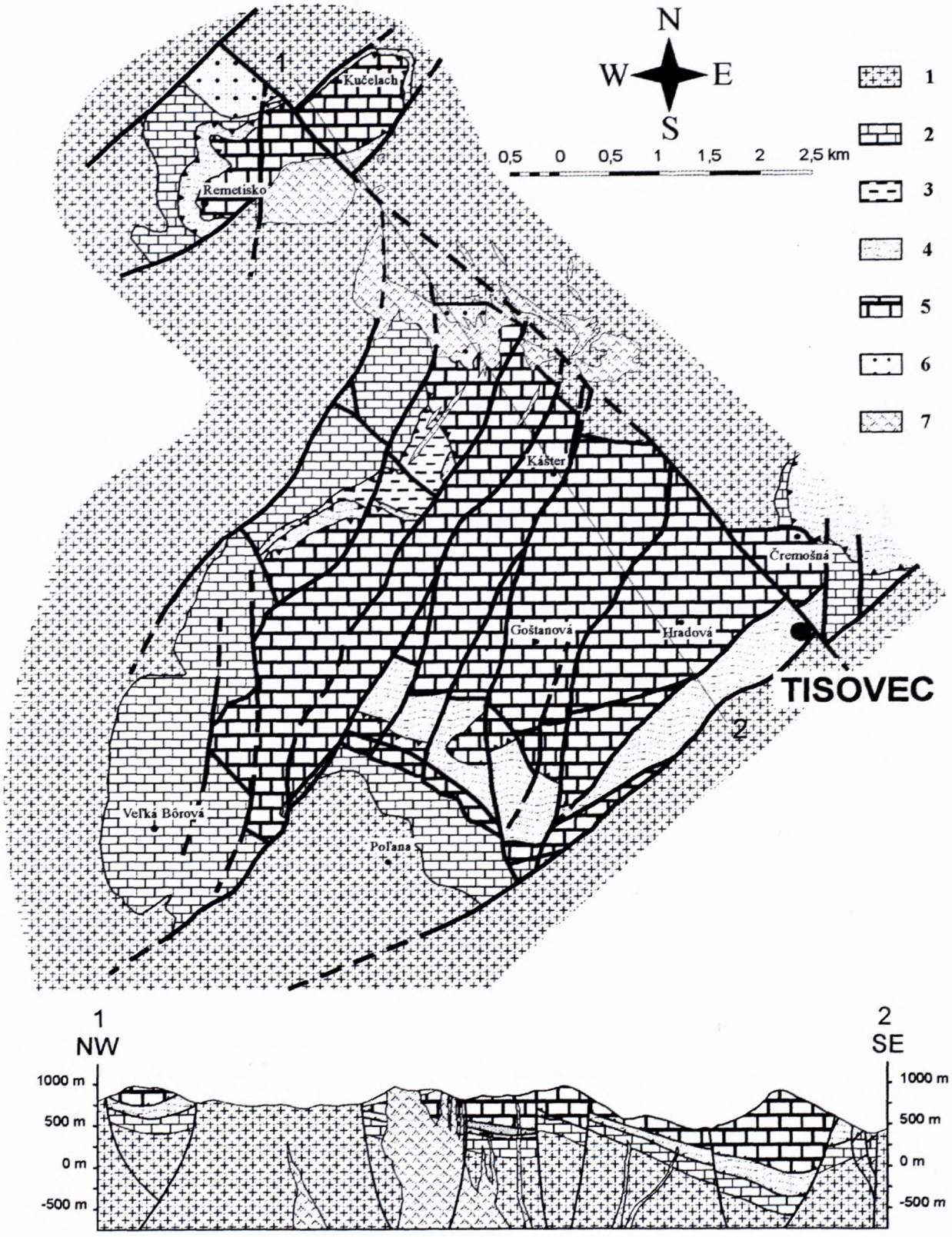

Fig. 2 Simplified tectonic map and geological cross-section (vertical scale is exaggerated) of the Tisovec Karst and the Kučelach Massif (after Vojtko, 1999, 2000): 1 – South Veporic crystalline basement 2 –Foederata unit (Permian – Middle Triassic), 3 – Gemericum (Carboniferous), 4 – Turnaicum (Early Triassic – Middle Triassic), 5 – Silicicum (Middle Triassic – Early Jurassic), 6 – Paleogene sediments, 7 – Neogene volcano-plutonic complex

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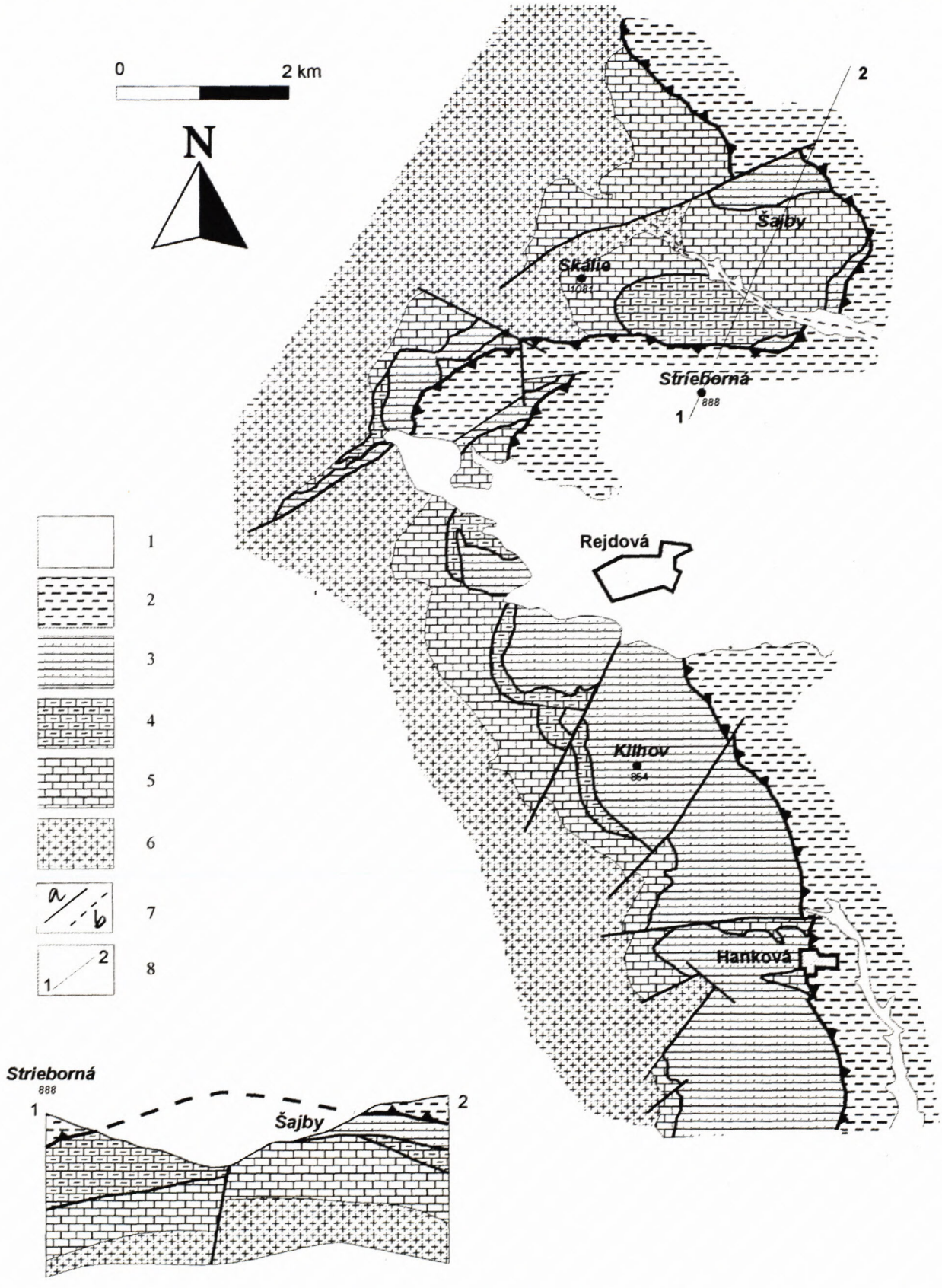

Fig. 3 Simplified tectonic map and geological cross-section (vertical scale is exaggerated) of the contact area between the South Veporicum and the Gemericum (after Madarás, J., Hók, J., Kováč, P., Lexa, O. & Ivanička, J. 1995) 1 – Quaternary and Tertiary, 2 – Gemeric Unit – undivided (Early to Late Paleozoic rocks), 3 – Markuška duplex (Carboniferous – Early Triassic), 4 – Foederata duplex (Carboniferous – Early Triassic), 5 – Foederata unit (Permian – Late Triassic), 6 – South Veporic basement, 7 – Faults a) observed, b) inferred, 8 – Line of geological cross-section

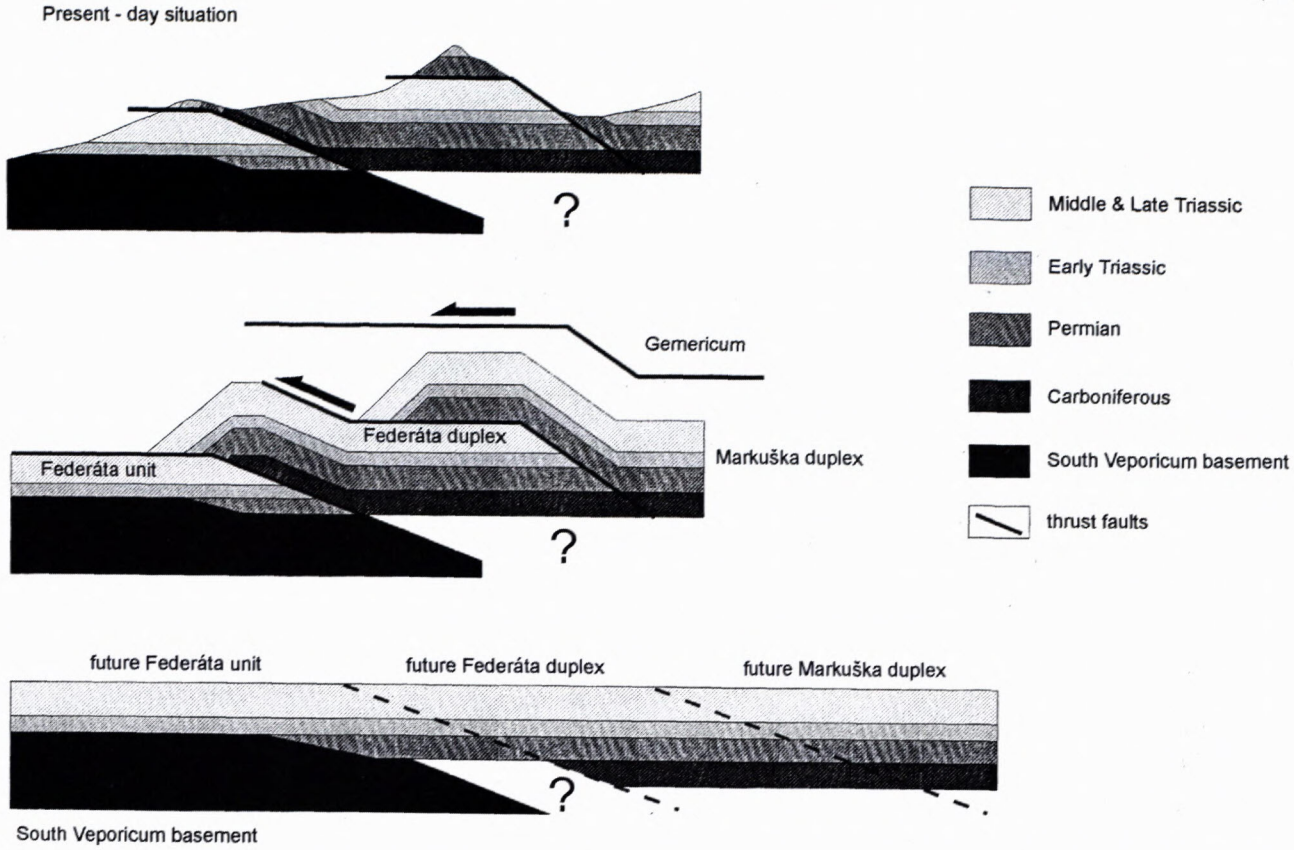

Fig. 4 Simplified reconstruction of the original sedimentation area of a particular tectonic duplexes. (after Madarás, J., Hók, J., Kováč, P., Lexa, O. & Ivanička, J. 1995). The substratum of the Markuška duplex is unknow.

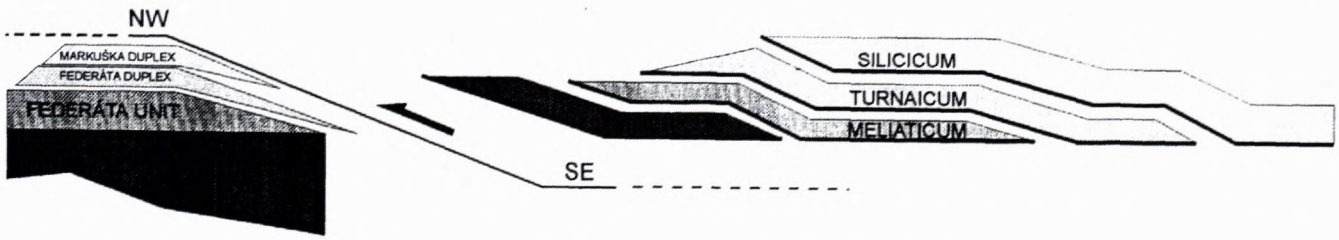

Fig. 5 Simplified model of thrusts (Late Jurassic – Early Cretaceous situation). (Hók & Kováč, original figure)

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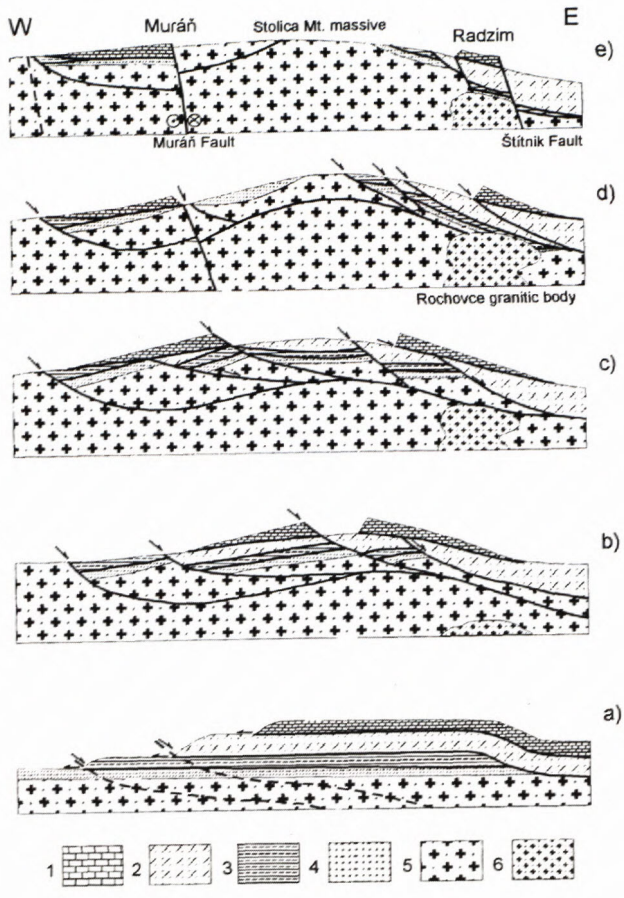

Fig. 6 Model of the Alpine extension unroofing (after Madarás et al., 1996, not to scale). a) Situation after the compression stage (Late Jurassic – Early Cretaceous). b) Beginning of the extension stage (Middle Cretaceous). c, d) Progressive extension, origin of listric faults and gravitational movement of nappes, emplacement of the Rochovce granitic body (Middle Cretaceous). e) Present day situation. 1 – Silicicum, 2 – Gemericum, 3 – Markuška duplex, 4 – Foederata unit, 5 – South Veporic basement, 6 – Rochovce granitic body.

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