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Structural record and tectonic history of the Mýto-Tisovec fault (Central Western Carpathians)

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Abstract: The NW-SE striking Mýto-Tisovec map-scale brittle fault distinctively affects the internal zones of the Western Carpathians. It cuts and evidently offsets Meso-Alpine tectonic units and structures and represents a zone of important geophysical anomalies as well. Using methods of structural analysis, the complex tectonic evolution of this long living fault has been restored. Six successive fault-slip related regional paleostress events, controlling the activity of the Mýto-Tisovec fault have been distinguished. The oldest recognized paleostress event, with NNE-SSW maximum principal stress axis operated after the Late Cretaceous and before the Middle Eocene. The orientation of the Miocene maximum principal stress axis rotated clockwise from NW-SE in the Early Miocene to a NE-SW direction in the Middle Miocene and E-W direction in the Late Miocene–Pliocene. NNW-SSE trending compression has been estimated for the Quaternary stress field. Correspondingly, three periods of Miocene tensional paleostress events with NE-SW, NW-SE and N-S orientation of minimum principal stress axis has been restored as well. The Mýto-Tisovec fault kinematically fluctuated in the changing paleostress field. However, the most evident structural records are related to the dominant dextral strike-slip regime. Dextral transtensional tectonic regime was responsible also for opening of a narrow and deep depositional depression — the Brezno Basin, related to the Mýto-Tisovec fault, where the Late Eocene–Early Miocene sediments of the Central Carpathian Paleogene Basin (CCPB) fill have been deposited and later preserved.

Key words: Tertiary, Western Carpathians, structural evolution, paleostress analysis, faults.

Introduction

This study is focused on the reconstruction of the tectonic evolution of the Mýto-Tisovec fault having affected post-nappe geological structure of Internides, the Central Western Carpathians (sensu Maheľ 1986; Plašienka 1999). During the Neo-Alpine period (the post-nappe period in the internal zones of the Western Carpathians) thrusting prograded to external zones, where Tertiary outer flysch units were incorporated into the huge Outer Carpathian accretionary wedge, while fault tectonics occurred in the already consolidated internal zones. The kinematic history of the Mýto-Tisovec fault reflects this processes of post-Cretaceous tectonic evolution of the Central Western Carpathians. This fault zone offsets Paleo- and Meso-Alpine tectonic units. A lot of fault related structures including mesoscale ones were observed and analysed within the fault zone. Utilizing geological, geophysical and structural data from published papers and archived reports and utilizing our recent and former structural field observations along the fault segment between the Brezno and Tisovec (Marko 1993b,c; Marko & Vojtko 2001; Vojtko 2003), the tectonic evolution of the area has been reconstructed.

The internal zone of the Southern Veporic area where the structural records of the Mýto-Tisovec fault were studied is built up by several superposed tectonic units, creating a sandwich-like character of geological architecture (Vojtko 2000). The lowermost *Southern Veporic Unit* comprises crystalline basement represented predominantly by granitic rocks and the Foederata sedimentary cover unit of Permian up to Late Triassic age (Hók et al. 1993; Plašienka 1993). The multiple tectonic reduction of the crystalline basement resulted in formation of tectonic slices, individualized along NE-SW trending mylonite shear zones (Bezák 2003). The *Gemeric Unit* is represented by the Upper Paleozoic metasediments, predominantly conglomerates, dark grey shales, limestones and dolomites, which are locally cut by Carboniferous diorite dykes. The Gemeric Unit was thrusted over the Southern Veporic Unit during the Early Cretaceous compressional tectonics (Plašienka 1993, 1999; Plašienka & Soták 2001). The *Silicic Unit* (Muráň Nappe) is the highest tectonic unit of the area containing mainly Scythian shales and the Middle to Upper Triassic carbonatic sequences.

The nappe units are covered by both post-nappe Eocene to Lower Miocene sedimentary formations (Subtatras group sensu Gross et al. 1984) of the Brezno Basin and the Neogene volcano-plutonic complexes (Bacsó 1964).

The Mýto-Tisovec fault — a review

The Mýto-Tisovec fault was first described as the *Mýto fault* by Zoubek (1935), after the village of Mýto pod Ďumbierom in its vicinity. The fault was later known under various names as the *Tisovec fault* (Bezák 1991), *Mýto fault* (Maheľ 1969; Kubíny 1998), *Mýto-Dúbrava fault* (Kubíny 1998), which represents the northwestern continuation of the Mýto-Tisovec fault into the Tatric Unit. The name Mýto-Tisovec fault (Marko 1993c) used herein unambiguously defines the southern studied segment (in between Mýto pod Ďumbierom and Tisovec) of this important NW-SE striking discontinuity.

The NW-SE striking Mýto-Tisovec fault can be followed as a straight, very distinctive first order map-scale dislocation running from the crystalline core of the Nízke Tatry

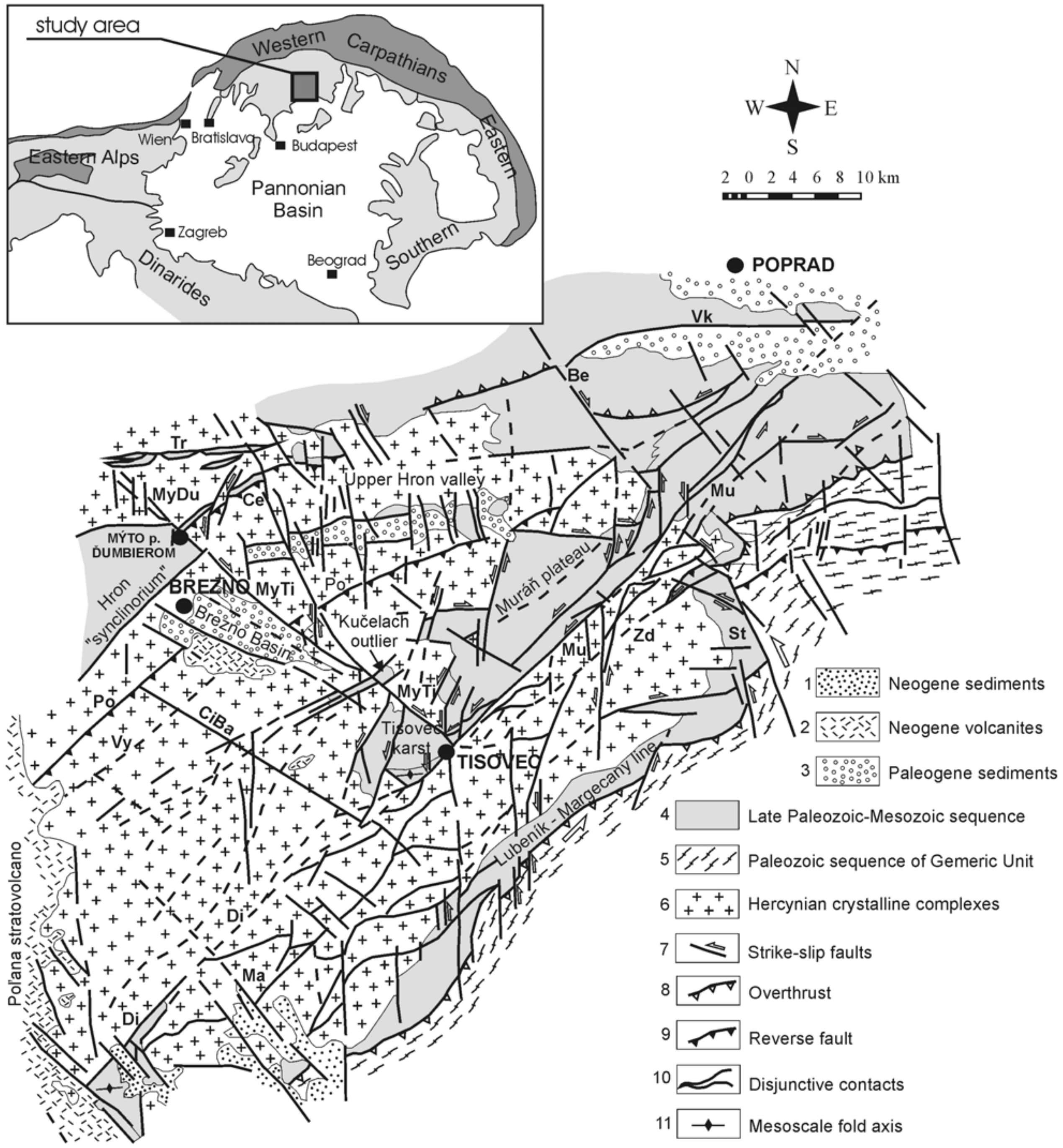

Fig. 1. Structural-tectonic map of the northwestern Veporic area (Marko 1993b). **1** — Neogene sediments; **2** — Neogene volcanites; **3** — Paleogene sediments (Subtatras group); **4** — Mesozoic and Late Paleozoic units (Cover unit, Krížna Nappe, Choč Nappe, Silica Nappe); **5** — Early Paleozoic complexes (Gemeric Unit); **6** — Crystalline complexes (Veporic and Tatric Units); **7** — strike-slip fault; **8** — thrust; **9** — reverse (high angle) shear zone; **10** — disjunctive contact; **11** — mesoscale fold axis. Coded names of faults and shear zones: Be — Benkovo fault, Ce — Čertovica shear zone, CiBa — Čierny Balog fault, Di — Divín fault, Ma — Málinec fault, Mu — Muráň fault, MyDu — Mýto-Dúbrava fault, MyTi — Mýto-Tisovec fault, Po — Pohorelá shear zone, St — Štítnik fault, Tr — Trangoška fault, Vk — Vikartovce fault, Vy — Vydrovo fault, Zd — Zdychava shear zone.

Mts (Kubíny 1998) up to the Tisovec town where it crosscuts and slightly offsets the Muráň fault. South-easternly of the Muráň fault we have no evidence for continuation of the Mýto-Tisovec fault because it is always difficult to follow the map trace of a fault within the monotonous lithology of a crystalline basement (Fig. 1). In contrast to the NE-SW brittle faults (so-called "Carpathian trend" faults), the NW-SE faults strongly affect geophysical fields and are zones of density and magnetic anomalies (Obernauer 1980, 1983). The NW-SE "cross faults" disrupt the NE-SW faults and Alpine shear zones of shortening (Zoubek 1935; Bystrický 1959; Siegl 1976; Klinec 1976). Thus their latest activity seems to be younger than the NE-SW faults/shear zones. The Mýto-Tisovec fault evidently offsets the Pohorelá shear zone (sensu Zoubek 1957). The dextral strike-slip offset coming from map interpretation of the Pohorelá shear zone (Zoubek 1957; Maheľ et al. 1964; Klinec 1971, 1976; Madarás et al. 1984; Pulec 1985; Bezák 1993; Kubíny 2002) accepted in Fig. 1 is considered to be ca. 4 km. The latest activity of the Pohorelá shear zone representing the tectonic boundary in between the Hron and Kráľova hoľa Crystalline Subunits is Cretaceous (Hók & Hraško 1990; Kubíny 2002; Bezák 2003), so the offset of the Pohorelá shear zone along the Mýto-Tisovec fault ought to be the Late or post-Cretaceous.

Nevertheless the Mýto-Tisovec fault was founded early in the Paleo-Alpine period (Maheľ 1969). The old origin of the fault in the crystalline basement was declared on the basis of its role as a tectonic border between the basic and more acid varieties of the Variscan granitoids of the Veporic Unit. The fault has been considered to be reactivated in the Neo-Alpine period as sinistral strike-slip (Zoubek 1935; Klinec 1976; Bezák 1988, 1991). As for the youngest movement normal-slip has been suggested (Klinec et al. 1976; Bezák & Klinec 1980), thanks to which Mesozoic and younger sediments were preserved in downthrown hanging wall blocks. The Brezno Basin has been regarded as genetically related (not specified) to the Mýto-Tisovec fault dynamics as well (Maheľ 1972; Pulec 1985; Bezák 1991).

Jaroš et al. (1966) described Neogene reactivization of "cross faults" including the Mýto-Tisovec one from the area of the "Hron synclinorium" built up by a subsided pile of Meso-Alpine Mesozoic nappes. The Badenian-Sarmatian activity of the Mýto-Tisovec fault is indicated by occurrences of andesite volcanic bodies (volcanic complexes near Brezno, Tisovec). In spite of the young activity, NW-SE faults do not operate as recent drainage ways for subsurface water, because almost no water springs follow these faults. Most water springs are related to the NE-SW faults (Pospíšil et al. 1989).

Methods

A combination of field mesostructural observations and map-scale structure analysis has been applied as the research approache to solving the topic. As the basic principle, we have accepted an axiom, that small-scale structures can be related to large regional structures and that both scales reflect the same dynamics and kinematics (Angelier 1994).

Structural research has been focussed on investigation of brittle structures related to the paleostress field studied along the map trace of the Mýto-Tisovec fault. It involved:

— field structural research including measurement and collection of field structural data, kinematical analysis of slickensides (Petit 1987; Marko 1993a), geological mapping.

— processing of structural data including orientation and paleostress analysis. For paleostress analysis direct inversion method (Angelier 1984), and its software application Jahans & Villemin in Charlesworth et al. (1992) has been used. Several successive tectonic stages characterized by orientation of principal stress axes, stress ratio ($\phi=(\sigma_2-\sigma_3)/(\sigma_1-\sigma_3)$), tectonic regime and age of deformations have been identified. Homogeneous populations of slickensides for computations of single paleostress events were separated and combined from all localities (Fig. 5a–e). This means that the whole studied area of the Mýto-Tisovec fault zone has been regarded as a homoge-

Table 1: Names of localities, where structural measurements were realized. Age of rock bearing structures is expressed by symbols: **N** — Oligocene–Miocene, **M** — Mesozoic (Silicic Unit, Foederata Unit), **V** — pre-Mesozoic (Veporic Unit).

No.	Locality	Tectonic unit	Rock sequence	Age of rock sequence
1	Brezno-Podkoreňová pit	Subtatras Group	sandstones, breccias	Oligocene/Early Miocene (N)
2	Brezno-Rimavská pit	Subtatras Group	sandstones	Eocene–Priabonian (N)
3	Brezno-Mazorníkovo pit	Subtatras Group	sandstones, breccias	Oligocene/Early Miocene (N)
4	Brezno-Rohozná quarry	Veporic Unit	metadiorite	Carboniferous (V)
5	Tisovec-Strieborný potok outcrop	Veporic Unit	porfyric granodiorite	Carboniferous (V)
6	Tisovec-Slávča quarry	Veporic Unit	porfyric granodiorite	Carboniferous (V)
7	Tisovec-Čremosná quarry	Silicic Unit	Tisovec limestone	Triassic–Carnian (M)
8	Tisovec-Pod Dielom quarry I	Neogene volcanite	Amf+Px±Grt andesite	Miocene–Badenian (N)
9	Tisovec-Remetisko outcrop	Silicic Unit	Wetterstein limestone	Triassic–Ladinian (M)
10	Pohronská Polhora-Zbojská quarry	Foederata Unit	metaquartzite	Triassic–Scythian (M)
11	Tisovec-Griľka quarry I	Silicic Unit	Wetterstein limestone	Triassic–Ladinian (M)
12	Tisovec-Hradová hill	Silicic Unit	Wetterstein dolomite	Triassic–Carnian (M)
13	Tisovec-Pod Dielom quarry II	Neogene volcanite	Amf+Px±Grt andesite	Miocene–Badenian (N)
14	Tisovec-Griľka quarry II	Silicic Unit	Wetterstein limestone	Triassic–Ladinian (M)
15	Tisovec-Šťavica quarry	Foederata Unit	metaquartzites	Triassic–Scythian (M)

neous structural domain. The angle between the theorethical and measured orientation of striae was used as the discrimination criterium for separation of slickensides to homogeneous populations.

— interpretation of the gained data and structural synthesis of field observations including: restoration of paleostress fields and nature of regional (map scale) structures, resulted in the creation of a geodynamical evolutionary model of the area.

Structural data and field observations

The data used for structural analysis were collected from 15 outcrops (Table 1) situated in the Mýto-Tisovec fault zone in between Brezno and Tisovec towns (Fig. 2). Study was focused on brittle tectonics. Strikes of slickensides and mineral veins observed in rocks units of different age are presented in rose diagrams (Fig. 2).

Several dozens of kinematically defined meso-scale brittle faults were collected from rocks of various age (from Variscan crystalline rocks up to the Badenian volcanites — Fig. 3a). The kinematics of observed slickensides shows, that the dominant brittle deformation was generally of a strike-slip character.

The most spectacular brittle faults are exposed at the Tisovec quarry (Fig. 2, locality 7), located in the Mesozoic limestones of the Muráň Nappe Unit. This quarry is situated just within the deformational zone of the Mýto-Tisovec fault, where faults related to this zone are observable. The dominant strike-slip character of the NW-SE trending subvertical faults is clear from the fault surfaces (Fig. 3b). Even strike-slip duplexes arranged in flower structure are visible there in cross-section view to the fault plane (Fig. 3c), proving the intensity of strike-slip deformation at the Mýto-Tisovec fault. Records of strike-slip movements along the faults parallel with Mýto-Tisovec one show multiple fluctuation of the sense

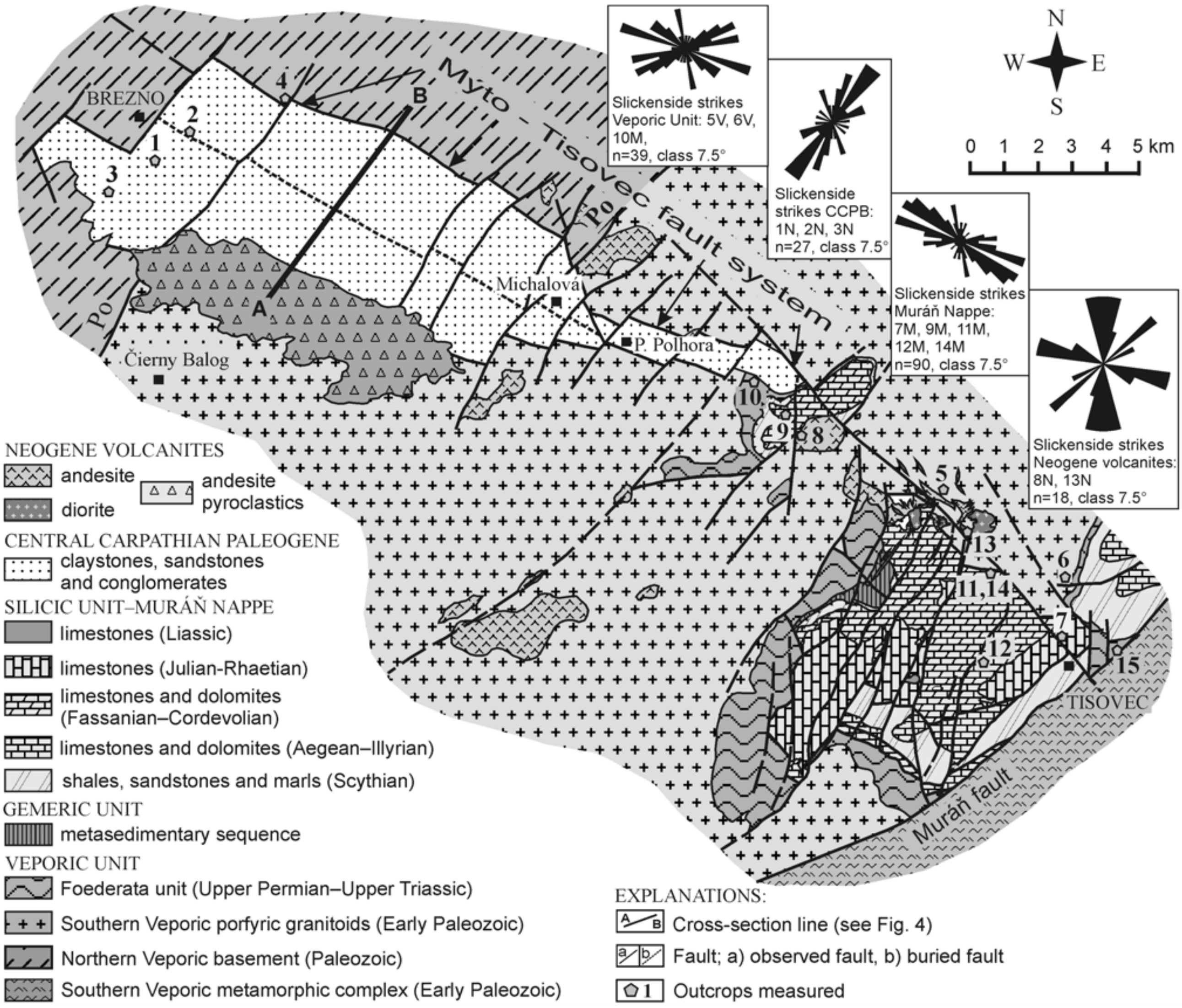

Fig. 2. Geological map of the studied area (cf. Vojtko 1999) with location of analysed outcrops.

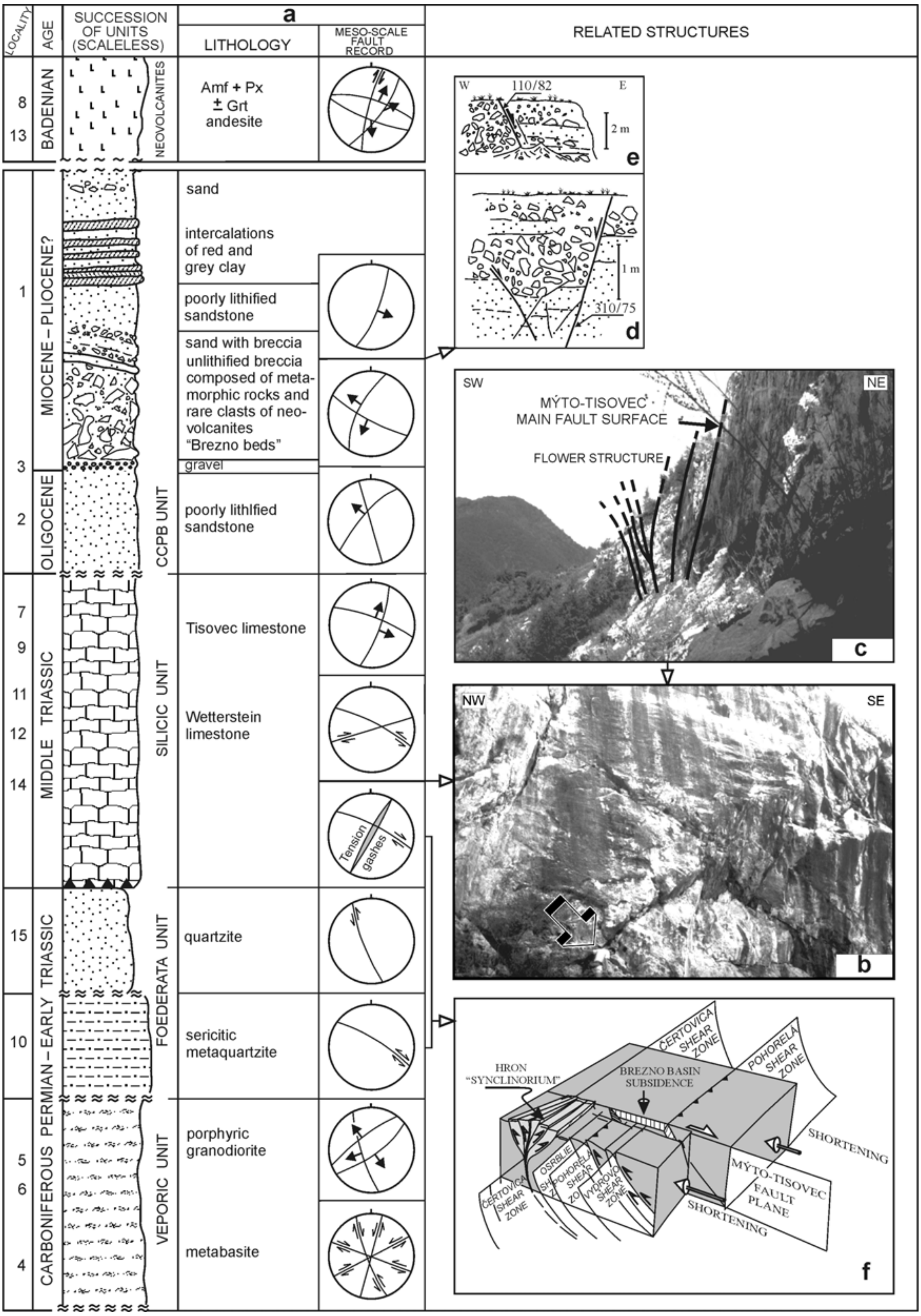

Fig. 3. Structural record related to the lithostratigraphy of different units. **a** — Simplified brittle records, diagrams represent lower hemisphere (CCPB — Central Carpathian Paleogene Basin). **b** — Front view of the large NW-SE strike-slip slickenside at the Tisovec quarry (locality No. 7). A person at the bottom for the scale (see arrow). **c** — View in the strike direction of the large NW-SE slickenside with evident strike-slip duplexes arranged in positive flower structure (locality No. 7). Scale is the same as in the Fig. 3b. **d, e** — NNE-SSW meso-scale normal faults in the Brezno Basin (locality No. 1). **f** — An alternative model of the Mýto-Tisovec fault early stages evolution. Lengths of horizontal arrows express different magnitude of shortenning within the northern and southern wall of the fault.

of movement. The most evident record — criteria for dextral strike-slip (accretional mineral steps, tool pits at the slickenside surface) are the result of the strongest event. However, there are some indices, that the youngest strike-slip movement along the NW-SE trending faults at Tisovec quarry has a sinistral sense. Anyway, the dominant horizontal striations are overprinted by younger dip-slip striations according to which the northern block subsided.

Apart from the field structural research, reambulation of the geological map has been done. According to the reinterpretation presented here the Mýto-Tisovec fault itself is composed of several overstepping en-echelon segments, connected by bridge areas (accomodation zones) and by smaller secondary faults. This left-stepping arrangement (sensu Biddle & Christie-Blick 1985) is typical for dextral strike-slip faults.

Stress field evolution and interpretation

Processing brittle fault-slip data led to distinguishing of five paleostress events. The youngest, sixth paleostress event of NNW-SSE compression was suggested only from evident offsets of map scale structures and geomorphological phenomena observed in the field. The kinematics of map scale faults has been evaluated in several successive paleostress events listed below.

NNE-SSW compression (Late Cretaceous/Paleocene–Early Eocene)

The oldest brittle records from the investigated area are those structures, which were caused or reactivated by NNE-SSW compression (Fig. 5a). The NNE-SSW compression induced a dextral transpressional regime in the Mýto-Tisovec fault zone. The Mýto-Tisovec "fault" being a deeply seated crustal shear zone operated during this early stage in brittle-ductile mode. Stretching lineations typical for the Paleo-Alpine period (Bezák 1993) parallel with the Mýto-Tisovec fault observed in the Permian-Triassic metaquartzites (Fig. 2, locality 10) are regarded as the product of this early stage in brittle-ductile conditions. The cross-cutting Muráň fault had to operate as a sinistral transtensional oblique-slip with dominant dip-slip separation, when the western block subsided (Muráň karst plateau and Tisovec karst block). Thanks to this event, formations of the Muráň Nappe have been preserved west of the Muráň fault. The age brackets — the Latest Cretaceous–Early Eocene of this period are well constrained from the locality Hrabušice, situated out of the studied area (Marko 1993b). There are exposed N-S map scale dextral strike-slip faults related to this paleostress period which tectonically juxtapose Late Cretaceous conglomerates with Triassic dolomites. These faults are sealed by overlying Middle Eocene basal sediments of the Central Carpathian Paleogene Basin.

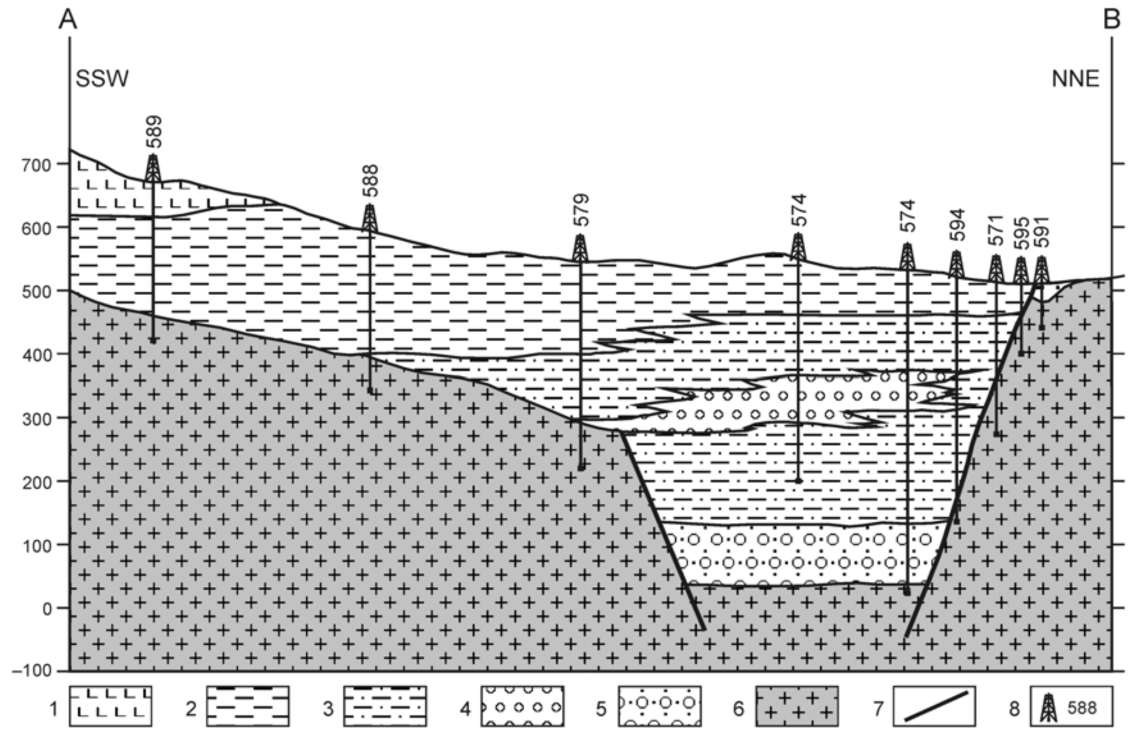

Fig. 4. Cross-section of the Brezno Basin verified by boreholes (slightly modified, after Pulec 1985). **1** — Badenian-Sarmathian andesite pyroclastics; **2** — claystone lithofacies (Eocene–Priabonian); **3** — sandstone-claystone lithofacies (Eocene–Priabonian); **4** — boulder conglomerates (Eocene–Priabonian); **5** — conglomerate-sandstone lithofacies (Eocene–Priabonian); **6** — Veporic crystalline basement (Paleozoic); **7** — fault; **8** — borehole.

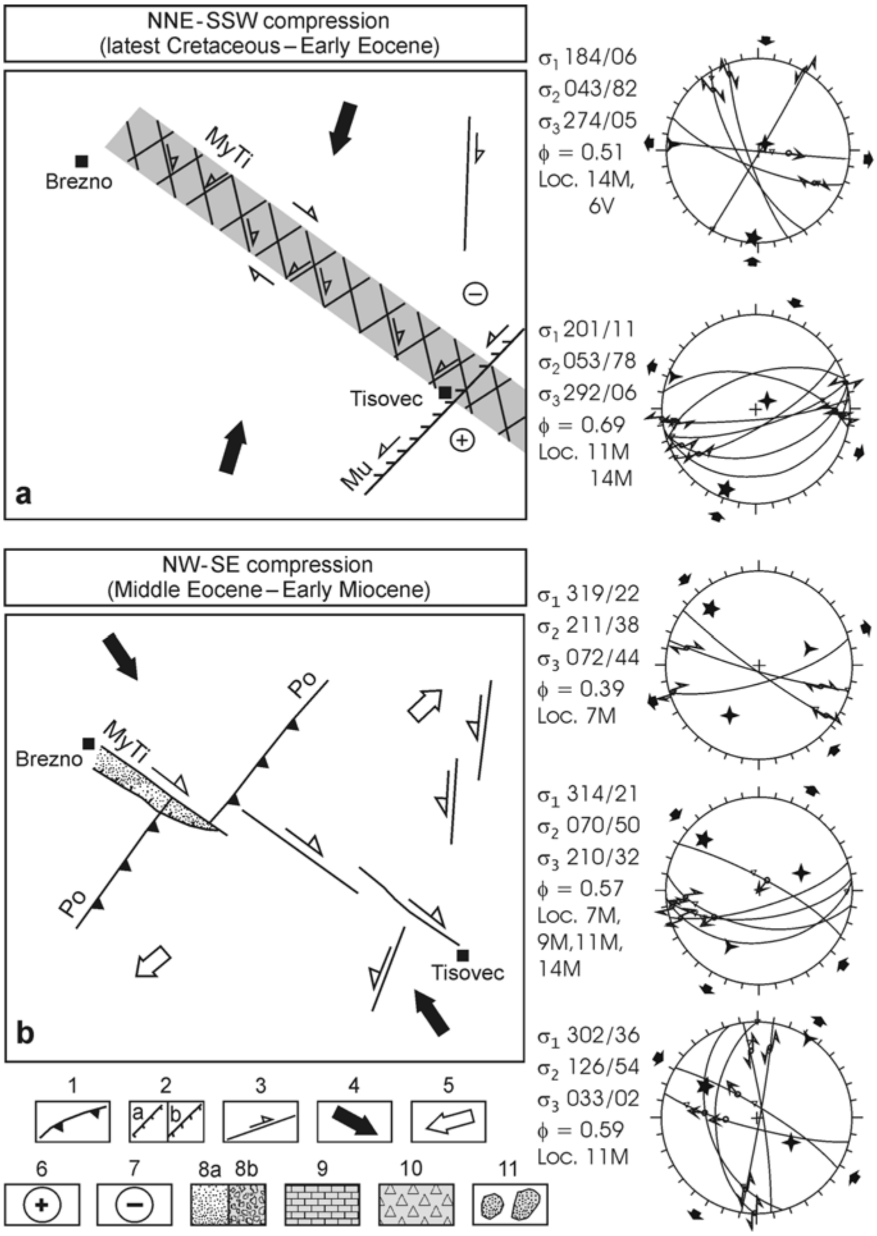

Fig. 5. Paleostress evolution and kinematic history of the Mýto-Tisovec fault. This model is schematic, drawn with respect to the recent coordinates and orientation of map-scale structures. Structural diagrams represent lower hemisphere. Localities from where faults of homogeneous populations were separated are listed in the bottom of each diagram. The age of slickenside bearing rocks is expressed by codes (see Table 1). **1** — thrust and reverse fault; **2a** — normal fault, **2b** — oblique-normal fault; **3** — strike-slip fault (relative magnitude of separation is expressed by length of shear sense arrows); **4** — direction of compression; **5** — direction of tension; **6** — upthrown block; **7** — downthrown block (magnitude of subsidence is expressed in meters); **8a** — sedimentary fill deposited and/or preserved in depressions; **8b** — debris sediments of Brezno beds; **9** — Mesozoic rocks of Kučelach block (relic of Silica Nappe); **10** — Badenian volcanites; **11** — huge rockfalls of Mesozoic rocks. MyTi — Mýto-Tisovec fault, Mu — Muráň fault, Po — Pohorelá shear zone, CiBa — Čierny Balog fault. *Continued on the next pages.*

NW-SE compression (Middle Eocene–Early Miocene)

During this paleostress event (Fig. 5b), a brittle transtensional regime was induced in the Mýto-Tisovec fault zone and WNW–ESE trending en-echelon segments of the Mýto-Tisovec fault developed with important dextral strike-slip separation. Complementary N-S, NNE-SSW sinistral faults operated in the surroundings. This kinematics is visible from the recent configuration and offsets of geological bodies in geological maps (Fig. 2). The greater part of the distinctive dextral offset of the cross-cutting Paleo-Meso-Alpine Pohorelá contractional shear zone was created during this period.

In the early stages of this period the embrionic Brezno Basin could has been founded as a strike-slip basin. A narrow slab rimmed by segments of the Mýto-Tisovec fault, which subsided due to the local transtension along the fault zone, was filled with the Middle-Late Eocene basal formations. The cross-section of the basin (Fig. 4) suggests, that the normal-dextral NW-SE faults operated in the Middle to Late Eocene as synsedimentary ones.

NE-SW tension (Middle Miocene)

This is complementary paleostress field to the former one. The most distinctive record of this paleostress event (Fig. 5c) is the structure of the Brezno Basin, which is spatially related to the Mýto-Tisovec fault zone. A narrow, relatively deep pull-apart basin was opened. A 550 m thick fill of Eocene-Oligocene sediments (Pulec 1985) is preserved there, the youngest sediments are of Miocene age. During the end of this or beginning of the next period, a facial change in lithology shows a radical change of conditions during the sedimentation. Poorly sorted and indurated breccias of debris type, the Late Badenian-Early Sarmatian Brezno beds were observed at the localities 1 and 3 (Fig. 2). They consist of very angular blocks of metamorphic rocks. This breccia overlies Oligocene sandstones and is covered by alternating beds of sands and variegated clays (Fig. 3). According occurrences of fossil flora in coal intercalations in the underlying basal sandstones (Sitár 1965) the age of these debris sediments is interpreted as post-Oligocene. The upper age limit of these sediments is constrained by occurrences of rare clasts of Badenian volcanites. The coarse poorly rounded and sorted sediments, transported only a short distance, could be ex-

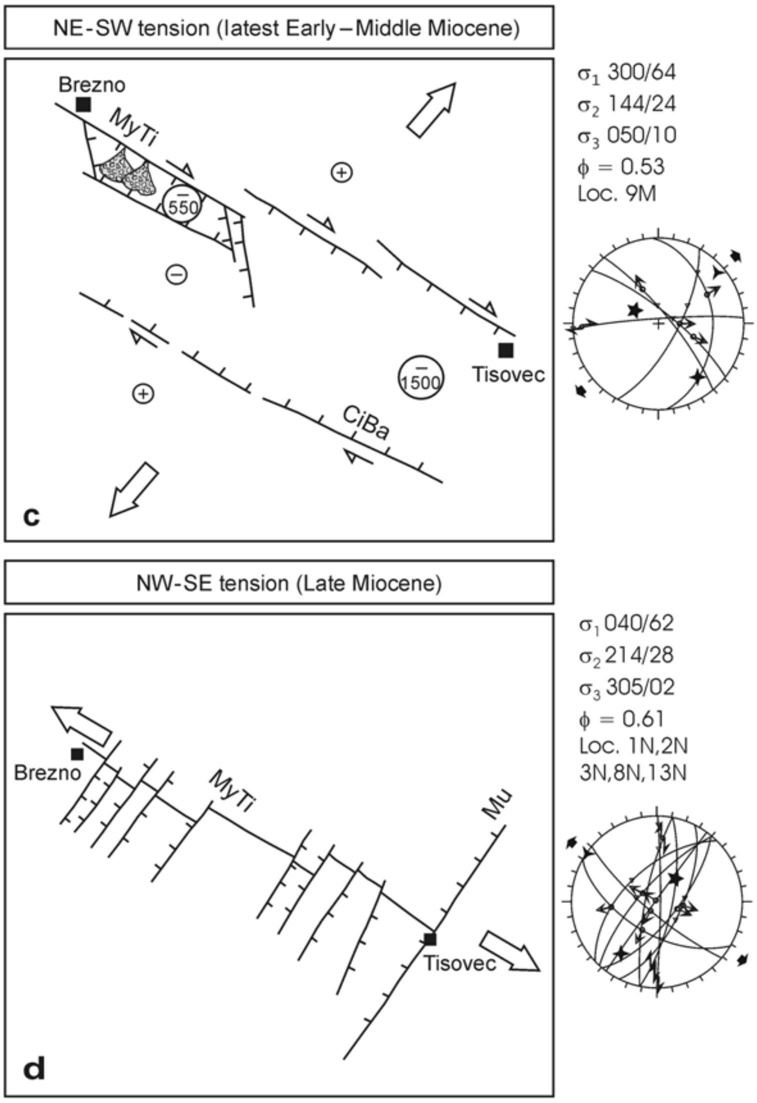

Fig. 5c–d. *Continued.*

plained by an emerging proximal crystalline rocks source with high surface relief.

Preservation of the Muráň Nappe and underlying units in the Tisovec karst block, which subsided 1500 m compared to the Muráň karst plateau is also a result of rapid subsidence within the NW-SE corridor rimmed by the Mýto-Tisovec fault from the north and parallel Čierny Balog fault (Bezák 1991, 1993) running southerly. Emplacement of the NW-SE oriented subvolcanic diorite bodies near Tisovec occurred in this period.

NW-SE tension (Late Miocene)

There are meso-scale as well as map-scale structural records of NW-SE tension (Fig. 5d). Meso-scale NNE-SSW striking normal faults (Fig. 3d,e) were observed in the Upper Eocene–Lower Miocene sediments of the Brezno Basin (Fig. 2, locality 1, 3). NW-SE striking normal faults are present as a minor population too. The age relations of these two populations of extensional faults are not clear, but according to the paleostress calculations they could be coeval, being produced by one single paleostress event — NW-SE tension (Fig. 5d).

NW-SE tension has great importance for preservation of the Muráň Nappe in the western block of the Muráň fault, which continuously subsided also during this period. A lot of NE-SW trending, map-scale normal faults developed during this tensional event. They cut the Tisovec karst block, Brezno Basin and they are responsible for preservation of the Kučelach outlier of the Muráň Nappe, which subsided along NE-SW normal faults. The complicated internal structure in the Tiso-vec karst is the result of alteration of differentially subsided blocks (Vojtko 2000). The emplacement of the youngest NE-SW striking volcanic dykes was controlled by NW-SE tension as well. As a complementary paleostress event for this period, a NE-SW (NNE-SSW) horizontal compression is suggested, because a few strike-slip slickensides related to this stress field were measured too. The NE-SW (NNE-SSW) compression was coeval, or slightly predated the NW-SE tension. This paleostress field left a distinctive structural record in the Eocene sediments of the southern margin of the Central Carpathian Paleogene Basin, where it produced a numerous population of conjugate strike-slip slickensides with modest separation (Marko 1995).

ENE-WSW compression, NNW-SSE tension (Late Miocene/Pliocene)

This paleostress event is recorded in a meso-scale slickenside population — frequent NW-SE striking sinistral strike-slip slickensides in Mesozoic rocks and kinematically variegated slickensides in Neogene volcanic rocks (Fig. 5e). We suggest, that ENE-WSW compression slightly predated NNW-SSE tension. During this period sinistral transtensional regime operated along the Mýto-Tisovec fault. This event could generate dextral strike-slip movement with modest magnitudes of separation along the NE-SW striking Muráň fault.

The preservation of a narrow belt of the Paleogene sediments at the easternmost tip of the Brezno Basin could be explained as pull-apart subsidence in overstepping transtensional bridge in between two en-echelon segments of the Mýto-Tisovec fault.

Large map-scale E-W trending normal faults active during this period allowed preservation of Paleogene and Neogene sediments in morphotectonic depressions such as the Upper Hron Valley Depression (Fig. 5e). These faults also evident in the recent pattern of the geological map (Fig. 1) affect the morphotectonic character of the area, as well as the surface water drainage network (for example the Hron river).

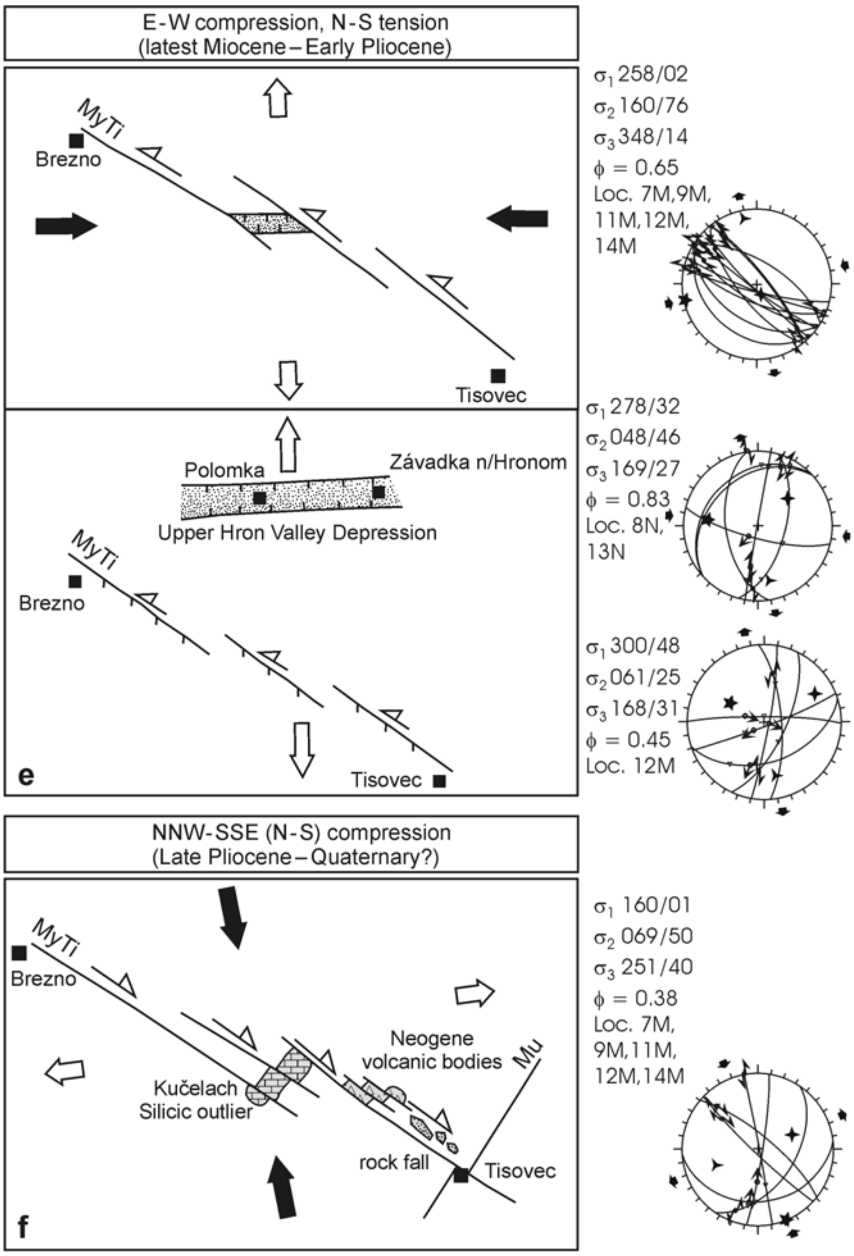

Fig. 5e–f. *Continued.*

NNW-SSE (N-S) compression (Pliocene–Quaternary?)

The youngest stress event characterized by a ca. N-S oriented maximum principal stress axis was described according to the map-scale structures arrangement (Fig. 5f). We do not have reliable mesofault-slip records of this paleostress event in the youngest (Miocene) rocks. However, several slickensides creating homogeneous population related to NNW-SSE compression were observed only in Mesozoic rocks.

The most spectacular map-scale evidence of this latest tectonic event are dextral offsets (ca. 200 m magnitude of separation) of the Kučelach block, bodies of the Badenian volcanites and the Muráň fault along the Mýto-Tisovec fault. Huge rock falls observed on the eastern segment of the fault are regarded as evidence of subrecent dextral strike-slip activity of the Mýto-Tisovec fault. There are large blocks of Mesozoic rocks fallen down from the edge of the Muráň Nappe block (Vojtko 1999). We suppose that these blocks fell down due to strong sudden energy triggered by probably seismogenic dextral strike-slip along the Mýto-Tisovec fault generated by ca. N-S trending compression during the Quaternary.

Discussion and conclusions

Six successive events of tectonic evolution characterized by stress tensors and related tectonic regimes have been restored in the study area. Thanks to the age variability of rocks bearing brittle deformations, it was possible to restore the succession of paleostress events. Nevertheless, it was rather difficult to establish the precise age brackets for the paleostress events. It was not always possible to use the age of rocks bearing structural records for dating paleostress events. Sometimes records of young paleostress events were not observed in young formations as, for example, records of ENE-WSW as well as NNW-SSE compression. Explanation of this controversy could lie in the heterogeneous distribution of the structural record or in incorrect dating of these paleostress events.

The importance of the youngest N-S compression, E-W tension can be inferred from the conspicuous population of map-scale N-S striking faults. These very frequent faults in the Western Carpathians offset older stuctures. They could be generated during N-S compression as well as during complementary E-W tension, which ought to be related to a rollback effect of subducted crust under the eastward propagating Carpathians (Doglioni et al. 1991). In this case the Early Pannonian E-W tension would has predated the period of N-S compression.

Restored evolution of the Neogene–Quaternary paleostress field submitted herein fits well with the paleostress evolution of the ALCAPA (Alpine-Carpathian-Pannonian) junction area (Nemčok et al. 1989; Csontos et al. 1991; Fodor 1995; Marko et al. 1995; Marko 2002). In spite of this similarity, no blok rotations (well known from the ALCAPA junction area) have been taken into account in the geodynamic model of the Mýto-Tisovec fault area evolution. It has been decided due to the lack of paleomagnetic data from the northwestern Veporic and a few zero paleomeridian rotations measured in Jurassic rocks (Kruczyk et al. 1992) in the similar terrane — the area of the Vysoké Tatry Mts.

Combining the gained paleostress data with other relevant geological information we have reconstructed the tectonic story of the study area. After the Meso-Alpine nappe thrusting, shortening of the Western Carpathian orogene continued. In this post-nappe period (after the middle/Late Cretaceous) further northward propagation of Carpathians was accommodated in the internal zones by brittle faulting, which divided the Central Western Carpathians into individually moving blocks. The NW-SE and NE-SW faults operated as conjugate during the Neogene period. The Mýto-Tisovec NW-SE trending fault, deeply seated in the crust operated during most of its tectonic life as dextral strike-slip, but it kinematically fluctuated in changing paleostress conditions. Map-scale structural evidence (Bezák 2003) points to different intensity of shortening in blocks divided by the Mýto-Tisovec fault. Shortening was realized by NE-SW shear zones, but the southern block was affected by more numerous shear zones than the northern one. The Mýto-Tisovec fault, operating during this early stage in a brittle-ductile regime, could play the role of a "transform" fault accommodating different shortening in northern and southern blocks (Fig. 3f).

The formation of the Brezno Basin and the distribution of Miocene volcanic bodies in the area were controlled by the Mýto-Tisovec fault activity. It is clear from the paleostress history, thickness, facial character of the Brezno Basin sedimentary fill and its shape, that it is small pull-apart basin open as a narrow strike-slip basin related to the early transtensional dextral strike-slip and later extensional regime within the Mýto-Tisovec fault zone. Because Paleogene sediments often overlay crystalline basement within the area of the Myto-Tisovec fault, huge erosion of Mesozoic rocks cover before sedimentation of Paleogene clastics ought to be expected. This erosion, probably supported by tectonic exhumation (Hók et al. 1993; Plašienka 1993; Fodor 1995) was realized after nappe thrusting in the middle/Late Cretaceous and before the transgression of the Middle Eocene sediments. Erosion removed Mesozoic cover and exhumed crystalline rocks in the area of the future Brezno Basin. This process suggests updoming, elevation of this area, which could be the result of squeezing blocks separated by NE-SW contractional shear zones during continuous Neo-Alpine shortening. Today's occurrences of Paleogene sedimentary cover show, that the whole area were covered by the Paleogene sediments, which were later eroded. A thicker remnant of the basin fill was preserved only in a deeper depression — the Brezno Basin, subsided along the Mýto-Tisovec fault. This scenario supposes very strong erosion after the Paleogene, too. The distribution of the Miocene volcanic rocks could be similarly understood. It seems, that today's occurrences of volcanites in the focused area are only remnants of a formerly huge stratovolcano (dozens kilometers wide in diameter), which was eroded. The center of this stratovolcano ought to be situated northwest of the Tisovec, within the zone of the Mýto-Tisovec fault, which operated as a path way for ascending volcanic and subvolcanic bodies during NE-SW tension. There are superficial occurrences of subvolcanic varieties of extrusive rocks, which points to the great depth of erosional level after the Miocene volcanism.

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