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Geologic and tectonic evolution of the Turiec depression in the Neogene

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Abstract: The Neogene fill of the Turiec Depression represents a halfgraben filled above all in the Middle and Late Miocene. The material transport was from W toward E, the basin axis was situated in the NE-SW direction. The sediment distribution was determined by altered palaeostress field. During the Early Miocene a compressional component was oriented in the NW-SE direction and gradually it rotated into NE-SW direction in the Late Miocene. During the Pliocene a compressional component was again oriented in NW-SE direction. The paper contains lithostratigraphic division of Neogene deposits and we define a new lithostratigraphic unit - Turiec Formation.

Key words: Neogene tectonic, geology, sedimentology, Neogene basin, Western Carpathians.

Introduction

The Turiec Depression is bounded to the west to Kriváň part and to the north to Lúčany part of the Malá Fatra Mts. according to the regional-geologic division (Vass et al. 1988). From the eastern part the boundary separates the depression from the Veľká Fatra Mts. From the south the Turiec Depression is bounded to the Žiar Mts. and volcanics of the Kremnice hills (Fig. 1).

The basic data dealing with Tertiary structure and fill of the Turiec Depression were published in the works of Buday (1957, 1962) who also suggested the first stratigraphic division of the Neogene deposits (Tab. 1). The work of Andrusov (1954) mainly concerned the more detail stratigraphic and tectonic assignment of the Neogene deposits. The tectonics and spatial distribution of the main rock types were mainly analysed in the works of Gašparik (1989, 1995), Gašparik & Halouzka (1989) and Gašparik et al. (1991). The basic works on paleontologic research and stratigraphic assignment of the Neogene deposits was submitted by Němejc (1957, 1957a), Rakús (1958), Pokorný (1960), Sitár (1969, 1976, 1982), Ondrejíčková (1974), Brestenská & Planderová (1979) and Gašparíková (1987).

Methods and objectives of the work

The field research was based on the published map at the scale 1:50 000 Gašparik & Halouzka (1989). It consisted of the gathering of the basic sedimentological, paleontological and structural data. If the characteristics and the sufficient exposure of rocks allowed, the outcrops were evaluated complexly applying all the methods. The results and data obtained by field research were subsequently processed and synthetized in laboratories.

The sedimentological study was done on the suitable outcrops at all locations where data on deposition character, direction and mode of clastic deposition and depositional environment were missing. At the same time we have taken samples for macropaleontological and micropaleontological study. The structural research was aimed at the gathering and analysis of mainly brittle deformations from which a tectonic regime for individual periods of the depositional record was intepreted. The methodology of Angelier & Gougel (1979) and Angelier (1979) respectively, were applied for the structural data processing.

The obtained results and their interpretation

The Turiec Depression represents an intermountain depression filled by the Paleogene, Neogene and Quaternary deposits. In general, the deposits dip toward west (Fig. 1). The uniform dip of the sedimentary sequence point to the long-term activity of faults near the western margin of the depression.

The Turiec Depression, similarly to other Neogene basins in the Western Carpathians, contains older Tertiary rocks in its fill, which represent preserved relics of the original depositional areas. Into this category we assign Paleogene and Early Miocene deposits cropping out on the eastern and southeastern margin of the depression as well as in the basement of the Miocene basin fill (Gašparik & Halouzka 1993, Gašparik et al 1995).

The Paleogene deposits are exclusively exposed on the eastern and northeastern margin of the basin and they are assigned to the Subtatric Group (Gross et al.

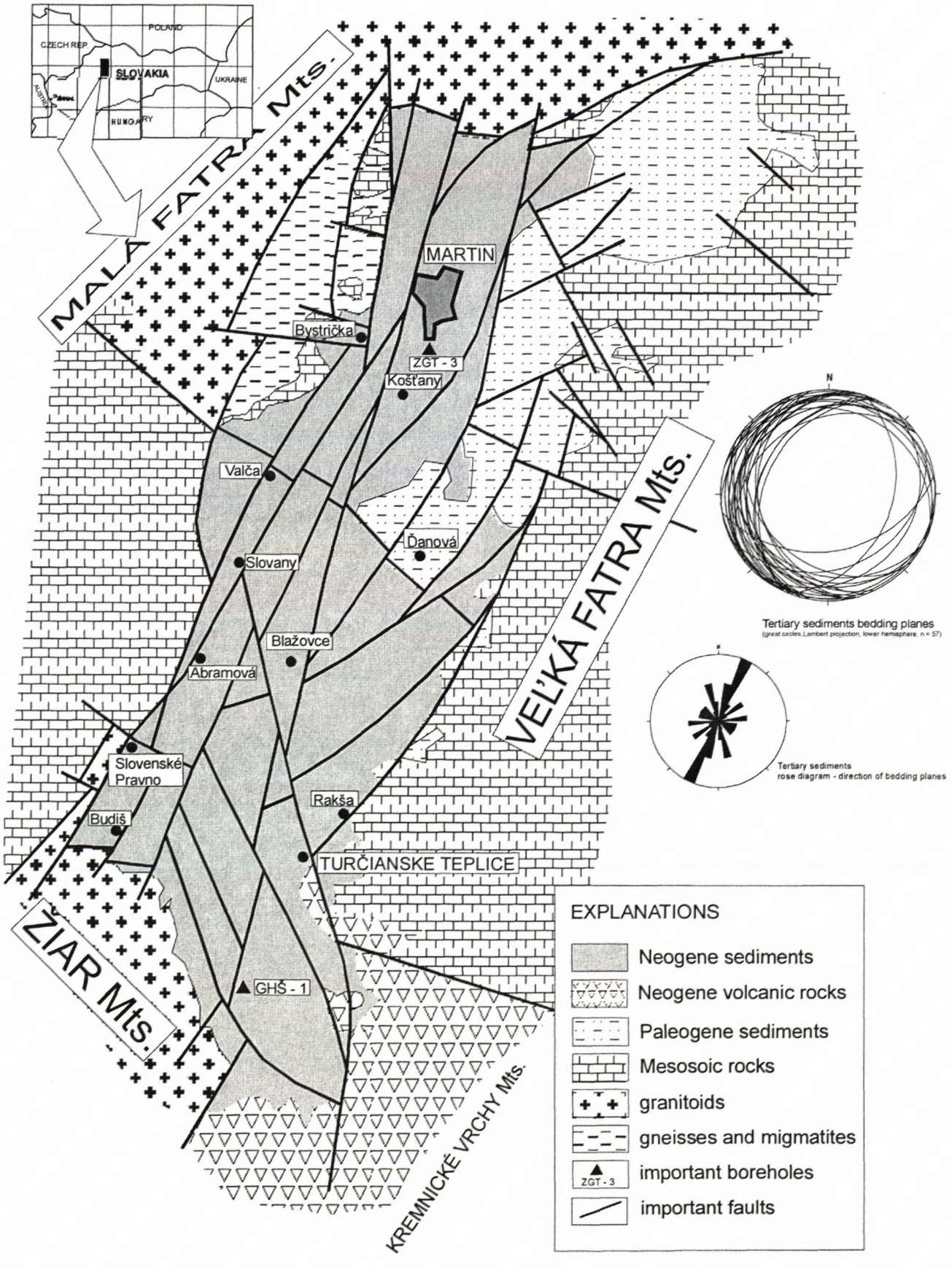


Fig. 1 Schematic geological map of the Turčianska kotlina depression (compiled by Hók, 1997, after Maheľ et al., 1964 and Gašparik and Halouzka, 1989)

NEOGENE	PLIOCENE	Dacian	Diviaky member	clays, andesites gravels (50 - 60m)	freshwater facies	last movements along west situated marginal fault 3rd transgression
		Pontian		missing		
	MIOCENE	Pannonian		missing		
		Sarmatian	Martin member	gravels, clays (50 - 300m) marls,coaly clays	freshwater facies	strong subsidence, shalow water, movements along NW oriented faults
				marls, limestones and rare coaly clays (200 - 500m)	brackish facies	strong subsidence, andesite volcanics, rhyolite volcanics
				gravels, limestones, volcanic tufits		2nd. transgression
		Badenian ?		marls, sands, sandstones	marine facies	1st. transgression

Tab. 1 Litthostratigraphic column of the Neogene fill of the Turčianska kotlina depression (compiled by Hók, 1997 – according to Buday, 1962

1984). According their lithologic content and stratigraphic level they may be divided into the following formations:

- Borové Formation (Lutetian - Early Eocene)

It is a basal formation and it only occurs in the northeastern part of the Turiec Depression. It contains coarse-grained deposits - breccias, conglomerates, locally also limestones and sandstones. The composition of breccias and conglomerates usually reflects lithologic character of the immediate basement.

- Huty Formation (Priabonian - Late Eocene)

In the greater part of the area it substitutes the basal facies and it lies directly on the Mesozoic basement. The thickness of the formation reaches up to 1 000 m (the borehole ZGT-3, Fendek et al. 1990). The Huty Formation is the main lithofacial member of the Subtatric Group in the Turiec Depression. Lithologically it consists of clays and claystones predominating sandstones.

- Zuberec Formation (Early to Late Oligocene)

In the Turiec Depression it is only developed in the denudation relics in the surroundings of Daňová. Lithologically it represents deposits of turbidity flows - alternation of claystones, sandstones and sandy shales.

The tectonic deformation of the Paleogene bed succession (locality Daňová) by folding with the fold axis ENE - WSW and vergency to SE is consistent with the deformations observed in the area of Malé and Brezovské Karpaty Mts. or in the area of Zázrivá (Kováč et al. 1989, 1993, Marko et al. 1995) and they are comparable with deformations observed in the Rajec Depression (locality Kľače). The structures of the folded Late Eocene and Early Oligocene deposits in the depression show general palaecompression direction NW-SE. The deposits of the Krížna nappe are deformed by a similar compression in the Turiec Depression (Dolné Jaseno). It is necessary to note that thrusts indicate displacement toward NW. However, it does not refuse the NW-SE orientation of the palaestress compressional component. At the same time the compression is younger and it has different characteristics as the compression responding the displacement of the Krížna nappe. The deformation of the Paleogene rocks probably originated during the desintegration of the Paleogene depositional area after the Oligocene and before the deposition of the Early Miocene clastics similarly to the area of the NW margin of the Malé Karpaty Mts. (Kováč et al. 1989, Marko et al. 1995).

The compressional tectonic regime of the active Central West Carpathian front having palaeostress field characterized by compression of NW-SE direction controlled origin and palaeogeographic distribution of sedimentary areas during the Early Miocene. The denudation relic of their fill is Rakša Formation of Eggenburgian age in the Turiec Depression. It consists of basal carbonate lithofacies containing marine macro- and microfauna (Gašparik et al. 1995).

The uplift of the Žiar Mts. is documented from 46 ± 5 to 52 ± 7 Ma by FT ages of apatites (Kováč et al. 1994). The uplift of the Žiar Mts. occurred on NW-SE oriented faults as it is well documented by distribution of the sedimentary sequence in the Horná Nitra depression (Hók et al. 1995). We assume sedimentation in the southernmost part of the depression (Fig. 2). The occurrence of the Early Miocene deposits in this part of the depression is undirectly indicated by redeposited microfossils of the Early Miocene in the borehole GHŠ-1 (Gašparik et al. 1995). The orientation of the Early Miocene sedimentary environment axis probably was in NW-SE direction as it was in the Horná Nitra depression (Hók et al. 1995).

The activity of the NW-SE oriented faults was also connected with the uplift of crystalline complex of the Žiar Mts. Mostly coarse-grained, micaceous, quartzite sandstones (arkoses) and fine-grained conglomerates of Early? to Middle Badenian Budiš Formation (Gašparik et al. 1995) or Budiš Member was deposited on the foothill of this mountain. The deposits represent gravity sediments on the mountain slope or alluvial fans respectively, which is well documented by the outcrop in the area of Rudno composed of sheet flow deposits.

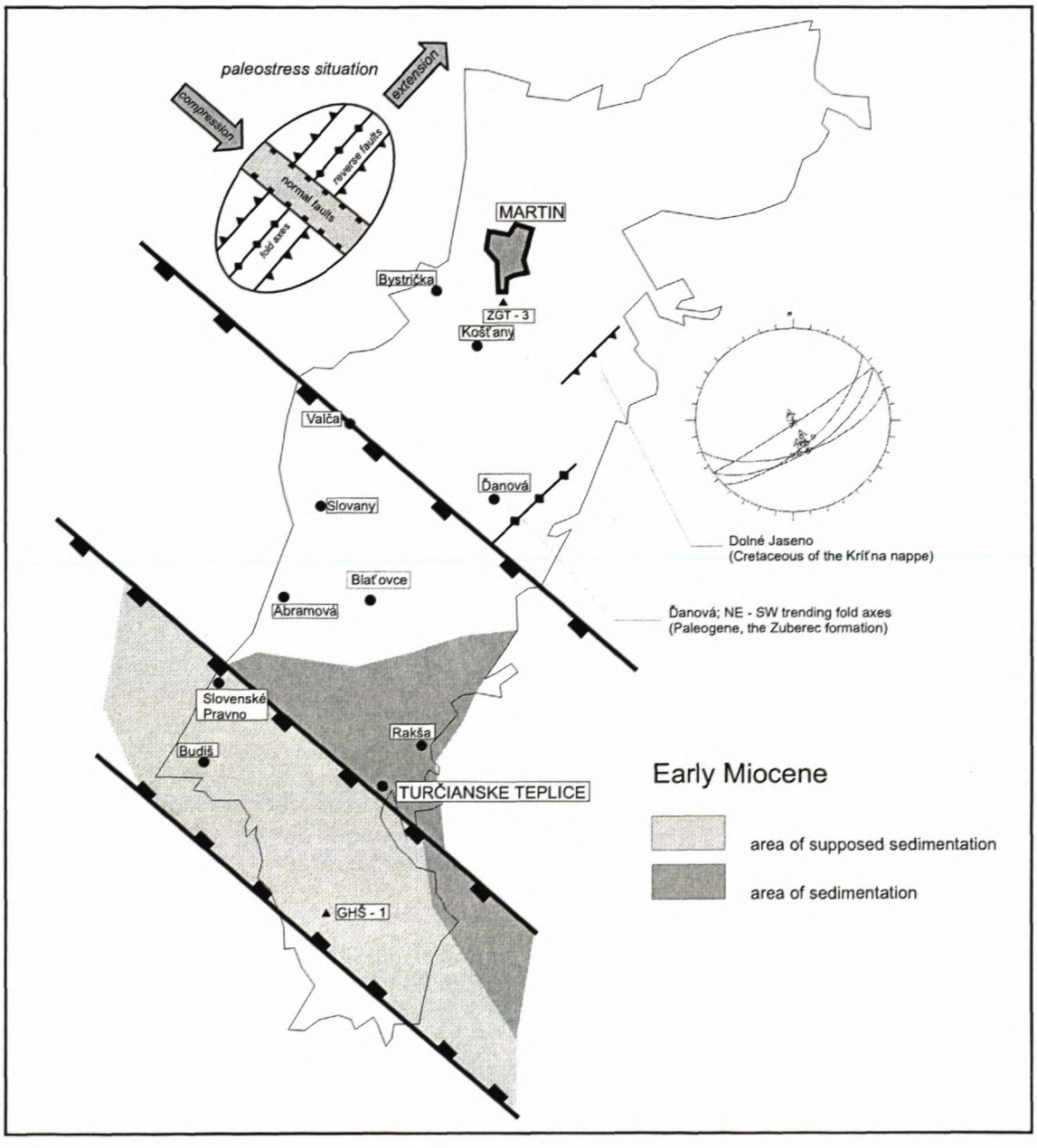


Fig. 2 Supposed paleogeographic and paleotectonic situation in Early Miocene

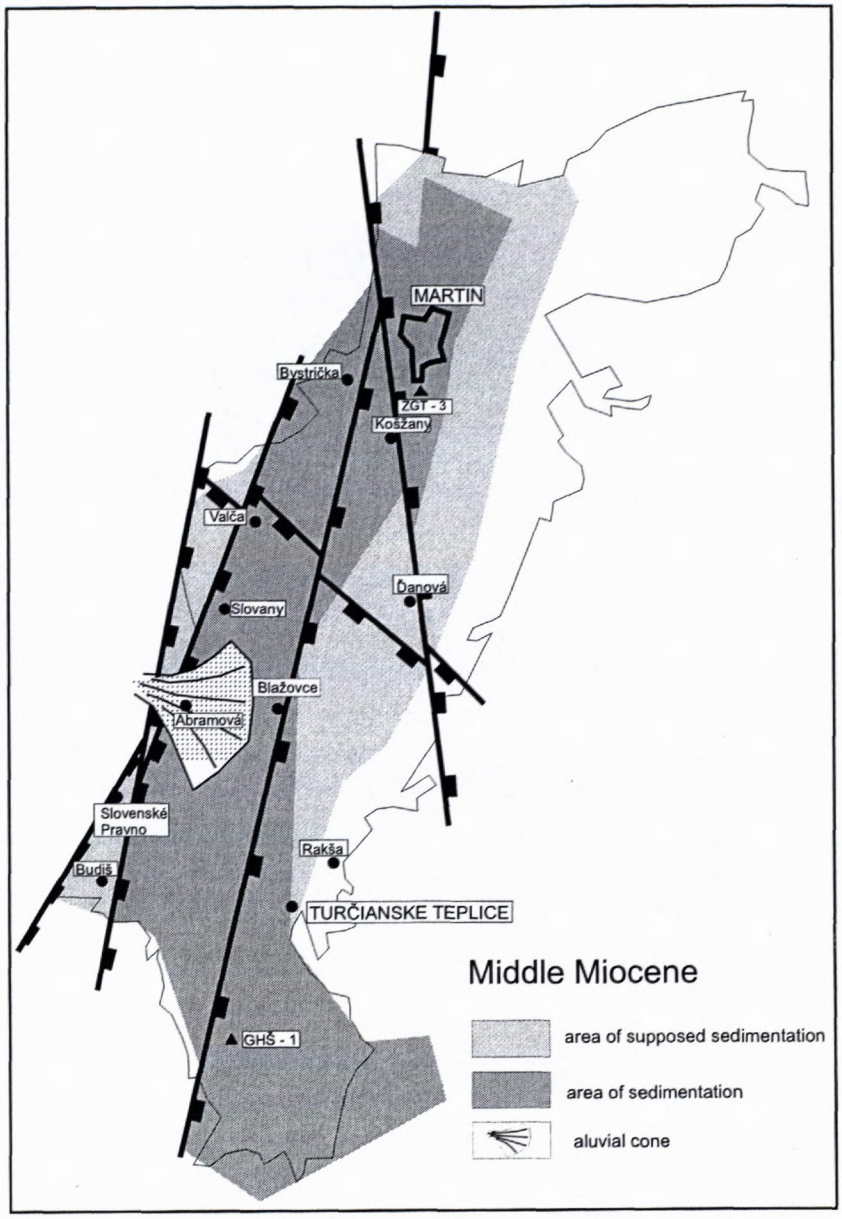


Fig. 3 Supposed paleogeographic situation in Middle Miocene

The orientation of the palaeostress was principally changed in the Middle Miocene. It determined the configuration of the sedimentary area from the NW-SE to N-S and NE-SW direction. The abundant findings of the endemic fauna (Rakús 1958, Pokorný 1960) point to the separation of the Turiec Depression from other intermountain depressions of the Western Carpathians in that time.

The continuation of the Žiar Mts. uplift as well as rejuvenation of subsiding NE-SW faults on the western margin of the Turiec Depression was determined by mantle diapirism accompanied by volcanic activity in the middle Slovakian area (Nemčok & Lexa 1990).

Volcano-sedimentary formations (Turčok, Kremnický Štít and Rematy) reflect the volcanic activity in the southernmost part of the depression in the Late Badenian to the Early Sarmatian age. We assign coarse-grained marginal development of the Abramov Member (Gašparik et al. 1995) and correlable fine-grained basin facies studied at Kolísky, Abramová, Trebostovo, Ležiachov, Valča, Moškovce outcrops into this lowermost etage.

Abramov Member consists of coarse grained deposits of debris flows deposited as alluvial fans on the margin of uplifted mountain (Fig. 3). The marginal, coarse-grained development is toward the basin interfingered by fine-grained lacustrine deposits containing fossil remnants of plants. The plant association is represented by numerous termophile elements of species *Lauraceae – Daphnogene polymorpha* and *Ficus cf. Lanceolata, Sequoia langsdorfii, Celastrus cassinefolius.* Species *Equisetum parlatorii, glyptostrobus europaeus, Taxodium dubium, Salix tenera, Quercus pseudocastanea, Castane atavia, Acer tricuspidatum, A. pseudomonspessulanum, A. integerrimum, liquidambar europaea, Betula prisca, Alnus ducalis, species of genus Carpinus, Carya denticulata, Ulmus longifolia, Zelkova zelkovaefolia* are common forms in the Slovakian Late Badenian and Sarmatian (Sitár 1982). Palaeotrope elements, especially *Echnatisporites miocaenicus, Leiotriletes pseudomaximus, Lygodiosporites sp., Platycaryapolllenites miocaenicus, Symplocoipollenites sp., Engelhardtia type, Sapotaceoidaepollenites sapotoides, Quercoidites henrici, Q. microhenrici, Myricipites bituitus* dominated in the palynospectrum. Occasionally representants of the arctotertiary geoflora, especially pines of *Pinus* genus and genus of the species *Taxodiaceae*, occurred. The pollen analysis of deposits indicated extremely warm, humid subtropic climate. Fauna is represented by a group of ostracoda suggesting fresh water environment of swamps and small lakes in the depression area.

The coarse-grained development is expressed by high-density gravity flow mechanism in subaerial and subaquatic environment. The fine-grained lacustrine deposits does not show traction current features in the basin (for example cross bedding), on the contrary some indices suggest deposition from turbulent suspensions (pebbly mudstone, grading). They consists of tuffs, siltstones and fine-grained sandstones with tuff admixture (Kolísky, Abramová, Trebostovo and Ležiachov), passing upward into siltstones and fine-grained dolomitic sandstones (Valča and Moškovec).

The alluvial fan bodies consist of fine-, middle- and coarse-grained conglomerates (locally of block size) transported on a short distance which are poorly sorted

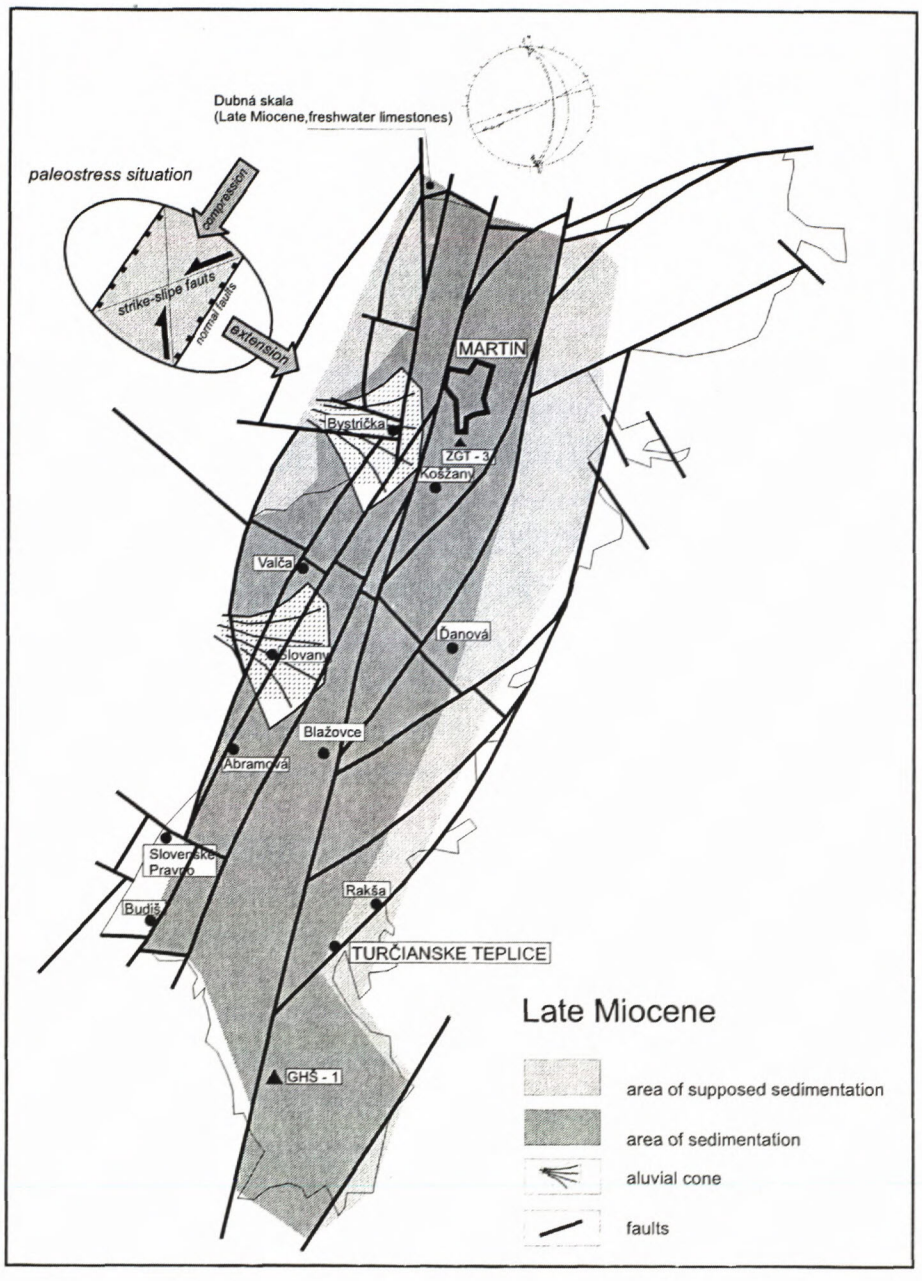


Fig. 4 Supposed paleogeographic and paleotectonic situation in Late Miocene

and weakly rounded. The occurrence of subangular clasts, mainly dolomites, is very frequent. The conglomerate clasts are mainly composed of Triassic sequences of Choč nappe (limestones and dolomites). The matrix is carbonaceous and consists of sand or clayey sand and clay. The coarse-grained development varies in a wide range from matrix-supported to clast-supported conglomerates. The bedding is only emphasized on boundaries with great grain-size difference (siltstones/conglomerates), otherwise it is faint and in most cases the beds are amalgamated. The conglomerate structure is mostly chaotic with local faint inverse grading, deposits of pebble ab toward west, normal grading. The large-scale trough cross-bedding was also observed (Valča and Moškovec).

The clast grain size decreases from the west toward the east, e.g. from the basin margin toward its axial part.

The general strata dip to the west as well as the increasing of the marginal clastics thickness in time suggests synsedimentary as well as postsedimentary activity of N-S to NNE-SSW normal slip faults (fig. 3). Based on analogues from other Neogene basins, particularly of neighbouring Horná Nitra Depression (Hók et al. 1995) we assume the orientation of the compressional palaeostress axis in N-S to NE-SW direction.

Abramov Member is partly overlain by deposits of so called Slovany Member, which Eggenburgian age (Gašparik et al. 1995) seems to be not substantiated on the basis of the field observation. The Slovany Member overlies Abramov Member at localities Slovany and Moškovec. The Eggenburgian deposits are paleontologically only proved from the surroundings of Rakša. The mudstone type, occasional imbrication with plane dip deposits of the Rakša Formation lie on the Middle Triassic Dolomites or on the basal Paleogene (Gašparik 1989).

The Slovany Member consists of carbonate gravelly conglomerates, coarse-grained gravels with interbeds of breccias conglomerates and sandstones. Clays and claystones comprise 20 – 30 cm thick beds in the conglomerates. The matrix consisting of dolomites, illite with kaolinite, chlorite, quartz ± calcite admixture is sandy-clayey, rusty brown. A layer of brownish-red shales of bauxit composition is described from the borehole GT-12 (Gašparik 1989) showing terrestrial environment. The immediate basement of a part of Slovany Member consists of crystalline complex of the Lúčany part of the Malá Fatra Mts. The fact that the deposits lie directly on the crystalline complex and the different lithologic composition of the Slovany Member evokes an substantiated assumption that they have originated after the Malá Fatra uplift and were transported on a short distance in subaerial environment deposited directly on the exposed crystalline basement. The Lúčany Malá Fatra Mts. uplift is according to FT apatite ages 28 ± 15 Ma (Kováč et al. 1994). Slovany Member as well as underlying Abramov Member (Valča and Moškovec) represent subaerial and subaquatic deposits of an alluvial fan.

The body of marginal clastics of the Slovany Member consists of sandstones and fine-, medium- and coarse-grained conglomerates (locally even blocky conglomerates) transported for a short distance by a dense, water-saturated gravity flow mechanism. The conglomerates are poorly sorted, the clasts, consisting of dolomites and Triassic limestone, are often subangular. The sandstones are coarse- and medium-grained, the sandstone beds with floating clasts in sandy matrix occur (Slovany). The carbonate material of clasts is mainly derived from th Triassic sequences of the Choč nappe. The matrix is sandy or clayey-sandy and clayey, locally it is rusty to red coloured (Trebostovo). The coarse-grained development varies in a wide range from matrix- to clast-supported conglomerates. The beding is emphasized on boundaries between different grain size (sandstone/conglomerates). The conglomerates are mostly chaotic, locally faint imbrication with a general ab plain dip toward west occurs. The faint trough-cross bedding was observed. The general dip of beds is again toward the west.

Slovany Member, represented by a coarse-grained marginal facies passes into finer-grained sandy to silty-clayey and clayey development of the upper part of the Late Sarmatian – Pannonian Martin Member (Trebostovo to Hrádok nad Bystričkou, outcrops along tank drome). The marginal coarse-clastic body of Bystrička Member was deposited above the mentioned deposits (Gašparik et al. 1995).

Bystrička Member consists of coarse-grained deposits of subaerial and subaquatic gravity flows (debris flows) deposited as alluvial fans. Marginal, coarse-grained development is in the today's erosive cut occuring above the basinal development of Martin Member. We can not exclude its basinward interfingering with fine-grained lacustrine deposits containing fossil remnants of Pannonian plants and molusks. We assume its Late Sarmatian to Pannonian age based on the underlying sandy-clayey beds of the rusty-brown colour containing prints of arctotertiary leaf mainly *Carpinus grandis, Betula prisca*, more species of genus *Quercus, Fagus, Castanea, Parrotia fagifolia, Zelkova zelkovaefolia, Acer tricuspidatum, Platanus platanifolia.* Even if the mentioned assemblage contains Badenian-Sarmatian elements (*Parrotia, Fagus, Quercus, Acer*), The Late Sarmatian and Pannonian forms (*Carpinus, Betula, Ulmus*) prevail. Probably it is an equivalent of the lower horizon of Martin brick yard (Sitár 1969).

The alluvial fan body consists of fine-, medium- and coarse-grained conglomerates (locally blocky conglomerates) and poorly sorted and weakly rounded sandstones transported on a short distance. The clast grain size decreases from the west toward the east e.g. from the basin margin to its axial part. The studied fanglomerates often contain subangular clasts of Krížna nappe rocks (mainly radiolarites and fleckenmergels). The conglomerate composition is mainly derived from carbonates (dolomites, limestones, fleckenmergel) and radiolarites of Krížna nappe. Conglomerates and sandstones probably of the Paleogene age occur relatively frequently.

The matrix of conglomerate is carbonaceous, clayey-sandy and clayey. The coarse-grained development varies in a wide range from matrix- to clast-supported conglomerates. The conglomerates are mainly chaotic, nearby the elevation point Hrádok nad Bystričkou pebbly mudstones occur. The bedding is unconspicuous, mostly amalgamation of more beds occurs.

Comparison of the clast composition of up till now described alluvial fan bodies located on the western margin of the Turiec Depression suggest a conclusion that the body of Bystrička Member was deposited from rivers which erosive base reached the deeper level of the thrust structure of the Central Western Carpathians and the area of the preserved relics of the Paleogene deposits.

The basinal development of the Turiec deposits consists of grey calcareous clays alternating with siltstones, fine- to coarse-grained sandstone and fine-grained conglomerate beds. The beds containing increased amount of the coalificated plant detritus, coal beds and fresh water limestones occur. The beds are rich on endemic fauna of molluscs and ostracods. The occurrence of swamp plant species (*glyptostrobus europaeus, Potamogeton martinianus, Nelumbium protospeciosum*), fossil roots in grew position as well as fresh water molluscs point to relatively shallow, fertile lacustrine depositional environment.

The grey calcareous clays with tuff beds are considered as the oldest deposits of the bed succession of Martin Member. They may be correlated with the marginal coarse-grained development of the Abramov Member of the Late Badenian – Early Sarmatian age containing rich microflora with dominant palaeotrope component represented by *Trilites multivallatus, Castaneoideaepollis sp.* and representants of swamp vegetation of swamp *Myricaceae, Nysaceae* and *Taxodiaceae* when the representants of the family *Taxodiaceae* grew directly in swamps. A warm subtropic climate dominated during the deposition of the lower etage deposits from the bed succession of the Martin brick yard.

The overlying grey calcareous clays alternating with siltsone, sandstone and fine-grained carbonate conglomerates, coal beds and endemic fauna of molluscs (Martin brick yard) represent a bed succession of the Late Sarmatian to Middle Pannonian. They are equivalent of the upper part of the coarse-grained Abramov and Slovany Members. The relative rise of lake level in that time is documented by a transgressive character of Martin Formation clays inspite of a fast subsidence of individual basin depocenters. A gentle increase of arctotertiary elements (*Ulmipollenites undulosus, Untratriporopollenites instructus, Tsugaepollenites sp., Cedripites sp., Betulaepollenites betuloides, Alnipollenites verus, Carpinipites carpinoides, Chenopodipollis sp., Graminidites sp.* in the palynospectrum of the central part of the bed succession suggests gentle cooling, besides the climate seems to be gently more arid – (*Chenopodiaceae, Gramineae*). The climatic change was also reflected in the vegetation character which composition has more afinity to the mountain type of vegetation (*Tsuga, Cedrus, Sequoia*).

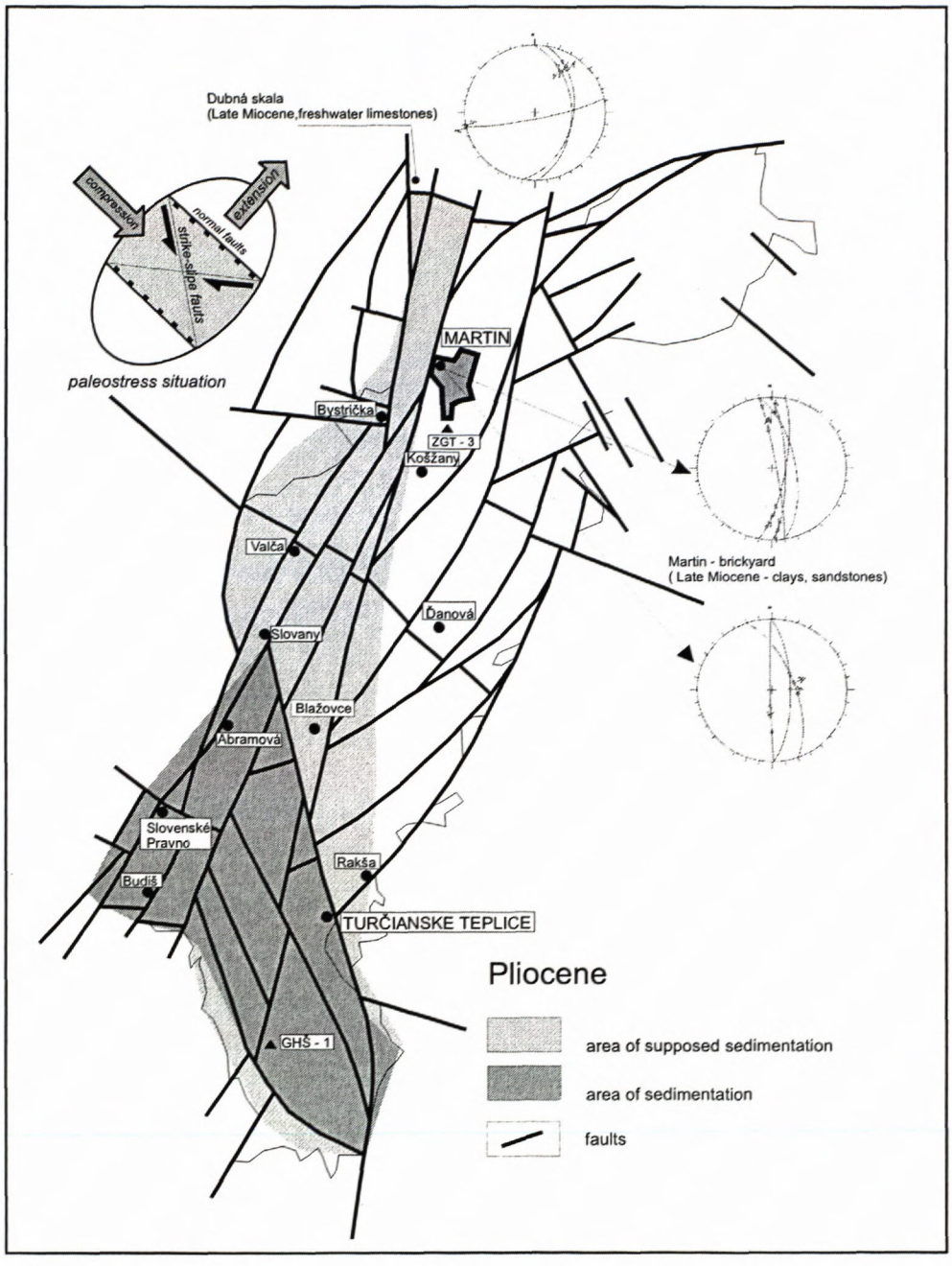


Fig. 5 Supposed paleogeographic and paleotectonic situation in Pliocene

The grey, calcareous clays with siltstone beds and fine-grained sandstones containing rich fauna of molluscs characterized by an occurrence of small congeria form are considered as the youngest, Late Pannonian deposits. The Pravno Member (Andrusov 1954) crop out in the southern part of the Turiec Depression (Slovenské Pravno) underlying fresh-water limestones with fresh-water and subaerial fauna of gastropods and lamellibranchata (Lúcky mlyn).

The body of fresh-water limestones, occurring in the area of Dubná skala in the northern part of the today's depression, is composed of thick beds of limestones and sandy limestones containing fauna and flora. Fossil remnants of organism suggest lacustrine depositional environment in the moderate zone of greenwood at the end of the Miocene. The carbonate conglomerates in the upper part of the bed succession document local source of clastics (clasts composed of Permian rocks). The clastics were not transported on the larger distance. Analogous to the Vienna and Danube Basins we assign the deposition of the greater fresh-water limestone bodies of Pravno Member to Pontian and Pannonian H, respectively.

From the Sarmatian to Pontian the stress field was stabilized and compressional component was generally oriented in the NE-SW direction enabling maximum extension in the NW-SE direction and continual subsidence of depositional areas (Fig. 4). The maximum thickness of the Neogene deposits occur in the immediate surroundings of Martin as it is well documented by borehole ZGT-3 and

geophysical data (Fendek et al. 1990, Panáček et al. 1991).

The peneplain development indicates a period of tectonic quiescence at the end of the Pannonian and in the Pontian. The peneplain relics are preserved in the southern part of the Žiar Mts. and in the western part of Kremnica Mts. (Mazúr 1964, Činčura 1969).

The fluvial deposits located in the central part of the Turiec Depression (Socovce – Stráža, Blážovce) are assigned to the Blážov Formation of the Pliocene age (Gašparik et al. 1995). The body of fluvial gravels and sands overlies by a sharp, probably erosive contact the underlying clays of Martin Formation (Socovce – Stráža).

The coarse-, medium- and fine-grained conglomerates mainly consists of carbonate clasts with various degree of roundness. They are relatively poorly sorted. The individual beds are 0,5 – 5 m thick, aften amalgamated . The bedding is emphasized by various grain-size or alternation of conglomerate, sandstone and siltstone beds. The sandstones and siltstones comprises 0,5 – 2,0 m thick beds, locally horizontal lamination occurs. The deposition by water current is documented by sporadic cross bedding and trough bedding, grading and clast imbrications. Based on the channel orientation and ab plain dip direction we assume deposition in an environment of smaller braided river flowing from the south toward north and northeast along the axial part of the basin (palaeo Turiec?).

After the Pannonian and more probably after the Pontian the orientation of the palaeostress changed in a substantial way when the compressional axis changed orientation from the NE-SW to the NW-SE direction. The changed palaeostress regime influenced clastic deposition mainly in the southern part of the Turiec Depression (Fig. 5). The depositional area axis of the Plio-Pleistocene deposits was oriented in the NW-SE direction. The Plio-Pleistocene deposits (clays overlying andesite gravels and sandstones) reach a thickness of 50 – 60 m and they are assigned to the Diviaky Formation (Buday 1962).

The Quaternary deposits were observed at the locality Ležiachov, Hrádok nad Bystričkou – creek bluff and Martin – part Močiar).

The locality Ležiachov represents Plio-Pleistocene deposits of alluvial fans deposited from smaller rivers emerging from valleys at the margin of the Turiec Depression from SW to NE. The carbonate conglomerates and sandstones containing beds of silt with clayey admixture pass upward into palaoesoil horizons. Their position in relation to the flood plain of Turiec river suggests valley incision in the Pleistocene. The locality Hrádok nad Bystričkou – creek bluff documents similar Plio-Pleistocene deposits of an alluvial fan deposited by a smaller river emerging from a valley at the margin of the Turiec Depression toward its axial part. It is possible to observe alternation of micaceous coarse- and medium-grained sandstones with coarse-, medium- and fine-grained conglomerates at the outcrops. The clasts are well rounded and sorted, grading and imbrication of ab clast plain occur. Besides the prevailing carbonates

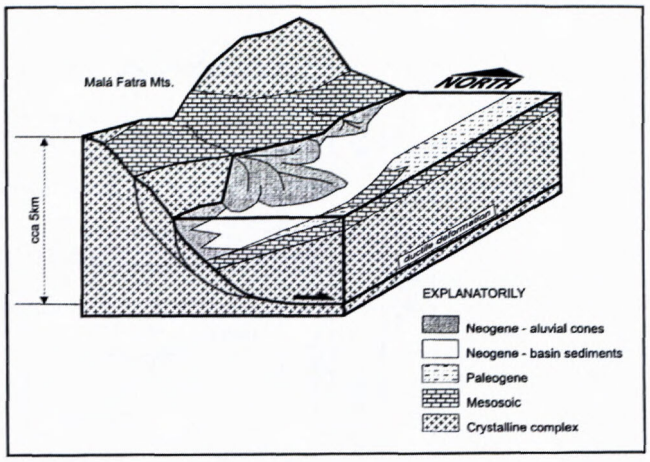


Fig. 6 The model of tectonic evolution – Late Miocene

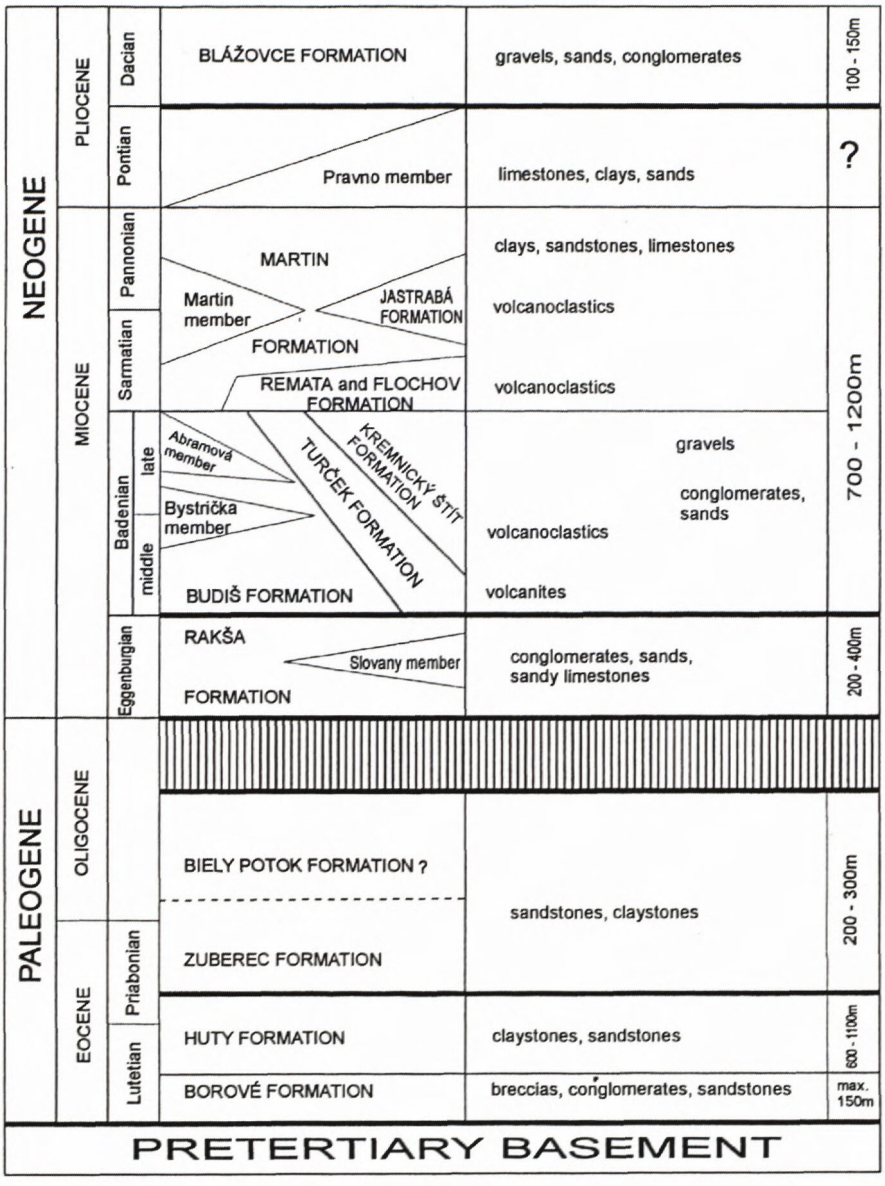
also crystalline clasts (granites 5% to 14%) occur. The locality documents Pliocene uplift of the Turiec Depression margins and erosive incision.

The locality Martin – Močiar represents the youngest – Holocene etape of the depression development. The blocky, coarse- to medium-grained conglomerates with sandy matrix predominantly consists of well rounded clasts of granites. The deposits of scree to alluvial fan are exposed at the root area in the fault zone of NW-SE direction. Similarly to the previous localities it documents a tectonic activity related to the uplift of the mountain margin in the palaeostress regime with compression in the NW-SE direction.

Discussion and conclusion

On the basis of the results obtained we can state that after the deposition of the Paleogene rocks the Eggenburgian deposits and later probably also Early Badenian clastics were deposited. They were deposited in the depositional environment restricted by NW-SE trending faults. In contrast to Gašparik et al. (1995) we do not consider Slovany Member (Tab. II) as a part of Rakša Formation (Tab. III).

We assume that from the Badenian the Turiec Depression was an isolated sedimentary basin in the framework of intermountain Neogene depressions of the Western Carpathians. This assumption is confirmed by endemic fauna found at more localities (Rakús 1958). The main reason of its isolation was the uplift of Žiar Mts. in the south, dated on the basis of FT apatite ages to 46 ± 5 to 52 ± 7 Ma (Kováč et al. 1994), and an intense neovolcanic activity which products are preserved mainly in the southern part of the depression (borehole GHŠ-1). The main phase of subsidence is represented by Turiec Formation deposits which were deposited in a basin with the axis in NNE-SSW direction. The sediment input into the basin occurred from the west toward the east and deposits comprise Abramov, Slovany and Bystrička Members.



Tab. II Lithostratigraphic column of the Tertiary fill of the Turčianska kotlina depression

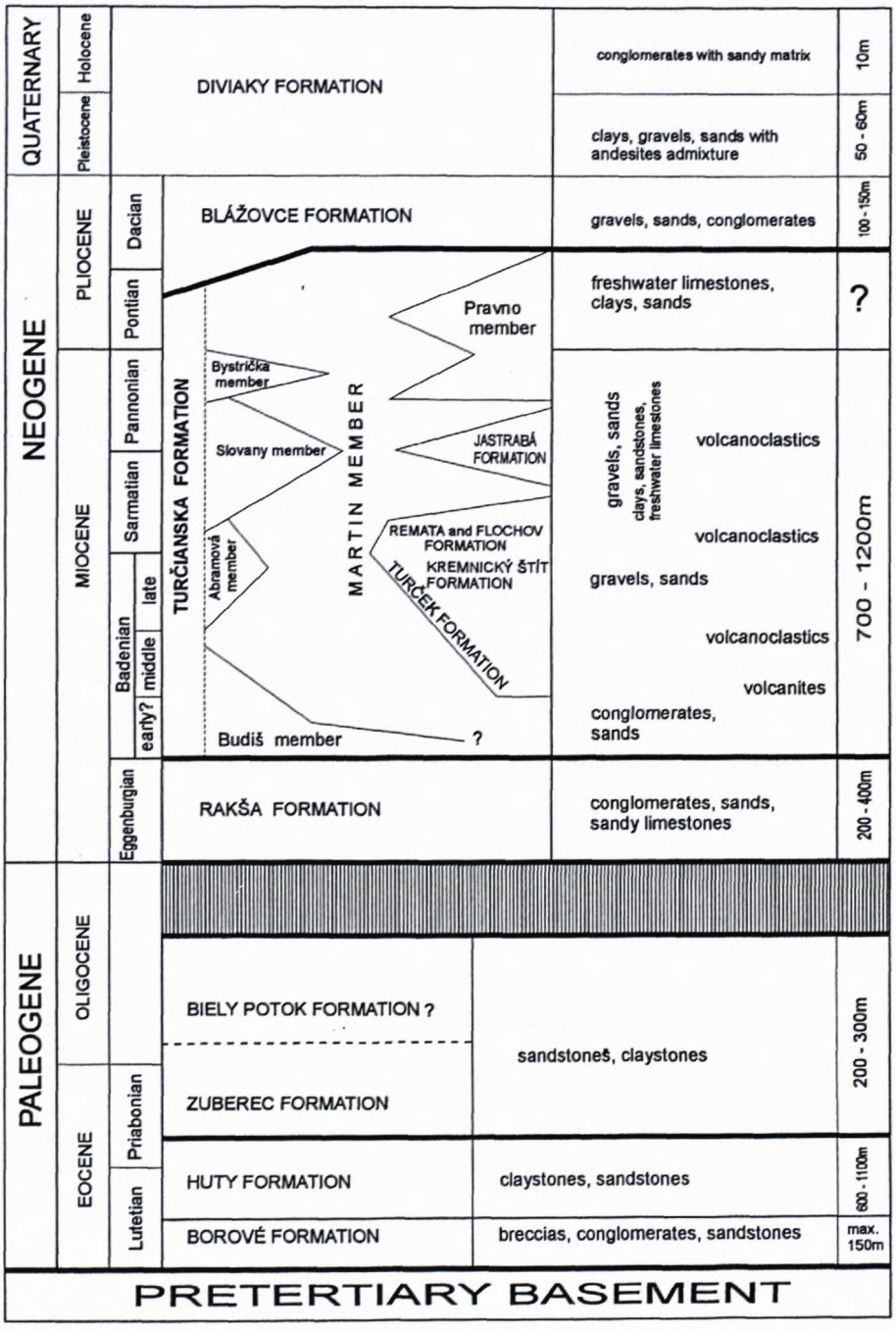
The verified thickness of the Neogene deposits in the basin centre is up to 1027 m (borehole ZGT-3). The compressional axis of the palaeostress field was during the Turiec Formation deposition (Early? Middle Badenian – Late Pannonian/Pontian) oriented in the NNE-SSW to NE-SW direction. The most conspicuous phenomenon of the Turiec Depression is tilting of its fill generally toward the west. The main role during the depression history had marginal listric faults nearby the west margin which were active during the whole Neogene development of the depression. The faults originated in an extensional regime and younger faults were activated gradually in the west direction (Fig. 6). The generally E-W oriented extension also determined an origin of the antithetic faults nearby the eastern margin of the depression. The marginal fault activities resulted in origing of huge alluvial fans of the Slovany, Abramov and Bystrička Members as well as in position of the Slovany Member, which material exclusively consists of carbonate rocks, over the crystalline basement. Such a position may be explained by strike faults along the north-south oriented fault systems. The result of these movements have been bridge structures. The Paleogene deposits hugging the whole eastern margin of the depression do not occur under the Neogene at the western margin of the depression.

During the Middle and Late Pannonian the connection between the southern sedimentary area of the Turiec Depression and sedimentary areas of Pannonian clastics in the other parts of the Western Carpathians occur. The connection of the sedimentary area was proved by the occurrence of congeria fauna (*Congeria exgr. Ornitopsis Brusina*) described by Andrusov (1954) and documented by our field investigation.

During the Pliocene the sedimentary area of the Turiec Depression is isolated which is probably related to the change of the palaoestress field. The compressional

component rotates from the NE-SW to the NW-SE direction. The maximum deposition in that time was concentrated in the southern part of the depression. In this part the clastic deposition continued to Pleistocene.

We assume new lithostratigraphic division of Tertiary deposits in the Turiec Depression where we introduced a new lithostratigraphic unit – Turiec Formation (Tab. III). We used a term Martin Member for the basinal pelitic facies. The lithostratigraphic division of mainly Neogene deposits sources from the previous works of Buday (1962, Tab. I), Gašparik et al. (1995, Tab. II) and, above all, from the conclusions of our research.



Tab. III Lithostratigraphic column of the Tertiary fill of the Turčianska kotlina depression (compiled by Kováč, Hók, Rakús and Nagy, 1997

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