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BLOCKS OF WEST CARPATHIANS AND NEOGENE MOLASSE BASINS

by

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According to the analysis of the regional and residual anomalies of the gravity field and DSS results in the West Carpathian region several expressive deep-seated physical boundaries can be determined. They probably reflect deep-seated faults (Fig. 1) associated with increased seismic activity, with distinct boundaries in the geothermal field and with recent vertical movements of the Earth's crust (FUSÁN et al., 1979).

Deep-seated faults disturb even the Moho discontinuity and divide the West Carpathian region into several crustal blocks. The crustal blocks are subdivided into partial blocks bounded by active, mostly seismically active faults penetrating the upper part of the crust.

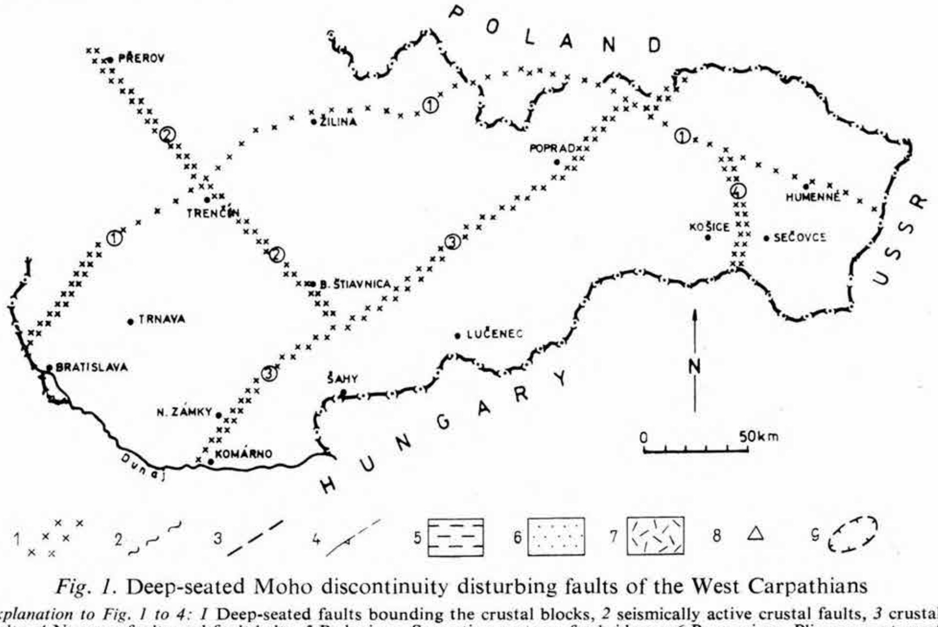

Fig. 1. Deep-seated Moho discontinuity disturbing faults of the West Carpathians

Explanation to Fig. 1 to 4: 1 Deep-seated faults bounding the crustal blocks, *2* seismically active crustal faults, *3* crustal faults, *4* Neogene faults and fault belts, *5* Badenian—Sarmatian centres of subsidence, *6* Pannonian—Pliocene centres of subsidence and shallow depressions, *7* vulcanites (mostly Badenian—Sarmatian in age), *8* volcanic centres, *9* depressions identified by geophysics near the crossing and along the Záhorie—Humenné and Štiavnica—Přerov deep seated faults.— Numbers in circles are symbols for: 1 Záhorie—Humenné fault, 2 Štiavnica—Přerov fault, 3 Vepor fault, 4 Slanec fault, 5 Ludince fault, 6 faults bounding the graben of Žitny ostrov, 7 Hurbanovo fault, 8 Komárno fault belt, 9 Hron fault, 10 Turiec depression, 11 Žiar depression, 12 Horná Morava depression, 13 Močarany—Topla fault belt, 14 Trebisov fault belt, 15 Falkusovce fault belt, 16 Čičarovce fault belt, 17 Levice—Turovce horst, 18 Šahy—Lysec volcanotectonic zone, 19 Strháre—Trenč graben, 20 Kunesov—Tisovnik volcanotectonic zone, 21 Hornád fault, 22 Komárovce depression, 23 Číž horst, 24 Kesov blocks

The breaking of the West Carpathians crust into crustal blocks may be geneticaly linked with the Middle—Late Miocene (16—11 m.y. B.P.) uplift and the creation of a mountain system (a morphogen). Recently the Middle Miocene uplift and emergence of West Carpathian crystalline rocks and intrusive bodies, originally deeply buried, are well proved by fission track method applied on apatites from the granitoid rocks of the West Carpathians (KRÁL', 1977).

It must be stressed that the Middle and Late Miocene was a period of fading out compression in the Outer West Carpathians (i.e. the Outer Flysch Zone).

The genesis of crustal blocks should be reflected in the development and structure of the molasse basins and in volcanic activity. The following general features of molasse basins and volcanic activity can be linked with the genesis of crustal blocks during the Middle and Late Miocene (VASS, 1980; 1981):

1 culmination of the main molasse development,

2 culmination of sedimentation rates in intramontane molasse basins and depressions (more than 20 cm/110 y.),

3 radical change in the structural pattern of intramontane basins,

4 culmination of fault activity including synsedimentary fault movements,

5 culmination of andesite volcanism.

Manifestations of crustal blocks structure—in particular molasse basins

The Danube crustal block (Fig. 2), bounded by a segment of the Záhorie—Humenné, Štiavnica—Přerov and Vepor deep faults was the home land of two molasse basins: the Galanta—Trnava intramontane Middle Miocene basin and the Gabčíkovo Upper Miocene—Pliocene basin which was a part of a large Pannonian—Pliocene basin in the back-deep area (predominantly on Hungarian territory). The Štiavnica—Přerov deep fault bounded the NE margin of both basins.

Near the crossing of the Záhorie—Humenné and Štiavnica—Přerov deep seated faults and along the both faults there are peculiar relatively deep depressions some of them mostly identified by geophysics. They are probably filled with Middle Miocene sediments (Beckov and Trenčín depressions), but the Bánovce depression is filled up partly with Lower Miocene sediments too. The Vepor deep fault between Komárno and Nové Zámky bounded on the E the Gabčíkovo basin principal depocentro.

The subsidence of the Danube block was differentiated and controlled by NW and NE crustal faults. The most important of them was the seismically active Ludince (Ölved) fault (K. TELEGDI-ROTH, 1929 fide T. BUDAY et al. 1967). The principal depocentres of the Trnava—Galanta basin filled with Badenian—Sarmatian deposits and volcanites 2000—3000 m thick are distributed around and to the NE of the fault. On the begining of the Pannonian an inversion in subsidence take place and gave rise to the Gabčíkovo basin. Its principal depocentre is situated to the SW of the Ludince fault.

Other seismically active NW fault passing from Komárno to Pezinok and another passing along the recent valley of Danube between Bratislava and Klížska Nemá limit the graben of Žitný ostrov (POSPÍSIL et al., 1978) and were active also during the Quaternary.

The NE trending crustal faults of the Danube block control the inner structure of the Galanta—Trnava basin dividing it into a system of horsts and grabens. One of the faults bounds the NW mangin of the basin.

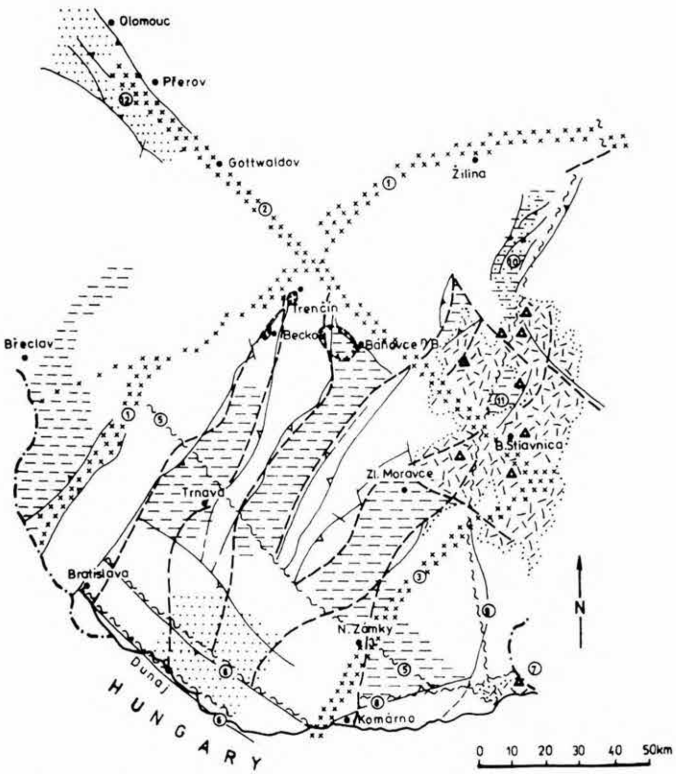

Fig. 2. The Danube crustal block and the structural features of alpine molasse basins reflecting the structure of the crust (for explanation see Fig. 1)

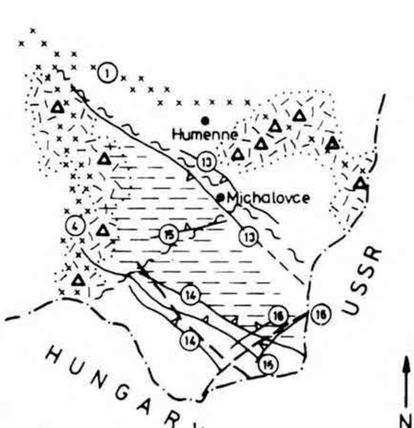

Fig. 3. The East Slovakian crustal block, the structural features of the East Slovakian alpine molasse basin reflecting the structure of the crust and spatial relation of Neogene volcanism to the deep-seated faults (for explanation see Fig. 1)

The east Slovakian crustal block is bounded by the Slanec and by a segment of the Záhorie—Humenné deep faults (Fig. 3). On the block there is the central part of the east Slovakian intramontane basin, east of the Slanec deep fault is located the most important depocentre of the basin filled mostly with Badenian and Sarmatian deposits and volcanoclasts, ca 4000 m thick. W of the deep fault the deposits of the same age are substantially thinner. There is also a Spatial relationship between the Slanec deep fault and the volcanic chain of the Prešov—Tokaj (or Slanec) Mts, Záhorie—Humenné fault and Vihorlat—Popričný volcanic Mts. The age of the volcanites is mostly Sarmatian. The east Slovakian block is dissected by crustal faults. One of the NW trending faults correponds to the Močarany—Topl'a fault belt and another to the Trebišov fault bolt as superficial structure (BUDAY et al., 1967). Both fault belts limit the central depression of the east Slovakian basin.

Seismically active fault trending NE wards corresponds to the Falkušovce fault belt, but the fault belt was active mostly in the pre-Badenian and Early Badenian times, respectively (ČVERČKO, 1977). Another crustal fault of the same direction corresponds to the Čičarovce fault belt (ČVERČKO, 1977) of superficial structure bounding SE margin of the principal depocentre of the east Slovakian molasse basin.

The Rudohorie—Pilis crustal block bounded by Vepor. Slanec and by a segment of the Záhorie—Humenné deep faults (Fig. 4) was mostly uplifted from the Middle Miocene till Pliocene.

The Vepor deep fault beside the role in the Gabčíkovo basin development had a deal for the origin of the Central Slovakian Volcanic Mts. The Badenian and Sarmatian volcanites are symmetrically distributed on both sides of the deep fault.

A crustal fault parallel to the Vepor deep fault corresponds to the Šahy—Lysec volcanotectonic zone of superficial structure with the volcanic manifestation from the Late Badenian till the Late Sarmatian (V. KONEČNÝ in VASS et al., 1979). The continuation of the crustal fault to the NE follows the northern margin of the Lučenec and Rimava molasse basins. The fault probably originated a slow and unextensive subsidence in the Uppermost Miocene resulting in sedimentation of the Poltár formation (Pontian age) with important ceramics raw material deposits. The seismically active Burbanovo fault had no direct on the thickness distribution of Badenian—Sarmatian molasse deposits, but had an important influence on the course of the Komárno fault system, causing a deviation from the SE trend to W—E. The Komárno fault system is an important structural element for Middle and Upper Miocene molasse sediments (B. GAŽA and M. BEINHAUEROVÁ, 1977).

The seismically active N—S crustal fault known as the Hornád fault (UHLIG, 1907) bounds the W margin of the east Slovakian molasse basin between Prešov and Košice.

Another N—S trending fault in the valley of the Slaná river tooks part in the structure of the Rimava molasse basin limiting the Číž horst and the Kesov blocks (D. VASS et al., 1985). The Číž horst is a rising structure till now. The fault controlled the distribution of Upper Miocene deposits in the E part of the Rimava basin but also the distribution of Quaternary river terraces.

The Slovak Karst and the Komárovce depression are limited by a crustal N—S fault. The Komárovce depression is a young one and is filled with Badenian—Pliocene sediments and volcanites.

In the frame of the Rudohorie—Pilis crustal block there are two crustal faults trending NW wards. Superficial manifestation of a crustal fault on the boundary between the Lučenec and Ipel' basins is the Strháre—Trenč graben (VASS et al., 1979) synsedimentary active during the Badenian. The NW continuation of the crustal fault

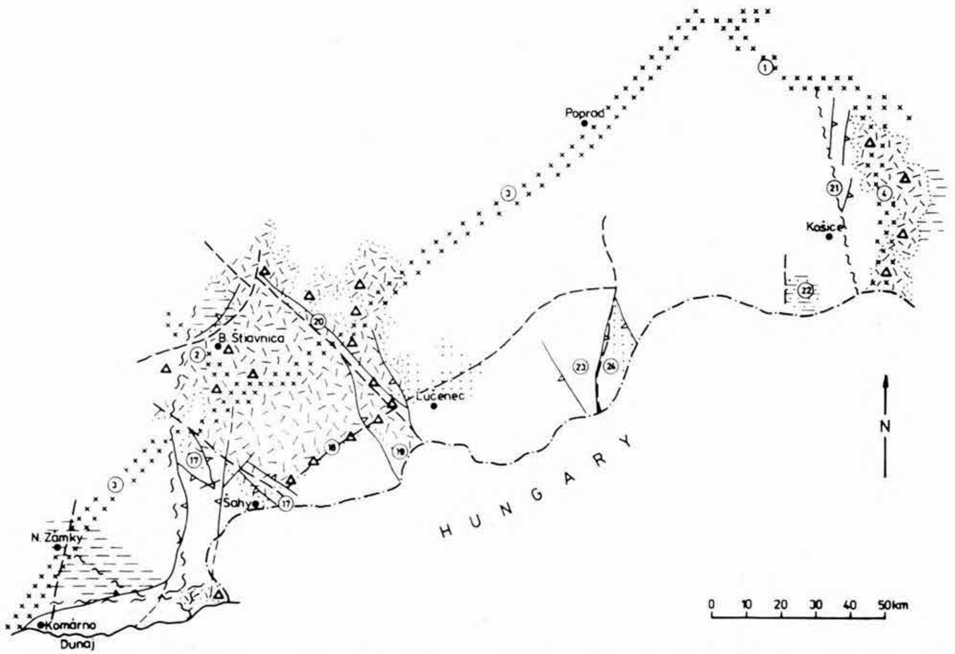

Fig. 4. The Pilis—Rudohorie (South Slovakian) crustal block, some crustal faults with the manifestation on the surface and relation of Middle Slovakian Neogene volcanites to the structure of the crust (for explanation see Fig. 1)

is represented on the surface by the Kunešov—Tisovník volcanotectonic zone (KONEČNÝ et al., 1978). Another NW crustal fault is overlapped by the Badenian Levice—Turovce horst (L. MELIORIS and D. VASS, 1982). The horst influenced essentially the evolution of Badenian sediments in the NE part of the Danube lowland.

The Slovak—Moravian crustal block bounded by the Záhorie—Humenné and by the Štiavnica—Přerov deep faults (Fig. 2) was an area of differentiated subsidence. Its southern part subsided during the Neogene (Vienna basin). The Záhorie—Humenné deep fault between Devínska Nová Ves and Jablonica limited SE border of the Vienna basin in the Middle and Late Miocene. The Štiavnica—Přerov deep fault gave rise to the Horná Morava depression which is a shallow graben filled with Pliocene sediments.

An important seismically active N—S crustal fault is running from Zázrivá to Štúrovo—Budapest and farther to the S follows the valley of Danube. Superficial manifestation of this crustal fault is the so-called Zázrivá—Budapest fault belt (KUBÍNY, 1962). Near Zázrivá it epigenetically disturbs the Klippen belt with a small strike-ship displacement. Small intramontane basins: the Turčianska kotlina and the Žiarska kotlina depressions filled mostly with Sarmatian—Panonian sediments generated on the mentioned fault belt. With the fault belt is connected the activity of middle Slovakian volcanism and metallogenesis (Badenian—Sarmatian in age, STOHL, 1976). Farther southwards the superficial manifestation of crustal fault is the northern branch of the Kravany—Hron fault (SENEŠ, 1963) bounding the E margin of the Panonian—Pliocene of the Gabčíkovo basin. The fault follows the lower valley of the river Hron predicting the distribution of the river Quaternary terraces.

Some deep-seated faults disturbing the Moho discontinuity and crustal faults apparently were active in the Early Miocene and/or in pre-Neogene time. Some surface faults coinciding with the Štiavnica-Přerov deep-seated fault were evidently active in pre-Neogene time (Skýcov fault, BIELY, 1962, Hrádok and Jastrabie fault, MAHEL, 1969), faults of the Horná Morava depression are pre-Devonian (RÓTH et al., 1962).

The Falkušovce fault felt in east Slovakian basin, as already mentioned, was active in the Early Miocene (ČVERČKO, 1977).

The crustal fault reflected on the surface by the Trebišov fault belt (east Slovakia basin) can be identified with Szamos line originating according to some authors in pre-Neogene time (T. BUDAY 1961, in T. BUDAY et al. 1967; P. GRECULA and I. VARGA 1979).

The Zázrivá—Budapest fault belt was active in the Eocene. The fault belt is responsible for a mobile zone by which the Buda and Inner Carpathian (Central Carpathian or Podhale) Paleogene were joined to each other (SAMUEL, 1973; VASS et al., 1979).

The crustal fault, manifested on the surface as the Šahy—Lysec volcanotectonics zone, is one of the NE fault system disturbing the pre-Neogene fundament of Krupinská planina Mts and Ipel'ská kotlina basin (S Slovakia). The fault belt come to existence in pre-Neogene time (VASS et al., 1979).

Conclusions. The blocks of the West Carpathians defined by geophysics reflected in the development of Neogene molasse basins and volcanism. A number of tectonic manifestations important for molasse forming epoch coincide in time with the supposed formation of crustal blocks (Middle—Late Miocene).

The supercrustal, deep—seated faults and crustal faults are manifested in the structure of molasse basins in the following manner:

— they control the principal depocentres and some of the molasse basin margins,
— they generated some small intramontane basins,
— young volcanic mountains are in close spatial relation with them,
— there is evident genetic relation between them and metallogenesis,
— surface manifestations of them are
— fault belts active in Middle—Late Neogene
— horst and/or grabens,
— volcanotectonic zones.

It should be noticed that some deep-seated, Moho discontinuity disturbing faults and crustal faults can be identified with the fault engaged in the tectonic or palaeogeographic evolution of the West Carpathians in pre-Badenian and/or pre-Neogene time.

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