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FAULTS AND THEIR RÔLE IN THE MESOZOIC OF THE INNER CARPATHIANS

(Fig. 1—5)

Abstract: The great variety of the lithofacies, of lithological-stratigraphical units and also the great number of Old Alpine structural units (of higher and lower categories), the diversity of the tectonic style, frequent changes in the structure and the abundance and variety of mineral springs, that all is in genetic relation to faults.

The Old Alpine West Carpathian geosyncline represents an archipelago type with block structure with faults of all the fundamental directions: NW, NE, W-E, SE. The number and variety of faults, their significant rôle in the development and structure is a specific feature of the West-Carpathian segment. Owing to them a particular model of the alpine geosyncline is concerned. Many of the significant Neogene faults developed on the foundation of Old Alpine faults. In the course of development of the Carpathian system also the type and rôle of fault were changing there.

The West Carpathians belong to those segments of the Alpine-Carpathian system that abound in a plenty of faults. They are conspicuously manifested in morphologically dissected character as well as in abundance and variety of mineral springs and ore veins. Up to lately and the most authors up to present have held the opinion that the origin of these faults is bound to final formation of the Carpathian system, thus with the latest (Neogene) period of development (D. Andrusov 1965). The leading rôle of plastic deformations with long-reaching horizontal shifts unbound attention from faults. The influence of Alpine literature was however evident, where the function of faults in the structure, especially of the East-Alps, was essentially lesser than in the Inner Carpathians.

With the variety in the direction of faults, faults of four directions played the main rôle: a) NE; b) NW; c) NS and d) EW and directions approaching them. Two couples of systems, more or less mutually perpendicular are essentially concerned there. These directions essentially agree with the direction of faults in neighbouring cratons, e. g. in the Bohemian Massif or in the Hungarian Midmountains. There are evidently systems of regional, perhaps of planetary importance. (This is just the reason why it is perhaps most suitable not to term the direction of the faults but to designate as northeastern or Siretian, north-western or Muresian — in the sense of H. Stille 1953, meridional and latitudinal).

Let us notice closer the mentioned systems, in the first place the position of faults in various tectonic styles and their function in Pre-Kenozoic stages of development. In the analysis we are thus based on Early Alpine tectonic elements (Cretaceous) and complexes of rocks, especially of the Mesozoic, partly also older.

Longitudinal Faults

The West Carpathians have as orogenic mountains distinct longitudinal structural elements: tectonic units and structural forms (anticlines, synclines). A part of the

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variegated tectonic style are also faults, longitudinally bordering these folded structures. They are to a certain degree bound to them.

The ununiformity of directions of longitudinal tectonic elements resulting from the semi-arched form seems to be characteristic for the West Carpathians. In the western part Early Alpine elements — tectonic units and tectonic forms and also longitudinal faults — are of NE direction, Post-Paleogene of NS or SSW-NNE direction. In the central part of the Carpathian arch Early Alpine as well as Late Alpine elements are of latitudinal direction EW. In the easternmost part the elements are of NW direction. As it is to be seen all the principal directions are manifested each in different part (and occasionally in different time) with changing intensity.

In classification of longitudinal faults we may proceed according to the range of order of tectonic units and forms which they are bordering as well as according to different tectonic style, of which they are a part. I choose this second procedure because the type of faults is more distinct with it.

a) In the tectonic map upthrusts of regional character of NE direction are distinct in the crystalline, separating partial units of the Vepor crystalline. An example is there the Pohorelá dislocation, mostly steeply dipping. On the basis of these dislocations separating zones or subzones with different stratigraphic-lithological filling it may be considered that they represent old deep faults renewed by Alpine tectonics (M. Máška, Vl. Zoubek 1960).

Analogous to the Pohorelá Fault Line is the Čertovica Fault Line in the section, where it separates the crystalline of the Krakľová and Ľubietová Zone. In the eastern part (where the crystalline of the Krakľová Zone directly contacts the Ďumbier crystalline) the fault acquires the form of subhorizontal thrust (Vl. Zoubek in M. Máška, Vl. Zoubek et al 1960). An analogous type is also considered the Ľubeník and Margecany Fault Line separating two types of the crystalline, the Gemeride, thrust upon the Vepor crystalline. Recently also large nappes (Peyve 1960—1966) are being related to dislocations of this type. Such opinions were reflected in our literature. With the Čertovica Fault Line the roots of the Krížna nappe and with the Margecany-Ľubeník Fault Line the roots of the Choč- or Choč-Gemeride nappe are put into connection (A. Biely, O. Fusán 1964).

Upthrusts of lower order divide some zones of the Vepor crystalline into a series of slices, e. g. in the northern part of the Kráľová hola Zone (D. Kubíny 1958) or of the Krakľová Zone (Vl. Zoubek 1931). They are upthrusts already known from the works by Vl. Zoubek (1930). The divergence with Post-Paleogene structures proves their Pre-Paleogene age. They are characteristic of the so called deep tectonic style and connected with the origin of Cretaceous structures of the crystalline.

b) A peculiar type of fault dislocations are upthrusts in Paleozoic complexes of the Spišsko-gemerské rudohorie Mts., situated near the margin of the Cretaceous anticlinorium of Volovec at its contact with Cretaceous synclinorii, with the southern margin of the North-Gemeride synclinorium and the northern margin of the synclinorium of the South Slovakian Karst (M. Maheľ 1953). In the western part they are of NE direction, to the east they turn into the direction W—E; in the eastern part of the Spišsko-gemerské rudohorie Mts. the direction of the upthrusts is NW—SE. They are running in zones of intense tectonic kneading, distinct development of Alpine schistosity, with which they are in symmetrological relation (L. Rozložník 1963). Their vergency is distinctly outwards, dipping 60—70° to the south, mostly within the range of average dip of schistosity.

In some sections there are several upthrusts running paralelly; the magnitude od the dip of upthrusts is changeable, depending on relation to folding structures and their type and on relation to schistosity as well as to the type of rock. In places where the upthrusts cut off limbs of isoclinally erected folds they reach deeper and are more consistent (e. g. in the area of Jedlovec and in the Mountains of Spišsko-gemerské rudohorie — J. G r e c u ľ a). Upthrusts in undeep structures (area of the Valley of Zlatá dolina) are to the contrary inconsistent and not deep reaching. In the character of upthrusts however also transverse folding structures are reflected. The structure of Dobšiná-Nižná Slaná of nort-southerly direction e. g. influenced final formation and reactivation of upthrusts, what played an important rôle in ore-forming processes (L. R o z l o ž n í k 1960). Transverse structures played an important rôle in splitting (virgation) of fault dislocations. At bends of transverse structures feather and torsion faults are frequent.

The age these marginal upthrusts is obviously identical with the age of the megastructures of synclinorii and anticlinorii, bordered by them. Nevertheless they are the consequence of compression movements that modelled the Cretaceous megastructures, the North- and South-Gemeride synclinorii. The genetic relation of the upthrusts to schistosity makes possible to know the relative age and at least partially also the process of formation of these fault dislocations. In this sense a good supplement is also the vein-filling. The most important veins of the Mountains of Spišsko-gemerské rudohorie are: Droždiak, Zlatnická, Grételská, Filip Vein, the veins of Rožňava, the vein system of Luciabaňa, being the partial filling of these upthrusts.

The oldest dislocations are perhaps more or less contemporaneous with formation of S_1 (L. S n o p k o), i. e. they arose with the commencement of the Alpine process of folding. They are filled up with quartz-fuchsite, quartz-chlorite and quartz-hematite mineralization. The problem is whether partially Hercynian dislocations are concerned. The most abundant are dislocations formed before the origin of S_2; the last mentioned namely interferes with the dislocations. The mineral filling consists of siderite-ankerite-quartz. The most important veins of the Mountains of Spišsko-gemerské rudohorie belong to this group. Some of the dislocations were formed immediately after the origin of the transverse schistosity of S_2; they have quartz-sulphidic filling, so called rejuvenating mineralization. They are mainly situated near the inner side of marginal ore-bearing zones and farther in the middle of the Volovec anticlinorium. Many veins have the mineral filling of all the mentioned phases; the tectonic lines were evidently reactivated several times. The veins of the individual phases are not always overlapping, even a change in the strike may be observed. In the area of Rožňava (J. G r e g o r), for example, siderite veins in porphyroids striking E—W to SE—NW are of a course different from the younger veins in the quarzite-schistose complex, being rich in sulphides and barite. The later ones turn more to the SE and S. The spatial distribution of the individual mentioned types of veins is also different. The process of formation of fault zones — a tectonic process — was similarly as the process of mineralization not proceeding all at once but in several phases with different manifestations of the structural elements with different tectonic preparation and mineralization.

Disturbing of the crystalline substratum by upthrusts in the linking limb of the anticlinorium and synclinorium made possible formation of conditions for plastic deformation of overlying younger Mesozoic complexes by upthrusts near the inner marginal parts of the North-Gemeride synclinorium. The parallel inclination of several upthrusts, originated at the limbs of the folds, conditions the tectonic style of slices. More frequently the character of fold upthrusts is evident in them. At the contact of

Mesozoic complexes with the crystalline an interesting transition of deep tectonic style to superficial with submersion of the Mesozoic affected by metamorphosis beneath the Paleozoic to the SE may be followed (M. M a h e ľ 1957; see fig. 1.).

c) Another type are longitudinal faults in the Mesozoic and that b e t w e e n t h e i n d i v i d u a l p a r t i a l u n i t s o f t h e C h o č n a p p e (Low Tatra, Little Carpathians) o r o f t h e K r í ž n a n a p p e (Strážovská hornatina, Inovec, Little Carpathians).

In the sense of orthodox conception of the nappe structure there are planes of nappes or partial nappes formed by imbrication of individual thrusting masses one above another. A more detailed analysis however indicates many of them to have been completed and minor structures perhaps also formed after thrusting to the present space of distribution only (M. M a h e ľ 1957, 1961). There are somewhere steep disturbances of upthrusts character, not dipping outwards as it is the case at deep tectonic style but inwards. They pass laterally and vertically into flatter thrusts. In the Highlands of Strážovská hornatina these disturbances cut off narrow anticlines. We may speak about f o l d u p t h r u s t s. Concerning the direction in the Little Carpathians and the Highlands of Strážovská hornatina (NE) they claerly diverge with Post-Paleogene structures (NNE) (see the tectonic map). We assume that they originated after thrusting of nappes in the time of later phases of the Cretaceous period of folding, perhaps in the time of the Laramide phase, when development of the structural character of thrust masses was completing also in spaces of accumulation of nappe masses.

Recent years have brought quite convincing evidences of the Old Alpine age of upthrusts of southern vergency in the Highlands of Stratenská hornatina. The „variegated" strata near the Dobšiná Ice Cave, previously already considered as Upper Cretaceous on the basis of high tectonization, are also affected by upthrusts. Paleogeographical (different material and distribution — M. M a h e ľ 1967), sedimentological (different character of paleocurrents — R. M a r s c h a l k o 1967) and also biostratigraphic evidences (presence of pollen-grains of Upper Cretaceous-Paleocene age — communication by P. S n o p k o v á) have been however found, quite unambiguously indicanting its age older than Middle Eocene.

While in the western part of the Inner Carpathians the upthrusts of the type mentioned are of NE direction, in the central part in the Low Tatra and High Tatra, analogous Cretaceous structures are of E—W direction, in the easternmost part of the Czechoslovak Carpathians, in the Mountains of Humenské pohorie and in the Čierna Hora of NW direction. As analogous upthrusts I consider faults of southern vergency, cutting off the individual blocks of the Slovak Karst — a region far-away from intense manifestations of Post-Paleogene folding. The course of these lines parallel with Cretaceous folding structures, the bend to the SE in the eastern part and delimitation of blocks with different Mesozoic filling incite to consider them as a consequence of later phases of Cretaceous folding.

The conclusions expressed are at variance with the spread opinion, according to which all the southern vergencies of important folds and faults are Post-Paleogene.

d) A peculiar type is represented by the Muráň (Muráň-Divín; Vl. Z o u b e k) Fault Line in its complicated character and development. It is morphotectonically so distinct that many authors considered it as typical young dislocation of the character of normal fault (D. A n d r u s o v 1965). In some parts nevertheless the manifestations of this dislocation were already evident in the time of the Cretaceous folding (the section of Divín). The complicated combined character of this dislocation is especially distinct in the Vernár part. Along the whole length of the Highlands of Stratenská hornatiny it

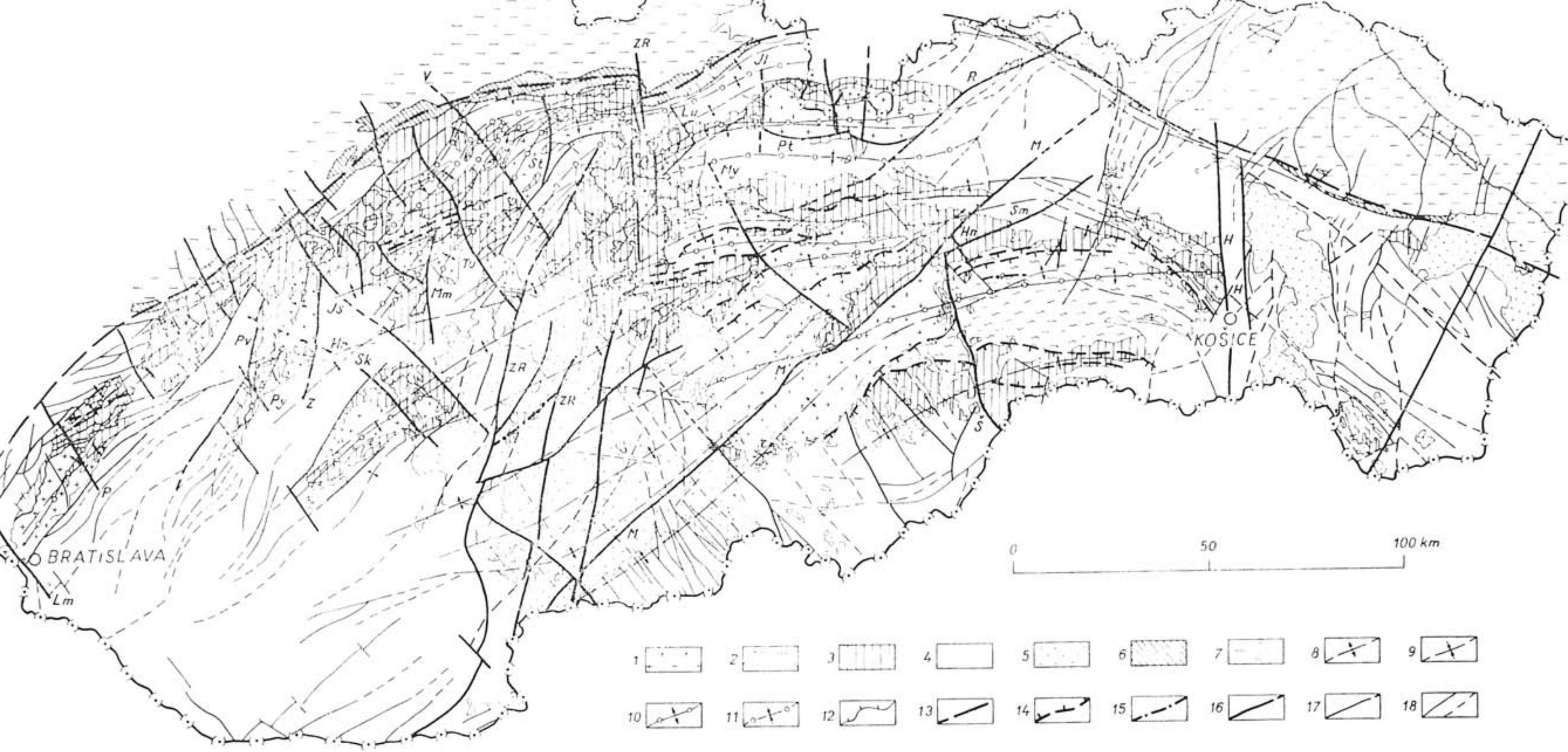

Fig. 1. Explanations to the Tectonic Outline of the Inner Carpathians (M. Mahel 1967).
1. Crystalline; 2. Paleozoic; 3. Mesozoic of the Inner Carpathians; 4. Tertiary filling of the inner basins; 5. Neovolcanites; 6. Klippen Belt; 7. Flysch-Belt; 8—11. Axes of regional folded structures: 8. Axes of Cretaceous anticlines; 9. Axes of Cretaceous synclinorii; 10. Axes of Post-Paleogene anticlines; 11. Axes of Post-Paleogene synclines; 12. Nappe planes; 13. Lineament zone; 14. Cretaceous upthrusts; 15. Old (mesozoic) tectonic dislocations-ways of the ascent of Cretaceous granitoids; 16. Important faults or fault zones, manifested as early as the Mesozoic, mostly later rejuvenized. P — Píla-Fault, Hr — Hrádok-Fault, Sk — Skýcov-Fault, Py — Piešťany-Fault, Js — Jastrabie-Fault, Tu — Tužina-Fault, V — Val-Fault, M — Mýto-Fault, Lu — Lúčky-Falt, Hn — Hnilec-Fault, ZR — Zázrivá-Revúca Zone, H — Hornád-Zone, Š — Štítnik-Fault, St — Strečno-Fault, Mn — Malá Magura-Fault, Pv — Považie-Fault, Jl — Jalovec-Fault, M — Muráň-Fault, Sm — Smižany-Fault, Pt — Subtatra-Fault, R — Ružbachy-Fault, L — Lamač-Fault; 17. Important Tertiary faults (older foundation unproved); 18. Faults of local importance and supposed faults.

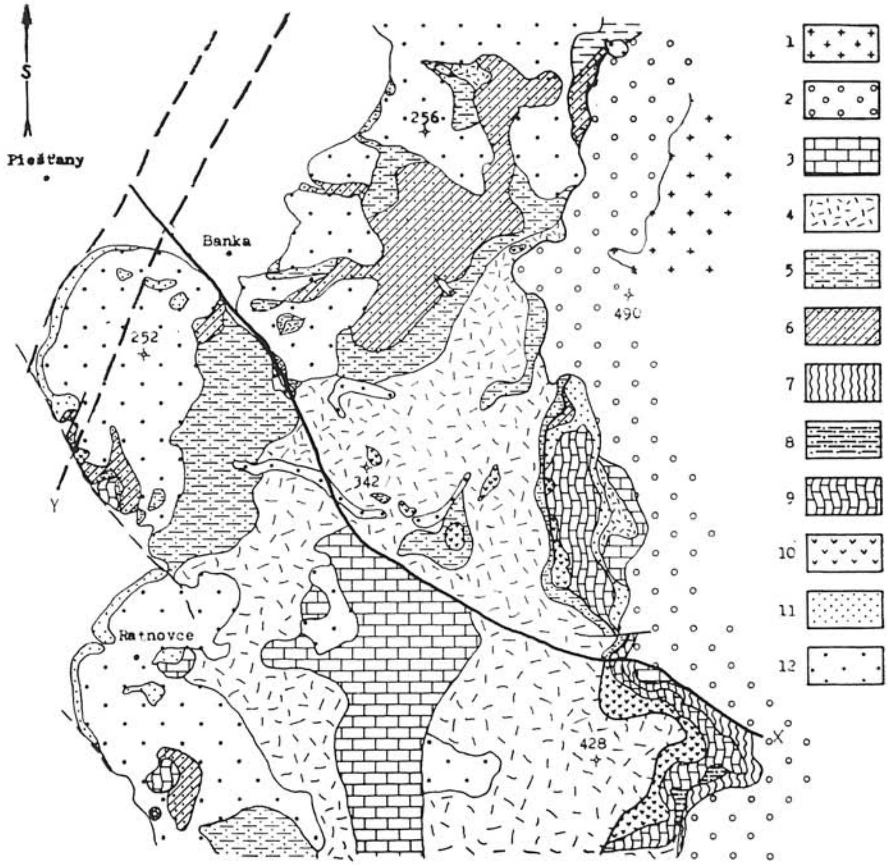

Fig. 2. Geological Map of the Southern Part of the Inovec (M. Maheľ 1950).
Explanations: 1. Crystalline; 2. Lower Triassic: quartzite complex; 3. Middle Triassic: dark-coloured limestones; 4. Ladinian—Carnian: dolomites; 5. Carpathian Keuper, 6. Carpathian Rhaetic. 7. Lower Liassic: dark-grey, partly crinoidal limestones; 8. Upper Liassic: variegated limestones; 9. Neocomian: marls and marly limestones; 10. Albian: marlstones and sandstones; 11. Pliocene: Piešťany Formation; 12. Pleistocene: travertines; x — Piešťany Fault, y — Váh Fault.

separates two principal structures and also two groups, the Stratená- and Vernár-Group. The dislocation represents a steeply dipping upthrust, 80—90° S, parallel to the partial unit a structure formed by the Vernár Group (the strip of Vernár) also with the axis of the structures of the Stratená Group. The tectonic contact is predominant running between the Upper Triassic dolomites of the Vernár Group on the northern side, dipping 65—80° S and the Verfenian Beds of the Stratená Group, crenulated (minute folds with changing dip and strike). In the northern part in the neighbouhood of the Spišská kotlina Basin on an older upthrust Post-Paleogene normal faults are superimposed. The Muráň Fault Line is evidently an old dislocation, to a various degree rejuvenated in various parts with the change of the types of the dislocation. The morphological character and genetic type of the dislocation is consequently multifarious.

I suppose the Muráň-Dislocation has been in the Alpine period of equal development as the Smižany-Dislocation of lower order in the Highlands of Stratenská hornatina, separating two principal structures, different in development, the structure of Gľac from the NW and of Matka Božia-Geravy from the SE. In the area of Lipovec in the western part it is of the character of upthrust to the SE. inwards, cutting off a narrow anticline formed by the Lower Triassic and Anisian. Towards the E its overthrust character is distinct, which towards the Valley of Tomášovská dolina (in the easternmost part) changes again into an upthrust. Northerly in the area of Lešnica the older upthrust is interrupted by two parallel Post-Paleogene faults — normal faults-reaching as far as the Spišská kotlina Basin.

All the above described types of upthrusts, longitudinally bordering the Cretaceous structures are genetically bound to them. They are in the first place the product of the Cretaceous period of folding. Some of them are however masked with superimposed young dislocations of normal fault type (Muráň Fault Line, longitudinal faults in the Highlands of Stratenská hornatina).

In regions of the Carpathian arch, where Cretaceous structures are of the direction identical with Post-Paleogene ones, thus in places of overlapping of directions of both types of structure., superimposition of Neogene upthrusts (somewhere also of normal faults) on Cretaceous upthrusts is most frequent. This is, for example, concerning the Subtatra Fault Line. A. Gorek (1967) even considers it as Pre-Mesozoic on the basis of the age of mylonite zones.

With the Cretaceous folding, its youngest phase, also formation of normal faults is connected, which directed the distribution of spaces of intense Eocene sedimentation. In the western part their direction is NE. In the Žilinská kotlina Basin their turning into E—W direction is distinct towards the east. In the eastern part of the Inner Carpathians the direction is NW.

To longitudinal Old Alpine strike dislocations also a fault of NW direction bordering the Cretaceous dome fold of the „island" of Sklené Teplice should be ranged. The intrusion of the granodiorite body (banatites) in the Hodruša dome is genetically bound to it (L. Rozložník 1968). The intrusions of acid granites in the Volovec anticlinorium in the Mountains of Spišsko-gemerské rudohorie show in places (area of Hnilčík-Snopka) signs of genetic binding to longitudinal dislocations.

The mentioned types of longitudinal dislocations in the Inner Carpathians are obviously genetically bound to Cretaceous structures. At this place it is to underline that

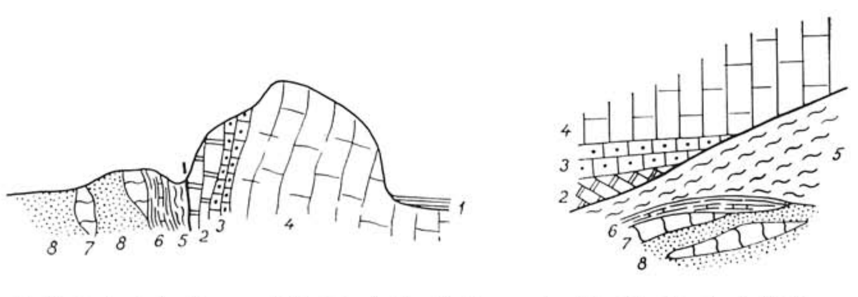

Fig. 3. Geological Section and Sketch of the Beckov rock-cliff (M. Mahel 1963).
Explanations: 1. Alluvium of the Váh river; 2—4. Choč unit; 2. Dark-grey limestone, Lower Anisian, 3. Flaggy cherty limestone, 4. Massive grey limestone; 5—8. Beckov subunit: 5. Shale complex, Albian—Cenomanian, 6. Marlstone-limestone complex, Neocomian, 7. Pink, in part nodular limestone, Malm, 8. Carpathian Keuper.

the distribution of individual lithological-stratigraphical and tectonic units is bound to the individual Cretaceous structures. In other words, some units are characteristic of one or another Cretaceous structure: the North-Gemeride Mesozoic for the North-Gemeride synclinorium, the southern threshold types of the Križná unit for the Hron synclinorium. There is no doubt about the relation between longitudinal faults and the distribution of lithological-stratigraphical units. This is indicated by already older origin of faults. The existence and especially the distribution of longitudinal faults during development stages of the Inner Carpathian geosyncline is however a more complicated problem.

Direct evidences of the existence of faults longitudinally dividing the Carpathian geosyncline in the Triassic—Lower Cretaceous period of sedimentation were mostly wiped out with formation of nappes (in nappe units) or covered with overthrusts (in envelope units). We have however also many indirect evidences for the solution of the age of faults.

The upthrusts frequently separate complexes belonging to various groups or developments, and that within the same unit. In some cases there are even complexes antagonistic paleogeographically, e. g. trough (Zliechov Subunit) — cordillera-complexes (Vysoká-, Belá-Subunit) in the Krížna unit. This indicates some upthrusts to have had their predecessor in older synsedimentary dislocations, perhaps of the character of normal fault, but only when compression changes of the space distribution were taking place.

Great changes of thickness as well as of facies in the Permian near the margins of the North-Gemeride and South-Gemeride synclines indicate bordering of these areas of deposition by faults. The signs of the existence of longitudinal faults in the Permian, in the stage of foundation of the geosyncline are bodies of melaphyre of the type of linear eruption in the Little Carpathians and Low-Tatra. Maximum development and extension of volcanic rocks near the Rožňava Fault Line indicates an old fault line, having manifested in the Mesozoic and also in the Paleozoic. The existence of old longitudinal faults is also indicated by the distribution of facies depending on tectonic unrest, e. g. bioherms in the Carboniferous of the Mountains of Spišsko-gemerské rudohorie.

It is quite evident that many of the longitudinal upthrusts are of older foundation and influenced the development of the geosyncline before the Cretaceous folding as dislocations of the character of normal faults. With the archlike distribution of Cretaceous upthrusts, conditioning uparching of the West-Carpathians, the question of the direction of longitudinal faults in development periods of the geosyncline is more complicated. In this sense an important contribution is the latest information of R. Marschalko in R. Marschalko, M. Pulec (1968) from sedimentological investigation of the Lunz Beds of the Krížna unit, showing in the western part NE direction of the area of sedimentation, E—W in the Tatra region. It is noteworthy from this aspect that faults of SW—NE direction were manifesting in the development of „Fore-Carpathian" Mesozoic at SW margin of the Carpathians, i. e. in the envelope Mesozoic of the Bohemian Massif, covered with Neogene molasses and flysch nappes. Such are the faults of Mailberg, Steinabrunner and Wollmannsberg (J. Kapounek, A. Kröl, A. Papp, K. Turnovský 1967). Later on in the time of Neogene they were reactivated and became distinct. The distribution of the Mesozoic in the western part of the Hungarian Midmountains also indicates the NE course of the areas of sedimentation there (F. Horusitzsky 1961). The opinions of the prevalence of roughly W—E distribution of the areas of sedimentation (T. Buday, V. Špička

1967) just in the western part of the Inner Carpathians seem to me to be at least exaggerated since also in the Paleogene, on which the mentioned authors are mostly based in their analysis, the area of sedimentation was not of W—E direction but in an archlike way NE—EW—SW (R. Marschalko 1968). I think the Mesozoic envelope groups are a quite reliable indicator of the course of the areas of sedimentation. This is shown well by the Core mountains of Inovec and Tribeč, situated side by side, both broken into halves by the Hrádok-Skýcov Dislocation Zone of almost E—W direction, more or less uniform in older periods, of Pre-Mesozoic foundation. Their envelope groups are however very different in paleogeography. In the southern part of the Inovec the Inovec Subunit with Jurassic facies of euxinic type similary to the northen-Orešany development of the Little Carpathian Subunit appears (linking of the area of sedimentation in SW—NE direction is more logical), the Tribeč Subunit characteristic of the southern part of the Tribeč Mts. consists of Jurassic members essentially different in paleogeography, of cordillera type. The east—westerly direction of the units is characteristic only of the central part of the Inner Carpathians, especially of the High Tatra. In the western part (as I am going to mention next) transverse faults of NW and N—S direction played a significant rôle in the area of sedimentation in the Mesozoic. They largely participated in breaking of blocks and thus in the dissection of the areas of sedimentation bound to the present belt of Core mountains.

Transverse Faults

Transvere faults are running transversely to perpendicularly to the tectonic structures, essentially faults of three principal directions NW, NS and NE. In each of the group mentioned several categories may be distinguished, according to the importance in the structure.

In our work we are going to deal with faults, reaching in their importance outside the West Carpathians — faults of I. category and more distinct faults, influencing the development of West Carpathian units — faults of II. category.

The first category of faults, of NW direction, includes the marginal fault system, separating the West Carpathian segment from the East Alps. The existence of such a system had been stated long ago. The old foundation of this fault system has been only found after recent study of the geology of the Little Carpathians (M. Maheľ 1962). The Little Carpathians were considered as link between the Alps and Carpathians and generally the common signs of the structure were stressed. Closer knowledge however permits to find also the differences in both the systems.

In spite of common signs in the structure of the Little Carpathians, this terminal range of mountains, and certain resemblance of the facies to the eastern part of the Alps, there are many essential morphotectonic, structural-tectonic differences as well as differences in stratigraphical-lithological filling. Both the compared terminal parts differ in the manifestations of Post-Paleogene tectonics, tectonic relations to the Flysch Zone, different tectonic units and mutual relations, some different facies as well as whole groups of the Paleozoic, Mesozoic and Paleogene. The Little Carpathians have essentially all the fundamental signs of Core mountains (basin filling with Central Carpathian Paleogene, the character of a Neogene vaulted horst, three fundamental groups of Mesozoic units: the envelope, Krížna and Choč unit; large granite massifs in the crystalline core). On the other hand the easternmost part of the Alps shows all fundamental signs of the East Alps. Such fundamental changes that justify to speak aobut different segments — the East Alpine and West Carpathian one, are hardly explicable without the existence of a dislocation zone of old fundation (as early as Pre-Mesozoic). A wide dislocation zone, partly covered by the Vienna Basin is evidently concerned there. The anomalous structural character of the crystalline of Pezinok-Pernek in the Little Carpathians, the NW strike of its folds, slices and schistosity, i. e. an direction uncommon in the western part of the Inner Carpathians but parallel to distinct old transverse faults, indicate genetic linking. I consider transverse dislocations of the second order, the Lamač- and Píla-Dislocation, accompanying the above mentioned structures of the crystalline, as northern marginal parts of a wide dislocation zone bound to a threshold manifesting gravimetrically (T. B u d a y, A. D u d e k, J. I b e r m a y e r 1967), separating the East Alps from the West Carpathians.

T h e L a m a č F a u l t is accompanied by a Neogene depression. The different development of the Jurassic and differences in the representation of Triassic members: the Devín development in the south of the fault (relatively thick masses of Triassic dolomites and limestones, particular facies of grey Doggerian and Malmian limestones) and the Borinka development in the north (thick Borinka Limestones and Mariatal Shales in the Liassic, dark-coloured cherty limestones in the Dogger) shows an old fault to be concerned, manifested in the time of the sedimentation of the envelope unit. The monoclinal structure of the envelope unit south of the Lamač Fault is in sharp contrast to the complicated tectonic relations of the Mesozoic and crystalline in the northern part (north of the fault).

T h e P í l a F a u l t, accompanied by a series of parallel faults, is distinct in different structure of blocks. The wide strip of the Mesozoic north of the fault changes into three narrower synclinal strips south of the fault. The function of this fault in the Mesozoic is manifested in the distribution of different developments of the envelope unit: the Orešany-development (without the Borinka Limestones, with cherty and marly limestones in the Liassic) in the north and the Borinka-development south of the fault (without cherty limestones but with the Borinka facies — also with dolomites and Mariatal Beds). The Píla Fault however also manifests in different type of structure of the nappe units in both blocks. The fault played its rôle in formation, completion of the tectonic style of the Krížna unit and Choč-nappe, separating blocks with the substratum variously influencing formation of minute structures. Concerning the type of the fault in the western part, the uplift of the northern block, in the eastern part the uplift of the southern block is evident to the contrary. With the system of the Píla Fault also the change of direction of Mesozoic (Cretaceous) structures is connected with ENE course to the north of the fault into NE—SW south of it. The different development of the envelope unit, its different tectonic style in individual blocks but also the differences in the structure of the Krížna- and Choč- unit at the Píla-Fault show quite distinctly its function as early as the Mesozoic; the parallel direction with the axes of Paleozoic structures also indicates their Pre-Mesozoic foundation.

Distinct faults of NW direction of old foundation in the Inovec are the Hrádok- and Piešťany-Fault.

The H r á d o k F a u l t was also manifesting in the structure as early as in the Paleozoic. It is especially distinct near the western margin of the Inovec in the Valley of Hrádocká dolina, complicated in details. The distribution of the Mesozoic changes at it conspicuously. At the fault the envelope unit disappears, lenticles of a subunite of the Vysoká-type appear, unknown elsewhere in the south. At the fault the Krížna-unit narrows essentially. Complexes of this subunit, being thick in the southern blocks are thinning into a series of lenticles north of the fault. This also concerns to a considerable degree the Choč-nappe. Roughly with the course of this fault the boundary of two different wholes of the crystalline agrees. This boundary is however not striking to the E northerly of the course of the younger fault and strikes E—W. Nort of the fault especially mica schists are present, accompanied by thick Carboniferous and Permian complexes, more southerly to the contrary prevailingly the granite core appears. An analogous type regarding to the distribution of the crystalline and Later Paleozoic is represented by the Skýcov Fault, separating two parts different in structure in the Tribeč Mts.: the northern part — masses of the Razdiel and the southern — Tribeč-Zobor part. In this case there are also differences in the structural plan of both blocks. In the northern part besides the envelope unit of peculiar type with particular type of the Triassic (Razdiel Subunit) also the Krížna- unit and the Choč-nappe are represented. The crystalline is represented by mica schists and gneisses. South of the fault to the

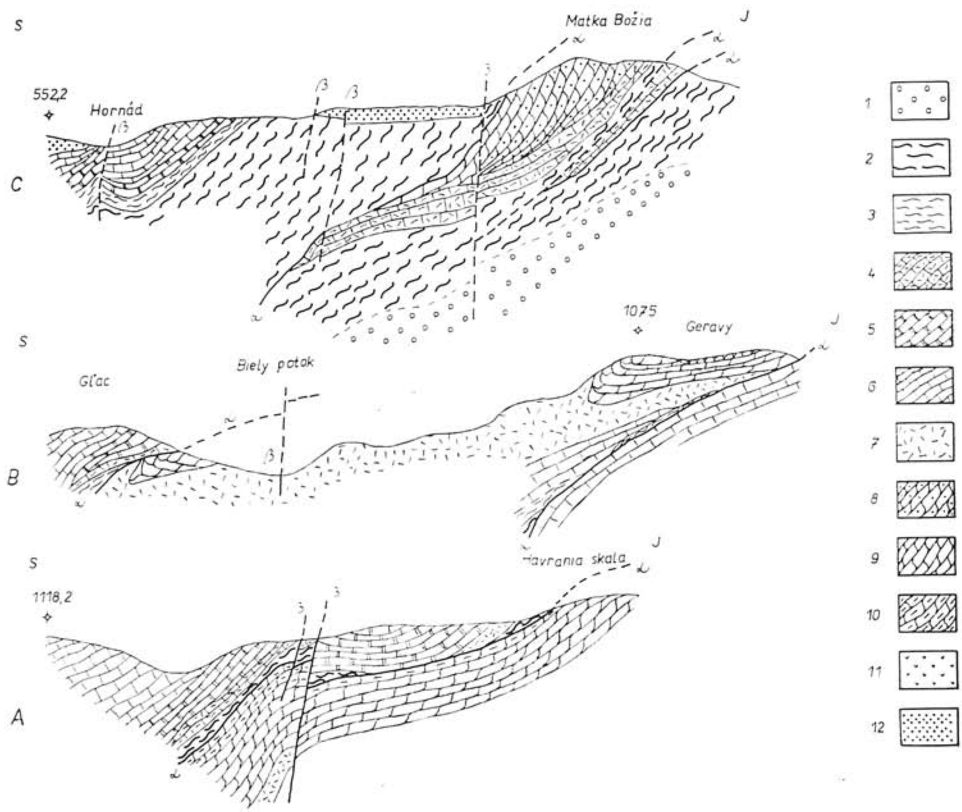

Fig. 4. Geological Profiles of the SE Part of the Stratenská hornatina Mts. (M. Mahe ľ 1967).

Explanations: 1. North-Gemeride Permian; 2. Shale-sandstone complex — Lower Triassic; 3. Marlstone complex — Upper Campilian; 4. Dark-coloured dolomites — Anisian, 5. Light-coloured limestones — Middle Triassic; 7. Dolomites — Ladinian—Carnian; 8. Dark-coloured cherty limestones — Norian; 9. Light-coloured limestones — Norian; 10. Light-coloured limestones — Rhaetic; 11. Shale-limestone complex — Liassic; 12. Central-Carpathian Paleogene; α — Upthrusts originated by the Laramide folding; β — Young faults of Neogene age; a) Profile in the area of Lipovec; b) Profile in Tomášovská Belá; c) Profile in the area of Lešnice.

contrary the envelope unit of different development is vigorously developed the so called Tribeč Subunit, affected by metamorphosis but without accompanying of the Krížna- and Choč-nappe with crystalline represented by granites.

The Piešťany Fault also crosses Mesozoic structures. At its intersection with the marginal Považie-Fault bordering the western margin of the Inovec horst the akratothermes of Piešťany issue. The old foundation of the fault results from the different type of developments of the Jurassic of the envelope unit in both blocks — the southern type with varied Jurassic in the south, the typical euxinic type of the Inovec Subunit in north. In structural sense the fault is manifested in the tendency towards a sigmoid, in the distribution of the members of the envelope unit and especially in the different structural character of the Krížna unit. Continuation of this fault to the west is evidently one of the faults crossing the Mountains of Čachtické pohorie, either the Šipovec- or the Čachtice- Fault. Both are distinctly manifested in step distribution of the Klippen Belt.

The boundary of regions different gravimetrically, the northern characterized by distinct negative anomalies, little differentiated and the southern with prevailingly positive anomalies is put into connection with a dislocation of old foundation running in the area of Trenčín — the Bánovská kotlina Basin — NE margin of the Tribeč Mts. (T. Buday, A. Dudek, J. Ibermayer 1967). Its manifestation as early as the Mesozoic is indicated by the essentially different style of structure in two blocks: heaping up of Mesozoic units in the Highlands of Strážovská hornatina and that as far as the southern margin and the vigorous representation of the crystalline core with small share of the Mesozoic in the northern part of the Inovec Mts.

The differences in the structure of both the blocks are manifested in all units. In the northern block in the Highlands of Strážovská hornatina the envelope unit with the Jurassic of euxinic type, considerable thickness, large spatial extent and great variety of the Krížna unit are distinct; especially vigorous is the development of the Zliechov Subunit and the Albian—Cenomanian. A considerable extent is also occupied by the Manín unit. The Choč nappe is characterized by the presence of a subunit with the share of light-coloured limestones but also of the subunit of the Čierny Váh type (with prevalence of dolomites) and of the subunit of the Biely Váh type (with Lunz Beds and Reifling Limestones). In full contrast to the mentioned variety and heaping up of Mesozoic complexes is the block of the nothern Inovec Mts. with vigorous crystalline core, accompanied by thick Carboniferous and Permian. The envelope unit shows with the Jurassic members a cordillera type, the Krížna unit is rudimentarily represented, the members of the Zliechov Subunit appear only near the margins of the Klippen Belt, little represented. The Manín unit is closely linked up with the Klippen Belt, in the Choč nappe the „lower" subunits are lacking, the Nedzov Subunit with prevailing light-coloured limestones is represented. The uncommonly distinct alpine strain in the crystalline of the southern block (in the Tribeč and Inovec Mts.) is remarkable, in which way it approaches the Vepor crystalline.

In the Highlands of Strážovská hornatina faults of NW direction are rather distinct at the western margin near the Klippen Belt. In the narrow Klippen Belt, significant morphologically, faults are very conspicuosly manifested, as it is comprehensible, not only in spatial shift but also in the content. The Vlára Fault, for example, separates the northern part of the Klippen Belt with extensive klippes, especially of the Czorsztyn development (Group of Vršatec) and also with large klippes of the Kysuce development, whereas south of the fault especially members of the klippen envelope prevail. The width of the Klippen Belt is essentially lesser. Another very distinct fault separating segments of the Klippen Belt very distinct in structure, is manifested in the structure in the Púchov sigmoid, also in pushing out of smaller klippes far to the north near Záriečie. The eastward continuation of this fault is running at the boundary of two sections of the Manín unit, the Budkov- and Manín-section, farther to the SE to ESE

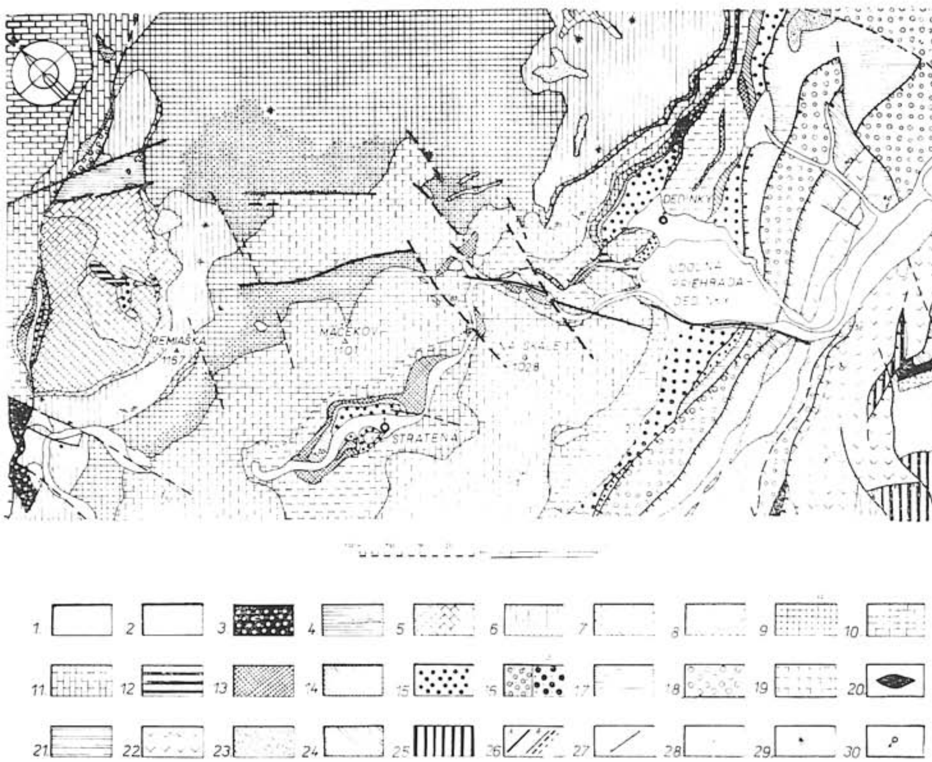

Fig. 5. Geological Map of the Wider Area near the Stratená Fault (Stratenská hornatina Mts.) (M. M a h e ľ 1955).

E x p l a n a t i o n s: 1. Alluvium; 2. Loamy and loamy-siliceous colluvial sediments (deluvia); 3. Sandstones, shales — Upper Cretaceous (Paleocene?); 4. Liassic-black shales with dark-coloured limestone intercalations; 5. Upper part of the Norian (Rhaetic?) — grey and dark-grey organogenic limestones; 6. Norian (Upper Carnian in places) — white organogenic limestones; 7. Middle Triassic — dark-grey limestones; 8. Light-coloured limestones of uncertain position; 9. Dolomites — partly Carnian, a) partly Upper Ladinian; 10. Ladinian (including Illyrian places): algal limestones; 11. Upper Anisian — grey to white limestones; 12. Middle Anisian — dark-coloured shales, marlstones, dark-coloured limestone intercalations; 13. Lower Anisian: dolomites (Hydaspian); 14. Upper Campilian — marly-limestone complex; 15. Seissian-Lower Campilian — shale-sandstone complex; 16—18. Permian: 16. Conglomerates and breccias with quartz porphyry pebbles; 16a) Sandstones and quartzites; 17. Variegated shales, sandstones, arkoses and greywackes; 18. Basal conglomerates and breccias; 19—20. Carboniferous: 19. Grey limestones, dolomitic limestones; 20. Grey sandstones, sandy shales, dark-coloured shales, sericitic in places; 21—25. Rakovec-Group: 21. Siliceous-sericitic and sericitic-chloritic phyllites; 22. Compact, fine-grained diabases, locally with diabase tuffs and tuffites; 23. Predominately tuffites, rocks of diabase character in little representation; 24. Amphibolites; 25. Quartz diorites; 26. a) Stratená-Faults of local character; 27. Upthrusts and smaller thrusts; 28. Strike and lip; 29. Localities of fossils; 30. Important springs.

along the southern margin of the Paleogene basin of Pružinská kotlina and is manifested as an old fault in the changes of structual dissection of the Krížna unit and also in the structure of the envelope unit. The envelope unit south of the fault shows a simple monoclinal structure, while in the northern block doubling is common for it. The described dislocation — we term it the T u ž i n a D i s l o c a t i o n — is linking with the fault cutting off the western margin of the Žiar Mts. towards the SE.

The dislocation zone od deep foundation at the line Hranice-Bytča, manifesting in the development of the Flysch Belt (Z. R o t h 1961) has its prolongation along the western margin of the crystalline of the Malá Fatra (massif of Veľká Lúka). The western margin of the Veporides and of the South-Slovakian synclinorium and at the Bückh Mts. fall into its strike continuation (NW—SE). The irregular contact of Mesazoic complexes of the Krížna unit — without accompanying of the members of the envelope unit and in places also without Triassic members of the Krížna unit — with the crystalline of the Malá Fatra and the NW strike of mylonite zones in the crystalline show the manifestation of this dislocation (we term it the Z b ý ň o v - V a l č a D i s l o c a t i o n) also in the period of Cretaceous folding. It is also indicated by the structure of the Skalky anticline, different in two blocks separated by this fault.

The older Mýtno Fault Zone of NW—SE direction disturbs the western part of the Vepor and Low Tatra. Its at least Old Alpine age is indicated by: differences in the structure of individual Mesozoic blocks and the complexity of the structure of the western promontory of the Muráň Plateau, the strike of mylonite zones in the crystalline parallel to the complications and irregularities (oral communication by A. K l i n e c) of the structure of the crystalline, the direction of the Paleogene basin of Brezno (evidently founded along Cretaceous faults) uncommon in the West Carpathians, eastern cutting off of the unit of the Ľubietová crystalline and the Hron synclinorium, western termination of the Trangoška syncline; bending of structures of the Ďumbier crystalline; changes in the complexity of the structure of Mesozoic complexes at the northern slopes of the Low Tatra (less complicated threshold structure as compared to the western as well as eastern block). The continuation of this fault zone to the north may be also the Lúčky Fault, accompanying the transvere anticline in the Mountains of Choč.

An example of a transvere fault of NW—SE direction, at which the different structural character of separated blocks is very distinct, is the H n i l e c F a u l t in the Highlands of Stratenská hornatina (see fig. 5). To the east up to three Mesozoic slices are repeating one upon another in the profile, with considerable share of the Upper Triassic; west of the fault there is only a uniform vigorous complex formed by the Middle Triassic. In the NW part at the slopes of the Low Tatra this fault also separates two blocks with different structure. At the fault a large body of the Melaphyre Formation commences to appear and also the development of the Middle Triassic changes.

Faults of N—S Direction and Related Faults

The importance of this group of faults in the development and structure of the Carpathians has been so far appraised least. From faults of higher order are included here in the first place: the fault systems of Zázrivá-Revúca and the Hornád River. Both played an important rôle with Neogene volcanism.

The opinion of the origin of the so called Central Carpathian Dislocation Zone, about 40 km wide, as early as during the Saalian folding phase is expressed by D. K u b í n y

(1962), who puts large block thrusts of the massifs of Ľubochňa and Ždiar into connection with it. The prolongation of the Danube Fault Line (T. Szalay 1956, 1958) from the Hungarian Midmountains and reaching as far as the Flysch Carpathians (geological window of Żiwiec) is concerned there. Direct evidences of the rôle of the Revúca Fault as early as in the development of the Carpathian geosyncline are connected with working out of a new division of the envelope units of the Inner Carpathians (M. Maheľ 1962, 1964). The variety of the envelope unites has been shown to be much more greater to the west of this system: groups of euxinic and cordillera type are represented. East of the Revúca Fault System only shallow-water-cordillera groups are known. The dissection of the area of sedimentation was different on both sides of the fault system, greater in the west than in the east. It is surely remarkable that the present morphotectonic dissection is essentially greater in the western block than in the eastern one. The narrow longitudinal Mesozoic anticline of NS direction with vergency of the folds to the E (clearly) exposed in the big outcrop of Malm-Tithonian at the road from Ľubochňa to Ružomberok is evidently in genetic connection with this Fault system.

The Hornád Fault Zone,distinct morphotectonically, separates two blocks, very different in structure: the Central Carpathian segment from the easternmore one. The later is characterized by another type of the Paleozoic (Extra-Carpathian Carboniferous) and simpler structure of the Mesozoic without the Choč nappe, the Zliechov Subunit in the Krížna unit, without possibility of separating the Krížna and envelope unit, as the results of study of the Mountains of Humenské pohorie show (M. Maheľ 1963).

I suppose a fault morphotectonically so distinct as the Štítnik Fault is to be of old foundation. The Mesozoic to the west of it is of essentially simpler development, less varied in facies than in the easternmore part of the Slovakian Karst. The structure of the Paleozoic is also esentially simpler e. g. the Rakovec Group and typical North-Gemeride Permian are lacking. There are indications that the crystalline in this part is not situated in great depth, what signifies an essentially lesser thickness of the Paleozoic complexes than in the east of this fault. In connection with the Štítnik Fault the possibility of shifting of the eastern block and thus of pushing out of the Volovec Massif to the north related to the Veporide block appears. With such considerations it is however necessary to regard that present position of the Štítnik Fault need not fully agree with the position of the old fault. Its NNW strike is also remarkable.

In this connection we touched the problem of shifting of fault lines, to which not sufficient attention has been so far paid by us. At ore fields under exploitation, e. g. in Rudňany, however wrench faults with combined movement of overlying and underlying parts of the deposit in horizontal and vertical direction are known. In these cases shifting by tens of m are mostly concerned. It is however logical to suppose that with tangential pressures from the S or SE, deep reaching at fault lines of N—S direction, separating the individual blocks, shifts of greater extent also manifested, frequently connected with thrusts, completing the complex stock of disjuctive dislocations.

Old foundation shows the Strečno Fault separating two divergently running parts of the megaanticline of the Malá Fatra, different in the composition of the crystalline core, the type of envelope groups and the structural character of Mesozoic units. The Veľká Lúka part of the megaanticline of the Malá Fatra lying in the west of the fault is of NNE direction with considerable share of gneisses of the crystalline mantle, tectonically reduced envelope unit, vigorous Permian complex in the Kozel anticline, the Ďurčiná Group accompanying the Krížna unit. The easternmore Kriváň block of the Malá Fatra turns into E—W direction. Its core especially formed by granites is accompanied by the distinct enveloppe of the Malá Fatra Subunit with specific signs; the Krížna unit is of vigorous development, not accompanied by an analogous Ďurčiná Group. Towards the N the dislocation forms the eastern border of the Žilinská kotlina Basin.

Equal N—S direction and probably also old foundation show the marginal faults in the Highlands of Strážovská hornatina, especially the Malá Magura Fault, and in the Inovec the western Považie and the eastern Závada Fault (Dubodiel-Závada Fault according to J. K a m e n i c k ý). Direct evidences of their old foundation are however scarce. We consider as such at the Malá Magura Fault the thickness of the Paleogene at the margin of the fault. At the Inovec Fault there is an uncommon, particular contact of the Choč unit (steep and directly with the Beckov Subunit), considerable reduction of the Krížna unit and klippenlike style of the structure in the northern section of the fault, especially distinct near Beckov.

A system of fauts of N—S direction of old foundation breaks also the Western Tatra into a series of blocks. In genetic connection with it are the uncommon variety of the development of the envelope unit (up to 15 groups according to Zb. K o t a ń s k i 1961) and the transverse elevations of Salatín, Končiská and Jahňací vrch and transverse depressions (Goryčkova and Javorinská Široká) known long ago. They played a very important rôle in the distribution and structure of Mesozoic units. A. G o r e k (1967) supposed the foundation of the mylonite zones and tectonic lines connected with them to have been old, Pre-Permian; the mylonites are in pebbles of Permian conglomerates. Especially important in the structural plan of the Western Tatra is a fault of N—S direction cutting off the crystalline core in the west, accompanied by irregularity in the structure of the envelope unit, Krížna and also Choč unit.

Relation of Early and Late Alpine Faults

The above mentioned shows that all the four fundamental directions of faults manifested in the Early Alpine structure and in earlier stages of development of the West Carpathian geosyncline. One part of faults manifest in relation to Old Alpine tectonic units and anticlines and synclines as longitudinal faults (faults of NE and E—W direction, a part of faults is of NW direction); another part represents transverse faults (faults of N—S direction, the most part of faults of NW direction and a small part of faults of NE direction). All the mentioned fundamental directions of faults however manifest in the Late Alpine structure and in formation of morphotectonic units — as young faults. In many cases rejuvenized faults are only concerned or fault zones renewed and stressed or widened on the basis of old faults. With this rejuvenization wiping out or masking of the character of the old fault was taking place in the way that the younger fault is of different sense, represents a different type. Early Alpine upthrusts were very frequently covered by Late Alpine normal faults (Muráň Fault Line), elsewhere upthrusts covered normal faults (Malá Magura Fault etc.).

Some faults changed in the course of their development also their relation to the course of structural forms. The Považie- and Závada Fault as Early Alpine faults e. g. ran obliquely to the structures in the northernmost part, as Late Alpine faults they represent marginal longitudinal faults of the megaanticlinal horst of the Inovec Mts. Other faults (especially of E—W direction), e. g. the Subtatra Fault, preserved the character of longitudinal faults in both stages of development.

Younger structural elements in the Neogene are perhaps faults of NNE direction — formed in the time of the Later Styrian phase in the area of the Vienna Basin (V.

Špička 1966). They are parallel to Late Alpine anticlines and synclines of the Little Carpathians. They are also manifested in the northwestern part of the Highlands of Strážovská hornatina.

Even with numerous differences in the character and position of the faults in the Early and Late Alpine structural plan we may say that the fundamental block character of the substratum, largely broken, is equal in the Early as well as Late Alpine stage. There is nothing to change this fact, even if we admit a large number of faults in the Neogene and their more distinct function. The function of the faults and their manifestation in the development were changing in the course of development of the geosyncline, as it is understandable. In the Triassic mostly longitudinal faults seem to have manifested, in the Jurassic there was also a great activity of transverse faults. Many principal longitudinal faults, of the character of normal faults in the time of sedimentation, were changing into upthrusts during the Cretaceous period of folding.

The analysis performed in this paper contradicts the conception, according to which the faults in the West Carpathians were typical of the latest development stages of the geosyncline ony (D. Andrusov 1939—1967). Although in every orogenic system, also in the Carpathians, the activity of the faults has been most distinct in the latest stages of development, considerable breaking into blocks by faults has been characteristic of the Carpathian segment even earlier. No new facts indicate the necessity of a revision (T. Buday, V. Špička 1967) of the opinions about relation of the individual groups of the envelope unit to one or another crystalline core, expressed by the author in the last ten years. The greater distinctness in the structure and tectonic independence of the Core mountains in the Neogene, emphasized by the author also in a double classification of structural-tectonic and morphotectonic structures of the Inner Carpathians (M. Maheľ 1965) do not signify that blocks bordered by faults did not manifest as the „predecessors" of present crystalline cores and in this way they contributed to the dissection that reflects in the quantity and variety of Mesozoic groups (M. Maheľ 1957, 1959). The variety of the envelope groups has not been so self-evident up to lately. If such a variety is being accepted at present, then it is necessary to explicate the reason. A further step forward in our knowledge is in finding the fact that: the changes in the lithological-stratigraphical content of the envelope groups correspond with the faults. Such an opinion of the specificity of the development of the envelope groups in individual Core mountains, even in some parts of them (M. Maheľ 1957—1967), grouped into two large groups (with cordillera- and euxinic type of the Jurassic) is essentially different from the opinion of the existence of several zones situated along the Carpathian system, acknowledged for decades (A. Matějka, D. Andrusov 1931).

The problems, to the solution of which T. Buday and V. Špička (1967) want to contribute, are very complicated. The solution of the division of the envelope groups and their relation to the Krížna unit still requires many detailed regional and methodic studies. The more dubious is their intention to solve them by aid of the material from several borings (inpersistent core borings), at which the determination of belonging to units of higher order, e. g. envelope and Krížna unit is frequently doubtful and where ranging is usually carried out on the basis of one guide complex only. At present state of knowledge of the variety of the envelope and Kížna unit one cannot be based on some simplified scheme. The Krížna unit just in the western part of the Inner Carpathians (which is the subject of studies of the quoted work by T. Buday and V. Špička) is not by far uniform neither in the lithological-stratigraphical nor in the tectonic sense: in these part it shows a great variety to the contrary: in some groups the analogy in development even of the most part of members with the groups of the envelope unit is distinct. The opinion of the tectonic relation of the envelope and Krížna unit and their division is changing, being modified, however always with contribution of new factual material that contributes to understanding of the regularities of variability and relation of units as different paleogeographically as e. g. the Zliechov-, Vysoká-, and Veľký Bok Subunit. An old-fashioned scheme does not contribute to the solution because scientific contribution is not in the question if we confess to a scheme nearer or farther away from the truth but by what we contribute to deeper knowledge, enrich the scientific fund.

Conclusion

The analysis of some faults in the Inner Carpathians makes possible to express several important conclusions:

1. The West Carpathians are characterized by a great quantity of faults of all fundamental directions NE, NW, NS and EW.

2. All the mentioned fundamental directions were evident in the development of the West Carpathians as early as the older stages of the geosynclinal development and caused great variegatedness with a plenty of lithological-stratigraphical units. The changes of groups and developments and the interruption of facies of adjoining units, mainly in autochthonous groups, correspond to the course of the younger faults and are one of the indicators of the older foundation of these faults.

The faults manifested largely as follows: a) in the Early Alpine Period in the individualization of the tectonic units of higher and lower order (as the boundary of groups of different mechanical qualities already); b) as disjunctive planes with thrusting and shifting of the tectonic units and individual blocks; c) in the formation of structural forms, mainly of synclinorii and depressions, in which the thrusting masses accumulated; d) in the complection of the tectonic style during the Laramide phase and consequently also in the formation of specs of the most intense Paleogene sedimentation.

The Early Alpine faults are manifested in the present structure on the basis of structural characters:

as tectonic upthrust boundary of the Cretaceous units;

as boundaries of blocks with different structural plan of autochthonous and also nappe units with different number or type of structural forms and units (frequently some units or structures end at a fault and others begin); irregularities of linear arrangement in the structure; as transversal, narrow anticlines, transversal lenticular zones, contacts of units that otherwise do not contact, e. g. the Envelope and the Choč-Unit;

changes in the thickness of members of the same age.

3. The most part of the fundamental young faults find their predecessors in the Early Alpine faults. The character of many faults however has changed, e. g. upthrusts into normal faults and vice versa (the character also changed in the older periods of development in many cases) and also the position in space, i. e. some faults, transverse in relation to the Cretaceous structures, became longitudinal in relation to the Post-Paleogene structures. A tectonic element that manifested more distinctly as late as the Neogene are mainly the faults of NNE

direction, parallel to some Post-Paleogene structure forms in the western part of the Inner Carpathians.

The old foundation of the most part of faults leads to the conclusion that the Inner-Carpathian geosyncline, heavily affected by the function of faults, represents a type with a plenty of small blocks. Some of them manifested as thresholds or cordilleras in the earlier stages of development. We have there a type of the geosyncline resembling an archipelago.

4. The faults are a part of the individual tectonic styles, the longitudinal faults their leading factor. With the type of the tectonic style — in dependence on the tectonic mature and reworking — also the rôle and function of the faults is changing.

In the deep tectonic style with the crystalline reworked by the Alpine orogenesis the longitudinal faults not only form the boundary of partial units and slices but also have conditioned the vertical distribution of the younger members (including the Mesozoic). The abundance of the faults is directly proportional to the tectonic reworking of the territory; the faults usually follow the boundaries of rock complexes of different plasticity; they are usually dipping 40—50° to the SE.

In the Gemer crystalline the Early Alpine folding affected the epimetamorphosed complexes, the longitudinal faults are roughly parallel to the schistosity S_2 and are dipping SE, S and SW in dependence on the strike of the faults being different in individual parts of the half-arch their dip varying within the values 30—60°. They are situated near the boundary of the Alpine megastructures: the synclinorii (the Nort-Gemeride and South-Gemeride synclinorium) and the Volovec anticlinorium. In the marginal parts of the Mesozoic complexes they have conditioned a slice structure, mostly with greater dip and inward vergency.

The more important faults in the Mesozoic complexes mostly follow boundaries of complexes of different mechanical qualities (different facial groups of various thickness). The upthrusts frequently pass into overthrusts and nappe planes. Cases of genetic linking to regional folded structures are also abundant: in such a case they have conditioned the contact of digitations. In the case of more frequent changes of the plasticity of complexes the longitudinal faults had a share in the formation of the slice-like (with flatter position of the complexes or lenticular and klippen-like style (with deeper folding in).

The transverse faults were manifested in the formation of the structural plan either as strike fault planes (frequenly combined with overthrusts) or as the factors which acted in the rise of the differences in the structural plan of the individual blocks as transversal, narrow and wider thresholds and grabens which influenced the distribution of the thrust Mesozoic messes.

5. The present srtucture of the Inner Carpathians however appears to be a typical Alpine one with a very important rôle of the nappes. Those were however superimposed and directed by a largely broken substratum. In the displacement of blocks the strike faults obviously played an important rôle, mainly in the deeper parts.

6. It is not by chance that the most part of our mineral springs issue at the faults, we have classified as faults of older foundation. They are evidently deep-reaching faults and is is their existence that conditions the uncommon richness of the mineral waters of Slovakia.

7. The half-arched shape of the West Carpathians is also genetically linked with the faults of old foundation.

8. The quantity of faults, the diversity of their types and their rôle in the development and structure of the Inner West Carpathians, their distribution conditioning the half-arched structure belong the specific features of the West Carpathian segment.

Translation by J. Pevný.

LITERATUR

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