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V. BEZÁK — A. KLINEC*

THE NEW INTERPRETATION OF TECTONIC DEVELOPMENT OF THE NÍZKE TATRY MTS. — WEST PART

(Fig. 1)

Abstract: The analyses of the geological structure and the conception of the tectonic development of a part of Ďumbier crystallinicum (the tatrides zone of the West Carpathians — south part) are given in this work on the basis of the crystallinicum complexes' study and finding folded strips of young paleozoic metasediments.

The authors determined four zones and three tectonic units in this region, from which every one had the individual tectonic style and development. Next is discussed the relationship between the tectonic structures' development and nappes' origination and the metalogenetic questions.

Резюме: В работе описаны анализ геологической структуры и концепция тектонического развития части дюмбиерского кристаллиника (южная часть татридной зоны Западных Карпат) на основании изучения структур кристаллинических комплексов и складчатых полос молодопалеозойских метаосадков.

Авторы определяют в этой зоне четыре зон и три тектонических единиц, из которых у каждой есть свой своеобразный стиль и развитие. Дальше дискуссируется отношение развития тектонических структур к возникновению покровов и к металлогенетическим вопросам.

Introduction

The west part of the Nízke Tatry Mts. crystallinicum was frequent subject of research in the past, as for geological and also resource point of view. The geological structure of this territory was in substance judged rather statically till now — as the autochthonous zones of granitoids, migmatites and crystallic schists, locally with folded cover — although in the works of some authors were mentioned observations which defined the mobility of this part of the West Carpathian crystallinicum during alpine orogenesis. Without notice to ultramobilistic theories after M. Limanowsky, it is necessary to mention mainly works of J. Koutek, J. Jaroš and K. Siegel, J. Koutek (1931) refers to the paraautochthonous, nearly nappe character of a part of granitoids; J. Jaroš (1971) divides the Nízke Tatry crystallinicum into two parts (separated by the Donovaly line): to the southern part which according to him represents the parent area of the Krížna nappe, and to the northern part, the tatrides part. K. Siegel in many works (e.g. 1973, 1975, 1976) directed his attention to the structural complexity of this crystallinicum and its tectonic development.

In 1979 during mapping in the scale 1 : 10 000, the authors had the possibility to analyse in detail a part of the Nízke Tatry crystallinicum in the area Jasenie — Kyslá. They jointed the previous studies in tectonically com-

* RNDr. Vladimír Bezák, RNDr. Albín Klinec, CSc., Dionýz Štúr Geological Institute, Mlynská dolina 1, 809 40 Bratislava

plicated Veporides zone. From the analyses followed the structural disunity within the framework of crystallinicum, and moreover, succeeding to find deeply folded strips of metamorphed sediments and volcanites of Upper—Paleozoic nearly Lower—Triassic age in this part of the crystallinicum. This urged the authors to find a new interpretation of the alpine tectonic development of this area.

Geological structure of the area

The rock structure of searched area includes, thought of the little areal extent, all basic types in substance, occurring in the Ďumbier crystallinicum (described in the report by O. Miko, 1977 at last). The new knowledges were obtained mainly about inner structure of the individual complexes, the individual position of orthogneissic types on the Struhársky grúň hill was stressed and the rock source was extended of weakly metamorphed sediments.

The individual rocks types occur within the framework of several zones, from which every one has the individual properties either petrographically or structurally. From north to south we can distinguish these zones:

1. zone of biotitic, partly hybridic granodiorites of the Jasenská hoľa hill;
2. zone of hybridic granodiorites — nebulites of the Zamostianska hoľa hill;
3. zone of stromatitic and ophtalmitic migmatites of the Špíglová;
4. zone of directed granodiorites (orthogneisses?) of the Struhársky grúň hill.

Zone of the Jasenská hoľa hill reaches also searched region but only by small part. It is built by middle-grained biotitic granodiorites in majority, sporadically with enclaves of paragneisses that is why locally increases their hybridic character. The border with the souther zone of the Zamostianska hoľa hill runs in strongly covered field. We assumed that it can be considered as tectonic border. According to nebulite structure the tectonic area is inclined in majority to north — NW, owing to this, some authors assumed granitoid overthrust from nort before. Contemporary area of granitoids above migmatites and their near surficial tectonic style, which was shown by J. Koutek (1931) on the example of the Tlstá fold, it is said about it that since a certain era this range ran through its individual tectonic development. Opposite this the original granitoid and migmatites structure is more than probable. The granitoid age was defined as Hercynian still former.

In the Zamostianska hoľa zone prevail hybridic biotitic granitoids — nebulites with paragneissic positions of different thicknesses (1—10 also more meters). Petrographically they are difefrentiated from the Špíglová zone rocks by larger neosome occurrence. The contiguity of these zones is tectonically with the inclination to NW. The width of every one of these zones (the Zamostianska hoľa and the Špíglová hills) in the range 1,2—1,6 km and direction SW—NE.

The rock source of the Špíglová zone consists of stromatitic and ophtalmitic migmatites, dislocated quite irregularly. Except for this there occur positions of biotitic paragneisses, amphibolic gneisses and amphibolites. Their last regional metamorphosis was Hercynian at conditions of amphibolic facies.

The significant feature of the Zamostianska hoľa zone and the Špiglová zone are folded 10—100 m thick strips of metasediments (metapsamites, metamorphed sand siltstones, locally metaconglomerates), lesser metamorphed volcanogenic rocks (on the southern margin also quartzites of the Lower Triassic). Metamorphosis had been realized in green schists facies (the chloritic, eventually biotitic zones). While the age of the crystalline schists developed in the amphibolite facies is minimally Lower-Paleozoic (the older age is not excluded) the age of these metasediments is with respect to metamorphic passing over, lithology and palynological finding (E. P l a n d e r o v á, oral communication) Upper Paleozoic in majority.

The next common feature of both mentioned zones is their structural variation and the same tectonic style. The s_1-planes are predominantly sheerly inclined (this confirms the subsurface style which is on the contrary to the Struhársky grúň zone style) and have variable direction of inclination. We can interprete it as folds, disrupted directly along the flanks but also by transversal faults (shiftings) which can be partly synkinematic. Also K. S i e g l (1975) mentions the applying of folding and shear deformation at structural origination of the Nízke Tatry Mts. The folds respond by their character to the direct and sheer ones with the vergency to NW and SE, morphologically they are open, nearly half-closed or half-closed till isoclinally fan-shaped patterned. Except for migmatites their organic components are also metasediment strips.

It follows from the described features that both zones (Zamostianska—Špiglová) ran througt the common tectonic development and that is why we can collect them into one unit, which is called the Špiglové structure. In its southern part the relics of anticlinal structure with NE directed axis along the Špiglová valley can be noticed. Also the inclinations of s_1-ylanes (in the northern part in majority to NW, in the south to the SE) and ascending of the higher tectonic elements in the flank demostrate the anticlinorium structure but nowadays, considerably deformed. According to our opinion — just this structure was appropriate for the accumulation of W, Au ore mineralization in this part of the Nízke Tatry Mts.

The Struhársky grúň zone builds the range of the same name. Petrographically they are fine-grained light aplitoid granitoids of the orthogneissic features with lineary patterned biotite with lesser positions of gneisses. The inner structures are different from the former two zones. The s_1-planes have mild inclinations (10—30°) and variable direction of the inclination. In the whole, this complex is subhorizontally deposited on the sheer erected migmatites. We can consider it as the nappe unit within the framework of crystallinicum. The contiguous line is bordered by quartzites with schists of the Lower Triassic.

Describing the geological structure it is necessary to mention also narrow zones where the movements of reverse fault character were realized and where degradation of the mineral associations of amphibolitic facies (cataclazites) and the next individual pegmatite veins, whose position is not too clear, came in. Next to this, there exist quite large areas caught by hydrothermal changes. The significant position in the geological structure had also faults (shiftings, normal faults).

Interpretation of the tectonic development

Reconstructing the tectonic development we had to start from several basic ideas which we had to explain and put in consequence. They are:

a) subsurficial tectonic style of the Jasenská hoľa zone and the Struhársky grúň zone which has lead us to their defining as the individual tectonic elements, what is acknowledged by distinct discordance in the case of the Struhársky grúň hill;

b) the assumed original forealpine space structure of granitoids and migmatites;

c) discovering of folded Late-Paleozoic — Lower-Triassic metasediments (the explanation was necessary to find, mainly for their metamorphosis and system of folding into the fundament);

d) anticlinorium character of contemporary structure with the folds of lower systems in the core in which also in substance the occurrences of W, Au ore mineralization are concentrated.

The view on nowadays structure of tectonic elements (the schematic profile E) signalizes dynamics of the crytallinicum fundament which had to react on the strong pressures and following from them its reduction during the alpine orogenesis. This was made either by flat overthrust character (in the upper subsurficial positions) or by new refolding (in the deeper parts). What tectonic style and what position have the individual tectonic units nowadays, was conditioned by their position in forealpine structure and the mechanic properties. From the detailed geological map and profiles which were collected on the basis of the research in 1979 follows the close structure of metasediments of the Upper Paleozoic Era with migmatites in structure of the Špiglová zone and so their common tectonic style and development. Still we have no facts to use which should restrain from the assumption that also the original sedimentary space of metasediments was based in the neighbourness of migmatites, eventually — partly on them. The existence of sedimentary depression in the Late Paleozoic was probably conditioned by faults, what should be acknowledged also by volcanogenic positions in sediments.

The development of schistosity in sediments and their metamorphosis in green schist facies (chloritic till biotitic zones) asks for the intensive folding of sediments at certain P—T conditions. Finding out the factors which might have been made by these conditions, we have to start from the direct surrounding of metasediments. Since this was not the matter of the classic subductive zone and metamorphosis should not be caused by mesozoic nappes, the possible explanation could be found in the shifting masses of granitoids (now in the Jasenská hoľa zone) and partly by „orthogneisses" of the Struhársky grúň hill. While the nappe character of „orthogneisses" is acknowledged (by the innner structures and the tectonic position in the ovetlying stratum of migmatites and metasediments), it is still quite discussible. The granitoid position in the overlying stratum of migmatites is, however, clear only in some segments, while in the farther ones it is covered by the younger faults and reverse faults. But the subsurficial tectonic style of granitoids is asknowledged also by the analyses of neighburing areas (J. K o u t e k, 1931) and also the flat deposited, not metamorphed Mesozoicum on the northern

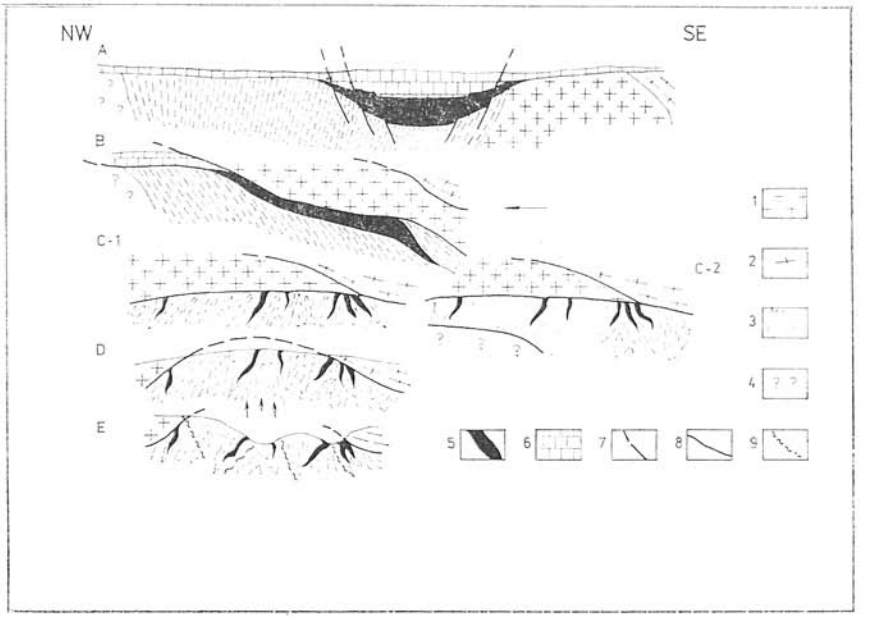

Fig. 1. — Scheme of the tectonic development of the crystallinicum in the Jasenie—Kyslá area.

Explanations: 1 — 4ranitoids; 2 — „orthogneisses"; 3 — migmatites (stromatits, ophtalmites and nebulites); 4 — hypothetic crystallinicum; 5 — metasediments (the Younger Paleozoic Era); 6 — sediments (Mesozoic Era); 7 — breaks; 8 — overlying lines; 9 — mylonites.

slopes of the Nízke Tatry Mts. in the direct overlying stratum of granitoids.

If we accept the presumption about the flat overthrust of granitoids and „orthogneisses" on migmatites and metasediments, then the granitoids and „orthogneisses" had to be in the original structure before the beginning of the alpine tectogenesis, situated southly from the migmatite range and also from the sedimentary space of the Late Paleozoic (the schematic profile A).

At the starting reduction of space the „squeezing out" of a part of granitoids and „orthogneisses" came in and their transition to the north, what was the cause of separation of a part of Mesozoic sediments and their shifting to the north. The remaining sediment part (in majority of the Upper Paleozoic age) there was forced the deep tectonic style — the remained part was metamorphically folded under the transiting granitoids, and in the next, it was shifted and folded into the overlying migmatites (the schematic profile B). Under the given P—T conditions migmatites should be also plastically deformed, where partly occured the degradation of the mineral associations of amphibolitic facies mainly on the direct contiguity with the water-bearing sediments. Refolding of migmatites and metasediments was done continuosly under the shifting granitoids, thus also the lower parts of nappes could be included into the folds. The metasediment strips are usually accompanied by

mylonites which at the farther folding could be conditioned mainly by originated inhomogeneity from the previous development.

By the analysis of metasediment deposition in migmatites we came to preliminary conclusion that metasediments represent either relics of isoclinal fold cores, which had been developed in the underlying migmatites and now they are fan-wise patterned (the schematic profile C-1), or metasediments asced in the flanks half-closed till open shear folds with the vergency to the north and south as the equivalent component of migmatites (schematic profile C-2). In the first case — migmatites should represent the autochthonous fundament and the metasediments — its tegumentum and then, the whole this zone should have the function of the „local" root zone (of course, only if above the depositions of the Upper Paleozoicum the Mesozoicum had been originally sedimented). The roots of some Mesozoic complexes in the analoguous zone were situated still by A. Matějka (1930). The second way asks for the common transition of metasediments and migmatites through the hypothetical crystallinicum before the main folding, (schematic profile C-2). In this case also migmatites would be alochthonous. (It is necessary to add that the subhorizontal deposion of s_1 -planes in migmatites in a certain phase of development is presumed also by K. Siegl (1975).

After finishing of folding gradually occurred the thinning of the area — to the origination of the anticlinorial structure (schematic profile D), under the continuous deposition of the upper tectonic elements. The deposition response should be represented by mild inclined cleavage areas in migmatites (they break the s_1 -planes). Among the next phenomena of tectonic development which complicated the origination of the „axial" structures, there are transversal faults, where the movements of horizontal shifting character were done, later on also of the descendal character.

The origination of megaanticlinal form was probably made by the combined effect of finishing folding and newly formed young intrusion in the depth, which was shown by the increasing of the temperature stream (the origination of postkinematic biotites in metasediments). It is possible that also the origination of some feldspathic porphyroblasts and mainly the penetration of high-thermal solutions are consequent with it. These caused the metamorphosis of rocks and they were the subject of ore mineralization. The solutions utilized the appropriate „relieved" structure — mainly the core of anticlinorium. The core is in substance identical with the Špiglová structure, on the flanks of anticlinorium are preserved also the upper tectonic elements granitoids in the north, „orthogneisses" in the south (schematic profile E). The whole this structure was still in conclusion of mylonitic zones and by movements repeating on the transversal faults, eventually by the origination of the new ones, (the „mosaic" descends). With the plutonism after-effects is connected also the hydrothermal activity which utilized mainly the fault structures.

Conclusion

The significant contribution to the knowledge about geological structure of this part of the Nízke Tatry Mts. was the discovering of low-metamorphed sediments of Late - Paleozoic age, which ascend directly in the centre of

migmatites. This fact and also the detailed analysis of crystallinicum structure of masses lead us to elaborating of the interpretation of tectonic development of this area in this work. We consider it, however, the work hypothesis — the first step as for enclearing the newly obtained knowledge about this part of crystallinicum. The special detailed researches in many ways would be needful to develop it.

This interpretation of tectonic development shows the trend which can become the new way in the structural diving of the Nízke Tatry Mts., in determining succession of the tectonic movements and their relationships to the ore mineralization. It concerns also the paleogeographical questions, problems of the origination of nappes and the root zones, which are significant from the whole West Carpathians point of view.

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