

New interpretation of the tectonic position of the Late Paleozoic - Mesozoic rock sequence in the Nízke Tatry Mts. – eastern part (Western Carpathians)

JÁN MADARÁS¹, JÁN IVANIČKA¹ & RASTISLAV VOJTKO²

¹ Geological Survey of Slovak Republic, Mlynská dolina 1, 817 04 Bratislava, Slovakia. e-mail: madaras@gssr.sk

² Department of Geology and Paleontology, Comenius University, Mlynská dolina G, 842 15 Bratislava, Slovakia. e-mail: vojtko@nic.fns.uniba.sk

Abstract: The complex of the Late Paleozoic – Mesozoic rocks occurs at the eastern slopes of Kráľova hoľa Mt. in the Nízke Tatry Mts. and they are interpreted as a cover unit of the Southern Veporic crystalline basement. Cover sediments underwent the Alpine low-grade regional metamorphism. Rock complex forms a brachyanticlinal structure with fold axis dipping to the NE. It comprises the Permian to the Mesozoic meta-sediments in autochthonous position and the Upper Carboniferous to the Upper Triassic volcanoclastic rocks and metasediments as allochthonous partial tectonic slice.

Key words: Western Carpathians, Veporicum Unit, Late Paleozoic, Mesozoic, Alpine tectonics, mesostructures.

Introduction

The sequence of low-grade metamorphosed sedimentary and volcanoclastic rocks until now has been known as the Predná hoľa Complex (Bajaník et al., 1979). This complex occurs at the north-eastern and eastern slopes of Kráľova hoľa Mt. at the eastern part of the Nízke Tatry Mts. The occurrence of the Predná hoľa Complex is not large (10 km²) and its position among different tectonic units indicates, that comprehension its geological structure is very important for clarify of surrounding tectonics.

The aim of the contribution is to present a new viewpoint at the stratigraphic and tectonic position of the rock sequence described and its position in the framework of the Veporic Zone based on a new research and published works about age of the complex.

Metasedimentary and volcanoclastic rocks at the eastern slopes of the Kráľova hoľa Mt. has been considered mainly of the Late Paleozoic age (the Carboniferous – the Permian) by older authors (cf. Kettner, 1937, Kubíny, 1959, Klinec, 1976).

Bajaník et al. (1979) named this sedimentary and volcanoclastic sequence as the Predná hoľa Complex in the form of lithostratigraphic unit and described the complex the Devonian age based on the results of the palynological research (Planderová in Bajaník et al., 1979).

Plašienka (1980, 1984) respected the Devonian age of the Predná hoľa Complex and included it into the Markuška Nappe, which is a transitional and simultaneously unifying element between the Veporic and the Gemeric Zone. This nappe has some common structural, metamorphic and lithological features of both the Veporicum and the Gemericum. Vozárová & Vozár (1988) left only the Early Paleozoic sequence in the Predná hoľa Complex, they included the Permian rocks into the Northern Veporicum (the Predajná Formation) and affiliated the Scythian

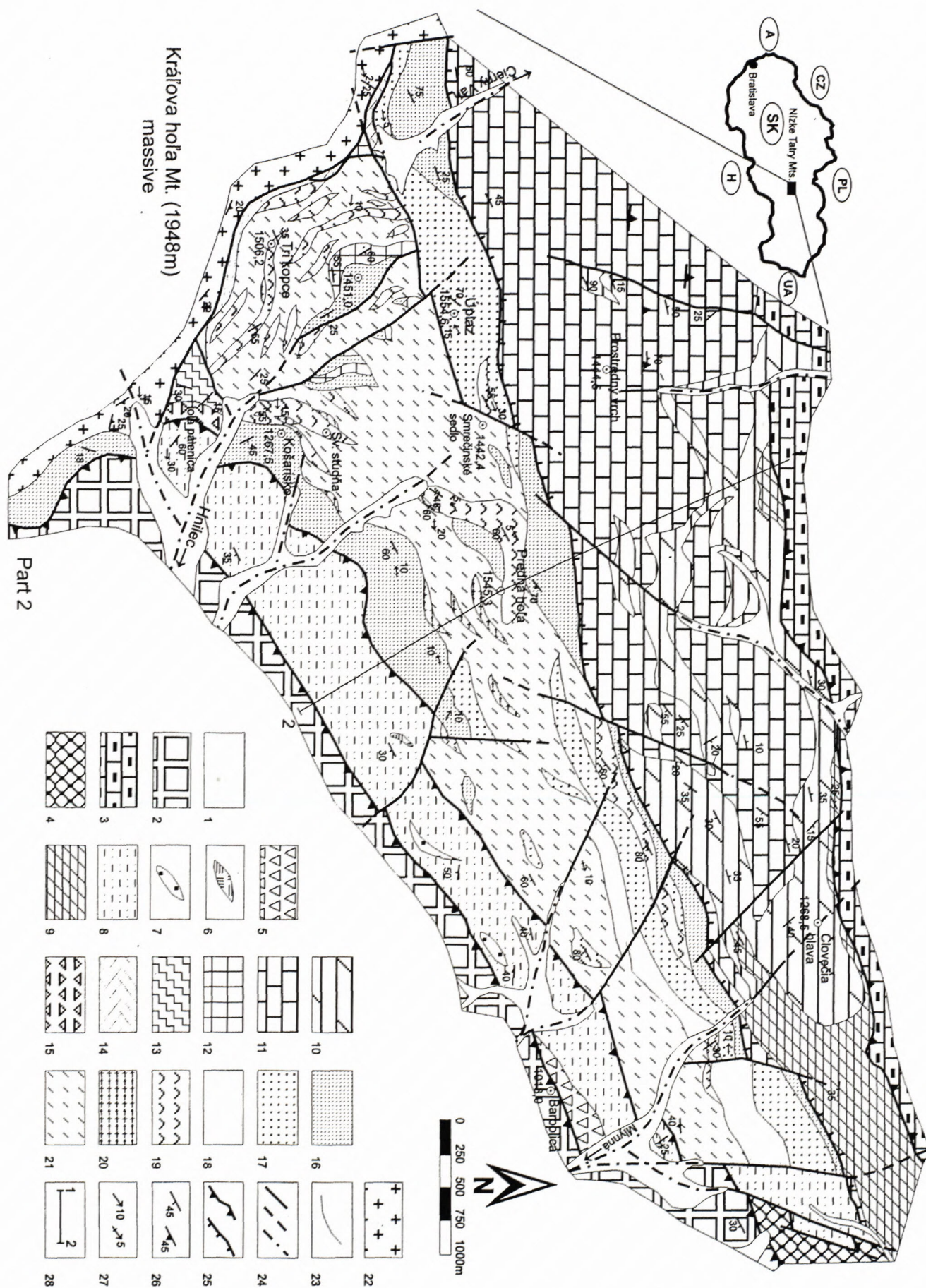
metaquartzites and carbonates to the Veľký Bok Unit and the zone between the Pálenica hill and Vernár village into the Choč Nappe (the Hronicum).

This conception was presented also in the regional geological map of the Nízke Tatry Mts. in the scale 1:50,000 (Biely et al., 1992). According to Putiš (1989; in Krist et al., 1992) the mentioned complex except arcosed metasandstones, belongs to the partial Predná hoľa Nappe of the Rimavica Nappe system.

Plašienka et al. (1989) dealt with metamorphism in the Predná hoľa area, and Korikovský et al. (1992) at the northern slopes of the Kráľova hoľa Mt. The rock complexes were Alpine metamorphosed in the temperatures about 250-350 °C in both areas. This fact has been confirmed also by the grade of preservation of the palynomorphs in the studied area (Planderová, 1991). Mazzoli & Vozárová (1989) ascertained low-pressure character of the Hercynian metamorphism on account of results of *b₀* values of muscovites from phyllites in the Predná hoľa Complex.

Geological setting and lithological composition of the rock complexes

New conception of stratigraphic and tectonic position of rock complexes on the eastern slopes of the Kráľova hoľa Mt. rely on the geological research, which is presented in the regional geological map of the Slovenský Raj Mts., the Galmus Mts. and the Hornádska kotlina valley (Mello et al., 2000). There is no need to distinguish the Predná hoľa complex, because its lithological composition and probably also age is compatible with the Slatviná and the Rimava Formations of the Revúca Group (Fig. 1a,b).



Crystalline basement

The crystalline basement at the eastern and southern slopes of the Kráľova hoľa Mt. is predominantly created by granitoids (biotite granodiorites and medium-grained tonalites). The granitoids lie on phyllonites of mica schist and on metagranites of the Kráľova hoľa massif in a slice form with maximal thickness about several hundred meters (partial nappe of the Veľká Vápenica – cf. Putiš, 1987, 1989, Krist et al., 1992). Their cover is mainly formed by the Permian metaarcoses and the Lower Scythian metaquartzites.

The Revúca Group

The Revúca Group as a part of the Veporicum has been defined by Vozárová & Vozár (1982) in the Revúcka vrchovina highland. The group consists of the Slatviná and the Rimava Formations (Vozárová & Vozár, l.c.). It is a sequence of terrigenous sediments with rare occurrences of volcanoclastic rocks. The Scythian quartzites and the Middle Triassic carbonates of the Foederata cover Unit lie on the sediments of the Revúca Group. The Veľký Bok cover sequence is overthrust on the Revúca Group with the general dip to the south. The Hronicum Unit (the Nižná Boca Formation) is overthrust on the Revúca Group with the general dip to the north. The thickness of sediments of the Revúca Group is variable and maximum thickness is 600–800 meters.

The Slatviná Formation (Carboniferous)

The Slatviná Formation builds lower part of the Revúca Group. At the typical locality in the Southern Veporicum this formation has been put by Planderová & Vozárová (1978) into the Upper Carboniferous (the Stephanian C-D - Autunian), on account of the lithostratigraphic research

and spore biostratigraphy. The Slatviná Formation is represented by sediments of sandy-phyllitic character and basic-acid volcanic rocks. These rocks are Alpine metamorphosed in the lower part of the greenschist facies.

The Rimava Formation (Permian)

The Rimava Formation forms the upper part of the Revúca Group (Vozárová & Vozár, 1982, 1988). Its underlies is formed by the Slatviná Formation. The boundary between the Rimava and the Slatviná Formations is lithologically gradual and locally tectonized emphasized (The Uplaz area). The Scythian quartzites of the Foederata Unit formed overlying of the Rimava Formation. Sediments of this formation have not features of the cyclic sedimentation. The formation consists of clastic sediments predominantly, coarse-grained metagreywackes, metaarcoses and metasandstones. These rocks contain layers of metaconglomerates, which create only incoherent beds. Concomitant components are formed by originally fine-grained sediments (sandy phyllites and fine-grained metasandstones), small bodies of rhyolites and rhyolite volcanoclastic rocks.

The Foederata cover Unit

Cover sediments of the Southern Veporicum crystalline basement have been distinguished and defined mainly in the Dobšinský potok area and the tectonic contact area between the Veporicum and the Gemericum. By the problem of the Foederata Unit was discussed mainly by Vozár (in Bajaník et al., 1983) and Plašienka (1980, 1993). This sequence prolongs also to studied area, but only locally. The relicts of the Foederata Unit, which are formed by metaquartzites, rauhwackes, metadolomites, metalimestones and black schists occur at the eastern and southern slopes of the Kráľova hoľa Mt. Stratigraphic

Fig. 1a. Geological map of the eastern part of the Nízke Tatry Mts. in the Predná hoľa Mt. area. Compiled by: J. Madarás & J. Ivanička, 2000. Compiled on the basis and using the maps: Madarás, 1998; 1999; Ivanička & Polák, 1999.

1 – Quaternary sediments undivided, 2 – Mesozoic sediments and volcanics undivided (Silicicum Unit, Silica Nappe), 3 – Late Paleozoic sediments and volcanics undivided (Hronicum Unit, Choč Nappe), 4 – variegatedly coloured conglomerates, sandstones and shales (Permian - Malužiná Formation), 5 – vein diorite bodies (Permian), 6 – basic volcanoclastic rocks (Upper Carboniferous- Nižná Boca Formation), 7 – conglomerates (Upper Carboniferous- Nižná Boca Formation), 8 – dark gray shales and sandstones (Upper Carboniferous- Nižná Boca Formation), 4–8 Hronicum Unit (Choč nappe – Ipolica Group), 9 – gray, dark gray, marly limestones, marls and marly shales (Lower Cretaceous - Tithonian – Hauterivian), 10 – dark, black, crinoidal laminated limestones, partly with cherty limestones, black clayey - marly shales (Lower Lias); greenish, rose and white metamorphosed and marmorised limestones, marmors, partly with radiolarites (Dogger–Malm), 11 – rauhwackes, Ramsau Dolomites (Ladinian), Lunz beds (Carnian), Hauptdolomites (Carnian – Norian), grey dolomites (Middle – Upper Triassic), Carpathian Keuper (Norian), 9 – 11 North Veporicum Unit (Veľký bok Unit), 12 – grey to dark gray dolomites (Carnian - Norian), 13 – slaty limestones with cherty and dark grey marly shale beds (Ladinian - Carnian), 14 – dark to black laminated crystalline limestones (Anisian - Ladinian), 15 – rauhwackes and rauhwackized limestones (Anisian), 16 – metaquartzites (Scythian), 12 – 16 – South Veporicum Unit (Foederata Unit), 17 – metamorphosed arkoses and grauwwackes, partly with volcanogenic materials, rarely conglomerates and phyllitic shales beds (Permian – Rimava Formation), 18 – grey to black phyllitic shales, fine - grained metamorphosed sandstones, locally with metabasaltic volcanoclastics beds, 19 – metabasaltic tuffs to tuffites, epidote-chlorite phyllites, 20 – quartz keratophyres and their volcanoclastics, 21 – quartz - sericite and chlorite – sericite phyllites with metasandstone and metaarkose beds, 18 – 21 Upper Carboniferous - Slatviná Formation, 17 – 21 South Veporicum Unit – Revúca Group, 22 – crystalline basement - biotitic granodiorites and medium grained tonalites – Kráľova hoľa Complex, 23 – geological boundaries, 24 – faults and tectonics boundaries generally: observed, approximated, covered, 25 – overthrusts lines, thrusts, 26 – primary bedding, metamorphic and mylonitic foliations; strike and dip, 27 – mineral lineations, fold b-axes; strike and dip, 28 – geological section line.

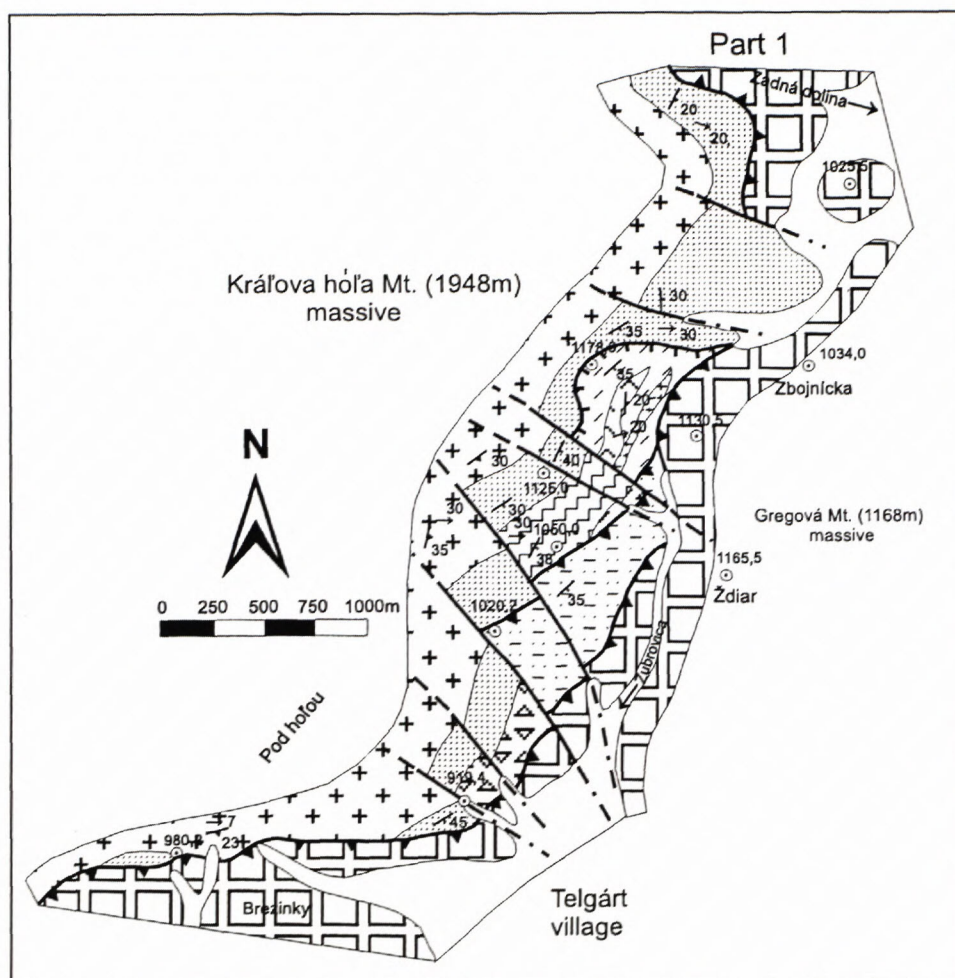


Fig. 1b Geological map of the SE part of the Nízke Tatry Mts. in the Telgárt village area. Compiled by: J. Madarás, 2000. Compiled on the basis and using the maps: Plašienka, 1981; Madarás, 1998; 1999. Explanations see Fig. 1a.

division of some members of the Foederata Unit was defined on account of lithology and correlation with the similar Triassic facies of neighbouring units and on account of superposition. Local occurrence of Conodonts in the upper part of members of this unit (Straka, 1981) enables to determine their age as the Carnian.

Discussion about the age of the Predná hoľa Complex

The age of the Predná hoľa Complex was determined by research of the palynomorphs and sporomorphs (Planderová in Bajaník et al., 1979). Observed assemblages of the palynomorphs have been determined as the Middle-Upper Devonian, but some from their were till the Carboniferous age. Planderová (1991) age of the Predná hoľa Complex advanced up to the Upper Devonian, eventually at the start of the Lower Carboniferous (the Tournaisian), however, at the Košarisko-Svätá voda locality presents other assemblage of the palynomorphs, which occurs in the last work. There are identified the palynomorphs by Planderová (1991): *Densioisporites* sp., *Lycospora imeperialis* JANS., *Taeniaesporites* sp., *Cirratridatites* sp. The palynomorphs are expanded to the Upper Paleozoic (the Carboniferous) age. Planderová & Vozárová (1978) quoted the same assemblage of the palynomorphs from the Turčok locality (the Slatviná

Formation), which were explicitly identified as the Upper Carboniferous (the Stephanian C-D) age. Two floras are mixed, the first is older (the Westphalian) and the second is younger (the Stephanian C-D age). This is explained by resedimentation of older microflora into the younger formation. It is probably also the case of the Predná hoľa Complex and the occurrence of resedimented the Devonian and the Lower Carboniferous sporomorphs is possible also here.

Tectonic position of the rock complex

Studied area is built up of three basic tectonic units:

The Veporicum is built by granitoids of the Kráľova hoľa massif of the Hercynian age, the Revúca Group, the Foederata Unit and the Veľký Bok Unit. Granitoids of the Veľká Vápenica partial Nappe have almost exclusively features of the Alpine overprinting and the Hercynian structures at upper part of crystalline have not been reliable proved. Sedimentary and volcanoclastic rocks of the Revúca Group and the Triassic Foederata Unit were Alpine metamorphosed in the middle part of the greenschist facies P-T conditions. These rocks have been overprint by strong tectonodeformation processes at the transpression phase of the Alpine orogen. Rocks are deformed in a shear regime with mineral lineations and folded.

The Mesozoic complexes of the Veľký Bok Unit are present mainly in a tectonic overlies of the Revúca Group and in underlies of the Choč Nappe. Tectonic contact between the Revúca Group and the Veľký Bok Unit is characterized by a reverse fault with 70° - 80° dip-slip toward the north or north-west. The Veľký Bok Unit has been overthrust on the Revúca Group as a back thrust (Fig. 2). This line follows the contact zone between the Northern and Southern Veporicum cover Units, which is correlated with the eastern part of the Pohorelá tectonic line according to Madarás et al. (1994).

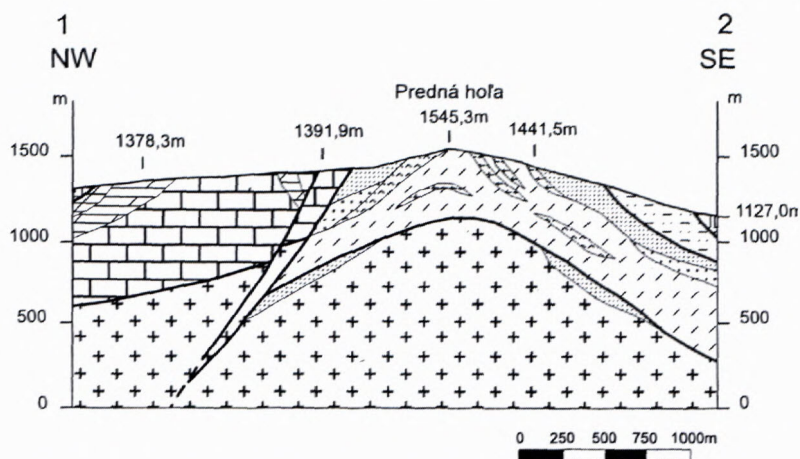


Fig. 2 Geological cross section 1-2. Compiled by: J. Madarás & J. Ivanička, 2000. Explanations see Fig. 1a.

The Revúca Group and the Foederata Unit are folded in the form of brachyanticline fold with fold axis dipping toward north-east. The cover sequence forms an autochthon to the extensive partial tectonic slice, which can be correlated with the Markuška Nappe (Plašienka, 1984) or the Predná hoľa partial Nappe (Putiš, 1989), respectively. Autochthonous to paraautochthonous cover is created by the Scythian quartzites and the Middle Triassic carbonates and rauhwackes. Partial tectonic slice consists of the Slatviná Formation (Carboniferous), the Rimava Formation (Permian) and locally also the Foederata Unit (Triassic).

Succession of the Alpine deformation

The Alpine tectonic development is characterized by the low-temperature Alpine metamorphosis of the Veporicum „en block“ (crystalline and cover sequences), tectonic structuralization of crystalline basement and cover sequences in the compressional regime (reverse faults, thrust slices). The compressional regime is connected with reverse faults of the Pohorelá type (cf. Hók & Hraško, 1990, Madarás et al., 1994) and thrusts north-eastern vergency (in the present coordinates) changed due to the transpressional regime, which is characterized by stretching lineations in the crystalline basement, but also in the cover sequences (Madarás et al., 1996). Various metamorphosed types of crystalline and different facial types of covers (the Foederata and the Veľký Bok cover sequences) came into contact along these tectonic lines. While in the external zone of the Northern Veporicum transpression finished, the tectonic regime began to change to extensional or transtensional regime in the central part. Similar ages of transpression at the northern part and extension at the central part of the southern Veporicum are identified by similar radiometric ages of rocks - 90-80 Ma (cf. Cambel et al., 1990, Maluski et al., 1993, Dallmeyer et al., 1993, Kováč et al., 1994). The unroofing with eastern vergency is obvious mainly at the eastern margin of the Veporic Zone, at the contact with the Gemericum Unit and the superficial nappes. Extension is expressed by subhorizontal mylonite (shear)

zones (for example: the Kráľova hoľa massif), by change of originally overthrust lines into the normal listric faults (for example: the Pohorelá tectonic zone) and by an origin of mineral lineation. Extensional regime staid main tectonic phenomenon also along finish main phases of the Alpine folding in the area during the Upper Cretaceous. The last phases of deformation continued to the brittle conditions (Hók et al. 1993). At last effect of unroofing is uplift of whole massif of the Kráľova hoľa Mt. and stripping of crystalline in the upper part, erosion of rests of sedimentary cover and slipping the superficial nappes and nappe duplexes into depressions (the Choč Nappe toward north, the Stratená Nappe of the Silicicum tectonic Unit toward east and the Murán Nappe of the Silicicum toward south-east).

Conclusion

The main aim of this contribution is to clarify the tectonic position of metasedimentary and metavolcaniclastic rock sequences at the eastern slopes of the Kráľova hoľa Mt. Improved cartographic map enables to correct of existing researches, revalueing of the complex age and present new conception its stratigraphic-tectonic including.

Our conception is supported by the research of the contact zone between the Veporicum and the Gemericum Units in the Dobšinský potok valley (Hók et al. 1993, Madarás et al. 1995), where it was expressed imagination about lithological, stratigraphic and tectonic relations of the Southern Veporic cover sequence and the Predná hoľa Complex. These authors only follow up older ideas presented mainly by Plašienka (1980, 1984, 1993). Stratigraphically the lowermost part of cover sequence is correlated with the Upper Carboniferous Slatviná Formation, the Permian sediments with the Rimava Formation and the Triassic sediments with the Foederata Unit. Minimal two partial slices of cover successions have been identified also in the Predná hoľa area. The lower part in the autochthonous position on the crystalline basement contains mainly Scythian rocks, predominantly quartzites and less Middle Triassic carbonates. The upper part of the sequence (in a form of one or more small partial tectonic

slices) contains mainly rocks of the Slatviná Formation (phyllites, metasandstones, metaconglomerates, acid and basic volcanics, metatuffites and metagreywackes), the Rimava Formation (metaarcoses and layers of acid and basic volcanics and tuffites), the Scythian metamorphosed quartzites and the Middle Triassic metamorphosed and recrystallized carbonates.

The carbonates have an affinity to the Foederata cover Unit. This fact solves also the problem of continuing of the Pohorelá overthrust line directly to the east. Including of sedimentary and volcanoclastic rocks of the Predná hoľa complex into cover units of the Southern Veporicum indicates that it follows the contact between the Foederata and the Veľký Bok Units.

Acknowledgements

The data used in this paper are the results of the following projects on which the authors participated: Grant of the Comenius University No. UK/68/2000 and regional projects of the Geological Survey of Slovak Republic – No. 110 – Geological map of the Slovenský raj - Galmus Mts., and Hornád depression (1997-2000), No. 130 – Tectonogenesis of sedimentary basins (1998-2004).

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