GEOLOGICKÝ ZBORNÍK — GEOLOGICA CARPATHICA 30, 1, BRATISLAVA, MARCH 1979

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CHOČ AND STRÁŽOV NAPPES, NEW DIVISION AND STRUCTURE

(Fig. 1–9)

Abstract: After distinguishing a new lithological — stratigraphical unit — Bebrava group — (close to the Strážov nappe in content, but tectonically belonging to the Choč nappe) a new subdivision and delimitation and some new aspects of tectonics of the Choč and Strážov nappes in the West Carpathians are presented. The new paleogeographical sketch-map of the Triassic of the West Carpathian geosyncline indicates relations to the Eastern Alp and the Hungarian massif.

Резюме: В статье приводится новое расчленение и новые границы и некоторые новые данные по тектонике Хочского и Стражовского покровов, которые исходят из определения новой литологической и стратиграфической единицы — Бебравской серии. Эта серия по своему содержанию близко Стражовскому покрову, но тектонически принадлежащая Хочскому покрову. На новой палеогеографической схематической карте триаса Западнокарпатской геосинклинали, автор показывает на ее соотношение к Восточным Алпам и Венгерскому массиву.

Introduction

The first stage (years 1925–1935) of systematic study of the region of central Slovakia (Low Tatra, Veľká Fatra, Chočské pohorie mts.) has shown complication of structure with several tectonic units built up of limestone-dolomitic complex, overlying Cretaceous members of the lower Subtatric (Krížna) nappe (R. Kettner, 1931, 1931 a; R. Kettner — V. Šťastný, 1931; A. Matejka, 1927; 1935; J. Koutek, 1935). With finding more precise criteria for tectonic assignment of these limestone — dolomitic masses, gradually ranged as the Choč nappe, the opinion of its predominantly monofacial character in some areas with several digitations has got used (D. Andrusov, 1936, 1938, 1968). The following succession of the Choč nappe (called also Poludnica or middle Subtatric nappe): Melaphyre group, Gutenstein limestones, Choč dolomites, Reifling limestones (attributed to the Upper Ladinian first), Lower Carnian Lunz beds and Hauptdolomit, is considered as characteristic. Lacking Reifling limestones in some areas and a thin layer of the Lunz beds separating masses of thick Middle Triassic dolomites from Upper Triassic ones — or dolomite development close to the Rohr development in the Alps — a type known from the Veľká Fatra and the western end of the Low Tatra (E. Spengler, 1932) — were considered as local phenomenon (D. Andrusov, 1936). Overlying the Choč nappe, the higher Subtatric nappe, so called Strážov nappe D. Andrusov, 1936), is distinguished in the Strážovská hornatina mts. The Veterník unit, known already earlier from the Malé Karpaty mts. (L. Lóczy, 1915), is assigned to this nappe. Light-coloured Middle Triassic limestones (overlying darker Anisian limestones) are considered as criterion of the Strážov or

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other higher nappes, e. g. the Nedzov nappe in the northern part of the Malé Karpaty mts.

The stage of compiling general maps of Czechoslovakia and the Regional geology of Czechoslovakia (1955–1965) brought important knowledge, pointing to facial and tectonic heterogeneity of the Choč and higher nappes.

a) It has been shown, that in the Choč nappe dolomite development is not a local manifestation, deviation from the standard sequence, but builds up extensive areas. In most mountain ranges two developments of the Choč nappe occur: one with dolomites predominating and one with Reifling limestones and thicker Lunz beds. For the first development the name Čierny Váh group was introduced, for the second the name Biely Váh group (M. M a h e ľ, 1961). Particularly characteristic of the Čierny Váh group are Upper Triassic marly dolomites with intercalations of variegated Keuper shales. Because of closer facial relation to the Krížna nappe, working designation of the dolomite development was first Krížna — Choč development (M. M a h e ľ, 1956). Both distinguished developments — group are considered as linked with each other through transitions and accompanied by the Melaphyre group (Upper Carboniferous — Lower Triassic M. M a h e ľ, 1961 a).

b) in the Choč nappe several occurrences of Middle Triassic light- coloured limestones were found, more abundant in western Slovakia, mainly in these mountain ranges, where the Strážov and higher nappes were already distinguished earlier. Light-coloured limestones (considered as criterion for higher nappes) amidst the Choč dolomites, but also stratigraphically linked to Reifling limestones, also called Raming limestones) stimulated the view of the existence of transitional groups between the Čierny Váh and Biely Váh and the Strážov group (M. M a h e ľ, 1967).

c) The whole complex of groups overlying the Krížna nappe is considered as group of subordinate units in stratigraphical — lithological as well as tectonic sense and the designation Choč unit (M. M a h e ľ, 1961 a) or Choč nappe (M. M a h e ľ, 1967) is retained for it. In such a conception the Choč nappe represents a tectonic unit of higher order of polyfacial character.

In some areas the polyfacial nappe, however, occurs as a uniform body, i. e. one tectonic unit with lateral transitions and lateral replacement of facial types, for instance in the major part in the Strážovská hornatina mts., Malá Fatra, Považský Inovec, Veľká Fatra mts. There are, however, areas, in which the individual facial types occur in partial structures, particular slices or subordinate nappes. The clearest example is in the Low Tatra (A. B i e l y, 1963). Just the situation in the Low Tatra was for supporters of the view of monofacial nappes the basis to divide the Choč nappe in its whole extension into two nappes. For the part of nappe or subordinate nappe, in which the former criteria for the Choč nappe remain valid (mainly Reifling limestones and thicker Lunz beds), thus for the Biely Váh type, they keep the original name, the Čierny Váh type they distinguished as particular tectonic unit and designated it as Šturec nappe (D. A n d r u s o v — J. B y s t r i c k ý — O. F u s á n 1973; J. B y s t r i c k ý, 1973). Such an approach and used terms appear to be logical. A precondition of them is, however, structural independence of both units in the whole extent of the West Carpathians. Both subordinate nappes, the Choč and Šturec nappes, together with the accompanying Melaphyre group, they consider as part of a high-order unit, called Hronic. Following validity of used

criteria of the unit with light-coloured Middle Triassic limestones (Steinalm – Upper Anisian and Wetterstein – Ladinian) they consider the Strážov nappe as part of further unit of higher order (A. Biely – J. Bystrický – O. Fusán, 1968) and the latter as part of the Gemeric (D. Andrusov – J. Bystrický – O. Fusán, 1937).

So we are confronted with a very serious problem in the Choč nappe (an equal situation is in the Krížna nappe) to what extent are nappes polyfacial M. Maheľ and to what extent monofacial (D. Andrusov, J. Bystrický, O. Fusán, etc.) in the West Carpathians. Classification and nomenclature of tectonic units is also connected with it. These questions can be solved only on the basis of knowledge from the whole Inner Carpathians and not only from one of their areas.

In the last years the state of knowledge essentially widened by us, owing to more complex study of several areas and to detailed stratigraphic investigations. We distinguished another lithostratigraphical unit, the Bebrava group (M. Maheľ, 1973), a characteristic member of which are white organodetrital limestones, crowded with dasycladaceans, distributed in form of larger and smaller bodies amidst light-coloured dolomites (Wetterstein dolomites).

Solving the above mentioned questions, it is useful to be based upon knowledge from the Eastern Alps, because just the Triassic limestone dolomitic complexes of the Choč nappe and other more southern Mesozoic units perhaps display most accordances with units of the Northern Calcareous Alps, not only in the type of individual stratigraphical – lithological members (hence designation of most members), but also in lithological – stratigraphical complexes – groups in their facial types and lateral relations.

State of up to present knowledge on the number of facial types of the Choč unit and their relations to geometric bodies.

The Choč nappe is present in all core mountains in the West Carpathians. Complicatedness and variety of its structure are however, not equal everywhere, most varied in the Low Tatra, Strážovská hornatina mts. and Malé Karpaty. It builds up large areas in the Veľká Fatra, Chočské pohorie, Považský Inovec and Branisko.

In the Low Tatra, as mentioned above, two facial types are very distinct – the Čierny Váh and Biely Váh groups. In the last mentioned also occurrence of the Dachstein limestones should be stressed. The Jurassic to Lower Cretaceous members form a particular slice, the uppermost structure element of the Čierny Váh group.

The Čierny Váh group, accompanied by the Melaphyre group, builds up two partial units (. Biely, 1963), called the Boca and Malužiná units by D. Andrusov (1968). The upper partial unit of the Choč nappe, so called Svarín unit, is built up of the Biely Váh group, intensely refolded with large digitations, mainly in the Poludnica area (R. Kettner, 1931).

The Biely Váh group forms also the eastern part of the Chočské pohorie mts. It means that in the transversal zone, which occupies the eastern part of the Chočské pohorie mts. and the central part of the Low Tatra, the Biely Váh group is typical, thick, dissected structurally. In the mentioned part of the Chočské pohorie mts. the Biely Váh group is also intensely refolded, with

digitations (J. Koutek, 1935); building up several slices. In the uppermost of them the Reifling limestones are also replaced by a "more southern" facies-variegated Schreyeralm limestones (R. Mock – M. Škarba, 1973).

At the southern slopes of the Low Tatra, in the Hron synclinore, are also three slices of the Choč nappe (A. Biely, 1963) in the eastern part, all built up of the Biely Váh group, the middle in accompaniment of the Melaphyre group. The uppermost slice contains light – coloured Ladinian limestones (also called Raming limestones; J. Bystrický 1972), with gradual transition from the underlying Reifling limestones. The lower slice in the more western – part of the Hron synclinore is built up of the Čierny Váh group. Tectonically interesting is the position of the slice in underlier of thick masses of the Melaphyre group in its western part formed by the Čierny Váh group as well as in the eastern part formed by the Biely Váh group. Although distribution of groups in the Low Tatra is most similar to monofacial type of nappes, it is necessary to take into account division of the Čierny Váh group on the northern slopes into two subordinate units of larger extent and other slices of local importance and of the Biely Váh group in the eastern part of the Hron synclinore even into three slices.

In the westernmost part of the Low Tatra and in the eastern area of the Veľká Fatra the Choč nappe, although relatively thick – mainly in the Revúca depression – is, however, structurally more or less homogeneous. From the thirties are already known lateral changes of facies here: partial replacement of Reifling limestones by light-coloured limestones (A. Matějka, 1972) and transitions of facies with Reifling limestones and Lunz beds into dolomite facies (E. Spengler, 1932).

The stratigraphic range of the Reifling limestones has been shown variable also in this area. In some places the Reifling limestones represent the Upper Anisian and the whole Ladinian and grade up into the overlying Lunz beds. In other areas they are represented by light-coloured organogenic and gravelous limestones, so called Raming limestones in their almost whole extent (J. Bystrický, 1969, 1972) (Fig. 1). The presence of sponges, corals, crinoids, *Tubiphytes obscurus* resembles the sponge-coral facies of Wetterstein limestones (A. Bujnovský et al., 1975). In areas where these light-coloured limestones occur, thickness of overlying Lunz beds is reduced, they are even fading out. The Aon beds mostly replace the bioherm, so called Korytnica limestones in some areas; oolitic limestones with abundant cyanophyceans, foraminifers, lamellibranchs. There is obviously a particular development of the Biely Váh group- I call it Ludrová development according to the brook of equal name (Fig. 2).

A bioherm character display also Carnian to Lower Norian dolomites rich in crinoids (*Encrinus* sp.), colonial corals, calcareous sponges and gastropods. At their transition to bedded dolomites megalodontidae and algae are more abundant in lower layers – *Andrusoporella duplicata* (A. Bujnovský – M. Kochanová, 1973).

The bulk of the Choč nappe of the western margin of the Low Tatra and Veľká Fatra, mainly in the area of Malý Šturec, is built up of dolomites. D. Andrusov – J. Bystrický – O. Fusán (1973) assigned them to the Čierny Váh group which they identified with the monofacial subordinate nappe, called Šturec nappe, in the whole extent of the West Carpathians. Amidst thick

Fig. 1. Geological map of the Choč nappe in the Korytnická dolina, valley, showing transition of the Biely Váh group to the Ludrová development (A. Bujnovský, 1973).

1–2. Krížna nappe: 1. marly limestones and marls (Upper Berriasian – Hauterivian); 2. shales, limestones, sandy – glauconite limestones (Barremian – Lower Albian); 3–10. Choč nappe: 3. Gutenstein limestones (Lower Anisian); 4. dolomite (Pelsonian); 5. Reifling limestone (Illyrian – Langobardian); 6. light-coloured organogenic reef limestones = Raming limestone (Cordevolian); 7. gravelous and coral limestones, shales (Lower Julian); 8. Lunz beds (Julian); 9. bedded Hauptodolomit (Tuvalian – Lower Norian); 10. massive Hauptdolomit (Tuvalian – Lower Norian); 11. overthrust planes and faults; 12. localities of fossils.

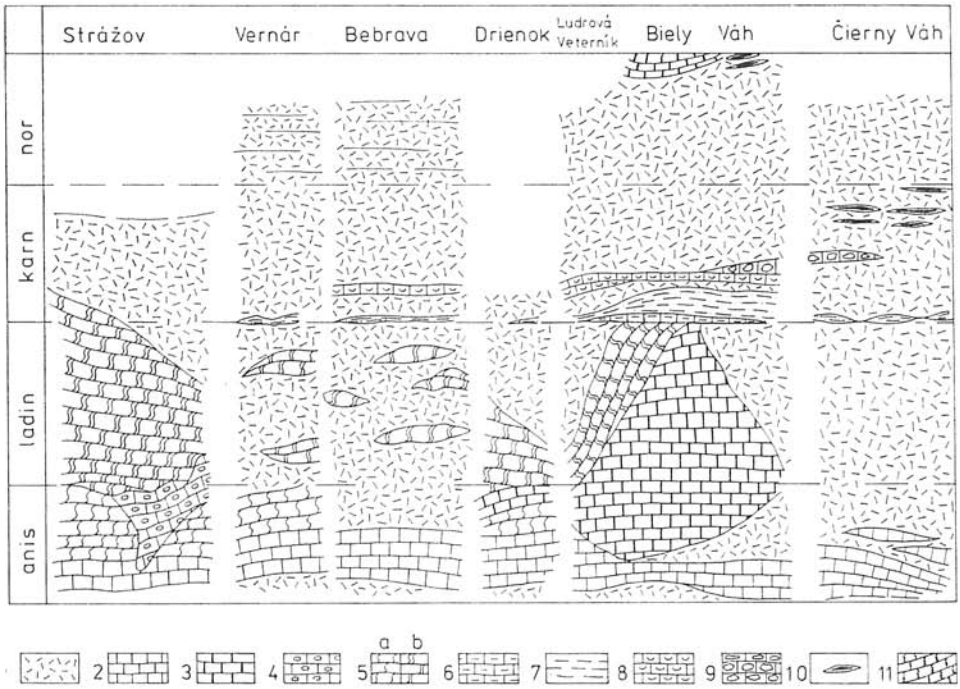


Fig. 2. Lithological-stratigraphical table of Choč-nappe groups in the West Carpathians (M. Maheľ, 1978)

1. Dolomites; 2. Gutenstein limestones; 3. Reifling limestones; 4. Schreyeralm limestones; 5. light-coloured limestones, a) Steinalm limestones (Anisian), b) Wetterstein (Raming) limestones; 6. Aon beds; 7. Lunz beds; 8. Cardita beds; 9. Opponitz limestones; 10. intercalations of variegated shales (Keuper); 11. Dachstein limestones.

dolomite masses, however, layers of dolomitic limestones and Wetterstein limestones occur. The dolomites proper in their considerable part represent the Wetterstein type and not Ramsau dolomites. The described dolomite group of the Choč nappe, the Bebrava group, is so different from the Čierny Váh group as we know it from the northern slopes of the eastern part of the Low Tatra. The tectonic position of the Bebrava group in the Veľká Fatra mts. (although not clear everywhere) appears to be also at least partly tectonically higher in units built up of the Čierny Váh group. In the basal part of the Choč nappe in the area of Harmanec—Tajov slices of dark-coloured limestones, in places also with cherts (Reifling limestones) occur. In such a case the Bebrava group would build up the main unit of the Choč nappe in the Veľká Fatra—Šturec unit.

It is also interesting that above a thick complex of Triassic dolomites also blocks of the Strážov nappe occur in the Veľká Fatra (M. Peržel, 1967). It is built up of grey to dark-grey Lower Anisian limestones with *Meandrospira dinarica* Kochansky Devide — Pantić, *Diplopora hexaster* (Pia) Pia, *Physoporella discita* (Gümb.). — Pia, *Ph. praealpina* Pia, *Oligoporella pilosa* Pia var. *pilosa)*, which gradually pass into light-coloured limestones in upper

layers with Ladinian diplopores (*Diplopora annulata* (S c h a f h.) S c h a f h. var. *annulata* P i a. *D. annulata* (S c h a f h.) S c h a f h. var *debilis* P i a, *D. annulata* (S c h a f h.) S c h a f h. var *dolomitica* P i a, *Teutloporella herculea* (S t o p p.) P i a. The limestone masses of the Strážov nappe form a recumbent fold, known as the Tlstá fold.

In the western part of the Chočské pohorie mts. lateral transitions of the Reifling limestones into light-coloured limestones are evident (e. g. on the mount Mních). More often the Biely Váh group (with light-coloured limestones overlying the Reifling limestones), its Ludrová type, passes into a group with predominating dolomites, which build up the bulk of the mountain group of Choč. Amidst Middle Triassic dolomites light-coloured limestones, in places also Reifling limestones are found; the Lunz beds are hardly several metres thick. In this area, equally as in the Malá Fatra, assignment of the Choč nappe to one or another group is problematic; mixed types occur here. It is, however, apparent that in the transversal zone represented by the Malá and Veľká Fatra but also Žiar mts. and the easternmost part of the Strážovská hornatina mts. is no typical Biely Váh group and in dolomite types of groups it is not always easy to distinguish the Čierny Váh group from the Bebrava group, also because they pass into each other.

The Choč nappe is of particular position in the Strážovská hornatina mts., not only because of its extent but mainly for facial and structural variety. This permits to solve relations for individual lithostratigraphic units to one another and to rectonic units. Moreover, in the Strážovská hornatina mts. the presence of more extensive masses of the Strážov nappe makes possible to solve also relations of higher nappes than the Krížna nappe.

In the Strážovská hornatina mts. the Choč nappe is most completely represented. It is built up of: the Melaphyre group, Čierny Váh, Biely Váh, Bebrava groups and thicker younger members Rhaetian to Lower Cretaceous (Fig. 3). In the Strážovská hornatina the Melaphyre group, known only from the southernmost part of the mountain range, represents the northernmost slices (already without the Carboniferous and in the northernmost parts with Lower Triassic members only) of an extensive zone, which underlies the neovolcanics of the Vtáčnik mts. and displays a complicated structure with the presence of thicker Carboniferous in the northeastern part of the Tribeč.

Slices of Triassic limestones and dolomites, which accompany the Melaphyre group, most probably belong to the Čierny Váh group. A thicker Čierny Váh group occurs as basal structure at the eastern slope of Rokoš at the southern margin of this mountain group, underlying the Biely Váh group.

Anisian dark limestones at the base of unit are partly highly dolomitized. Dolomites, mainly Middle Triassic, are darker (Ramsau type). The Lunz beds are found as thin irregular intercalations only. In the lower part of Upper Triassic dolomites are layers of highly dolomitized limestones.

Thicker complexes of the Čierny Váh group build up the Choč nappe in the northwestern part of the Strážovská hornatina mts., mainly in the frontal part of nappe. Just here are especially characteristic Upper Triassic dolomites, partly marly, banked to platy, with intercalations of variegated clay shales; their occurrences from Košecké Rovné and Košecké Podhradie were known already earlier (M. M a h e l, 1948).

In no other mountain range so thick complete bed sequences of younger

members are wide spread from Rhaetian limestones to the shaly Hauterivian sequence. All known occurrences of members younger than Norian in the Choč nappe of the Strážovská hornatina mts. are linked with the Čierny Váh group. This is also valid for its occurrence in the southern part of the mountain range at the southeastern foothill of Rokoše near Diviaky (Fig. 4).

The bulk of the Čierny Váh group in the northern part of the Strážovská

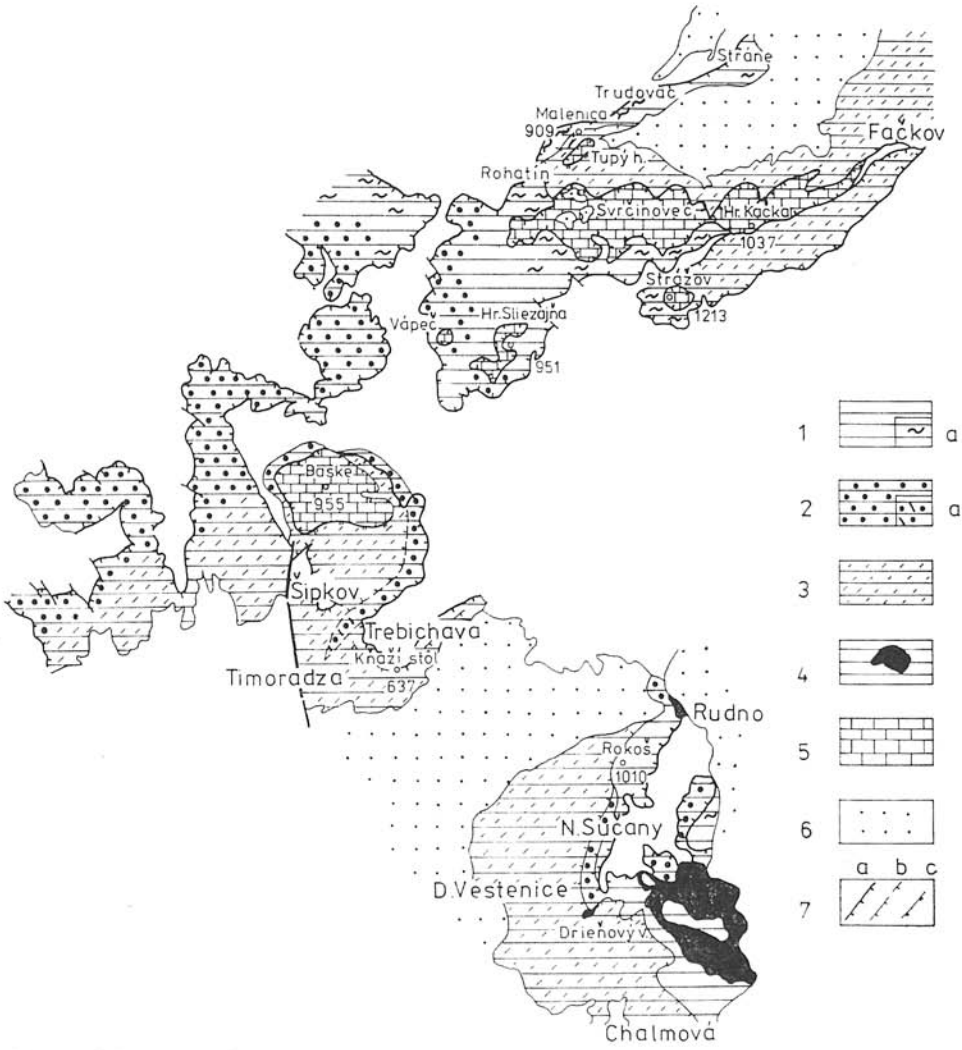


Fig. 3. Scheme of distribution of groups of the Choč nappe in the Strážovské vrchy mts. (M. M a h e ľ, 1978)

1—4. Choč nappe: 1. Čierny Váh group, a) younger members (Rhaetian — Neocomian); 2. Biely Váh group, a) Ludrová development; 3. Bebrava group; 4. Melaphyre group; 5. Strážov nappe; 6. Paleogene; 7. overthrust line, a) nappe of higher order, b) nappe of second order, c) upthrust.

hornatina mts. in the area of its largest extension displays a simple nappe structure in normal sequence of members from dark Anisian limestones at the base. In the marginal frontal part, however, the nappe forms a recumbent fold with core built up of thick dolomites and younger members at the limbs. The younger members of the Rhaetian-Neocomian in the upper (normal) limb are refolded, with digitations, partly imbricate (Fig. 9). In the overturned limb of the nappe the base is represented by the Neocomian, which often lies directly on the Neocomian of the underlying Krížna nappe. In the more northern marginal part of the Choč nappe at the northern slopes of Malenica only younger members of the overturned limb are preserved from the Čierny Váh group, underlying the Triassic masses of the Bebrava group. Until lately the structure of the frontal part of the nappe, mainly in the mountain group of Rohatín and Malenica, was interpreted as two digitations of equal development of the Choč nappe: digitations of Rohatá skala and Malenica (D. Andrusov, 1968). After proving the Anisian age of limestones (on the basis of foraminifers — J. Hanáček, 1976), considered as Rhaetian first, it turned out that the digitation of Malenica is a higher subordinate unit built up of the Bebrava group in the sense of M. Maheľ, also considered as the Strážov nappe (J. Hanáček, 1975).

The studied northwestern part of the Strážovská hornatina mts., with preserved frontal part of the Choč nappe, provides a clear example of lateral transition of the dolomite strip of the Bebrava group of the stretch Rohatín—Malenica to dolomites of the Čierny Váh group, forming the mountain group of Trudovac — Strana (lying north of the Domanižská kotlina depression) (Fig. 3).

In some profiles, e. g. in the profile of Biely potok, not only the Čierny Váh group but the whole Choč nappe in its frontal part is reduced to the youngest members, which form slices between the underlying Krížna and overlying Strážov nappe.

The Biely Váh group occurs to a limited extend in the southern part of the Strážovská hornatina mts., mainly at the southern margin of the Rokoše group, overlying the Čierny Váh group. It is characterized by Reifling limestones in their typical development; platy dark, partly nodular limestones, very overgrown with cherts, in places accompanied by thin intercalations of black clay shales. They, however, display sudden and frequent lateral transitions to coarse-banked to massive limestones with only rare cherty nodules and without them. The Reifling limestones most often pass directly from the underlying dark-grey Lower Anisian limestones. In places they are separated from them by up to tens metres thick dolomites.

Extensive areas are built up of the Biely Váh group in the northwestern part of the Strážovská hornatina mts. The Reifling limestones in places accompany relatively thick (more than hundred metres) Lunz beds. In their lower layers, at transition to the Reifling limestones, are in places (Šipkov, Ilavka, Sopkov kameň) thicker marly shales with layers of organogenic limestones with *Halobia rugosa* (Guemb.) and *Cruratula damesi* Bittn. Another much wide spread member in the Strážovská hornatina mts. are Cardita beds; 10—20 m thick layers of platy, slightly marly, also dolomitic and lumachelle limestones distributed in lower layers of Upper Triassic dolomites. They are characterized by the presence of such fossils as *Schafhaeutlia mellingi* (Hauer), *Lopha montiscaprilis* (Klips.), *Newagia obliqua* (Münst.).

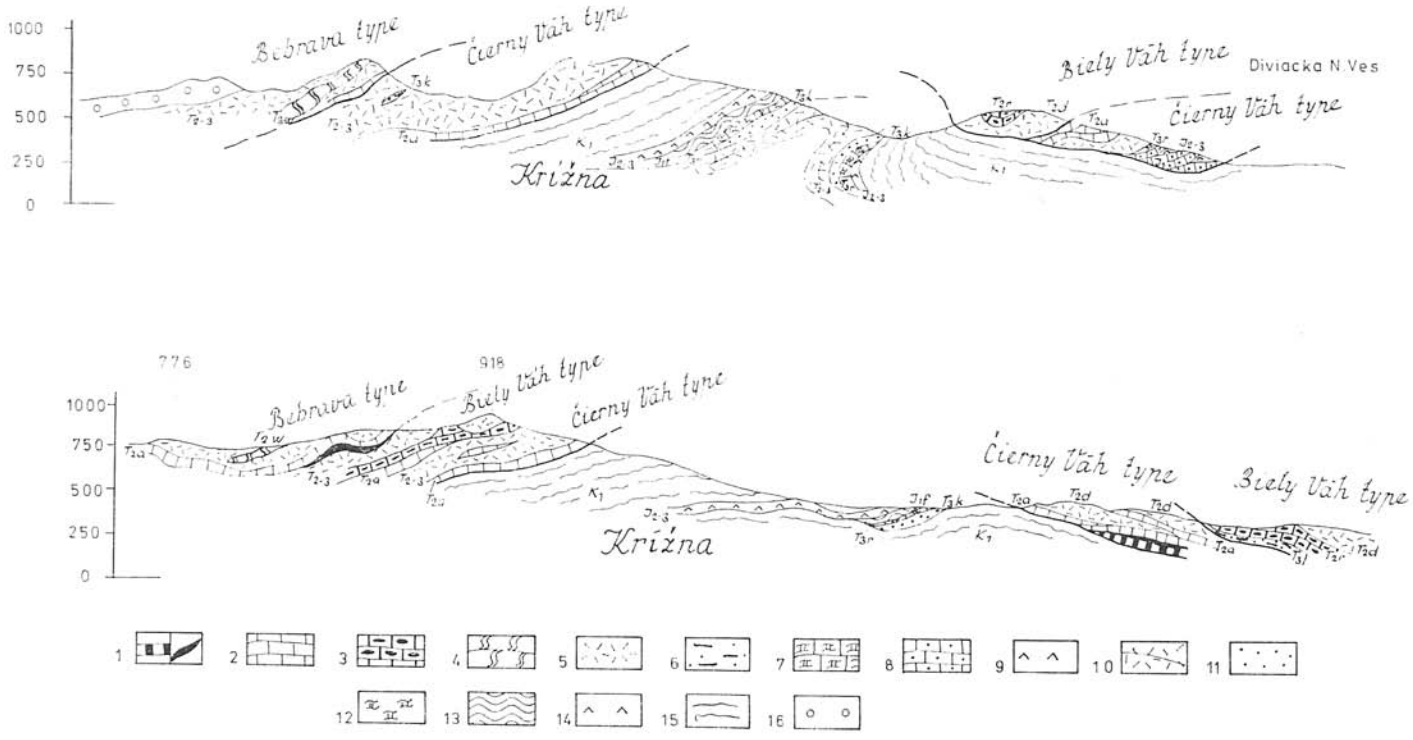


Fig. 4. Geological profiles in the southern part of the Rokoš hills (Strážovské vrchy mts.).

1—9. Choč-nappe: 1. sandstones (Lower Triassic), a) Werfenbeds; 2. Gutenstein limestones (Anisian); 3. Reifling limestones (Illyrian and Ladinian); 4. light-coloured limestones (Illyrian--Ladinian); 5. dolomites; 6. Lunz beds (Lower Carnian); 7. organogenic Rhaetian limestones; 8. crinoidal limestones (Lias sic); 9. cherty limestones (Dogger); 10—16. Krížna nappe; 10. dolomites (Middle-Upper Triassic); 11. Carpathian Keuper; 12. Rhaetian; 13. Fleckenmergel (Upper Liassic); 14. radiolarites (Dogger-Malm); 15. marly limestones (Neocomian); 16. Paleogene.)

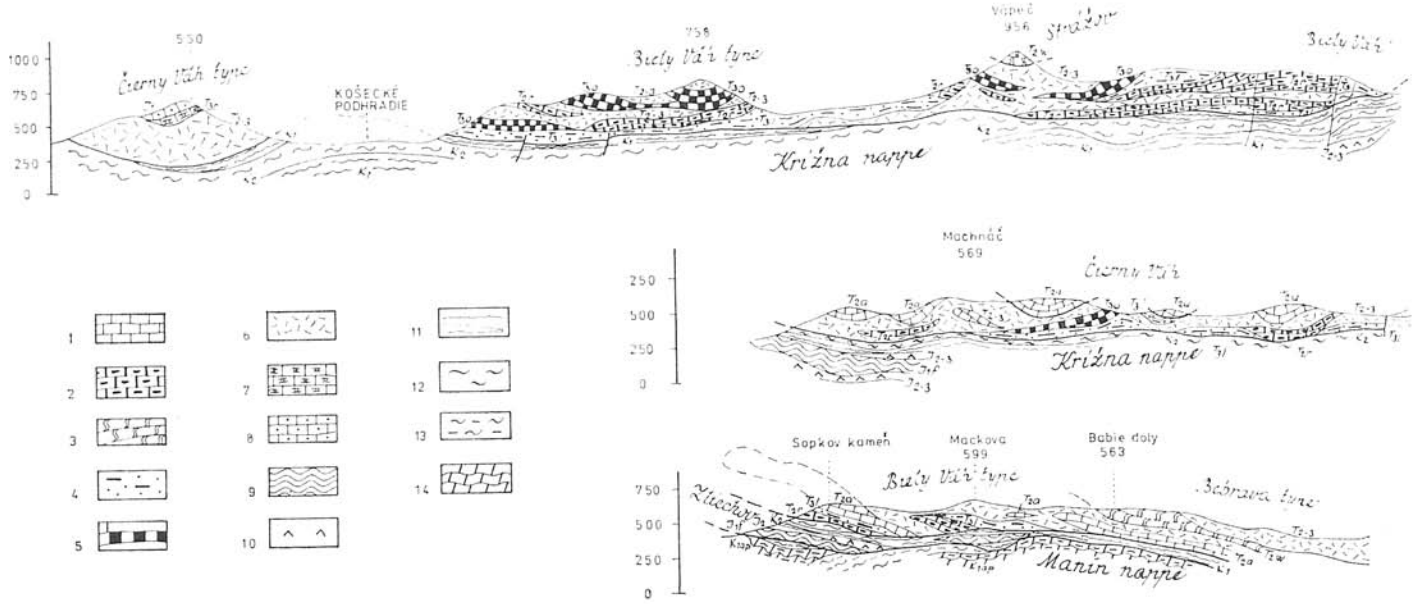


Fig. 5. Geological profiles trough the Choč nappe of the central and western part of the Strážovské vrchy mts. (M. M a h e ľ, 1978)

1–8. Choč and Strážov nappes: 1. Gutenstein limestones (Ani-sian); 2. Reifling limestones (Illyrian — Ladinian); 3. light-coloured limestones (Ladinian); 4. Lunz beds (Lower Carnian);; 5. Cardita beds (Upper Carnian); 6. dolomites (Middle — Upper Triassic); 7. organogenic limestones Rhaetian); 8. crinoidal lim estones (Liassic); 9.–12. Krížna nappe: 9. Fleckenmergel (Liassic); 10. radiolarites (Dogger — Malm); 11. marls and marly limest ones (Neocomian); 12. marls and sandstone layers (Albian — Cenomania); 13.–14. Manín nappe: 13. marly shales and marls (Cenomanian); 14. organodetrital limestones (Barremian — Aptian).

In areas built up of the Biely Váh group tectonic structure of the Choč nappe is characterized by complexity with frequent folds of metre to hundred metres dimensions, mainly in platy cherty Reifling limestones. The reverse bed sequences and recurrence of individual members of the Biely Váh group, especially clear in the profile Vápeč–Malá Slezajna (Fig. 5a), also at the western slope of Klepáč and at the western margin of the Strážovská hornatina mts. in the profile Sopkov kameň – Macková show, that recumbent folds of not great thickness are up to tens of km large. Most often sliced overturned limbs of folds have preserved. Only in the southern part of the Strážovská hornatina mts., on the southern slopes of the Rokoše group, thus in the rear part of the nappe, in the zone close to the area of the Melaphyre group strip, the Biely Váh group forms a higher slice, a higher subordinate unit of the Choč nappe. In the major part of its extension in the southwestern part of the mountain range the Biely Váh group represents the basal structure. Very often the Lunz beds as member of overturned limb of recumbent fold are lying directly on the Neocomian or Albian-Cenomanian sequence of the underlying Krížna nappe.

In a few places lateral replacement of the Čierny Váh and Biely Váh groups is so clear as in the middle part of the Strážovská hornatina mts. It is very clear in the area of the villages Košecké Podhradie–Košecké Rovné–Kopec–Horná Poruba where lateral transitions of both groups are observed. Whereas the hills Norovica–Pancier, the northern and eastern slopes of Malá and Hrubá Slezajna, are built up of the Čierny Váh group with thick dolomite masses, at the eastern slope of the Suchá Hora, Vápeč and at the Starý Háj Reifling limestones and Lunz beds occur in the lower part of dolomites and in their underlier. In this area lateral transition of the Čierny Váh group into the Biely Váh group is evident from north to south and east to west (Fig. 6).

In its extent and thickness at least equivalent to the Čierny Váh and Biely Váh group is another group of the Choč nappe – Bebrava group in the Strážovská hornatina mts. It forms the essential parts of the mountain group of Rokoš and Drieňovo but also of the southern and northern parts of the Zliechovské vrchy mts. This area I consider as an example for solution of its relations to the Čierny Váh, Biely Váh, groups also to the Strážov nappe. Therefore I chose for the group with thick Wetterstein dolomites accompanied by layers of light-coloured organogenic limestones a name from the Strážovská hornatina mts, and called it Bebrava group according to the name of the brook, on the slopes of which its sequence is particularly characteristic (M. Maheľ, 1973, 1974).

The lowermost known member of the Bebrava group is seldom preserved, only a few metres thick variegated quartz sandstones and shales, higher up marly shales with layers of marly limestones and marly dolomites with Campilian fauna with *Tirolites cassianus* Quenst. (known from Timoradza and Šipkov; M. Maheľ 1946), also from the Chalmovská dolina valley and the southern slopes of Rokoše. The base of the group is usually represented by dark-grey to grey (Annaberg) limestones, in places with transition to grey limestones in higher layers (with *Physoporella dissita* (Gümb.) Pia and *Ph. praealpina* (Pia). The fundamental member of the group are thick light-coloured dolomites, often with diplopores (*Diplopora annulata* Schafh.). The dolomites, predominantly light-coloured to white, are grained, with phantoms of organic bioclasts (M. Krivý, 1975), often highly brecciated to powdery, only locally stromatolitic with evinosponge structures. Irregular bodies of light-coloured

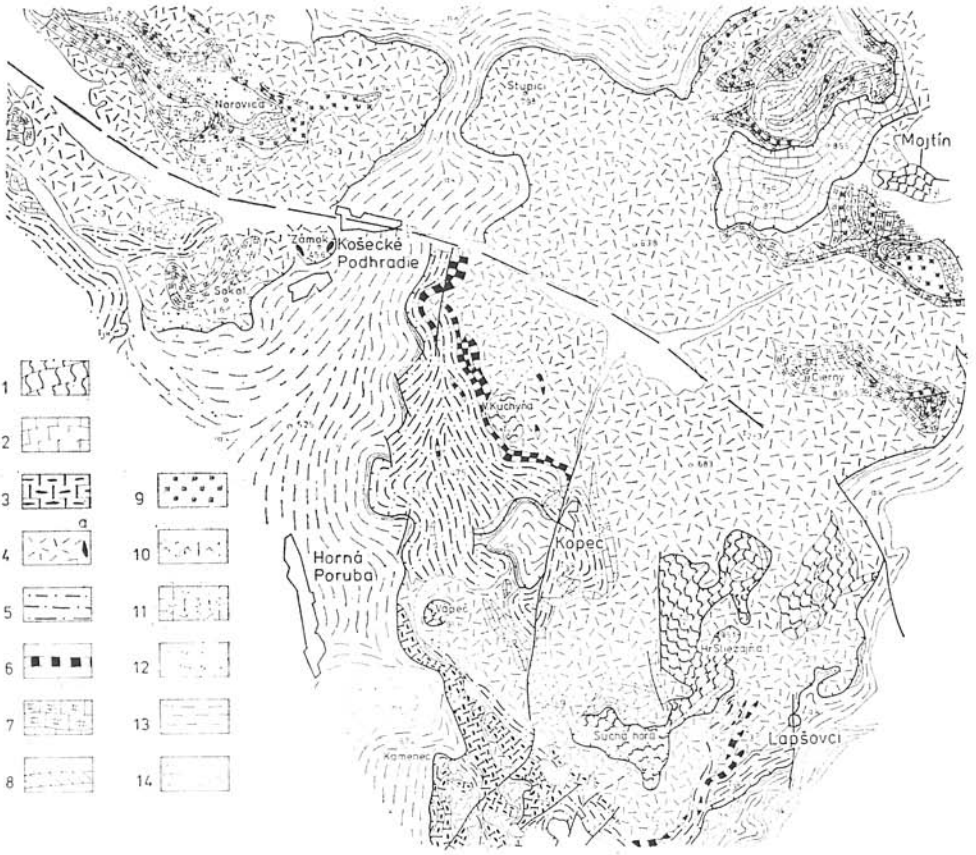


Fig. 6. Geological map of the Košecké Podhradie — Horná Poruba area, showing lateral transition of the Čierny Váh to the Biely Váh group (M. M a h e ľ, 1978).

1—12. Choč-nappe: 1. grey limestones (Middle Triassic) of the Strážov nappe: 2. Gutenstein limestones (Anisian): 3. Reifling limestones (Upper Anisian and Ladinian): 4. dolomites (Middle and Upper Triassic), a) intercalations of Keuper variegated shales: 5. Lunz beds (Carnian); 6. "Cardita" beds; 7. organogenic limestones (Rhaetian); 8. organogenic limestones Hettangian); 9. crinoidal limestones (Sinemurian to Bathonian): 10. cherty limestones (Upper Dogger): 11. red, partly nodular limestones (Malm): 12. marly limestones (Tithonian—Lower Neocomian): 13—14. Krížna nappe: 13. marlstones with intercalations of sandstones (Albian); 14. marly limestones, marls (Neocomian).

limestones, often algal, amidst the Wetterstein dolomites, are in places particularly abundant and extensive (Šipkov, Slatina). They are prevailingly biosparites with a variable content of dasycladaceans and organoclasts; only to a lesser extent biomicrites to biopelmicrites. The algae in them confirm a prevailingly Ladinian age of these limestones and of the bulk of surrounding dolomites: *Diplopora annulata* (S c h a f h.), *D. annulata* (S c h a f t.), *v. annulata* P i a, *D. annulata (S c h a f h)*, var *dolomitica* P i a, *D. annulatissima* P i a, *Teutloporella herculea* (S t o p p.); partly Lower Carnian with *Andrusoporella*

duplicata (P i a) B y s t r i c k ý[1]. The Upper Triassic is also built up of light-coloured dolomites, separated from Ladinian dolomites by thin lenticles of the Lunz beds only. In the Carnian also more continuous layers of the Cardita beds are more frequent, of the same type and with equal type of fauna as in the Biely Váh unit, more often near Krásna Ves.

Near Šipkov and Trebichava the Bebrava group with more frequent layers of light-coloured organogenic limestones is facially closer to the Biely Váh group also with layers of Reifling limestones in the uppermost part of thicker dark Anisian limestones. The bed sequence of this development is as follows: – dark Anisian limestones; in upper layers in places with cherts-Reifling type:-light-coloured dolomites-discontinuous layers of light-coloured organogenic limestones amidst the Wetterstein dolomites-Upper Triassic thin lenticles of the Lunz beds, Upper Triassic dolomites with intercalations of Cardita beds in the lower part.

Distribution of members of the Bebrava group shows that also in an essentially simple structure it forms larger recumbent folds at least in some areas (profile north of Šipkov) (Fig. 7). Its essential part represents the fundamental structure of the Choč nappe in the southern part of the Strážovská hornatina mts. In many cases Lower Anisian limestones are resting directly on the Neocomian of the Krížna nappe. In several places, however, in its underlier are thin, small slices of the Biely Váh group or also of the Čierny Váh group.

The Bebrava group evidently builds up higher tectonic units than the Čierny Váh and also Biely Váh groups.

Genetic and structural linking of the Bebrava unit with the group of Choč nappe units is indicated not only by facial relation to the Biely Váh but also to the Čierny Váh groups. East of Strážov and in the area of Čičmany the Čierny Váh group displays transition to the Bebrava group. Anisian dark-grey limestones have lighter – coloured layers and more organogenic. Amidst dolomites light -coloured limestones with algae *Teutloporella herculea* (S t o p p.) P i a, *Andrusoporella duplicata* (Pi a) P i a (occur) (J. H a n á č e k, 1976). Dolomites proper in the Fačkov area are highly organogenic; of Wetterstein type. Such a lateral transition of the Čierny Váh and Bebrava group is not rare; we encountered it already in the frontal part of the nappe also in the eastern part of the Strážovská hornatina mts., thus in an area where the Biely Váh group does not occur-it also concerns the adjacent Žiar mts.

The presence of light-coloured Middle Triassic limestones in the Bebrava group, however, leads to the opinion to assign its masses to the Strážov nappe (J. H a n á č e k, 1976).

It is not excluded that also the Strážov nappe has in places dolomites predominating in the Middle Triassic and so it is closer to the Bebrava group in its content. It would not be peculiar, the so called Lešnica dolomite development is known in the North Gemeride unit close to the Strážov nappe in its lithological-stratigraphic character. Lateral transitions of the Bebrava to the Čierny Váh and Biely Váh groups and its structural position in underlier of the Strážov nappe lead us to its assignment to the Choč nappe, to which its bulk has been ranged so far. Indubitably, however, the Bebrava group is indicator of origin in neighbourhood of the sedimentation area of the Strážov group, equally as its ana-

[1] Algae determined by Dr. Ján B y s t r i c k ý, DrSc.

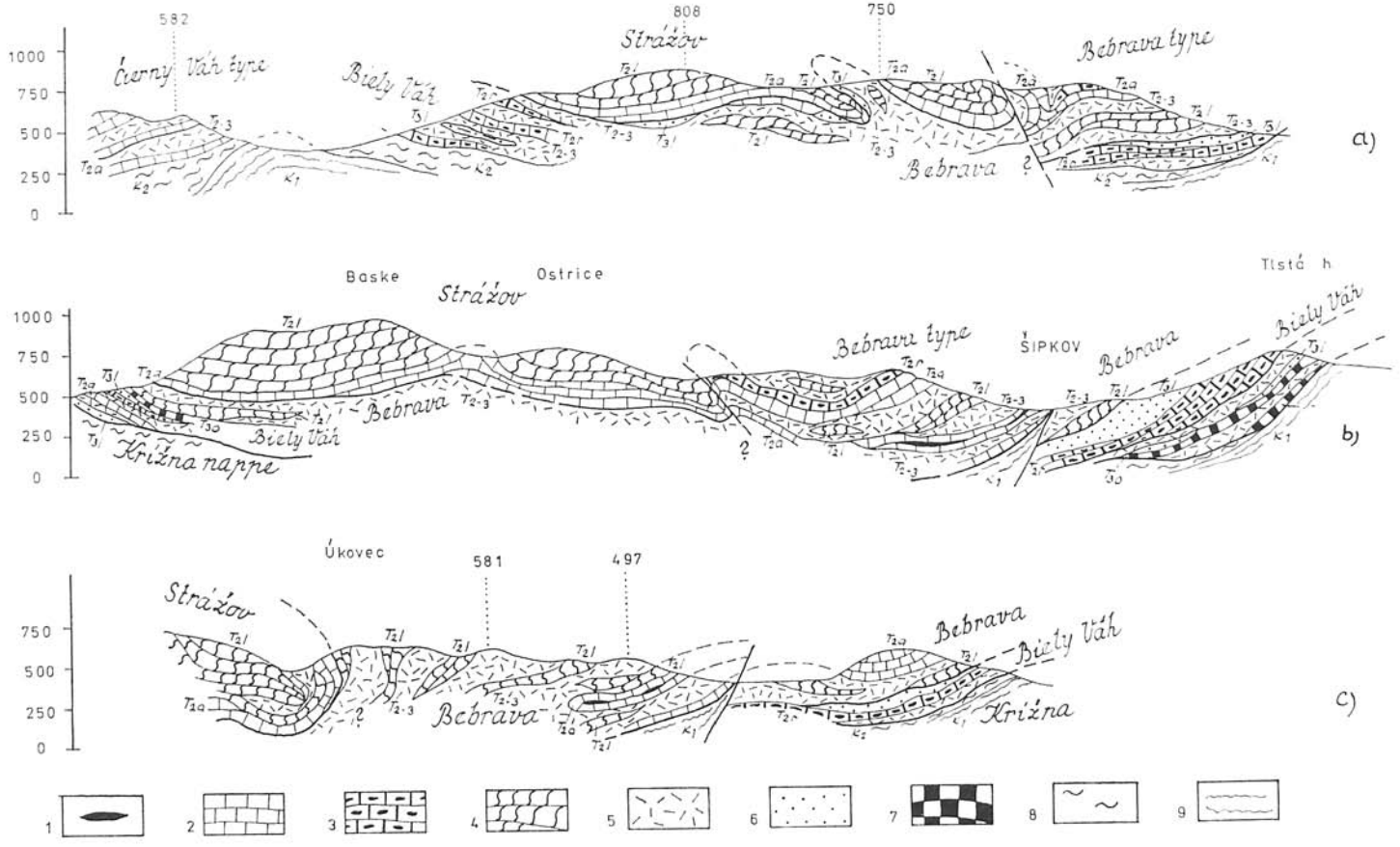
logue the Vernár group adjacent to the North Gemeride group (Fig. 8). The Bebrava and Vernár groups connect the more northern groups of the Choč nappe (Čierny Váh and Biely Váh groups withouth light-coloured limestones with the more southern Strážov and North Gemeride units characterized by thick Steinalm and Wetterstein limestones).

In the Strážovská hornatina mts. the Strážov nappe has its classical area. Here it was distinguished first by D. Andrusov (1936) as a higher nappe than the Choč nappe, characteristic of which are light-coloured Middle Triassic limestones. After distinguishing the Bebrava group and its assignment to the group of Choč nappe the extent of the Strážov nappe is narrower and the criteria for its distinguishment are modified, however, the essential characteristics remain. In the Strážovská hornatina mts. a higher tectonic unit than the formerly desribed subordinate units of the Choč nappe—Strážov nappe, has its characteristic members, thick masses of light-coloured Middle Triassic limestones as the main structure element.

The stratigraphic sequence of the Strážov nappe is as follows: The lowermost member are Lower to Middle Anisian grey limestones, micritic to microsparitic, with little representation of foraminifers *(Meandrospira dinarica)* and crinoid stems. In upper layers are often more continuous, several metres thick layers of nodular cherty limestones, often manycoloured, in places with intercalations of variegated shales-Schreyeralm limestones- thus a more southern facies. These limestones are particularly variegated and wide spread in the northern part of the mountains, pinkish, brown and red, massive and banked, nodular and pseudonodular, cherty; with irregularly distributed cherty nodules. Amidst limestone banks and plates are in places partings and thin intercalations of claystones. Layers of crinoidal limestones are also found. In some profiles they pass into grey to dark-grey nodular cherty limestones of Reifling type (M. Kriv ý, 1975). The fauna of brachiopods: *Tetractinella trigonella* (Schloth.), foraminifers *Citedella dinarica* (Kochanovská, Devidé-Pantić) and *Glomospira densa* (Pantić) most often points to a Middle to Upper Anisian age. Holothurian sclerites and conodonts point to a Lower Ladinian age of the upper parts of limestones (H. Kozur — R. Mock, 1974). The Schreyeralm limestones with irregular distribution and in the northern part of the Strážovská hornatina mts. laterally replace obviously also the lower layers of the Wetterstein limestones (M. Kriv ý, 1975).

Light-coloured Wetterstein limestones occur most often in coral sponge subfacies as pelmicritic or microsparites to biosparites with a wide scale of dolomitization. Limestones of algal subfacies, biosparites with variable content of dasycladaceans form only smaller lenticles, most often accompanied by dolomites. The fauna found indicates a Ladinian age of limestones-*Diplopora annulata* (Schafh.), *Teutloporella herculea* Stopp. The upper layers of limestones in places reach to the Carnian — *Diplospirella wissmani* Bittn., *Pomarangina heydeni* Diener, *Cornicardia hornigi* (Bittn.), *Andrusoporella duplicata* (Pia) Bystrický.

The Strážov nappe represents a particular structure element, which most often overlaps the Bebrava unit (southern slopes of Žihlavník, Hrubá Kačka — Sadočný vrch; in the northwestern part of the Strážovská hornatina mts.), also the Biely Váh group (northwestern slopes of Žihlavník, Vapeč). It often compensates the tectonically reduced Choč nappe. The Strážov nappe displays intense


582
808
750
1000
750
500
250
0
Černý Váh type
Biely Váh
Strážov
Bebrava type
Bebrava
a)
Baske
Ostrice
Strážov
Tlstá h
Bebrava type
ŠIPKOV
Bebrava
Biely Váh
Križna nappe
b)
Úkovec
581
497
Strážov
Bebrava
Biely Váh
Križna
c)
1
2
3
4
5
6
7
8
9

refolding in the northwestern part of the mountain range. Its blocks are folded in dolomites of the underlying Bebrava group of the Choč nappe. (Fig. 9).

South of the Strážovská hornatina mts., in the Považský Inovec, neither the Biely Váh nor the Čierny Váh group is evident more distinctly. The Reifling limestones are, however, known, from the eastern part of the mountain from Závada, accompanied by thin Lunz beds. The bulk of the mass of the Choč nappe in the middle part of the Inovec mts. is built up of masses of light-coloured dolomites, Ladinian and Upper Triassic. Characteristic of the former are organogenic layers with *Diplopora annulata* (S c h a f h.) var. *septentrionalis* P i a and *Aviculla bacillum* P i a-Wetterstein dolomites and layers of Wetterstein limestones with *Diplopora annulata* (S c h a f h.) var. *annulata* S c h a f h. (M. M a h e ľ, 1967). The dolomites are underlain by darkgrey, lighter-coloured in higher parts, Anisian limestones (with *Physoporella dissita* (G ü m b.) P i a, *Ph. pauciforata* (G ü m b.) S t e i n m. var. *undata* P i a, *Ph. praealpina* P i a). It is obviously the Bebrava group. Its Anisian limestones are directly resting on the youngest members of the Krížna nappe at the northern margin of the Choč nappe; in some sections the Bebrava group obviously represents the whole Choč nappe. In the southern part of the nappe limestones with cherts and intercalations of Werfen beds amidst Anisian limestones are found. At the base of nappe obviously thinner slices of lower Choč units occur.

In the Malé Karpaty nappes higher than the Krížna nappe take up large areas. They are, however, characterized by some particularities. The thick, partly sliced Melaphyre group is not accompanied by more distinct Čierny Váh group if thin slices of accompanying cellular dolomites or dark-coloured limestones are not assigned to it. The Biely Váh unit should be represented by dark Vápenica limestones with underlying Lower Anisian dolomites and thick Reifling limestones, in places with thicker layers of marly shales and marlstones (nowhere so thick in the West Carpathians). The overlying complex with thick light-coloured Ladinian so called Veterník (limestones), in underlier with darker limestones, resembles the higher, Strážov nappe, as considered by several authors (D. A n d r u s o v, 1968, D. A n d r u s o v — J. B y s t r i c k ý — O. F u s á n, 1973). We applied such an interpretation in the new geological map of the Malé Karpaty (M. M a h e ľ, 1972) and in the paper by J. B y s t r i c k ý — M. M a h e ľ (1970). The stratigraphic evidence, however, of the appurtenance of both complexes to different tectonic units does not seem to me convincing nowadays, mainly after several unsuccessful attempts of more precise stratigraphic assignment of the Reifling limestones and their overlier. The only evidence of the Ladinian age of the upper part of the Reifling limestones by the fossil Posidonia wengensis, which is so difficult to determine more precisely,

Fig. 7. Profiles showing position of the Bebrava group in the central part of the Strážovskáé vrchy mts. (M. M a h e ľ, 1978).
1—7. Strážov and Choč nappes: 1. Werfen beds (Lower Triassic); 2. dark-coloured limestones (Anisian); 3. limestones with chert ndules, Reifling limestones (Upper Anisian — Ladinian); 4. light-coloured limestones (Ladinian — Lower Carnian, in places also uppermost Anisian); 5. dolomites (Middle — Upper Triassic); 6. Lunz beds (Lower Carnian); 7. Cardita beds (Upper Carnian); 8—9. Krížna nappe: 8. marls and sandstones (Albian); 9. marly limestones and marls (Neocomian).

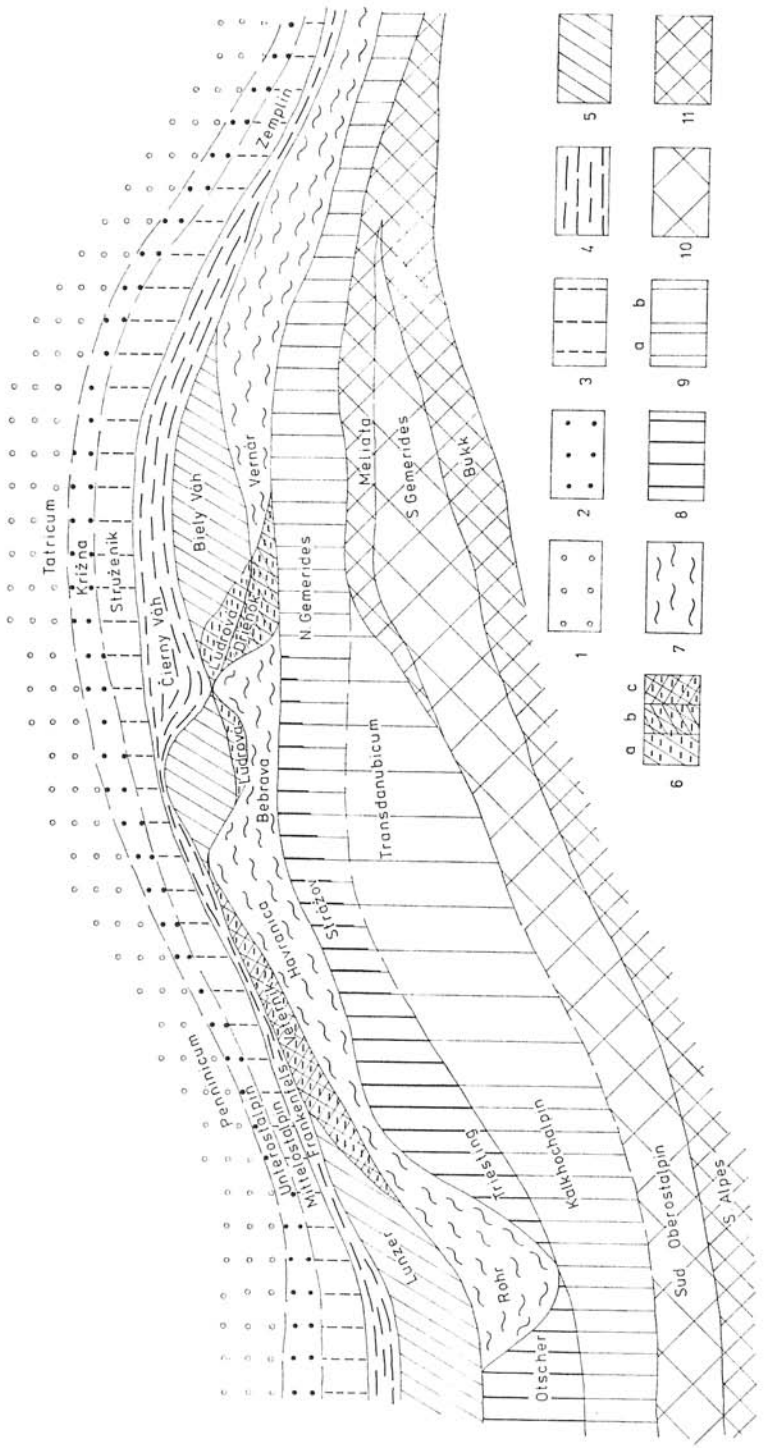
is hardly sufficient. On the contrary, in the overlying limestones the Anisian age has nowhere been proved. Under such circumstances the older alternative of a uniform Veterník group (M. M a h e ľ, 1962, 1967), with a profile quite similar to the Ludrová development of the Biely Váh unit but with thicker Reifling and Wetterstein limestones, cannot be excluded. Such an opinion is also justified by knowledge from the substratum of Neogene filling of the Vienna basin in Austria, in immediate neighbourhood of the Malé Karpaty. Here the Lunz, Sulzbach and Reisbach nappes built up the Schwarzenberk subfacies of the Lunz facies with thicker light-coloured limestones (A. T o l l m a n, 1976). Considerations about the Veterník unit with thick Upper Anisian Reifling and thick light-coloured Wetterstein Ladinian limestones are justified as also results from parallelization of the tectonically higher unit in the Malé Karpaty, mts., the Havranica unit with the Bebrava unit. The Havranica unit has thicker light-coloured limestones of Upper Anisian, partly Lower Ladinian age; however, these are laterally replaced by Wetterstein dolomites, which are the essential component of this unit. Characteristic of its Upper Triassic are thin Cardita beds amidst a thick mass of dolomites, a member we encounter in the Biely Váh and Bebrava groups in the West Carpathians. This is also valid for limestone-dolomite masses in the Jablonické pohorie mts. Only the Nedzov unit with thick Upper Anisian to Lower Carnian light-coloured limestones has all features of the Strážov nappe.

The occurrence of Dachstein limestones in the Havranica and Veterník units is for some authors an evidence of their appurtenance to higher nappes. In this regard I remind the occurrence of this facies in the Biely Váh group of the Low Tatra but also proximity of the Northern Calcareous Alps where the Dachstein limestones are not rare also for the Lower Oberostalpin nappes.

A particularity of higher nappes than the Krížna nappe in the Malé Karpaty mts. is the higher share of light-coloured Upper Anisian and Lower Ladinian limestones, their more continuous position in overlier of lower darker limestones. Thus they are developments in the frame of the West Carpathians, particularly the Veterník and Havranica ones, the former in the Biely Váh, the latter in the Bebrava unit. Another particularity of the Malé Karpaty is linking of younger members (Jurassic) also with higher subordinate units, again an indication of resemblance to the Alps; in other mountain ranges of the West Carpathians these members are part of the Čierny Váh unit only.

Fig. 8. Paleogeographical scheme of the Middle and Upper Triassic of the West Carpathian geosyncline (M. M a h e ľ, 1978).

1–3. stable shelf: 1. with Carpathian Keuper, prevailingly detrital; 2. with thick Carpathian Keuper (more abundant dolomite layers); 3. without thicker Keuper; 4–10. mobile shelf; 4. marginal part with prevailing Ramsau dolomites and Hauptdolomit; 5. deep-water depression with thicker Reifling limestones and Lunz beds; 6. deep-water depression with Reifling limestones, a) with Ramming limestones, b) with Steinalm and Wetterstein limestones and Wetterstein dolomites, c) with Steinalm and Wetterstein limestones; 7. shallow-water part with prevailing Hauptdolomit, only little share of Wetterstein limestones; 8. with prevailing organogenic limestones in the Middle Triassic; 9. with prevailing organogenic limestones in the Middle and Upper Triassic, a) greater facial diversity, b) more stable facies, larger thicknesses; 10. intraoceanic ridge; 11. trough with ophiolitoids.


Tatricum
Križna
Strúžanik
Čierny Váh
Biely Váh
Vernár
Zemplín
Ludrová
Ondrašová
Bebrava
N Gemerides
Meliata
S Gemerides
Bukk
Transdanubicum
Stratzol
Havranica
Fatricum
Mittelostalpin
Unterostalpin
penninicum
Lunzer
Rohr
Otscher
Triesling
Kalkhochalpin
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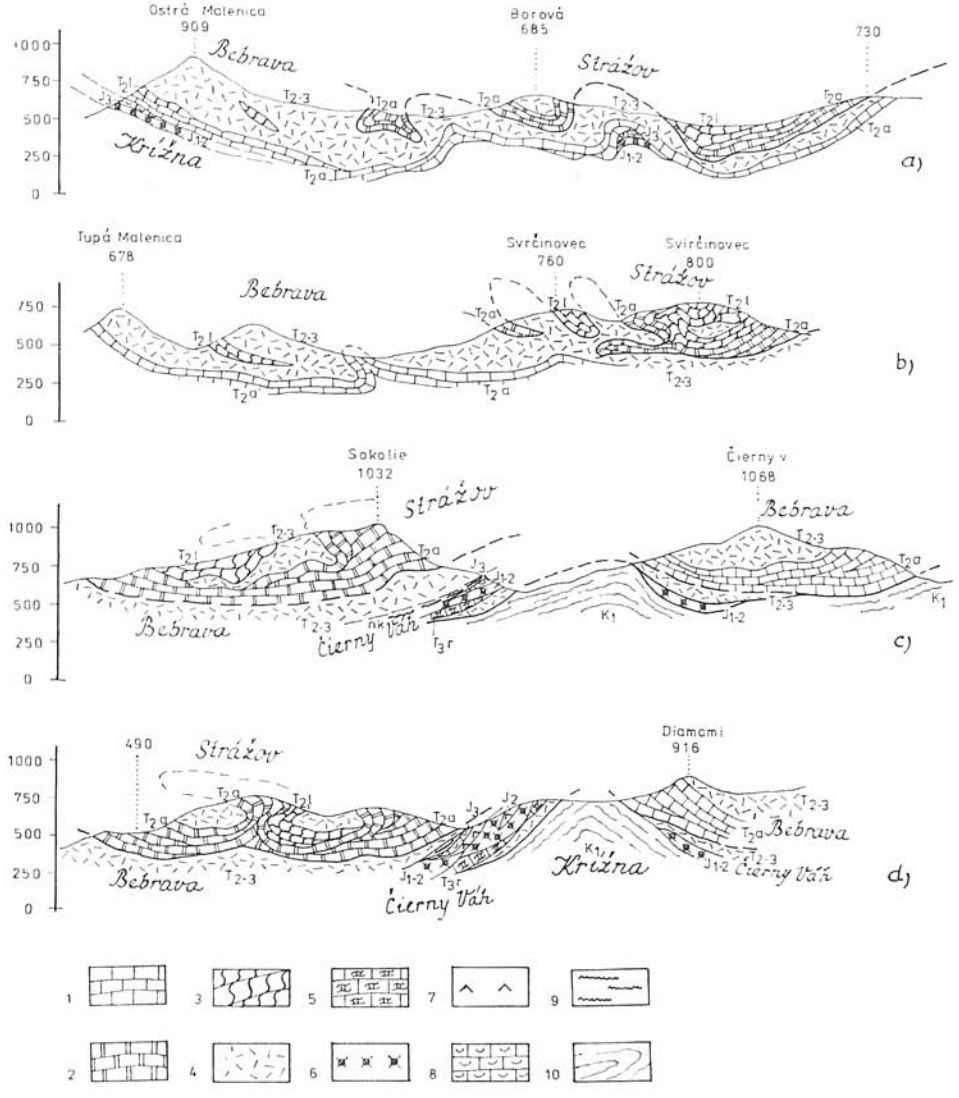

Fig. 9. Geological profiles showing position of the Bebrava group of the Choč nappe and its refolding with the Strážov nappe in NW part of the Strážovské vrchy mts. (M. M a h e ľ, 1978).

1—9. Strážov and Choč nappes: 1. dark-grey limestones (Anisian); 2. grey limestones, in upper layers Schreyeralm limestones; 3. light-coloured limestones, prevailingly Wetterstein limestones (Ladinian); 4. dolomites (Middle and Upper Triassic); 5. organogenic limestones (Rhaetian); 6. crinoidal limestones (Liassic — Lower Dogger); 7. cherty limestones (Dogger); 8. pink, partly nodular limestones (Malm); 9. marly limestones (Neocomian); 10. Krížna nappe: 10. marls and marly limestones (Neocomian).

After the discusion of the content and structure of nappes higher than the Krížna nappe in the West Carpathians it is suitable also to deal with the High Tatra. The higher nappes play a subordinate role in the structure here and this obviously makes their assignment to newly distinguished units in the West Carpathian difficult. The presence of the Jurassic (Koscieliska dolina valley) but also of Triassic with Upper Triassic dolomites, which have intercalations of Keuper shales (Mihulče unit), points to representation of the Čierny Váh group (M. Maheľ, 1967).

The stratigraphic succession from Farkaška and Kobylská, mentioned by Z. Kotański (1973), with dolomites in the Middle Anisian, Reifling limestones in the Upper Anisian, its Partnach beds (obviously layers of marlstones in Reifling limestones), Cardita beds — contains members typical of the Biely Váh unit. The Wetterstein dolomites with teutlopores are not rare in this unit, mainly in areas of its lateral transition to the Bebrava unit. The presence of teutloporels, ammonites and daonels is not rare in the Choč nappe. Their presence does not testify for appurtenance to the Strážov nappe or Gemerides.

At the Branisko mts. the Choč nappe builds up a prevalently thick complex of dolomites. According to intercalations of Keuper shales it may be concluded on presence of the Čierny Váh group (M. Maheľ, 1967). It forms a smaller outlier also in the Humenské pohorie mts. In the eastern part of the Inner West Carpathians the Biely Váh group is not cropping out. Its absence east of the Low Tatra may be supposed.

The Vernár group, which builds up the northern structure of the North Gemeride synclinore of the Stratenská hornatina mts., resembles the Bebrava group, mainly in its layers of the Wetterstein limestones amidst the Wetterstein dolomites (M. Maheľ 1957). A more continuous layer of light-coloured limestones, underlying thick dolomite masses in the upper part of grey Anisian limestones, in places also the presence of the Reifling limestones indicates a particular development of the Bebrava group with own type of the Permotriassic with thick porphyrites and quartz porphyries to be present. Structurally it forms a particular unit situated south of the rear part of the Choč nappe, more linked with the North Gemeride unit.

Conclusions

The analysis of the content and structure of the Choč and Strážov nappes in the West Carpathians shows some new important conclusions:

1. In the Choč nappe are at least two dolomite groups-the Čierny Váh group with Ramsau dolomites in the Middle Triassic and with Hauptdolomit containing intercalations of variegated Keuper shales. It is an analogue of the Frankenfels facies of the Eastern Alps. The Bebrava group with Wetterstein dolomites with irregular enclaves of Wetterstein limestones; it is a more southern type than the Čierny Váh and Biely Váh groups. It is an analogue of the Rohr facies of the Eastern Alps. The Vernár and Havranica units are built up of particular developments of the Bebrava group.

2. The Biely Váh group analogous to the Lunz facies of the Eastern Alps is not continuous throughout all the West Carpathians. It is situated in two areas-transversal zones: a) in central Slovakia in the zone — eastern part of the Chočské pohorie mts. — central part of the Low Tatra; b) in Western Slovakia in the western part of the Strážovská hornatina mts.

In marginal areas of these transversally running zones at transitions to the Bebrava group the characteristic members of the Biely Váh group gradually disappear. The Reifling limestones are replaced by light-coloured Raming limestones and Wetterstein dolomites and the Lunz beds attain metres thicknesses only. We call this development Ludrová development.

Close to the Ludrová development in facies is the Veterník group of the Malé Karpaty with thick Upper Anisian Reifling limestones but also with thick light-coloured Ladinian limestones; it is analogous to the Schwarzenberg subfacies of the Eastern Alps in sense of A. Tollmann, 1976.

3. The younger members, Jurassic and Lower Cretaceous, are part of the Čierny Váh group. Only in the Malé Karpaty they are also in paleogeographically more southern groups; it is Alpine influence.

4. After distinguishing the Bebrava group (with layers of Wetterstein limestones and Wetterstein dolomites present) the criteria for the Strážov nappe narrowed. The presence of light-coloured Middle Triassic limestones does not imply appurtenance to this nappe or to Gemeride units. Anyhow, the Strážov group appears as a distinct lithological-stratigraphical unit, analogous to the Triesting facies in the Eastern Alps (A. Tollman, 1975). Characteristic of it are thick light-coloured organogenic limestones in the Ladinian (partly reaching to the Lower Carnian) and the presence of Schreyeralm limestones in the Upper Anisian. A development of the Strážov group is possibly also the group of Drienok in the southern part of the Hron synclinore (J. Bystrický, 1964).

The share of light-coloured limestones, mainly Wetterstein limestones and Wetterstein dolomites increases also in the Choč nappe nearer to the Alps. So in assignment of the Malé Karpaty units it is necessary to extend the criteria by influences of the Alps. This concerns the Veterník and Havranica units in the Biele pohorie and Jablonické pohorie mts. with higher share of light-coloured limestones in the Middle Triassic. The influence of the Alps is shown in these units also in representation (although not thick) of Dachstein limestones-however, known from the Biely Váh group of the Low Tatra and mainly by the presence of Jurassic members in the Veterník and Havranica units. In other mountain ranges of the West Carpathians these members accompany the Čierny Váh unit everywhere.

5. Paleogeographical division of individual facies from north to south was as follows: the Čierny Váh, Biely Váh, Bebrava, Strážov groups analogous as in the eastern part of the Alps; Frankenfels, Lunz, Rohr, Triesting facies.

6. In some areas of the Choč nappe lateral transitions with mutual replacement or with "mixed" facies in the same structure unit are evident: of the Čierny Váh and Biely Váh groups (central part of the Strážovská hornatina mts.), of the Čierny Váh and Bebrava groups (northeastern part of the Strážovská hornatina and Malá Fatra), of the Biely Váh and Bebrava groups (western part of the Low Tatra and Chočské pohorie mts., Veľká Fatra). Characteristic of all three groups are thick Upper Triassic dolomites (mainly dolomites) with the Lunz beds at the base and with layers of Opponitz beds or Cardita beds. This testifies that the Čierny Váh, Biely Váh and Bebrava groups belong to a common unit of higher order, to the Choč nappe.

7. The Choč nappe as one unit is a polyfacial nappe. More often, most distinctly in its rear part (characterized by the presence of the Melaphyre group), the

individual groups form particular (in some places also several) slices – or subordinate nappes of local extent, most often bound to synclinores, as e.g. the Hron, Važec synclinores, etc. The Bebrava group forms the uppermost, the Čierny Váh group the lowest structure unit here. In some areas one of the groups represents the fundamental building element of the Choč nappe (e.g. the Bebrava group in the southern area of the Strážovská hornatina mts. or in the Šturec area of the Veľká Fatra).

The Strážov nappe most often lies on the Bebrava group (Veľká Fatra, northern part of the Strážovská hornatina., Nedzovské pohorie). There are, however, also areas of its position on the Biely Váh group (Vápeč and northern slopes of Žihlavník in the Strážovská hornatina mts.).

The Choč nappe appears to us at present as a complex of subordinate lithological – stratigraphical and structural units (M. M a h e ľ, 1967), it is a unit of higher order.

8. Location of the Melaphyre group in the southern rear part of the Choč nappe and more abundant younger members in the frontal part of nappe in the Strážovská hornatina mts. point to the shear character of nappe (D. A n d r u s o v, 1968). Extensive recumbent folds, in the range of more than 10 km (Strážovská hornatina mts.) and large digitations, partly sliced area of Poludnica (in the Low Tatra and in the eastern part of the Chočské pohorie mts.) in areas built up of thicker Biely Váh unit but also recumbent folds of kilometres dimensions in the Bebrava group (Strážovská hornatina mts.) testify to the important role of folded structures in building of the Choč nappe. Distribution of Middle or Upper Triassic limestone-dolomite complexes south of the Melaphyre group strip in its tectonic underlier (in the Hron synclinore, Betlanov development -slice -perhaps of the Čierny Váh group at the northern margin of the North Gemeride synclinore, slices underlying the neovolcanics) (personal communication by A. B i e l y) indicate the possibility of appurtenance to the overturned limb of fold nappe in the earlier stage of its formation.

Translated by J. Pevný.

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Review by M. MIŠÍK

Manuscript received August 9, 1978