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RED LIMESTONES – THE YOUNGEST LITHOLOGICAL UNIT OF THE CHOČ NAPPE, TATRA MTS.

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Abstract: The Upłaz and Brama Kantaka thrust sheets contain hitherto undescribed pelagic red limestones (middle Jurassic?), partly developed in filament facies. These limestones represent the youngest lithological member of the Choč Nappe, Tatra Mts. Within the Upłaz thrust sheet, the limestones form neptunic dykes which penetrate into zoogenic limestones, Lotharingian-Domerian (?) in age. The Brama Kantaka crinoid limestones, hitherto considered the youngest (Domerian-Toarcian?) member of the Choč series, were most probably formed during Lotharingian-Domerian times. These limestones pass laterally into cherty limestones, previously thought to have represented an older lithological member.

Key words: pelagic limestones, lithology, stratigraphy, Jurassic, Tatra Mts.

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INTRODUCTION

The main body of the Choč (middle Sub-Tatric) nappe in the Tatras comprises, almost exclusively, Middle and Upper Triassic deposits. Only in the Dolina Kościeliska Valley do three small thrust sheets occur, called the Upłaz, Kończysta, and Brama Kantaka scales (*cf.* Fig. 1), composed of strongly tectonically deformed Lower Jurassic deposits, assigned to the Miętusia Limestone Formation (*cf.* Lefeld, 1985).

Kotański (1965, 1979) ascribes the Upłaz scale to the Vepor Unit, by taking into account the lack of upper Anisian-middle Lower Jurassic lithological members. Zoogenic limestones of the Hierlatz type are underlain here by upper Anisian dolomites. The scale in question was not affected by metamorphism, known to have been active after the Upper Cretaceous charriage of the Vepor Unit in Slovakia had taken place. It has not yet been deciphered whether the contact between zoogenic limestones and Upper Anisian dolomites is of sedimentary or tectonic character. Considering this controversy, the author

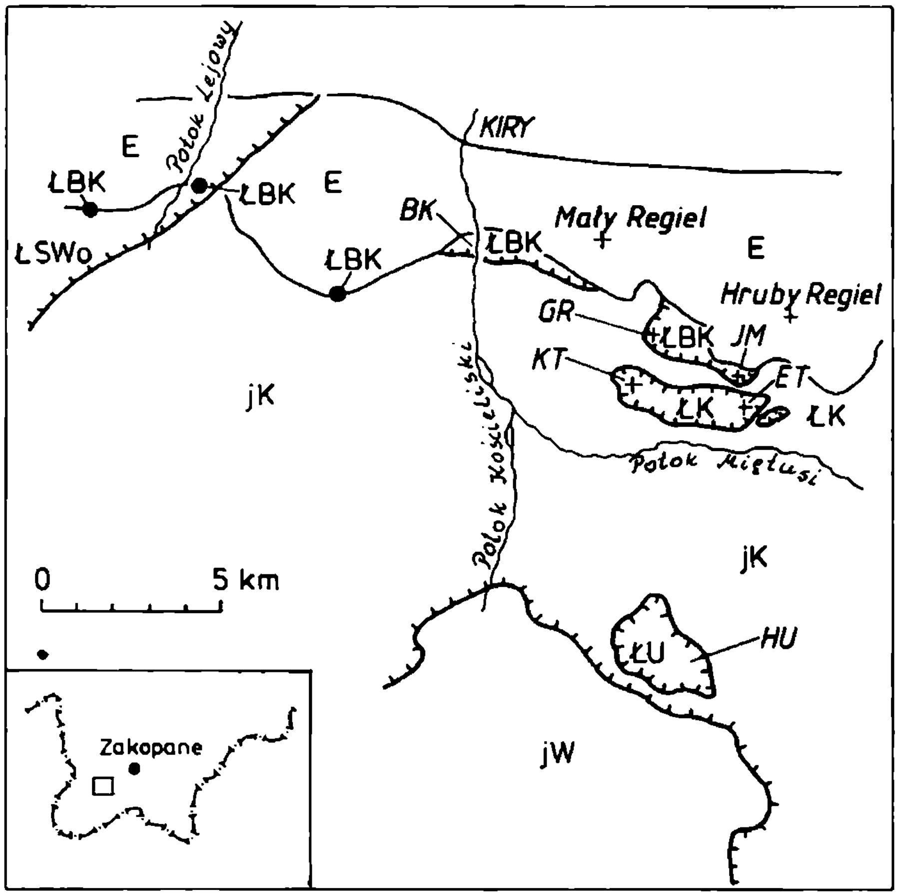

Fig. 1. Tectonic sketch showing the distribution of the Choč thrust sheets in the Dolina Kościeliska Valley. Choč nappe: ŁSWo – Siwa Woda thrust sheet; ŁK – Kończysta thrust sheet; ŁBK – Brama Kantaka thrust sheet; ŁU – Upłaz thrust sheet. Other tectonic units: jK – units of the Lower Subtatric (Križna) nappe; E – eocene posttectonic cover. Geographic names (italics): *GR* – Gronka; *KT* – Kończysta Turnia pike; *ET* – Eliaszowa Turnia pike; *JM* – Jaworzynka Miętusia; *HU* – Hala pod Upłazem alp.

follows those opinions (*cf.* Grabowski, 1976; Lefeld, 1985) which assign the Upłaz scale to Choč Unit.

Lithological sections of the Upłaz, Kończysta, and Brama Kantaka thrust sheets have been presented by Grabowski (1967) and Lefeld (1985). The latter formalized Grabowski's units. In this paper, traditional names of lithostratigraphic members have been used.

The aim of this article is to present pelagic red limestones, newly found in the Upłaz and Brama Kantaka thrust sheets. These limestones have not been yet described in the Choč Unit. The author considers them to be younger than the Brama Kantaka crinoid limestones, hitherto thought to represent the youngest deposits of the Choč Nappe in the Tatra Mts.

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STRATIGRAPHIC POSITION OF THE BRAMA KANTAKA CRINOID LIMESTONES

Crinoid limestones of the Brama Kantaka region (the Brama Kantaka Limestone Member) have hitherto been considered the youngest member of the Choč Nappe in the Tatra Mts. These limestones were thought to overlie cherty limestones, called the Eliaszowa Limestone member. Taking into account their lithostratigraphic position, Sokołowski (1925) assigned these limestones to the Domerian. Guzik (1959) in turn, put forward an hypothesis of the Toarcian age, based on similarities between these limestones and crinoid and manganese-bearing limestones of the Križna (lower Sub-Tatric) nappe. This opinion has been widely accepted (*cf.* Grabowski, 1967). Lefeld (1985), however, when reviewing previous elaborations, considered these limestones to be of uncertain age.

It has recently been found that the Brama Kantaka crinoid limestones differ from Toarcian crinoid and manganese-bearing limestones, known from the Križna nappe.

Predominantly massive Brama Kantaka limestones (encrinites – *cf.* Lefeld, 1985) contain trochites of differentiated size, ranging from 1 to 12 mm. Secondary ferric oxide and hydroxide mineralization is confined to tectonic fissures and brecciated zones. In some places, strong recrystallization can be seen. Algal growth structures are usually lacking. On the contrary, the predominantly bedded crinoid and manganese-bearing limestones of the Križna Nappe contain trochites of more or less equal size (several mm). Abundant primary mineralization by ferric and maganese oxides is developed planarly within upper part of these limestones. Algal growth structures also occur.

The Brama Kantaka crinoid limestones include alternations, several to a dozen or so metres thick, of cherty limestones, zoogenic limestones of the Hierlatz type, as well as pellet ("pseudo-ooid", *cf.* Figs. 2B,4) limestones, described from lower parts of the sedimentary sequence of the Choč thrust sheets, exposed in the Dolina Kościeliska Valley. These deposits are considered to be older than the Toarcian (Fig. 2A).

Within the Brama Kantaka thrust sheet (localities Gronka and Brama Kantaka), crinoid limestones pass laterally into cherty limestones, that is, silicified crinoid limestones interbedded with cherts. It is commonly accepted that crinoid limestones overlie the cherty ones. Lithological transitions, however, can be observed in the horizontal section. Cherty limestones dominate in the eastern part of the Brama Kantaka thrust sheet. These limestones represent, most probably, the middle part of the Lower Jurassic (*cf.* Lefeld, 1985). Crinoid limestones, in turn, occur above the cherty ones only in the northern slope of the Eliaszowa Turnia Pike, where they form a small, 30 m thick, lithosome, exposed close to the summit. These are grey and pink

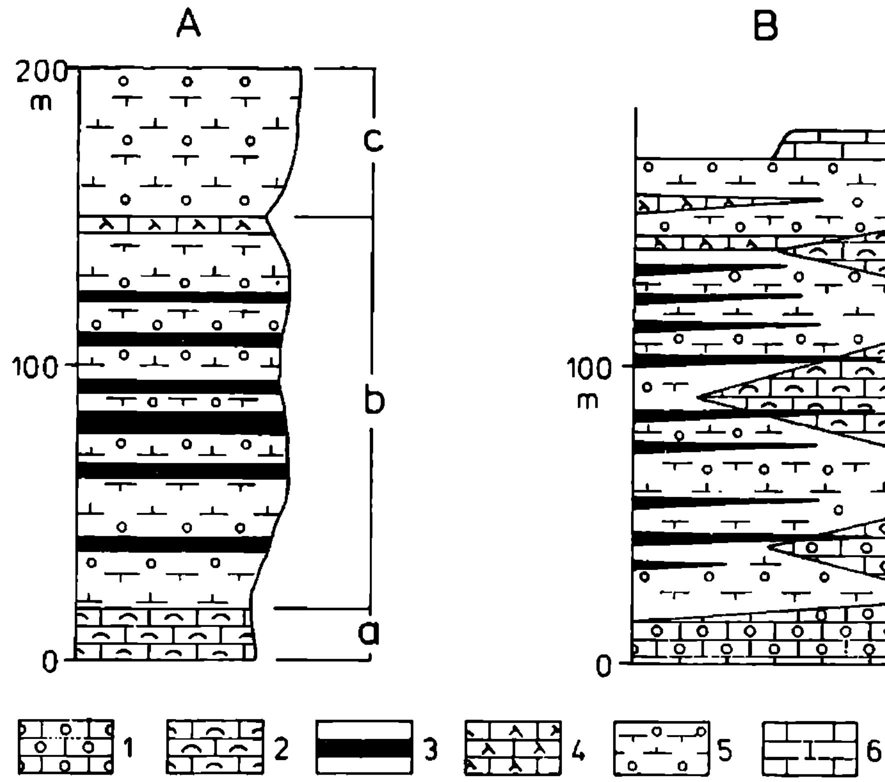

Fig. 2. Sections of the Brama Kantaka thrust sheet. *A* – lithostratigraphic log by Lefeld (1985) based on informal Grabowski's division: *a* – Upłaz Limestone Member (Lotharingian, Pliensbachian or younger) – equivalent zoogenic limestones; *b* – Eliaszowa Encrinite Member (Domerian?) – equivalent cherty limestones; *c* – Brama Kantaka Encrinite Member. *B* – section of the Brama Kantaka thrust sheet showing the distribution of lithological members. *1* – pellet limestones (Synemurian, Lotharingian ?); *2* – zoogenic (Hierlatz) limestones (Lotharingian – Domerian?); *3* – cherts (Lotharingian – Domerian ?); *4* – spongiolites (Domerian ?); *5* – encrinites; *6* – red limestones Middle Jurassic?)

crinoid limestones, bearing infrequent, disintegrated bivalve and brachiopod shells, as well as echinoid spicules.

Intercalations of zoogenic limestones hested within crinoid limestones contain, among other brachiopods, *Spiriferina* cf. *obtusa* Opp., Synemurian-Lotharingian and, possibly, Carixian and Domerian in age (*cf.* Almeras, 1964). There also occur *Oxytoma sinemuriensis* d'Orb. species, already described from the Brama Kantaka area by Siemiradzki (1919). This taxon is known from Hettangian-Lotharingian strata (*cf.* Kochanova, 1967).

It can be concluded, therefore, that the Brama Kantaka crinoid limestones are not Toarcian, But Lotharingian-Domerian in age, as documented by the above listed fossils and the positions within sedimentary sequence. Such a view approaches that expressed by Sokołowski (1925).

RED LIMESTONES

Within the Brama Kantaka thrust sheet, in the Gronka klippe situated to the north of Kończysta Turnia Pike, there occur red and reddish-brown limestones which have not been described so far (Fig. 3).

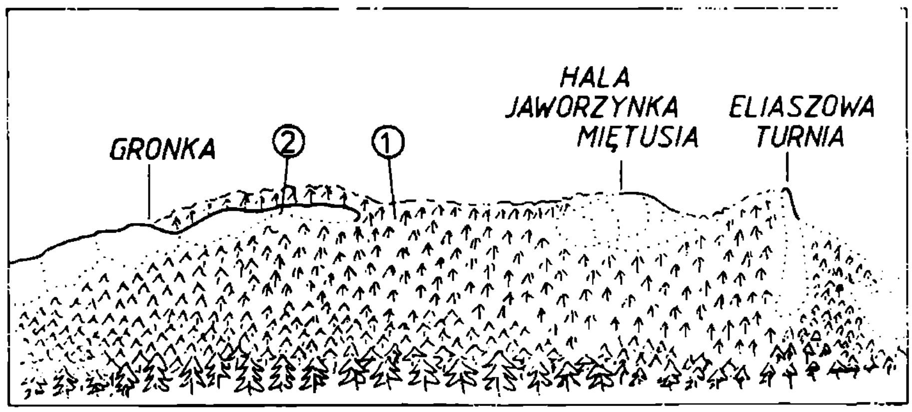

Fig. 3. Red limestones at Gronka (view from Kończysta Turnia pike); *1* — site no. 1; *2* — site no. 2. Drawing based on photo by Grabowski (1967)

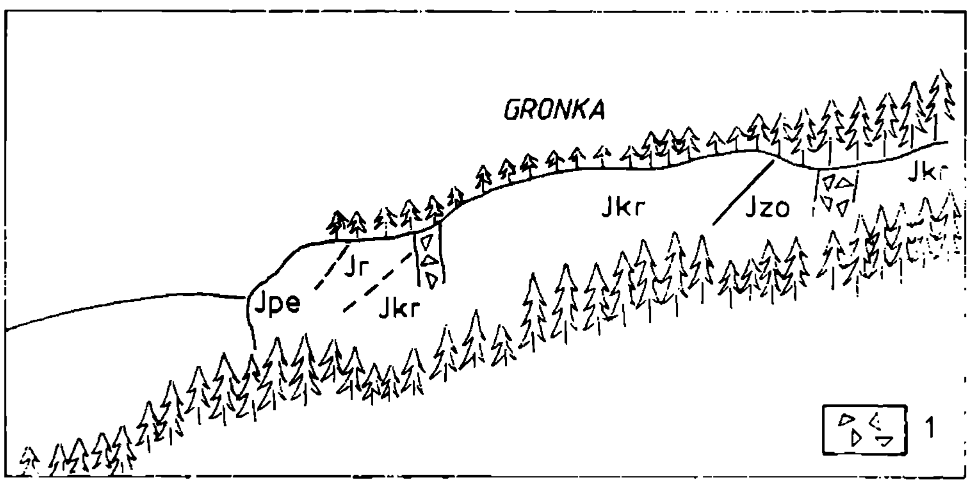

Fig. 4. Western part of Gronka (view from Kończysta Turnia pike). *Jpe* — pellet limestones; *Jzo* — zoogenic limestones; *Jkr* — crinoid limestones; *Jr* — cherty limestones; *1* — breccia zone. Drawing based on photo by J. Wieczorek

At site no. 1, a 30 m long and 4 m high rock wall built up from red limestones, is overlain and bounded by brecciated limestones known the Brama Kantaka area. Tectonic breccias bounding this site follow strongly limonitized fault zones (Fig. 5). The original top of the now overturned (*cf.* Grabowski, 1967) limestones is hidden under rock debris. A similar site (no. 2) is situated several tens of metres to the west of the previous one, within the same rock wall (Fig. 3). The red limestones are here overlain by a dozen or so centimetres thick brecciated crinoid limestones, passing into unbrecciated crinoid limestones. Hence, the red limestones are younger than crinoid ones.

In the Upłaz thrust sheet, the red limestones form fragments occurring among blocks of zoogenic, Hierlatz-type, limestones, Lotharingian-Domerian (?) in age. These blocks can be studied within a karstified block field in the Hala pod Upłazem alp, in its SE part. More or less planar fragments are separated from the zoogenic limestones by a layer of grey, fibrous calcite, 2 to 3 cm thick. Calcite crystals form several, usually four, generations. Fragments of the calcite layer, intermixed with zoogenic limestones are frequently found

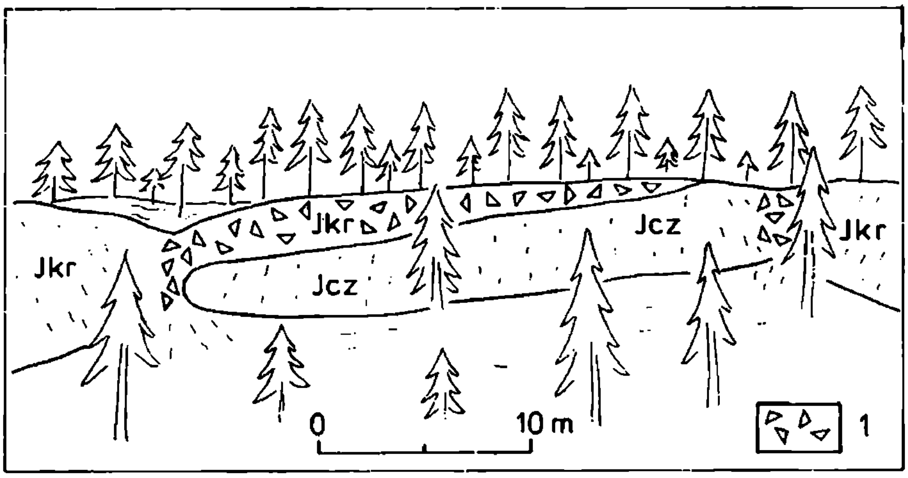

Fig. 5. Red limestones (*Jcz*) at Gronka — site no. 1; *1* — breccia zones — brecciated crinoid limestones (*Jkr*). Schematic field sketch

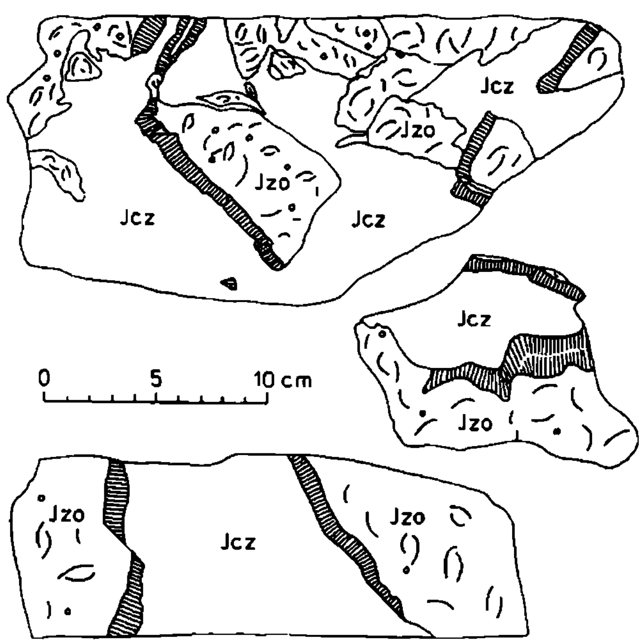

Fig. 6. Red limestones (*Jcz*) in neptunic dikes inside zoogenic limestones (*Jzo*) at Hala pod Upłazem alp. Hatchured zones — fibrous calcite cement forming several generations. Drawing from polished slabs

within red limestones. In some places, red limestones contact immediately with zoogenic ones (Fig. 6).

The red limestones represent massive, red and reddish-brown, biomicritic limestones, containing numerous fissures filled with calcite (Pl. I: 1), and showing well-developed stylolization. In some thin sections, taken from the Hala pod Upłazem locality, one can see irregular, strongly elongated and bow-like curved calcite needles, i. e. filaments. The latter have hithero been interpreted as algal remains. At present, these are considered thin-shell bivalve sections. As far as Jurassic deposits are concerned, these bivalves represent taxon *Bositra* (*Posidonia*) – *cf.* Flügel (1982). There also occur infrequent, partly dissolved crinoid trochites and other echinoid remains (PL. I: 3,4), sphaerical calcite-built forms, 200 to 300 μm in diameter (perhaps radiolarians or foraminifers), ostracods (?), foraminifers of the *Textuaridae* family (PL. I: 5), as well as planktonic foraminifers (PL. I: 1, 2). One can also find planar-like occurrences of organic remains. At the Gronka site no. 1, there occur belemnite rostra and small pyrite crystals, 0.2 – 0.4 mm in diameter, forming hexahedrons or, rarely, octahedrons.

INTERPRETATION

The lithology of the limestones in question, together with the presence of the remains of planktonic organisms, enables one to consider these deposits as pelagic ones. The basin bottom must have been locally washed-out, leading to a graded arrangement of larger organic remains (bivalves and others), as well as to their transportation from adjoining areas (crinoid trochites). Belemnites inhabited pelagic environments.

The striking feature is the lack of ammonites, commonly occurring in similar Tethyan facies. Partly dissolved crinoid trochites and other echinoid remains testify to a relatively intensive $CaCO_3$ dissolution. Such a process must have been responsible for the disappearance of ammonite shells.

The presence of planktonic foraminifers enables one to suppose that the red limestones were being deposited in the middle Jurassic. It is suggested that numerous filaments found in Jurassic deposits relate to remains of *Bositra buchi*, known to have occurred in the Toarcian-Oxfordian time-span (*vide* Flügel, 1982). Pelagic limestones developed in the filament facies (frequent in nodular limestone facies) were formed in the western Tethys from the middle Jurassic onwards. In the Bükk Mts. (Hungary), the filament facies is known from the Upper Domerian (*cf.* Geczy, 1971). Limestones of this type were being deposited upon submarine highs (Hallam, 1967), occupying bathyal to sublittoral depths (*cf.* Flügel, 1982).

The position of red limestones in relation to adjoining deposits is not clear. Within the Upłaz scale, these limestones fill neptunic dykes. Tectonic movements associated with expanding Tethys led to the formation of fissures within lithified zoogenic limestones. The walls of these fissures were being coated by calcite cement (*cf.* Hsü, 1983), and the fissures themselves filled in by calcareous mud, containing disintegrated debris derived from the fissure sides. Such processes point to synsedimentary tectonic movements within the basin (Fig. 6; *cf.* also Flügel, 1982).

As far as the occurrence of red limestones within the Brama Kantaka thrust sheet is concerned, it is difficult to decipher whether these deposits overlie crinoid limestones (as their top is invisible) or represent fragments of large neptunic dykes. Neptunic dykes of great dimensions and filled with limestones of differentiated age, have been described, for instance, from Sicily (*cf.* Wendt, 1971). The first option seems, however, to be the most probable one.

CONCLUSIONS

A lot of data concerning the youngest deposits of the Choč series, Tatra Mts., may be supplied by detailed analysis of transgressive Eocene conglomerates, resting upon most of the Choč thrust sheets. Another source of information is provided by poorly investigated Choč scales in the Slovak Tatra Mts., wherein only Triassic deposits have been found so far.

Nevertheless, one can put forward the following conclusions:

– The Brama Kantaka crinoid limestones were probably formed during Lotharingian-Domerian, and not Toarcian times. These limestones cannot be considered the highest member within the sedimentary sequence of the Choč thrust sheets, exposed in the Dolina Kościeliska Valley.

– The youngest deposits composing the Choč nappe are represented by pelagic red limestones, developed partly in filament facies, and representing Middle Jurassic times.

– In the Upłaz thrust sheet, red limestones fill neptunic dykes, formed during post-Lower Jurassic tectonic movements in the Tethyan basin.

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Streszczenie

WAPIENIE CZERWONE – NAJMŁODSZE OGNIWO LITOLOGICZNE W PŁASZCZOWINIE CHOCZAŃSKIEJ W TATRACH

Alfred Uchman

Choczańskie łuski: Upłazu, Kończystej i Bramy Kantaka (Dolina Kościeliska, Tatry) (Fig.1), zbudowane są głównie ze skał dolnojurajskich.

Wapienie krynoidowe z Bramy Kantaka uchodzące za najmłodsze w płaszczowinie choczańskiej Tatr, zaliczane były do domeru (Sokołowski, 1925), a później do toarku (Guzik, 1959) na podstawie podobieństwa (?) do wapieni krynoidowych i manganowych (toark) z płaszczowiny kriżniańskiej Tatr. Według Lefelda (1985) wiek ich nie jest określony.

Wapienie krynoidowe z Bramy Kantaka w przeciwieństwie do wapieni krynoidowych i manganowych są masywne, ze zróżnicowaną wielkością trochitów liliowców, na ogół silne zbrekcjowane, często z intensywną rekrystalizacją, bez struktur glonowych. Strefy mineralizacji tlenkami i wodorotlenkami żelaza związane są w nich ze strefami brekcji i spękaniami, a w wapieniach manganowych i krynoidowych mineralizacja tlenkami żelaza i manganu rozwinięta jest planarnie. W wapieniach krynoidowych z Bramy Kantaka występują wkładki sedymentycyjne wapieni peletowych („pseudo-ooidowych"), wapieni zoogenicznych typu hierlatzkiego i wapieni rogowcowych (Fig. 2, 4) znanych ze swoich głównych wystąpień w niższej części profilu jury choczańskiej Tatr. Wapienie rogowcowe (środkowa część jury dolnej – Lefeld, 1985; obserwacje własne) to skrzemionkowane wapienie krynoidowe przekładane nieregularnymi ławicami rogowców. Uważa się, że leżą one poniżej wapieni krynoidowych z Bramy Kantaka. Można jednak zaobserwować przejście w jednym poziomie od wapieni krynoidowych poprzez wapienie krynoidowe skrzemionkowane do wapieni rogowcowych (Gronka, Brama Kantaka).

W wkładkach wapieni zoogenicznych w obrębie wapieni krynoidowych w Bramie Kantaka występują m.in. ramienionóg *Spiriferina* cf. *obtusa* Opp. (obserwacje własne) znany od synemuru po lotaryng (? karyks-domer) (Almeras, 1964). Z Bramy Kantaka znany jest małż *Oxytoma sinemuriensis* (Siemiradzki, 1919) – zasięg od hettangu po lotaryng (Kochanova, 1967). Powyższe fakty świadczą o przynależności wapieni krynoidowych z Bramy Kantaka do środkowej części jury dolnej, a nie do toarku.

W odwróconej sekwencji łuski Bramy Kantaka (Gronka – stanowisko nr 1, Fig. 5; stanowisko nr 2, Fig. 3) oraz w łusce Upłazu występują znalezione przez autora wapienie czerwone, które uważa się za młodsze od wapieni krynoidowych z Bramy Kantaka.

Wapienie czerwone to biomikryty (Pl. I: 1) z filamentami (Hala pod Upłazem) oraz z częściowo rozpuszczonymi trochitami liliowców i innymi szczątkami szkarłupni (Pl. I: 3, 4). Występują tu również rostra belemnitów (Gronka), otwornice planktoniczne (Pl. I: 1, 2) oraz otwornice z rodziny *Textularidae* (Pl. I: 5).

Brak amonitów, niekiedy licznych w podobnych facjach Tetydy, świadczy o dość intensywnym rozpuszczaniu węglanu wapnia (częściowo rozpuszczone szczątki szkarłupni).

Otwornice planktoniczne w wapieniach czerwonych wskazują już na jurę środkową. Liczne filamenty to przekroje muszli małża *Bositra buchii* (toark – oksford) (*vide* Flügel, 1982). Wapienie pelagiczne z facji filamentowej (część wapieni gruzłowych) tworzyły się powszechnie w Tetydzie zachodniej w jurze środkowej, jak się przypuszcza na podmorskich wyniesieniach (Hallam, 1967) od głębokości batialnych do sublitoralnych (*vide* Flügel, 1982).

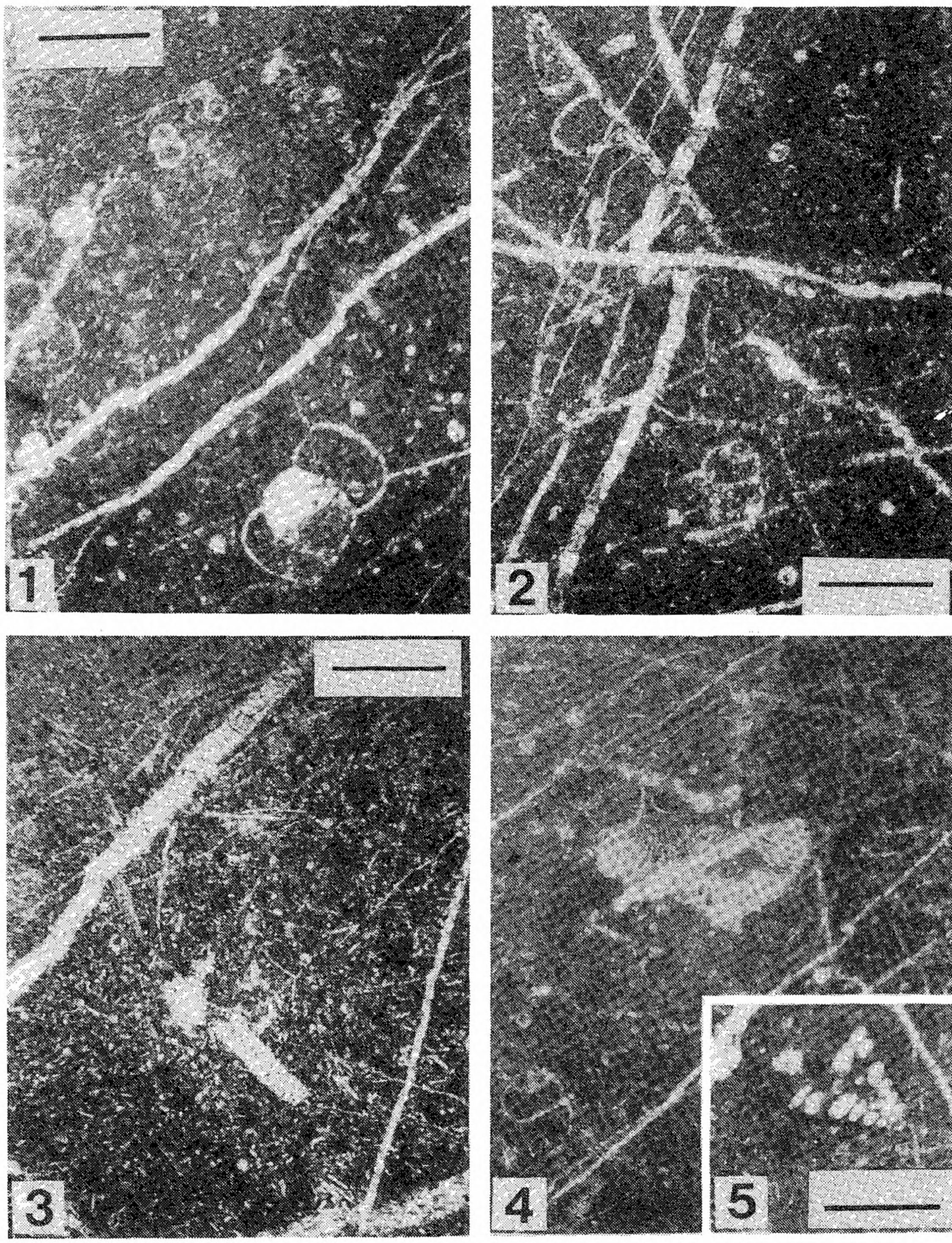
W łusce Upłazu wapienie czerwone występują najprawdopodobniej w żyłach neptunicznych w obrębie wapieni zoogenicznych (lotaryng – domer?). Szczeliny tektonicznego pochodzenia w wapieniach zoogenicznych powstałe na przełomie jury środkowej i dolnej (?) zostały wypełnione później pelagicznym osadem, w którym często grzęzły pokruszone fragmenty ścian szczelin, wyścielone kalcytowym cementem (Fig. 6). W łusce Bramy Kantaka wapienie czerwone występują przypuszczalnie jako normalny nadkład wapieni krynoidowych.

EXPLANATIONS OF PLATE

Plate I

Bar scale = 500 μm

1 – Planktonic foraminifers (?). Red limestones. Hala pod Upłazem alp
2 – Planktonic foraminifers (?). Red limestones. Gronka
3 – Partly dissolved echinoderms remains. Red limestones. Hala pod Upłazem alp
4 – Partly dissolved echinoderms remains. Red limestones. Gronka
5 – Foraminifer of the *Textularidae* family. Red limestones. Gronka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