

ZDZISŁAW BEŁKA & ANDRZEJ GAŹDZICKI

Anisian foraminifers from the high-tatric series of the Tatra Mts

ABSTRACT: The assemblage of Anisian foraminifers found for the first time in the high-tatric series of the Tatra Mts includes the stratigraphically important forms, *Glomospira densa* (Pantić) and *Glomospirella grandis* (Salaj), indicative of the latest Early Anisian through Early Illyrian age. The recognized Anisian assemblage appears markedly impoverished quantitatively and qualitatively in relation to the contemporaneous Tethyan assemblages, despite of identical microfacies development of the foraminifers-bearing sequences.

INTRODUCTION

The Anisian foraminifers in the high-tatric series have first been found in the course of microfacies studies of the Middle Triassic deposits at Mt. Kominy Tylkowe in the Tatra Mts (cf. Fig. 1; and Bełka 1976). The profile of the Anisian deposits continues from the Iwaniacka Pass (1460 m a.s.l.) to Mt. Rzędy on the southern slopes of Mt. Kominy Tylkowe, attaining about 320 m in thickness (Figs 2–3). The deposits are highly differentiated in petrology, being generally poor in floral and faunal remains.

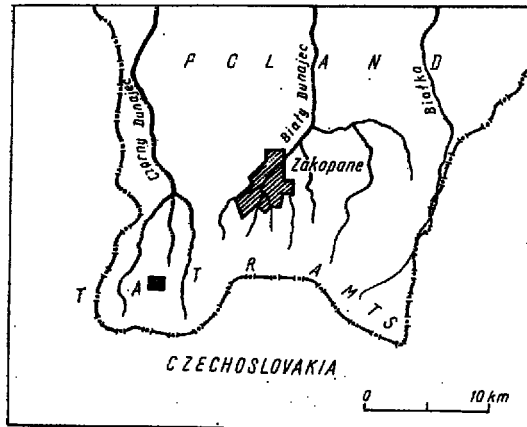


Fig. 1

Locality map of the high-tatric Middle Triassic deposits sampled for foraminifers at Mt. Kominy Tylkowe (cf. Text-fig. 2)

DISTRIBUTION OF FORAMINIFERS IN THE PROFILE

Anisian foraminifers were found only in the upper part of the profile at Mt. Kominy Tylkowe. They are limited to three horizons, *I*, *II*, and *III* (cf. Figs 3–4) in a series of biopelsparites, pelmicrites and ostracode biomicrites about 130 m thick (series "E" of Piotrowski, 1965, Pl. 1).

The foraminifer assemblage comprises the following taxa:

Ammodiscus incertus (d'Orbigny, 1839) — Pl. 1, Fig. 7

Ammodiscus sp. — Pl. 1, Fig. 6

Glomospira densa (Pantić, 1965) — Pl. 1, Figs 15–16

Glomospira cf. *densa* (Pantić, 1965) — Pl. 1, Figs 10–11

Glomospira sp. — Pl. 1, Fig. 13

Glomospirella grandis (Salaj, 1967) — Pl. 1, Fig. 14

Glomospirella triphonensis Baud, Zaninetti & Brönnimann, 1971 — Pl. 1, Fig. 12

Glomospirella sp. — Pl. 1, Figs 8–9

Nodosaria sp. — Pl. 1, Figs 1–5

Dentalina sp.

Stratigraphically important species, *Glomospira densa* (Pantić) and *Glomospirella grandis* (Salaj), were found in horizon *I*, in a sample taken from gastropod biopelsparites (Pl. 2, Figs 4–6) that occur 195 m above the conventional lower boundary of the Anisian, situated at 1640 m a.s.l. (cf. Figs 2–4). Some representatives of *Dentalina* sp. were found in

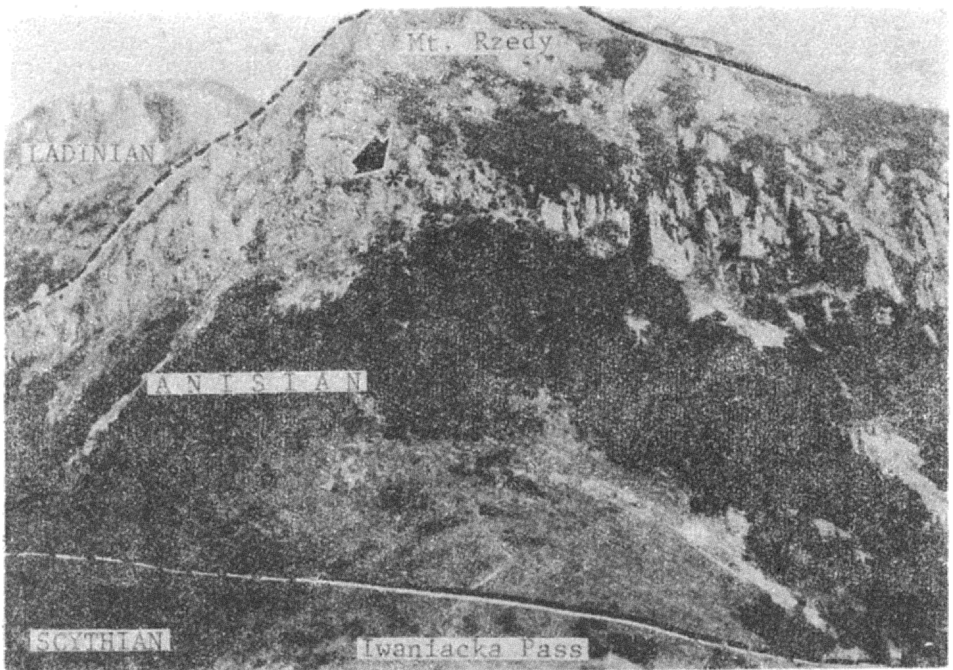
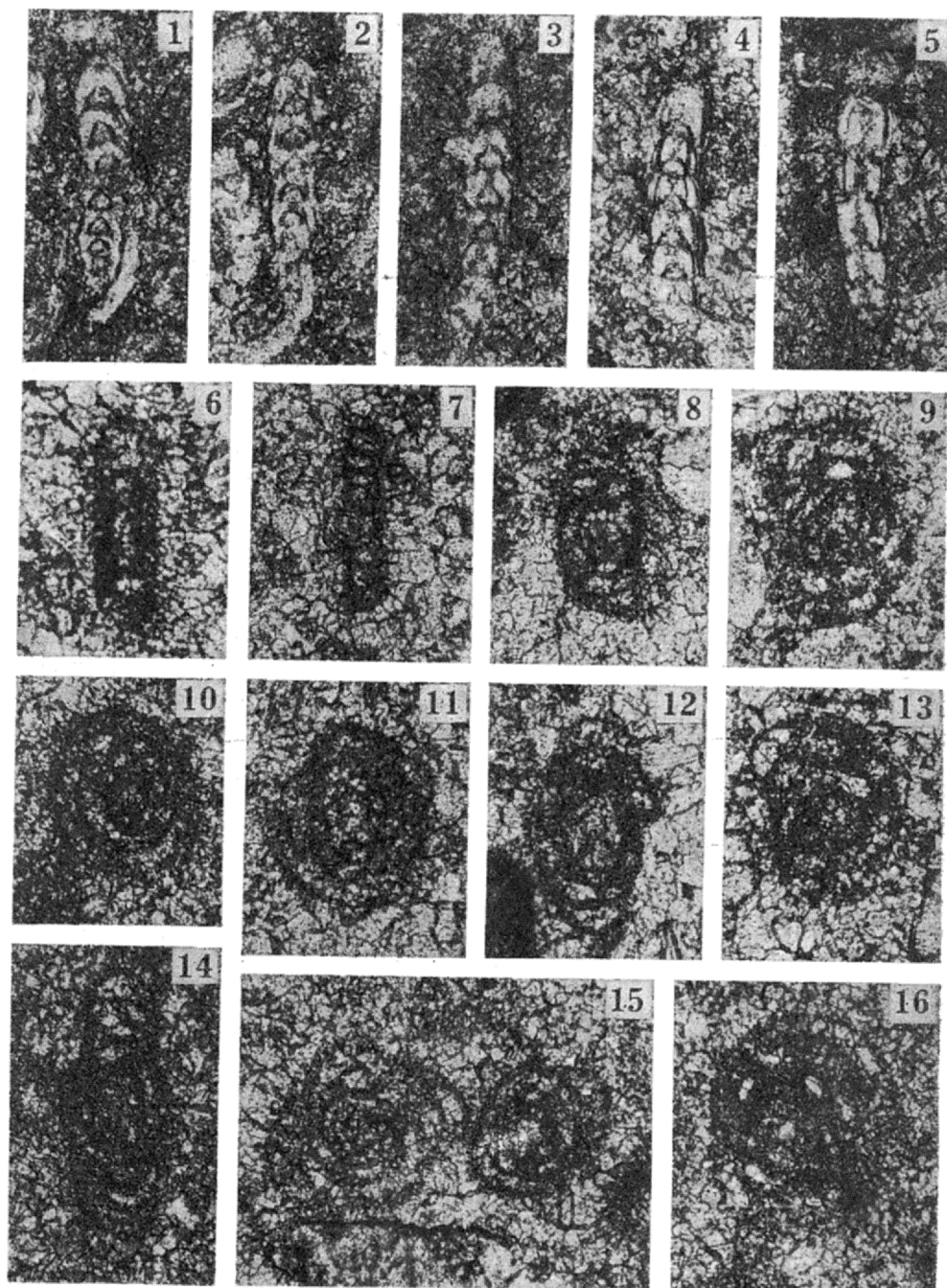
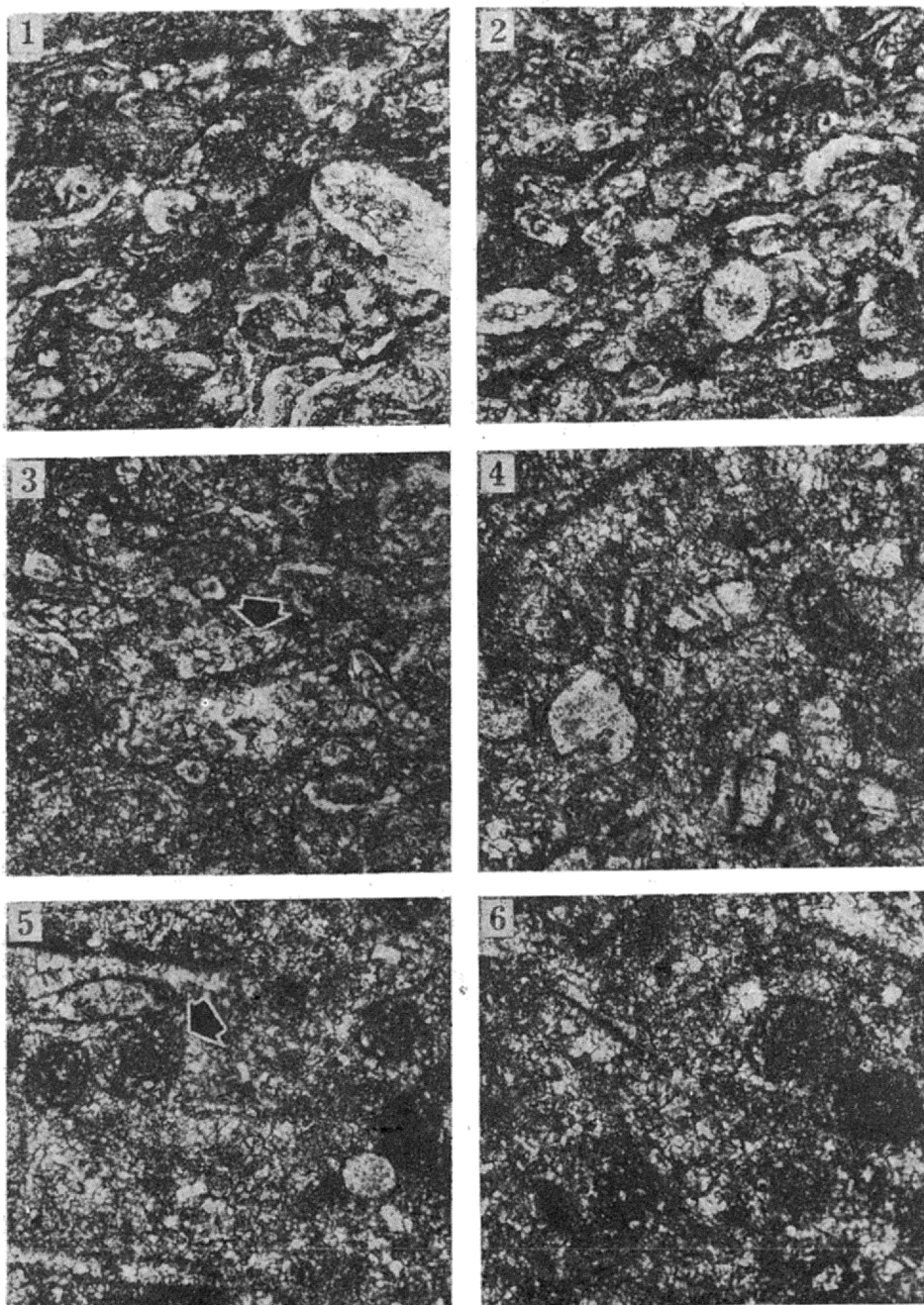


Fig. 2. Occurrence zone of the Middle Triassic deposits on the southern slopes of Mt. Kominy Tylkowe; the investigated profile (cf. Text-figs 3–4) exposed along the slopes from the Iwaniacka Pass towards Mt. Rzedy

Asterisked is the foraminifer-bearing horizon I



Anisian foraminifers from Mt. Kominy Tylkowe section
 1-5 *Nodosaria* sp.; horizon III, Upper Illyrian, $\times 100$; 6 *Ammodiscus* sp., $\times 170$; 7 *Ammodiscus*
incertus (d'Orbigny), $\times 150$; 8-9 *Glomospirella* sp., $\times 100$; 10-11 *Glomospira* cf. *densa* (Pantić),
 $\times 120$; 12 *Glomospirella triphonensis* Baud, Zaninetti & Brönnimann, $\times 120$; 13 *Glomospira* sp.,
 $\times 140$; 14 *Glomospirella grandis* (Sala), $\times 90$; 15-16 *Glomospira densa* (Pantić), $\times 120$; [6-16
 horizon I, uppermost Lower Anisian - Lower Illyrian]



Anisian microfacies ($\times 50$) from Mt. Kominy Tylkowe section

1—2 Ostracode biomicrite with *Nodosaria* sp.; horizon III

3 Microfacies with *Nodosaria* (ar:owed) in ostracode biomicrite; horizon III

4—6 Microfacies with *Glomospira densa* (Pantić) in gastropod biopelsparite, partially dolomitized; horizon I; the best preserved *Glomospira densa* is arrowed in Fig. 5

horizon II. Representatives of *Nodosaria* sp., very numerous and sometimes even of rock-forming importance (cf. Pl. 2, Figs 1–3), occur in horizon III, in ostracode biomicrites making up the top part of the Anisian profile at Mt. Kominy Tylkowe.

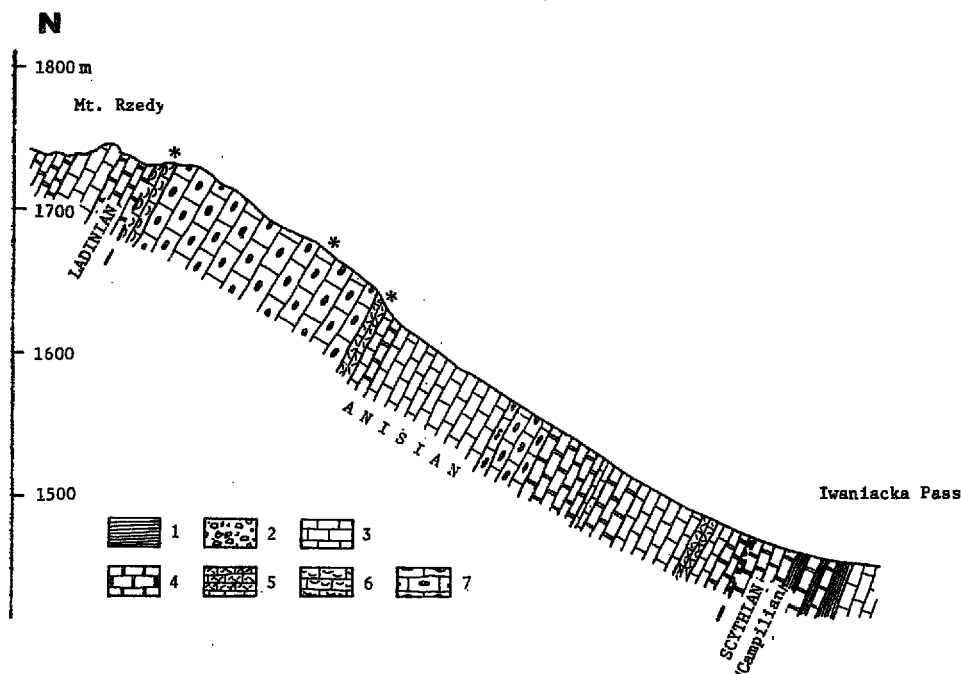


Fig. 3. Geological section of the Middle Triassic deposits of the high-tatric series at Mt. Kominy Tylkowe

1 shales, 2 breccia, 3 micrite, 4 dolomierite, 5 biopelosparite, 6 ostracode biomicrite, 7 pelmicrite
Asterisked are the foraminifer-bearing horizons (I, II, III, — cf. Text-fig. 4)

REMARKS ON FORAMINIFERS

The foraminifer assemblage comprises representatives of two families, Ammodiscidae (8 taxa) and Nodosariidae (2 taxa). The foraminifers are relatively poorly preserved, and their chamber walls are often recrystallized, the internal structure thereby being poorly visible. This is related to an advanced sparitization of originally micritic matrix, leading to a gradual "disappearance" of foraminifer tests in the matrix (*vide* Pl. 2, Figs 4–6).

The Anisian foraminifer assemblage from the high-tatric series of Mt. Kominy Tylkowe appears to be markedly impoverished quantitatively and qualitatively in relation to the contemporaneous assemblages known from the sub-tatric (Choč) series (cf. Gaździcki & Zawadzka 1973) and other parts of the Tethys (*vide* Borza 1970, Baud & al. 1971, Premoli Silva 1971, Urošević 1971), as well as from the epicontinental Muschelkalk

sequence of southern Poland (Glazek & al. 1973, Gaździcki & Kowalski 1974, Gaździcki & al. 1975). This impoverishment may be explained by environmental conditions unfavourable for faunas and floras predominating in that basin and resulting in an advanced "barren" character of the high-tatric Middle Triassic deposits of the Tatra Mts.

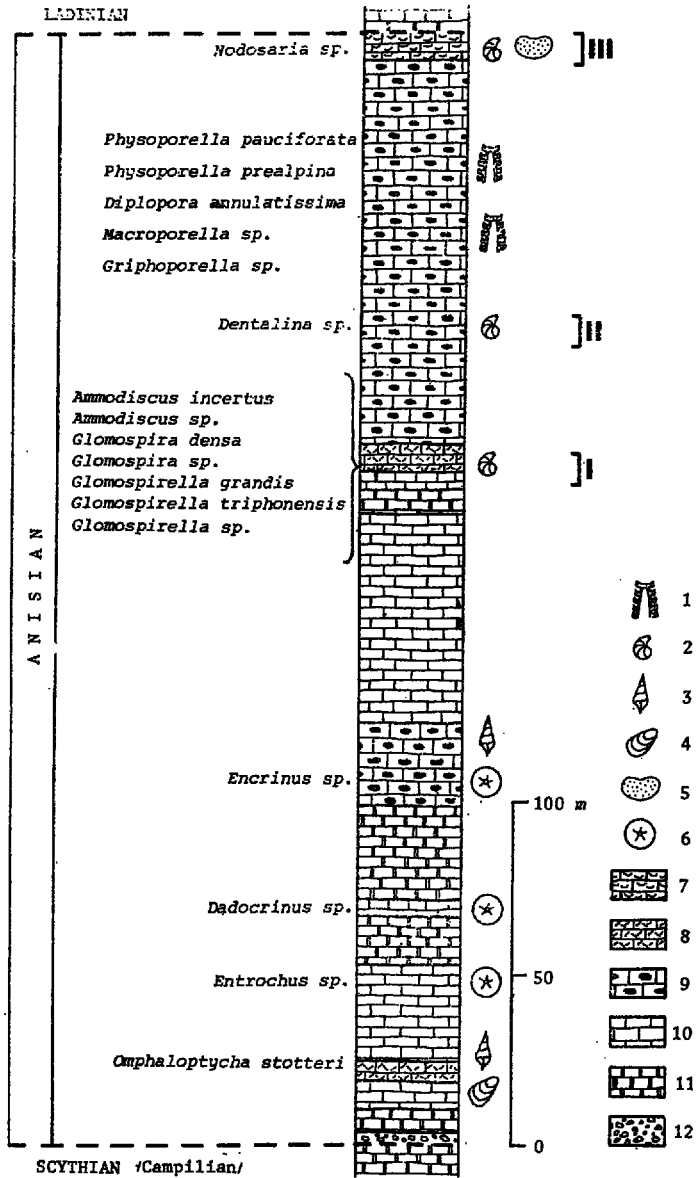


Fig. 4. Detail profile of the Anisian deposits at Mt. Kominy Tyłkowe
 1 dasycladacean algae, 2 foraminifers, 3 gastropods, 4 pelecypods, 5 ostracodes, 6 crinoids,
 7 ostracode biomicrite, 8 biopelagite, 9 pelmicrite, 10 micrite, 11 dolomicrite, 12 breccia
 I, II, III denote the foraminifer-bearing horizons

STRATIGRAPHY

The Anisian stage in the high-tatric series was distinguished by Lefeld (1957, 1958) who recorded the occurrence of the crinoid species *Dadocrinus grundeyi* Langenhan. The lower boundary of that stage was conventionally drawn at the basal breccia, as the underlying limestone and cavernous dolomite series was known to yield *Costatoria costata* (Zenker) and *Naticella costata* Winkler typical of the Upper Scythian, i.e. Campilian (cf. Kotański 1956, 1959). The upper boundary was drawn at the top of the series "E" of Piotrowski (1965) in the profile of Mt. Kominy Tylkowe yielding *Physoporella pauciforata* (Gümbel), *P. prealpina* Pia, *Diplopora annulatissima* Pia, *Macroporella* sp., and *Griphoporella* sp. indicative — according to Kotański (in Piotrowski 1965) — of the turn of the Pelsonian and Illyrian.

Only two foraminifers of those reported from horizon I, i.e. *Glomospira densa* and *Glomospirella grandis*, are of a marked stratigraphic importance. Their stratigraphic range coincides with that of the *Glomospira densa* Zone¹ (Range Zone: uppermost Lower Anisian, Pelsonian and Lower Illyrian).

Dasycladacean algae (cf. Fig. 4; and Piotrowski 1965), occurring above the foraminifer-bearing horizon I, are indicative of Pelsonian — Early Illyrian age (cf. Ott 1972a, b; 1974). It would follow, therefore, that foraminifers of the genus *Nodosaria*, reported from the foraminifer-bearing horizon III, are generally of Illyrian age.

The range of the *Glomospira densa* Zone is markedly wider than the range of the recognized assemblage of dasycladacean algae. The foraminifer-bearing horizon I is situated, however, about 90 m below the place where the first dasycladacean algae were found in this section; it seems, therefore, that the association of guide foraminifer species corresponds here only to the lower part of the total range of the *Glomospira densa* Zone. On the other hand, the upper part of the section that yields the dasycladacean algae may correspond to the upper part of the stratigraphic range of that assemblage. This seems to result from variability and succession of facies in the Upper Anisian of the Tatra Mts (cf. Fig. 4; and Belka 1976).

It may be concluded that the isolated records of foraminifers and algae from the Anisian of Mt. Kominy Tylkowe are insufficient for reliable drawing of the substage boundaries in this section.

¹ The upper part of the *Glomospira densa* zone *sensu* Salaj (1974) was thought to cover the whole Illyrian (Salaj 1974). However, correlations of that zone with dasycladacean and conodont zones (Jendrejáková 1973, Budurov & Trifonova 1974, Gaždickí & al. 1975) have shown that this zone does not comprise the Upper Illyrian.

SEDIMENTARY CONDITIONS

Dasycladacean algae and foraminifers were found in bipelsparites, pelmicrites and ostracode biomicrites forming the upper part of Mt. Kominy Tylkowe section. Although the stratigraphic ranges of these fossils overlap to a significant degree, their occurrence sites do not overlap in the section. This seems to be the result of dependence of these fossils on facies. The genera *Glomospira* and *Glomospirella* were found, in bipelsparites with clay admixture (cf. Pl. 2, Figs 4–6), and the number of individuals seems to increase along with enrichment of the rock in clay matter. The rocks of the foraminifer-bearing horizon I belong to that type rich in clay matter. The clay admixture is sharply reduced in pelmicrites overlying horizon I and in these pelmicrites dasycladacean algae appear for the first time (Fig. 4). This is in accordance with the widely held opinion that dasycladacean algae and especially *Physoporella pauciforata* almost exclusively occur in limestones devoid of clay admixture (cf. Hurka 1967, Bechstädt & Brandner 1970). Because of this clear dependence on facies, they cannot be treated as ideal guide fossils.

The microfacies studies have shown that the upper part of the Anisian from Mt. Kominy Tylkowe with its sedimentary sequence and fossils reflects a marked trend to shallowing of the sedimentary basin (cf. Bełka 1976). Representatives of *Glomospira* and *Glomospirella* are known from sediments deposited at about 30 m depths from other parts of the Tethys, and dasycladacean algae reported from the upper part of the section attain the maximum development in well-oxidated waters at 6–10 m depths (cf. Bechstädt & Brandner 1970).

FINAL REMARKS

The Middle Triassic floral and faunal remains occasionally found in the high-tatric series of the Tatra Mts are insufficient for any more detailed correlations and comparisons of this high-tatric sedimentary basin with those of other zones of the Tethyan geosyncline. Taking into account a wide distribution of the so-called vermicular limestones, the sedimentary sequence was compared to the contemporaneous deposits of the Briançonnais zone from the Western Alps (Debelmas 1961, Kotański 1964). However, considering the results of analysis of foraminifer assemblages and microfacies (Bełka 1976) it may be stated that comparable Middle Triassic microfacies with similar foraminifer fauna are fairly common throughout the Tethys. They are known, e.g., from the Dolomites (Bechstädt & Brandner 1970), Dinarides (Pantić 1965), Bulgaria (Trifonova & Čatalov 1975), Crimea (Voloshina 1974), Caucasus (Efimova 1974), Iran (Brönnimann & al. 1972) and Pakistan (Zaninetti & Brönnimann 1975).

Moreover, the investigated Middle Triassic microfacies of the high-tatric series bear some analogies to those known from the epicontinental Muschelkalk sequence of southern Poland (Głazek & al. 1973, Gaździcki & al. 1975).

*Institute of Geology
of the Warsaw University
(Z. Belka)*

*Institute of Paleozoology
of the Polish Academy of Sciences
(A. Gaździcki)*

Al. Żwirki i Wigury 93, 02-089 Warszawa, Poland

REFERENCES

- BAUD A., ZANINETTI L. & BRÖNNIMANN P. 1971. Les Foraminifères de l'Anisien (Trias moyen) des Préalpes Médiannes Rigides (Préalpes romandes, Suisse, et Préalpes du Chablais, France). *Arch. Sc. Genève*, 24 (1), 73–95. Genève.
- BECHSTÄDT T. & BRANDNER R. 1970. Das Anis zwischen St. Vigil und dem Höhlensteintal (Pragser- und Olang Dolomiten, Südtirol). *Festband Geol. Inst., 300-Jahr-Feier Univ. Innsbruck*, 9–103. Innsbruck.
- BELKA Z. 1976. Cechy sedimentacyjne węglanowych utworów triasu wierchowego w rejonie Kominów Tylkowych [unpublished report, University of Warsaw].
- BORZA K. 1970. Mikrofacies mit *Glomospira densa* (Pantić, 1965) aus der Mittleren Trias der Westkarpaten. *Geologický Zborník — Geologica Carpathica* 21 (1), 175–182. Bratislava.
- BRÖNNIMANN P., ZANINETTI L., BOZORGNIA F. & HUBER H. 1972. Ammonoiscids and ptychocladids (Foraminiferida) from the Triassic Elika Formation, Nessa-Hassanakdar section, central Alborz, Iran. *Riv. Ital. Paleont.*, 78 (1), 1–28. Milano.
- BUDUROV K. & TRIFONOVA E. 1974. Die Conodopten- und Foraminiferen-Zonen in der Trias des Ostbalkans. „Die Stratigraphie der alpin-mediterranen Trias”. *Symposium Wien, Mai 1973, Schriftenreihe Erdwiss. Komm. Österr. Akad. Wiss.*, 2, 57–62. Wien.
- DEBELMAS J. 1960. Comparaison du Trias haut-tatric avec celui des Alpes occidentales, Zone intra-alpine. *Acta Geol. Pol.*, 10 (2), 107–122. Warszawa.
- EFLIMOVA N. A. 1974. Triassic Foraminifera of the North-West Caucasus and Cis-Caucasus. *Questions of Micropaleontology*, 17, 54–83. Moscow.
- GAŹDZICKI A. & KOWALSKI W. R. 1974. Green algae *Actinella* Pia from the Muschelkalk of the Holy Cross Mts (Poland). *Bull. Acad. Sc., Sér. Sc. de la Terre*, 22 (1) 27–32. Warszawa.
- , TRAMMER J. & ZAWIDZKA K. 1975. Foraminifers from the Muschelkalk of southern Poland. *Acta Geol. Pol.*, 25 (2), 285–298. Warszawa.
- & ZAWIDZKA K. 1973. Triassic foraminifer assemblages in the Choć nappe of the Tatra Mts. *Acta Geol. Pol.*, 23 (3), 483–490. Warszawa.
- GLĄZEK J., TRAMMER J. & ZAWIDZKA K. 1973. The Alpine microfacies with *Glomospira densa* (Pantić) in the Muschelkalk of Poland and some related paleogeographical and geotectonic problems. *Acta Geol. Pol.*, 23 (3), 463–482. Warszawa.
- HURKA H. 1967. Variationsstatische Untersuchungen an anisischen Dasycladaceen. *N. Jb. Geol. Paläont. Abh.*, 128 (1), 41–100. Stuttgart.
- JENDREJÁKOVÁ O. 1973. Foraminifären aus Dasycladaceen-Fazies der Trias der Westkarpaten. *Geologický Zborník — Geologica Carpathica*, 24 (1), 113–122. Bratislava.

- KOTAŃSKI Z. 1956. High-tatric Campilian in the Tatra Mts. *Acta Geol. Pol.*, 6 (1), 65-73. Warszawa.
- 1959. Stratigraphy, sedimentology, and paleogeography of the high-tatric Triassic in the Tatra Mts. *Acta Geol. Pol.*, 9 (2), 113-145. Warszawa.
- 1964. Remarques sur le Trias briançonnais des Alpes Occidentales et sa comparaison avec le Trias haut-tatrique des Tatras. *Bull. Acad. Pol. Sci., Sér. Sci. Géol. Géogr.*, 12 (2), 97-104. Varsovie.
- LEFELD J. 1957. Geology of the Zawrat Kasprowy and Kopa Magury (Tatra Mts). *Acta Geol. Pol.*, 7 (3), 281-302. Warszawa.
- 1958. *Dadocrinus grundeyi* Langenhan (Crinoidea) from the High-Tatric Middle Triassic in the Tatra Mts (Poland). *Acta Palaeont. Pol.*, 3 (1), 59-74. Warszawa.
- OTT E. 1972a. Zur Kalkalgen-Stratigraphie der Alpenen Trias. *Mitt. Ges. Geol. Bergbaustud.*, 21, 455-464. Innsbruck.
- 1972b. Die Kalkalgen-Chronologie der alpinen Mitteltrias in Angleichung an die Ammoniten-Chronologie. *N. Jb. Geol. Paläont. Abh.*, 141 (1), 81-115. Stuttgart.
- 1974. *Catalogus Fossilium Austriae. Heft XVIIb: Algae (Dasycladaceae)*. Springer-Verlag. Wien.
- PANTIĆ S. 1965. *Pilammina densa* n. gen., n. sp. and other Ammodiscidae from the Middle Triassic in the Crmnica (Montenegro). *Geol. Vjesnik*, 18 (1), 189-192. Zagreb.
- PIOTROWSKI J. 1965. Le Trias moyen et la tectonique du massif de Kominy Tyłkowie. *Acta Geol. Pol.*, 15 (3), 355-392. Warszawa.
- PREMOLI SILVA I. 1971. Foraminiferi anisici della regione giudicariense (Trento). *Riv. Ital. Paleont.*, 77 (3), 303-374. Milano.
- SÁLAJ J. 1974. Contribution à la microbiostratigraphie du Trias des Carpathes Occidentales tchécoslovaques. VI^e Colloque Africain de Micropaléontologie, Tunis 1974. Tunis.
- TRIFONOVA E. & ČATALOV G. 1975. Mikrofacies in the Triassic calcareous rocks from the Teteven anticlinorium. I. Campilian-Anisian. *Paleont. Stratigr. Lithol.*, 2, 3-16. Sofia.
- UROŠEVIĆ D. 1971. A survey of Triassic fauna and flora of Stara Planina Mts (Carpatho-Balkan Region). *Annal. Géol. Pénin. Balkan.*, 36, 95-104. Beograd.
- VOLOSHINA A. M. 1974. Microfacies of the Triassic with the Ammodiscidae (Foraminifera) in the borehole of the Crimea Plain. *Paleont. Zbor.* 11, 10-13. Lvov.
- ZANINETTI L. & BRÖNNIMANN P. 1975. Triassic Foraminifera from Pakistan. *Riv. Ital. Paleont.*, 81 (3), 257-280. Milano.

Z. BEŁKA i A. GAŻDZICKI

OTWORNICE Z ANIZYKU SERII WIERCHOWEJ TATR

(Streszczenie)

W utworach anizyku odsłaniających się w profilu Kominów Tyłkowych w Tatrach (seria wierchowa), stwierdzono po raz pierwszy obecność otwornic. W zespole otwornic występują przedstawiciele rodzin Ammodiscidae i Nodosariidae, wśród

których obecne są formy o znaczeniu stratygraficznym — *Glomospira densa* (Pantić), *Glomospirella grandis* (Sala) oraz *G. triphonensis* Baud, Zaninetti & Brönnimann, określające wiek zawierających je osadów na najwyższy dolny anizyk aż po illyr. Stwierdzony zespół otwornic wykazuje wyraźne zubożenie ilościowe i jakościowe w stosunku do równowiekowych zespołów z obszaru Tetydy, chociaż wykształcenie mikrofacjalne osadów zawierających otwornice zarówno w serii wierchowej Tatr jak i w innych strefach Tetydy jest identyczne. Wydaje się zatem, że trias środkowy serii wierchowej Tatr porównywany dotychczas jedynie z triasem środkowym strefy briansońskiej Alp Zachodnich (Debelmas 1960, Kotański 1964), wykazuje również daleko idące analogie do innych rejonów Tetydy, a mianowicie: Dolomitów (por. Bechstädt & Brandner 1970), Dynarydów (por. Pantić 1965), Bułgarii (por. Trifonova & Čatalov 1975), Krymu (por. Voloshina 1974), Kaukazu (por. Efimova 1974) oraz Iranu (por. Brönnimann & al. 1972) i Pakistanu (por. Zaninetti & Brönnimann 1975).
