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Lower Liassic ("Gresten Beds") microfacies and foraminifers from the Tatra Mts

ABSTRACT: The carbonate intercalations from the sub-tatric (Križna) Lower Liassic ("Gresten Beds") yield relatively numerous and stratigraphically important foraminifers. The identified forms, *Ophthalmidium leischneri* (Kristan-Tollmann), *Nodosaria metensis* Terquem, *N. crispata* Terquem, *Marginulina spinata spinata* Terquem, *Frondicularia pupiformis* Haeusler, *Involutina liassica* (Jones), *I. farinacciae* Brönnimann & Koehn-Zaninetti, and *Trocholina granosa* Frentzen, are indicative of Hettangian-Sinemurian age. The sedimentary sequence, as well as the floral and faunal assemblages of the "Gresten Beds" in the Tatra Mts are almost identical to those of the contemporaneous rocks of various sections of the Alpine-Carpathian geosyncline; moreover, they appear somewhat similar to those of the epicontinental basin of north-western Europe.

INTRODUCTION

The Lower Liassic ("Gresten Beds") of the sub-tatric (Križna) series is represented by detrital rocks: marly shales and quartz sandstones with marly and limestone intercalations (Goetel 1916, 1917; Sokołowski 1948; Guzik 1959), resting on the Rhaetian with sedimentary continuity (Gaździcki 1974, 1975).

This paper presents the results of detailed microfacies studies on organodetritial limestones intercalating the Lower Liassic sequence, and particularly well-represented in the sections from Lejowa and Strążyska valleys (Figs 1—4). The rich foraminifer assemblage recently found in these intercalations (*cf.* Pls 2—4) made it possible to define more precisely the stratigraphic position of the sequence.

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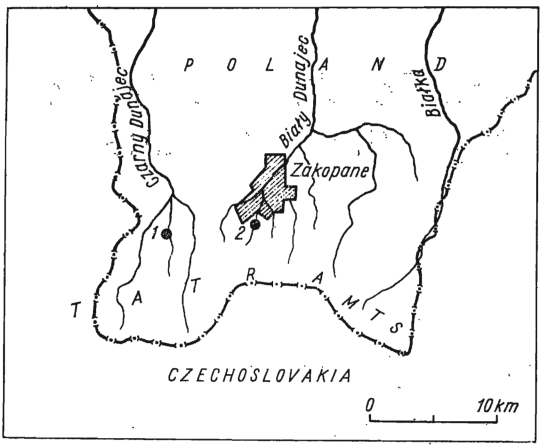
CHARACTERISTICS OF THE DEPOSITS

The Lower Liassic ("Gresten Beds") rocks crop out over a large part of the sub-tatric (Križna) exposure. They are exposed along the northern slopes of the Tatra Mts (*cf.* Uhlig 1911) where their thickness is estimated at up to 80 m. The recognition of the sedimentary sequence and the characteristics of inorganic, organic and biosedimentary components of the Lower Liassic rocks is based on analysis of selected sections from Lejowa and Strążyska valleys (Figs 1—4).



Locality map of the sub-tatric lowermost Liassic ("Gresten Beds") profiles sampled for foraminifers in the Tatra Mts
1 Lejowa Valley, 2 Strążyska Valley

LEJOWA VALLEY

The Lower Liassic ("Gresten Beds") rocks are best displayed on the northeastern slopes of Mt. Wierch Spalenisko (Figs 1—2). The exposures of these rocks were maped by K. Guzik, S. Guzik & Sokołowski (1958) and Bac (1971, Figs 3—4). The section analysed was traced along the line from Mt. Wierch Spalenisko to Huty Lejowe Alp (Fig. 2) at the altitude of 1040—990 m a.s.l. The strike and dip of the rocks equal 130°/30°N. The rocks belong to the Bobrowiec tectonic unit (*cf.* Bac 1971). The sequence rests on the Rhaetian with sedimentary continuity (*cf.* Gaździcki 1974) and is represented by a series, over 60 m thick of sandstones and marly shales with organodetrital limestone and marly intercalations.

The section comprises 7 units the general characteristics of which is as follows:

Unit 1. — Sandy deposits, about 8 m thick, directly overlying brown-gray, somewhat ferruginous marls and siltstones of the uppermost Rhaetian (*cf.* Gaździcki 1974, Fig. 3). The lowermost part of the sandy series is represented by calcareous sandstone with pelecypod shell debris (Pl. 1, Fig. 1), passing upwards into quartz sandstone with clayey-limonitic matrix (Pl. 1, Fig. 2). No foraminifers were found.

Unit 2. — Dark, sandy limestones, about 3 m thick, with quartz grains and some admixture of ostracode and crinoid debris. Single representatives of *Cyclogyra liasina* (Pl. 4, Fig. 9), *Glomospira* sp. (Pl. 4, Fig. 12), *Ophthalmidium leischneri,* and *Nodosaria* sp. were found.

Unit 3. — Brown-gray laminated marly shales, about 8 m thick, with admixture of fine-grained sand (Pl. 1, Fig. 3). No foraminifers were found.

Unit 4. — Well-bedded, dark-gray organodetrital limestones, about 12 m thick, with layers up to 15 cm thick on the average. Microscopically, the limestone may be classed as crinoid-gastropod biopelmicrite with *Pycnoporidium*? encrustacions and

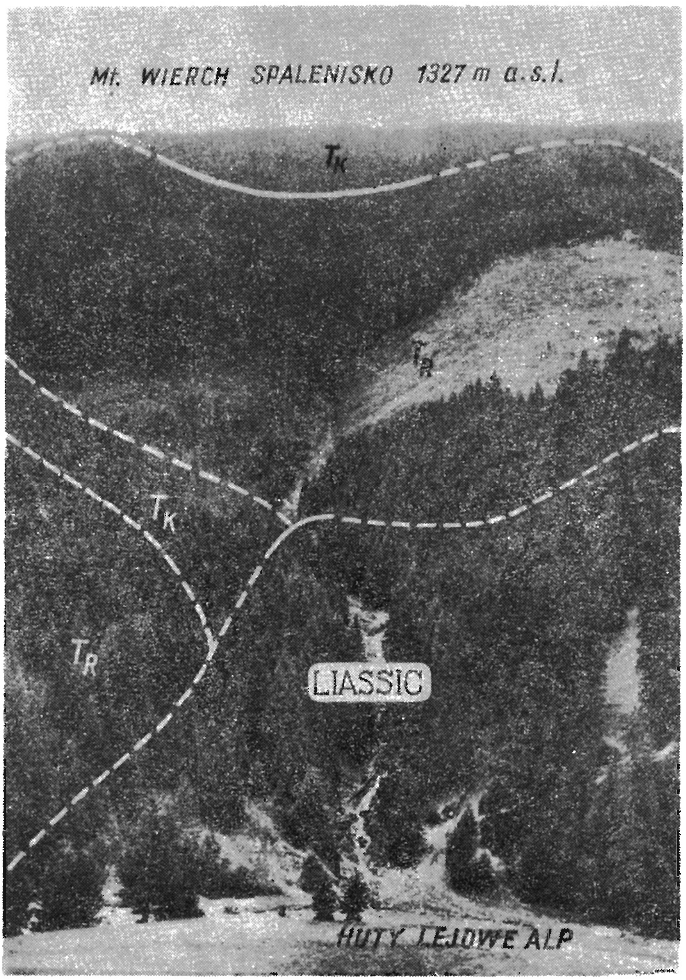


Fig. 2. Occurrence zone of the lowermost Liassic ("Gresten Beds") deposits on the NE slopes of Mt. Wierch Spalenisko in the Lejowa Valley; the investigated profile (*1* in Text-fig. 1; cf. Text-fig. 3) exposed along the ravine from Mt. Wierch Spalenisko towards Huty Lejowe Alp

T_K — "Keuper", T_R — Rhaetian (*cf.* Gaździcki 1974, Text-fig. 2) envelopes (Pl. 1, Fig. 5). The spores *Globochaete alpina* (Pl. 4, Figs 1—2) and *Eotrix alpina* (Pl. 4, Fig. 3) are common. Among the foraminifers, *Ophthalmidium leischneri, Planiinvoluta carinata* (Pl. 4, Fig. 8), *Nodosaria* sp. (Pl. 2, Fig. 4), *Lenticulina* sp. (Pl. 2, Fig. 12), *Marginulina spinata spinata,* and *Involutina* sp. predominate.

Unit 5. — Brown-gray, laminated, marly shales, sometimes with marly intercalations and admixture of very fine quartz grains, about 8 m thick. Echinoid spines and the single foraminifer, *Ophthalmidium leischneri,* were occasionally found.

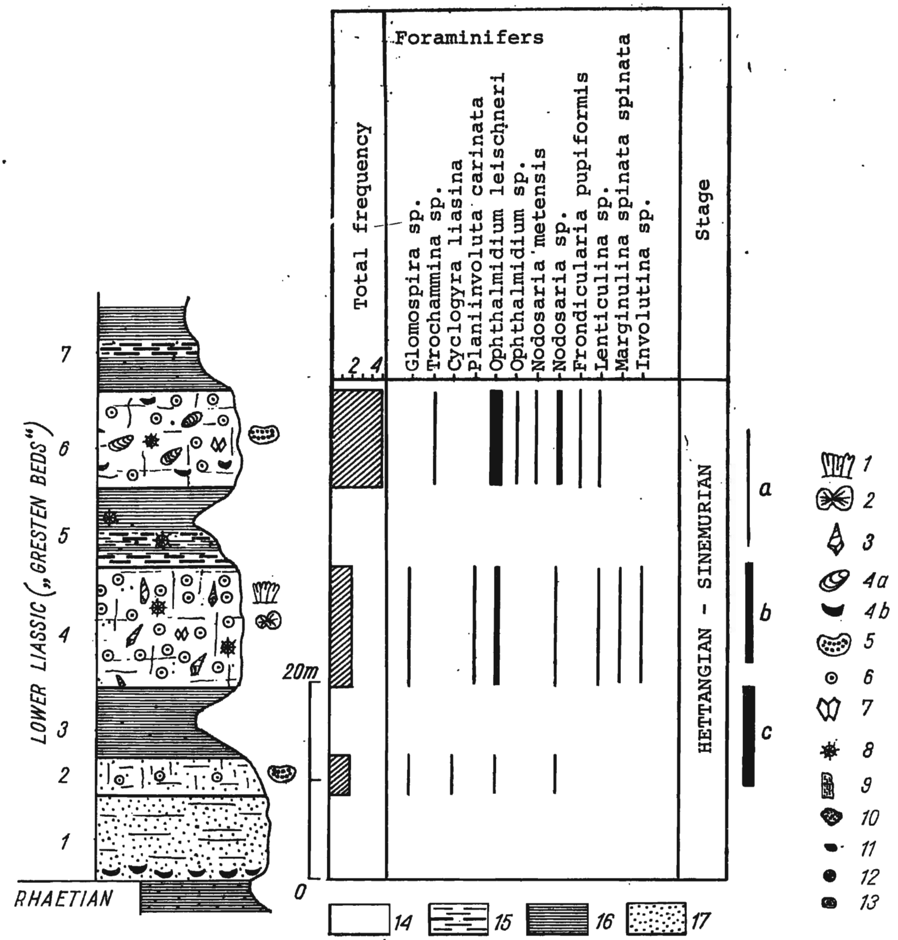


Fig. 3. Detail profile of the lowermost Liassic ("Gresten Beds") deposits in the Lejowa Valley (cf. Text-fig. 1); the profile presents lithology as well as frequency and distribution of foraminifers

Organic components: *1* algae *Pycnoporidium?*, *2* spores *Globochaete* and *Eotrix*, *3* gastropods, *4* pelecypods (*4a* entire shells, *4b* valve debris), *5* ostracodes, *6* crinoids, *7* ophiuroids, *8* echinoids, *9* coprolites *Parafavreina*

Inorganic components: *10* intraclasts, *11* pellets, *12* ooids

Biosedimentary components: *13* onkolites

Lithology: *14* limestones, *15* marls, *16* marly shales, *17* sandstones and detrital quartz

Total frequency of foraminifers: *1* 1—10 specimens, *2* 11—20 specimens, *3* 21—30, *4* 31—50, *5* more than 50 specimens in thin sections from a definite unit

Distribution of foraminifers presenting number of specimens of a definite species or genus in the unit: *a* rare (1—10 specimens), *b* frequent (11—25 specimens), *c* abundant (more than 25 specimens)

Unit 6. — Dark-gray encrinites, about 9 m thick. Microscopically, the limestones are primarily represented by crinoid-ostracode biopelsparenite, yielding single pelecypod valves and echinoid spines. Foraminifers very numerous, represented by: *Ophthalmidium leischneri* (Pl. 4, Figs 15—16) sometimes of rock-building importance, *Trochammina* sp. (Pl. 4, Fig. 10), *Lenticulina* sp. (Pl. 2, Fig. 9), and *Frondicularia pupiformis.*

Unit 7. — Brown-gray marly shales with marly intercalations and admixture of fine quartz grains, over 10 m in thickness. No foraminifers were found.

The higher part of the "Gresten Beds" is obscured by Quaternary deposits in the stream bed, and the opposite slope displays spotted limestones of the Lotharingian (*cf.* Bac 1971).

STRĄŻYSKA VALLEY

The Lower Liassic ("Gresten Beds") rocks exposed in Strążyska Valley belong to the other tectonic unit, the Grześkówki tectonic slice (*cf.* Fig. 1; and Guzik & Kotański 1963). The sequence resting with sedimentary continuity on the Rhaetian is over 70 m thick; the strike and dip equal 100°/50°N. It is represented by shales and sandstones with limestone and marly intercalations (Fig. 4). The sequence includes 8 units.

Units 1—3. — Brownish, marly shales and quartz sandstones, 14 m thick, resting on bluish-gray limestone of the uppermost Rhaetian (*cf.* Gaździcki 1974). No foraminifers were found.

Unit 4. — Dark-gray, organodetrital limestones about 8 m thick. Microscopically, the limestones may be classed as biointrapelsparenite and crinoid biopelmicrite composed of crinoid, ophiuroid, and gastropod debris, with onkolitic crusts as well as intraclasts, pellets, and occasional ooids (*cf.* Pl. 1, Figs 4, 6). The limestones yield numerous foraminifers, including: *Ophthalmidium leischneri* (Pl. 4, Figs 13—14), representatives of post-Triassic Involutinidae including *Involutina liassica* (Pl. 3, Figs 5—7), *I. farinacciae* (Pl. 3, Figs 1—3), *I.* cf. *turgida* (Pl. 3, Fig. 10), *Trocholina granosa,* some Nodosariidae as *Nodosaria* cf. *crispata* (Pl. 2, Figs 1—2), *Frondicularia* cf. *pupiformis* (Pl. 2, Fig. 3), *Lenticulina* sp. (Pl. 2, Fig. 10), as well as *Planiinvoluta carinata* (Pl. 4, Fig. 7) and *Planiinvoluta* sp. (Pl. 4, Fig. 6). Other organic remains identified include spores (*Globochaete alpina,* Pl. 4, Figs 4—5), ostracodes, and coprolites (*Parafavreina* sp.).

Unit 5. — Dark-gray, sandy limestones about 5 m thick, and yielding crinoid debris with onkolitic crusts, as well as some intraclasts and pellets. Here were found spores (*Globochaete alpina*) and some foraminifers: *Frondicularia pupiformis, Nodosaria* sp., *Lenticulina* sp. and *Ophthalmidium leischneri.*

Units 6—8. — Brown-gray, marly shales intercalated with marls, siltstones and, occasionally, with organodetrital limestones, over 40 m thick. Some foraminifers

(*Ophthalmidium leischneri*, single involutinids, and nodosariids) are occasionally found (only in unit 7).

The section analysed ends with unit *8*, which is overlain by overthrust "Keuper" rocks (*cf.* Guzik & Kotański 1963, Fig. 2).

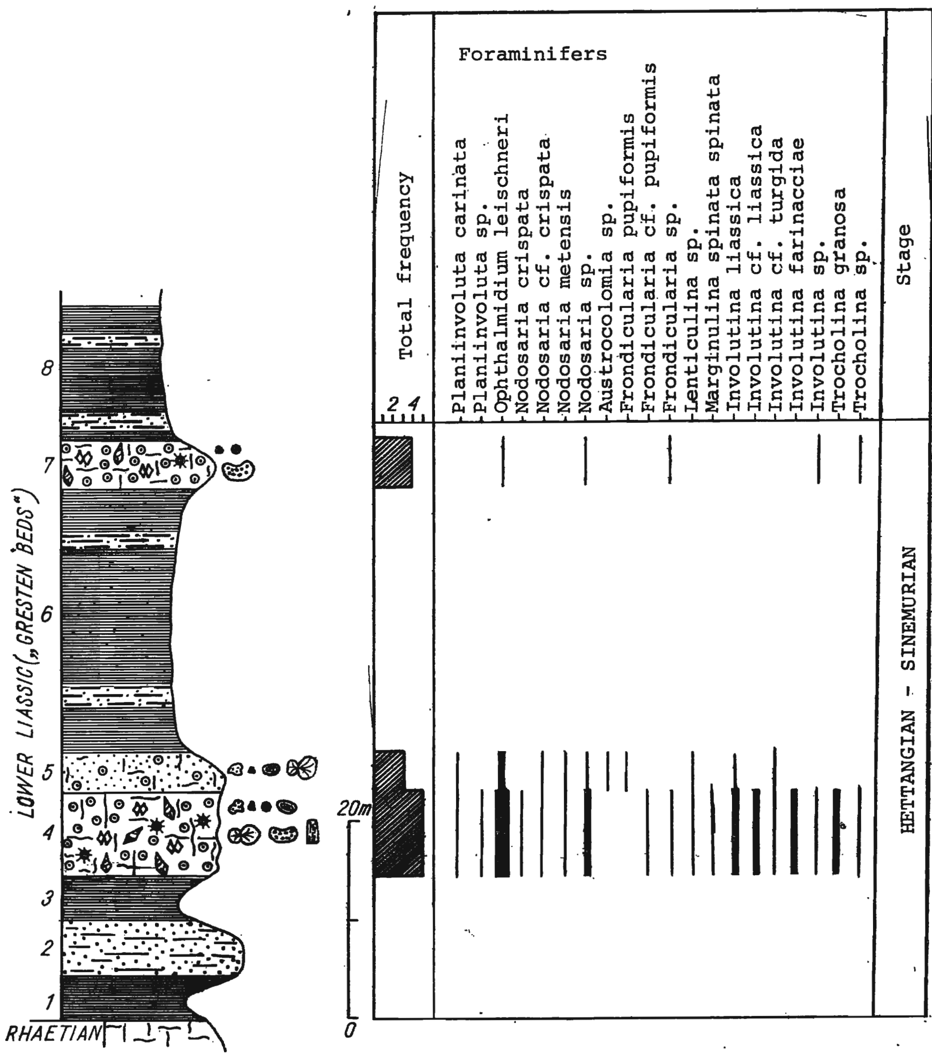


Fig. 4. Detail profile of the lowermost Liassic ("Gresten Beds") deposits in the Strążyska Valley (*cf.* Text-fig. 1); the profile presents lithology as well as frequency and distribution of foraminifers (explanations the same as for Text–fig. 3)

FORAMINIFERS

The foraminifers were found in organodetrital limestones and, occasionally, in marly intercalations in the sequences analysed. The foraminifers, fairly common in these rocks, are represented by 24 taxa, the majority of which are illustrated in Plates 2—4.

The foraminifer assemblage comprises:

Glomospira sp. — Pl. 4, Fig. 12
Trochammina sp. — Pl. 4, Fig. 10
Cyclogyra liasina (Terquem, 1866) — Pl. 4, Fig. 9
Planiinvoluta carinata Leischner, 1961 — Pl. 4, Figs 7—8
Planiinvoluta sp. — Pl. 4, Fig. 6
Ophthalmidium leischneri (Kristan-Tollmann, 1962) — Pl. 4, Figs 13—16
Ophthalmidium sp. — Pl. 4, Fig. 11
Nodosaria metensis Terquem, 1864
Nodosaria crispata Terquem, 1866
Nodosaria cf. *crispata* Terquem, 1866 — Pl. 2, Figs 1—2
Nodosaria sp. — Pl. 2, Figs 4, 7—8
Austrocolomia sp.
Frondicularia pupiformis Haeusler, 1881
Frondicularia cf. *pupiformis* Haeusler, 1881 — Pl. 2, Fig. 3
Frondicularia sp. — Pl. 2, Figs 5—6
Lenticulina sp. — Pl. 2, Figs 9—12
Marginulina spinata spinata Terquem, 1858
Involutina liassica (Jones, 1853) — Pl. 3, Figs 5—7
Involutina cf. *liassica* (Jones, 1853) — Pl. 3, Figs 8—9
Involutina cf. *turgida* Kristan, 1957 — Pl. 3, Fig. 10
Involutina farinacciae Brönnimann & Koehn-Zaninetti, 1969 — Pl. 3, Figs 1—3
Involutina sp. — Pl. 3, Fig. 4
Trocholina granosa Frentzen, 1941
Trocholina sp.

In this foraminifer assemblage, the families Nodosariidae and Involutinidae predominate both in number of taxa and individuals, being represented by 10 and 7 taxa, respectively. The families Fischerinidae (with 3 taxa), and Ammodiscidae and Trochamminidae (1 taxon each) are represented in subordinate numbers. In the case of the family Miliolidae (with two taxa), a special attention should be paid to *Ophthalmidium leischneri* (Kristan-Tollmann), represented by very high number of individuals (over 500) and locally gaining rock-forming importance (*cf.* Figs 3—4). This species was previously described under various generic names, as e.g. *Neoangulodiscus* or *Vidalina* (*cf.* Wernli 1972), and its revision is the subject of a separate paper (Gaździcki 1976).

The foraminifer assemblage found in the Lower Liassic rocks of the Tatra Mts is characterized by vast geographical distribution in the whole Lower Liassic of the Tethyan geosyncline, and its particular representatives are known from the Slovakian Carpathians (Mišik 1961, 1964), Vienna basin (Kristan-Tollmann 1962), Northern Alps (Weynschenk 1950; Hagn 1955; Leischner 1959, 1961), Southern Alps (Cita 1965; Cousin & Neumann 1971), Apennines (Farinacci 1967; Brönnimann & Koehn--Zaninetti 1969; Manganelli & Zuccari 1969), Karavanken Mts (Ramovš & Rebek 1970), Croatia (Gušić & Babić 1972), Taurus Mts (Brönnimann

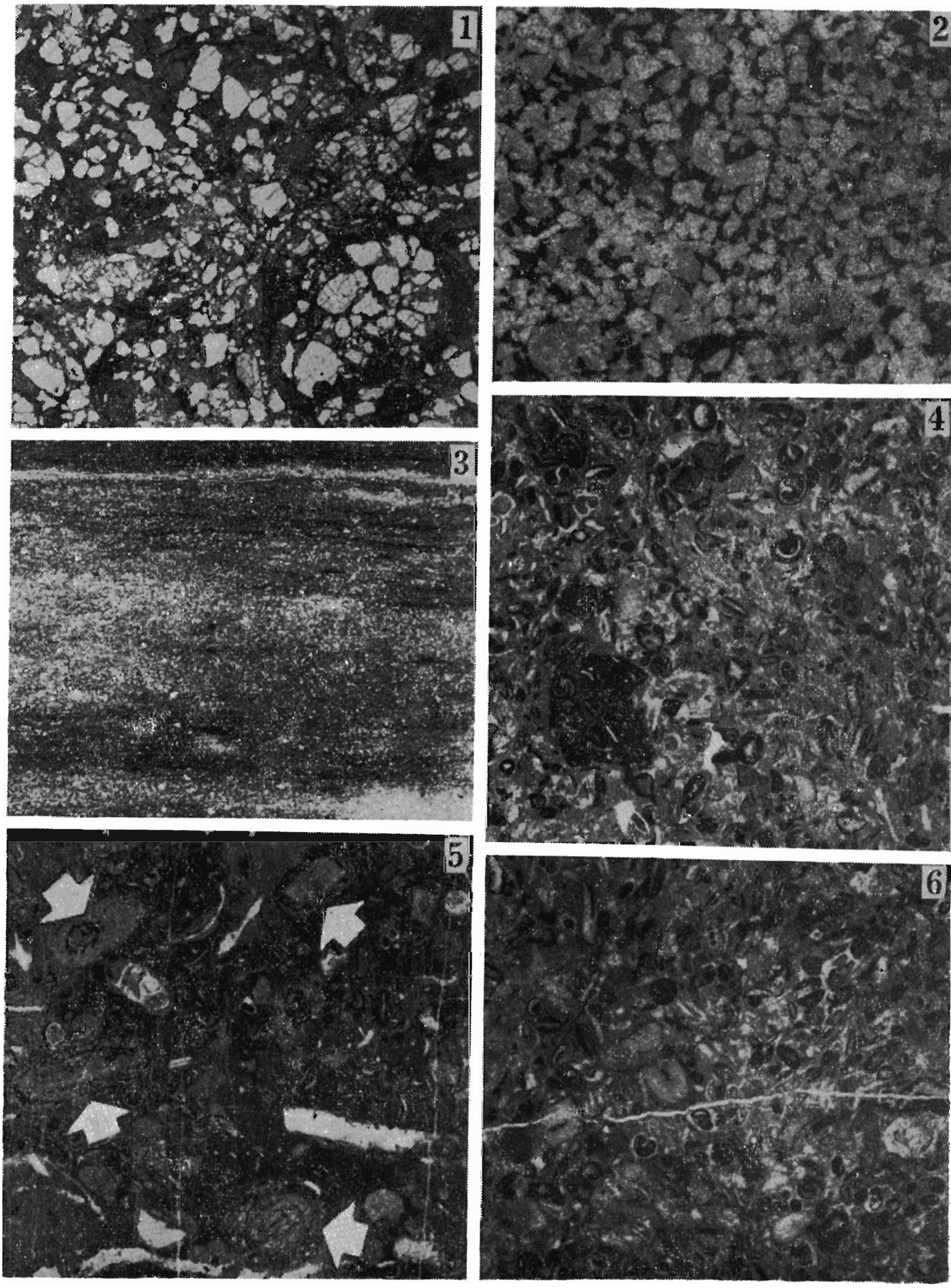
& al. 1970). Moreover, there is an important admixture (about 10 taxa) of elements in common with foraminifer assemblages of Early Liassic epicontinental basin of north-western Europe (*cf.* Franke 1936; Brouwer 1969; Schloz 1972). The species in common primarily include: *Involutina liassica, Trocholina granosa, Nodosaria metensis, Frondicularia pupiformis,* and *Cyclogyra liasina.*

STRATIGRAPHY

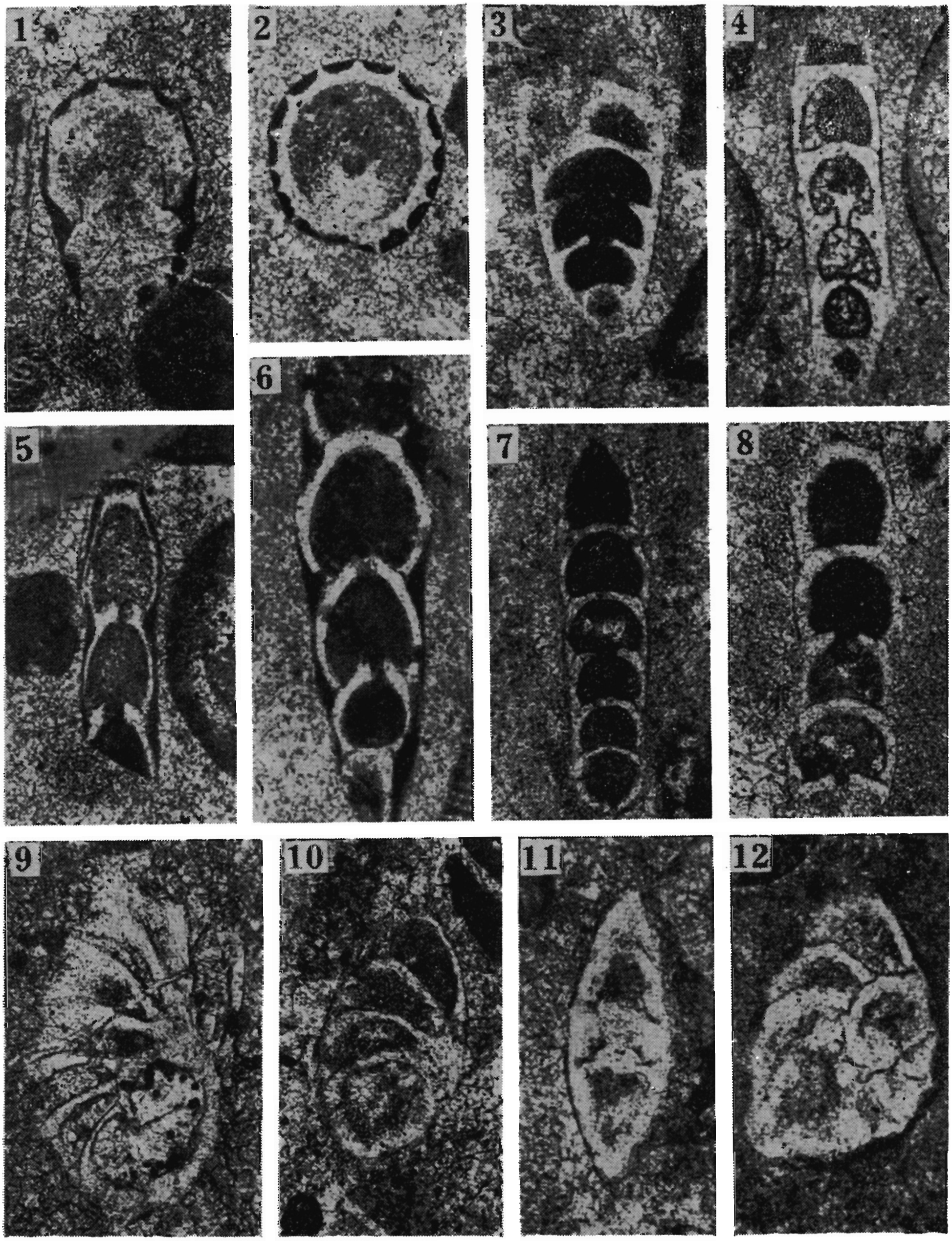
The sequence of Lower Liassic ("Gresten Beds") rocks rests with a sedimentary continuity on the Rhaetian rocks with a good stratigraphic record (primarily based on foraminifers; *cf.* Gaździcki 1974, 1975). The uppermost unit (with *Triasina hantkeni,* the guide fossil of the Upper Rhaetian [1]) and the lowermost unit (with Lower Liassic foraminifers, including *Ophthalmidium leischneri, Involutina farinacciae* and *I. liassica*) are separated by a 10-meter series of rocks representing facies unfavourable for foraminifers (*cf.* Figs 3—4; *see* also Gaździcki 1974, Fig. 12, and Gaździcki 1975, Table 1). Within this series, which at the same time represents the interval of correlational error, passes the Rhaetian/ /Hettangian (= Triassic/Jurassic) boundary in the Tatra Mts.

Because of the lack of ammonites, the stratigraphy of the "Gresten Beds" is also based on foraminifers. Some forms found in these rocks are of great stratigraphic importance. This is the case of the representatives of the families Involutinidae and Miliolidae. Close to the Triassic/Jurassic boundary, the former underwent accelerated evolution resulting in the origin of so-called post-Triassic involutinids characterized by umbilical masses composed of numerous pillars (*cf.* Pl. 3). Such forms first apear in the latest Triassic (*I. liassica, I. turgida*) but their bloom took place not before the Liassic, when several specific forms including *I. farinacciae* appeared (*cf.* Farinacci 1967; Brönnimann & Koehn-Zaninetti 1969). The species *Ophthalmidium leischneri* appears to be the most important here; it was reported from the base of the Liassic in several parts of the Tethys regions (Leischner 1961; Kristan-Tollmann 1962; Cita 1965; Romovš & Rebek 1970; Papp & Turnovsky 1970; Brönnimann & al. 1970; Gušić & Babić 1972) and never from rocks older than the Hettangian; moreover, in a borehole drilled in the Vienna basin (*cf.* Kristan-Tollmann 1962), this species was found in a core sample yielding *Arietites* sp., the ammonite typical of the Sinemurian, and this stage is tentatively accepted as the

[1] The species *Triasina hantkeni* Majzon was occasionally reported from the Lower Liassic (*cf.* Cros & Neumann 1964; Cousin & Neumann 1971), but these records were questioned by Salaj (1969) and the author (Gaździcki 1974, 1975). The sequence analysed does not demonstrate the occurrence of this species in the Lower Liassic; thus, taking into account the well-dated localities, it should be stated that the range of *Triasina hantkeni* does not pass beyond the uppermost Rhaetian.

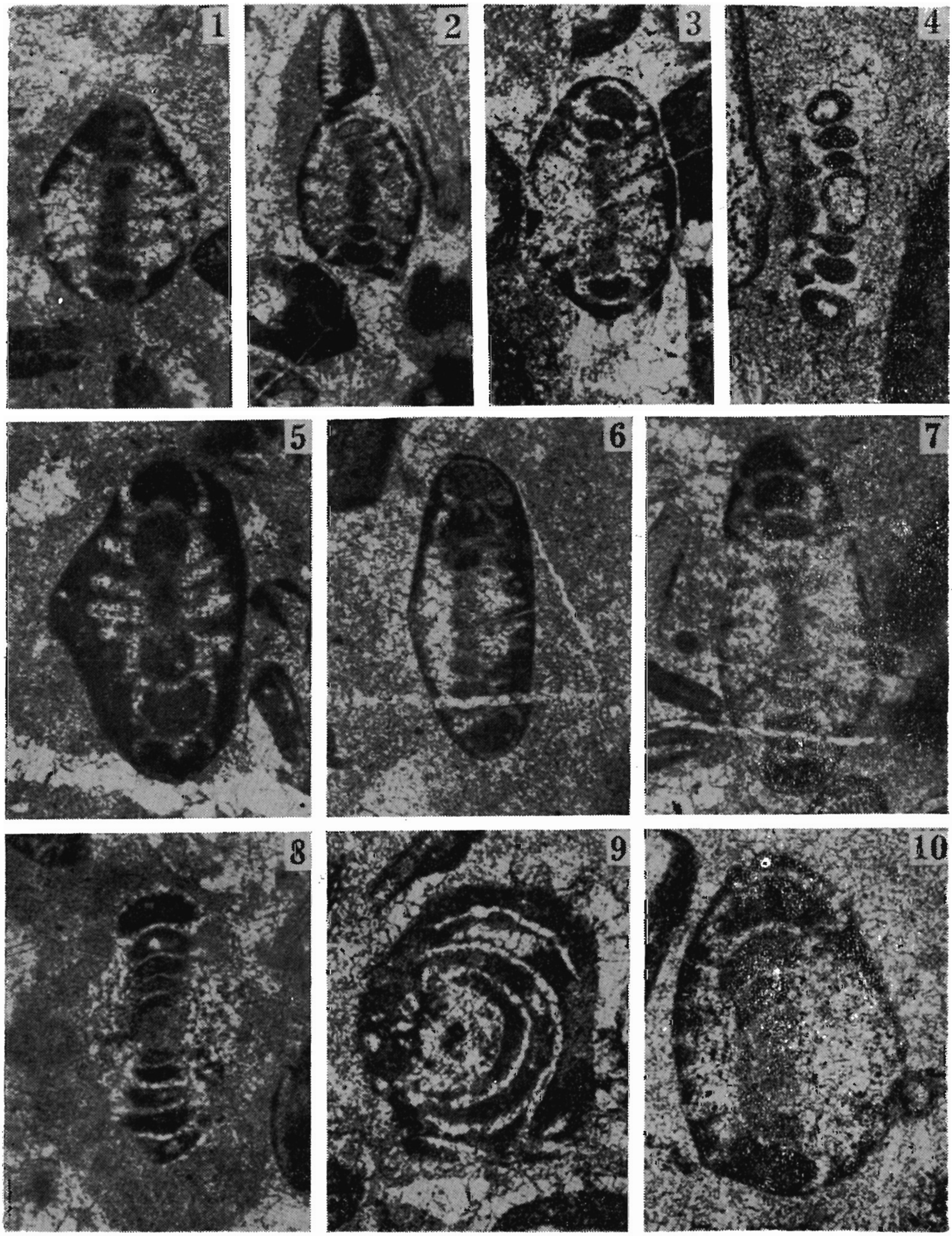


1 Calcareous, quartz sandstone with pelecypod debris; Lejowa Valley (unit *1*), × 5;
2 Quartz sandstone with clayey-limonitic matrix; Lejowa Valley (unit *1*), ×5;
3 Laminated marly shale with fine-grained sand; Lejowa Valley (unit *3*), ×5;
4 Biointrapelsparenite composed of gastropod, ophiuroid and crinoid debris with onkolitic crusts, as well as of intraclasts, pellets and few ooids; Strążyska Valley (unit *4*), ×10;
5 Crinoid-gastropod biopelmicrite with *Pycnoporidium*? encrustings (arrowed); Lejowa Valley (unit *4*), ×10;
6 Crinoid biopelmicrite; Strążyska Valley (unit *4*), × 10



Lower Liassic Nodosariidae

1-2 — *Nodosaria* cf. *crispata* Terquem; Strążyska Valley (unit 4), ×100.
3 — *Frondicularia* cf. *pupiformis* Haeusler; Strążyska Valley (unit 4), × 100.
4, 7-8 — *Nodosaria* sp.: 4 from Lejowa Valley (unit 4), 7—8 from Strążyska Valley (unit 4), × 100
5-6 — *Frondicularia* sp.; Strążyska Valley (unit 4), ×100.
9-12 — *Lenticulina* sp.: 9 from Strążyska Valley (unit 4), 10—12 from Lejowa Valley (units 4 and 6), × 100.



Lower Liassic Involutinidae
all specimens from Strążyska Valley (unit 4)

1-3 — *Involutina farinacciae* Brönnimann & Koehn-Zaninetti; axial sections, ×80.

4 — *Involutina* sp.: axial section, × 150.

5-7 — *Involutina liassica* (Jones); axial sections (*5* megalospheric form, *6—7* microspheric forms), ×80.

8-9 — *Involutina* cf. *liassica* (Jones): *8* axial section (microspheric form), *9* equatorial section (megalospheric form); ×80.

10 — *Involutina* cf. *turgida* Kristan; subaxial section, ×100.

The carbonate sediments are primarily represented by organodetrital limestones, as well as marly limestones and marls forming some intercalations in this sequence. Macrofauna of this unit, reported by Goetel (1916, 1917), includes *Gryphaea arcuata* Lamarck and *Pentacrinus* cf. *tuberculatus* Miller.

The organodetrital limestones, the only foraminifer-bearing rocks here, are characterized by the high contribution of various grained components, including bio- and intraclasts, pellets, ooids, onkolites and fine-grained detrital quartz.

The foraminifers are the main microfaunistic components of the communities which also comprise benthic forms attached to the bottom (pelecypods and crinoids) as well as vagile (gastropods, ophiuroids and echinoids), accompanied by spores *Globochaete* and *Eotrix* (Pl. 4, Figs 1—5), crinoid-bioclast encrusting algae *Pycnoporidium*? (Pl. 1, Fig. 5) and ostracodes. It should be noted that both bioclasts and single foraminifer tests often underwent onkolitization or, sometimes, oolitization. The former process involved formation of onkolitic crusts (Pl. 2, Figs 6, 12; Pl. 4, Fig. 5) and, subsequently, thin uniform envelopes (Pl. 2, Figs 1—2, 5; Pl. 3, Figs 1—3, 6—7, 10) and thick irregular coatings (Pl. 3, Fig. 5; Pl. 4, Fig. 4). The development of algal coatings around bioclasts or foraminifer tests indicates deposition under shallow-marine conditions in the photic zone. In turn, the occurrence of intraclasts, ooids, and numerous calcarenites (usually represented by crinoid bioclasts) indicates high agitation of waters, typical of the subtidal zone (*cf.* Heckel 1972).

The differentiation of deposits forming the "Gresten Beds" sequence of the Tatra Mts may be interpreted as the result of interference of several factors, e.g. hydrographic conditions, subsidence and tectonic setting, as well as the contribution of organism types adapted to life in certain zones of the sedimentary basin.

FINAL REMARKS

The investigated "Gresten Beds" sequence comprises shallow-water deposits, and is characterized by the predominance of terrigenic material. The character of these deposits reflects some general changes and especially epeiric movements active at the turn of the Triassic and Jurassic. The movements resulted in a marked decrease in the depth of the basin in relation to that of the Rhaetian times, some regression not leading to land emersion at the turn of the Rhaetian and Hettangian, and in the predominance of clastic deposits in the sequence studied.

The "Gresten Beds" rest on Upper Rhaetian rocks (Gaździcki 1974, 1975) and are overlayed by spotted limestones (*Fleckenmergel;* Goetel 1916), and they may be dated on the basis of foraminifers at the Hettangian-Sinemurian stages.

The variability and succession of deposits of the "Gresten Beds" of the sub-tatric Lower Liassic in the Tatra Mts fully math the definition given by Hauer (1853), who proposed the term "*Gresten Schichten*" and described lithofacies development of the Gresten sequence from the north--eastern Alps.

The sedimentary sequence and floral and faunal assemblages of the "Gresten Beds" of the Tatra Mts are almost identical to those from contemporaneous [2] rocks of various parts of the Tethyan geosyncline, and particularly those from the Slovakian Carpathians (Mišík 1964; Kochanová 1967; Čepek 1970), Vértes Mts (Knauer 1973), Northern Alps (Weynschenk 1950; Leischner 1959, 1961; Fabricius 1966), Southern Alps (Cita 1965; Fuganti & Mosna 1966; Gaetani 1970; Cousin & Neumann 1971; Tsamantouridis 1971; Bosellini & Broglio Loriga 1971), Apennines (Farinacci 1959, 1967; Boccaletti & al. 1969; Passeri 1971), Karavanken Mts (Ramovš & Rebek 1970), Croatia (Gušić & Babić 1972) and Taurus Mts (Brönnimann & al. 1970). On the other hand, it is possible to note some similarity to contemporaneous deposits of epicontinental basin of north--western Europe. This was already noted by Goetel (1917), who emphasized a marked resemblance of the sandstones with *Cardinia* from the Tatra Mts and Lower Liassic sandstones of Swabia in petrological characteristics and composition of faunal assemblages. The results of microfacies analysis as well as the analysis of foraminifer assemblages show some similarity of the "Gresten Beds" of the Tatra Mts and the Hettangian series of Baden-Württemberg that represents typical epicontinental deposits (*cf.* Schloz 1972).

It may therefore be concluded that the sedimentary conditions prevailing in the Tethyan geosyncline and epicontinental basin of the north-western Europe were quite similar during the Early Liassic, which was undoubtedly determined by the existence of efficient marine connections between these basins.

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Warsaw, April 1975

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[2] It should be noted that Lower Liassic sequence of the high-tatric series of the Tatra Mts, studied in detail by Radwański (1959a, b), appears entirely different from that of the "Gresten Beds"; this is attributable to an intrageoanticlinal setting of the high-tatric basin during the Mesozoic.

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MIKROFACJE I OTWORNICE Z „WARSTW GRESTEŃSKICH" DOLNEGO LIASU REGLOWEGO TATR

(Streszczenie)

W oparciu o profile z Doliny Lejowej i Doliny Strążyskiej przedstawiono następstwo osadów oraz charakterystykę mikrofacjalną „warstw gresteńskich" najniższego liasu płaszczowiny reglowej dolnej Tatr (*por.* fig. 1—4 oraz pl. 1). W węglanowych wkładkach w obrębie tej sekwencji stwierdzono obecność szeregu otwornic o znaczeniu stratygraficznym (*por.* pl. 2—4). Najliczniej reprezentowane są tutaj rodziny Nodosariidae, Involutinidae i Miliolidae, wśród których rozpoznano ponad 20 taksonów szczebla gatunkowego i podgatunkowego, m.in: *Ophthalmidium leischneri* (Kristan-Tollmann), *Nodosaria metensis* Terquem, *N. crispata* Terquem, *Marginulina spinata spinata* Terquem, *Frondicularia pupiformis* Haeusler, *Involutina liassica* (Jones), *I. farinacciae* Brönnimann & Koehn-Zaninetti oraz *Trocholina granosa* Frentzen. Wymienione otwornice określają wiek zawierających je osadów na hettang — synemur.

Zmienność i następstwo osadów, a także zespół elementów florystycznych i faunistycznych „warstw gresteńskich" dolnego liasu reglowego Tatr są prawie identyczne ze spotykanymi w analogicznych osadach w całej geosynklinie alpejsko-karpackiej. Osady te wykazują także pewne podobieństwo do równowiekowych utworów basenu epikontynentalnego północno-zachodniej Europy.
