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The Cretaceous transgressive deposits east of Częstochowa (Polish Jura Chain)

ABSTRACT: The Cretaceous transgressive deposits in the environs of Mokrzesz, Lusławice and Julianka, situated east of Częstochowa (Polish Jura Chain), are developed mostly as various glauconitic sands and sandstones containing abundant fauna. These deposits represent successive stratigraphic members from the Upper Albian till the Lower Turonian. Particularly numerous faunal assemblages occur in the Lower Cenomanian and contain various cephalopods (nautilids, ammonites and belemnites), which are elaborated in the palaeontological part of the present paper, and which include many forms of ammonites of the genera *Scaphites, Hamites, Sciponoceras, Mariella, Turrilites, Ostlingoceras, Schloenbachia, Mantelliceras, Sharpeiceras, Calycoceras* and *Paracalycoceras.*

INTRODUCTION

The present paper concerns the Cretaceous transgressive deposits which occur in the environs of Mokrzesz, Lusławice and Julianka, east of Częstochowa (Fig. 1). Their stratigraphy and facial development, together with their fauna, primarily ammonites, are described in the paper.

The area under study was the subject of elaborations of many authors (cf. Marcinowski 1969). The occurrence of the Cretaceous deposits in the area of Julianka was first found by Roemer (1870) who assigned them to the Senonian. Later investigators, distinguishing the Albian, Cenomanian, Turonian and Senonian, gave considerably varying stratigraphic positions of the particular lithological members. It was Różycki (1937) who first presented a stratigraphic schema, which, with some modifications, is satisfactory even at the present and who gave several data on the sedimentation and paleogeography.

The Cretaceous transgressive deposits in the environs of Julianka and Mokrzesz overlie a substratum differentiated morphologically and consisting of the Upper Jurassic butten limestones (Oxfordian-Kimmerid-

gian boundary, Marcinowski 1969). The Cretaceous transgressive members are here developed as clastic sediments whose age ranges from the (? Middle)/Upper Albian to the Lower Turonian. The oldest deposits till the Lower Cenomanian transgressively overlap each other and fill depressions in the Jurassic substratum (Fig. 2). The present paper is

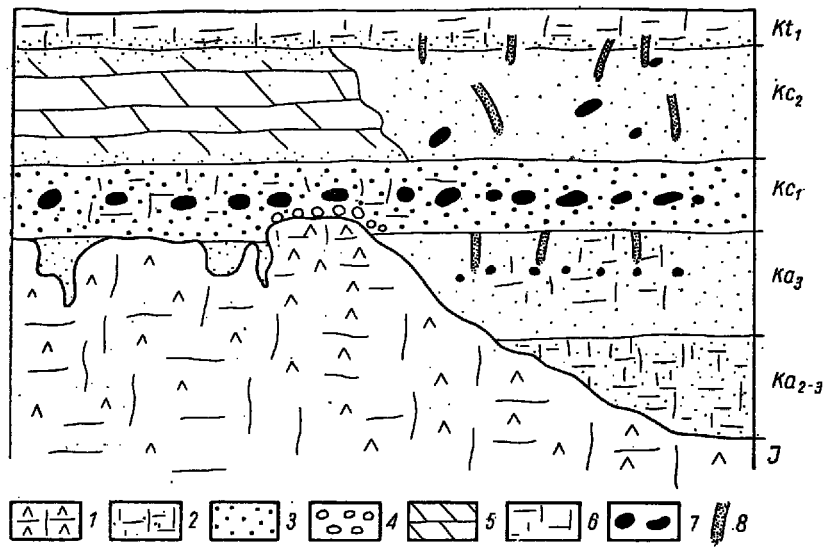


Fig. 2

Diagrammatic profile of the transgressive Cretaceous deposits in the investigated area, and their relation to the Upper Jurassic substratum (cf. Fig. 1)

J Upper Jurassic, Ka_{2-3} Middle or Upper Albian, Ka_3 Upper Albian, Kc_1 Lower Cenomanian, Kc_2 Upper Cenomanian, Kt_1 Lower Turonian

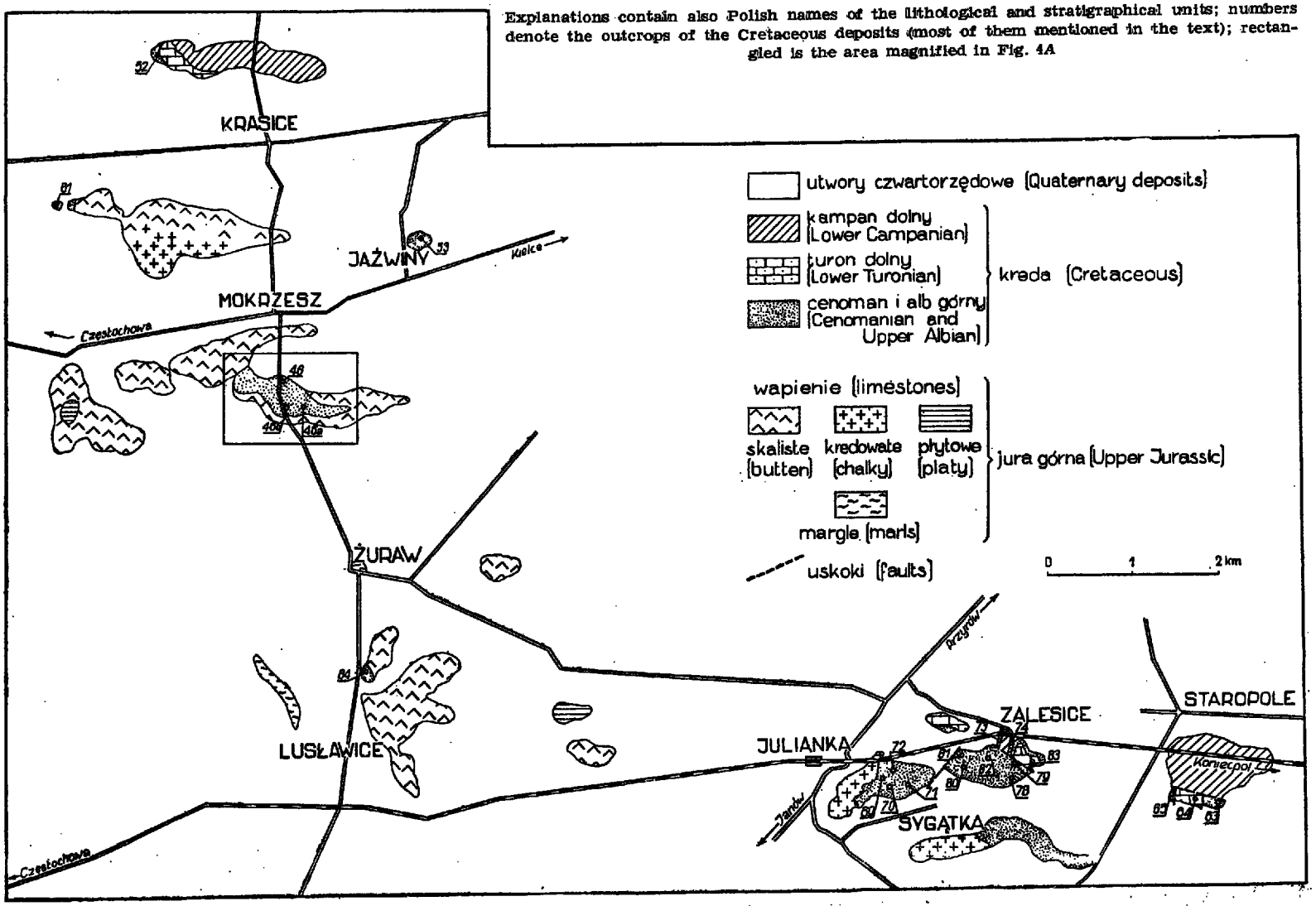
1 butten limestones, 2 sandstones, 3 sands, 4 gravels, 5 gaizes, 6 layered limestones, 7 phosphatic nodules, 8 burrows *Ophiomorpha nodosa* Lundgren

mostly devoted precisely to these deposits. It is only above the Lower Turonian deposits, which here complete the transgressive cycle, that the Lower Campanian marls occur. The stratigraphic gap from the Lower Turonian to the Lower Campanian was caused by a break in sedimentation, which led to the development of the hardground (Różycki 1937).

Of the rich fauna, the writer has primarily identified cephalopods, whose detailed description is given in the palaeontological part of the present paper. Corals have been identified by Dr. E. Roniewicz, brachiopods by Dr. E. Barczykowa, inocerams by Dr. S. Cieśliński, irregular echinoids by Dr. S. Mączyńska and shark teeth by Docent A. Radwański. The writer's gratitude is due to all these persons for their work and goodwill. He feels particularly indebted to Docent J. Kutek and Docent A. Radwański for their care and advice in the course of field studies and during the laboratory elaboration of the material collected.

Geological sketch map of the investigated area situated east of Częstochowa (Polish Jura Chain)

Explanations contain also Polish names of the lithological and stratigraphical units; numbers denote the outcrops of the Cretaceous deposits (most of them mentioned in the text); rectangled is the area magnified in Fig. 4A



LITHOLOGY AND STRATIGRAPHY

Middle or Upper Albian

In the area under study the oldest lithological member of the Albian is developed (Różycki 1937) as siliceous quartz sandstones with an admixture of glauconite and flakes of muscovite. The rock is gray-brown in color, fine-grained (siliceous and sandy laminae) and its stratification is emphasized by the presence of rusty streaks of iron compounds. These sandstones occur in the environs of Sygątka and Julianka (Różycki 1937). The rubble of this rock has also been found by the writer north of Krasice (outcrop *52*, cf. Fig. 1). He has not, however, succeeded in finding a direct contact of these sandstones with either the Jurassic deposits, or overlaying Upper Albian deposits documented faunistically. The fauna of the siliceous sandstones is very poor; *Galerites* sp. is cited by Koroniewicz & Rehbinder (1913) and *Inoceramus* sp. by Różycki (1937). The lack of the index and well-preserved fauna, as well as satisfactory outcrops, causes the impossibility of a more accurate stratigraphic recognition of these deposits. Siliceous sandstones occur in the sedimentary continuity below the Upper Albian deposits documented faunistically and, therefore, they may correspond to the lower part of the Upper or to the uppermost part of the Middle Albian.

Upper Albian

Noncalcareous, partly diagonally bedded, fine-grained quartz sands with glauconite and ferruginous-phosphatic nodules (Fig. 3C; Pl. I, Fig. 1) occur at Mokrzesz, in the western part of the area (outcrops *46*, *46a*, *46b*, cf. Fig. 1). It has been shown by the measurements of inclination of diagonal layers, that during the sedimentation of set *2* (cf. Fig. 3C), the material transportation took place approximately from the west, while during the sedimentation of set *4* — from the north. Burrows of decapods (Fig. 3C) occur at the top of sands directly below the Cenomanian documented faunistically. These are tubes a dozen or so centimeters long (the length is incomplete), to 2.5 cm in diameter and coated with coarser quartz grains. A characteristic, warty sculpture has been preserved on the surface of some burrows. They belong to the ichnospecies *Ophiomorpha nodosa* Lundgren (cf. Häntzschel 1952, Pls 13—14; Weimer & Hoyt 1964, Pls 123—124; Radwański 1970, Pl. 5). In the environs of Mokrzesz, a rubble of the Jurassic flints, thoroughly mixed with quartz gravels occurs at the bottom of the deposits under study, directly on the Upper Jurassic butten limestones (Fig. 4C). The size of these flints mostly

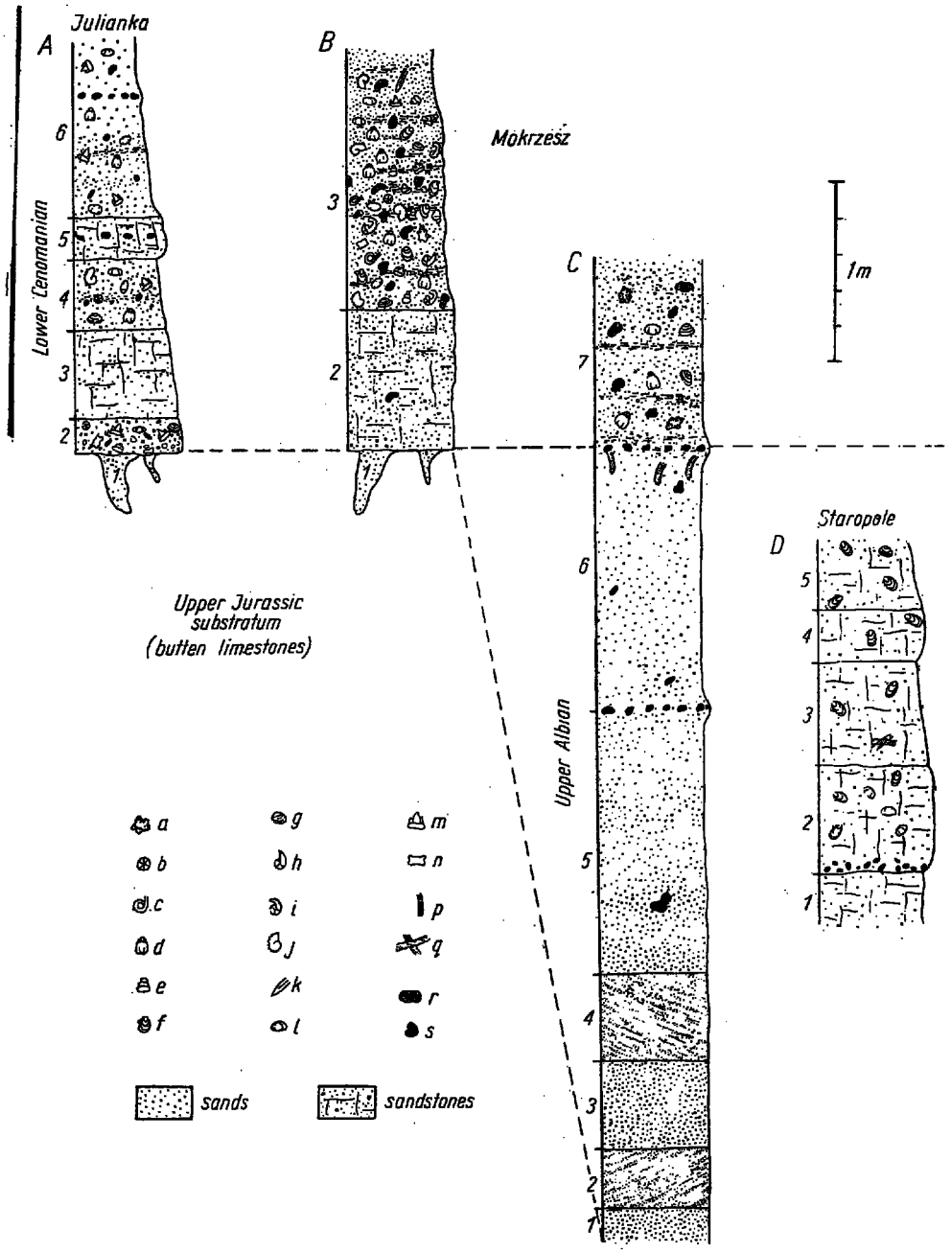


Fig. 3

Detailed profiles of the Upper Albian and Lower Cenomanian in the investigated area: *A* Julianka (outcrop *69*, cf. Fig. 1), *B* Mokrzesz (outcrop *46*), *C* Mokrzesz (outcrop *46a*), *D* Staropole (outcrop *63*); numbers at the profiles denote lithological sets discussed in the text

reaches 10—25 cm but larger ones are also met with; all of them have glauconitic coatings. As the Upper Jurassic substratum rises on the hill (cf. Fig. 4C), the thickness of the Upper Albian decreases, flint rubble disappears at all and, on the summit, the Lower Cenomanian deposits directly overlie a butten limestone. In this place, noncalcareous quartz sands with glauconite fill mere clefts in the butten limestones (Figs 3*B*; 4*B*, *C*). Similarly developed Upper Albian deposits which pass into the Lower Cenomanian, have been found at Jaźwiny, Krasice and Lusławice. The only difference is that at Jaźwiny and Lusławice, a 5-centimeter layer of phosphatic nodules occurs 1 m below the bottom of the Lower Cenomanian deposits. At Lusławice, *Aucellina gryphaeoides* Sowerby abundantly occurs in these nodules (outcrop *84*).

Noncalcareous sands and quartz sandstones with glauconite of a varying degree of cementation occur in the western part of the area (environs of Julianka and Staropole). The most strongly cemented are quartzitic sandstones with glauconite which, however, do not form regular layers but occur in the form of lumps among sandstones and sands weakly cemented (Różycki 1937). The burrows *Ophiomorpha nodosa* Lundgren also occur in slightly cemented sandstones at Zalesice (outcrop *79*). The occurrence of phosphatic nodules and a very abundant fauna (Fig. 3*D*; Pl. I, Fig. 2), represented only by:

echinoid *Pseudoholaster* sp.,

pelecypods: *Inoceramus anglicus* Woods, *I. concentricus* Parkinson, *Neithea* sp. and *Exogyra* sp.

has been found by the writer in the quartzitic sandstones of the environs of Staropole. Since *Inoceramus anglicus* Woods, whose stratigraphic range in Poland is limited to the Upper Albian only (cf. Cieśliński 1960, p. 9, chart 1), occurs in the deposits of Julianka and Staropole, the assignment of these deposits to the Upper Albian does not arouse present any doubts. These deposits were also assigned to the Upper Albian by Różycki (1937) who based such an assignment on the presence of *Inoceramus concentricus* and *Inoceramus* cf. *tenuis*. Attention should, however, be attracted to the fact that *Inoceramus tenuis* Mantell is not a form typical of the Upper Albian, since it occurs in the Lower Cenomanian (cf. Cieśliński 1965), whereas *Inoceramus concentricus* Parkinson occurs both in the Middle and Upper Albian (cf. Samsonowicz 1925, Passendorfer 1930, Cieśliński 1960).

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a sponges, *b* corals, *c* serpulids, *d* brachiopods, *e* gastropods, *f* pelecypods of the genus *Inoceramus*, *g* other pelecypods, *h* nautilids, *i* aberrant ammonites, *j* normally coiled ammonites, *k* belemnites, *l* echinoids, *m* shark teeth, *n* fish vertebrae and bones, *p* burrows *Ophiomorpha nodosa* Lundgren, *q* undetermined burrows, *r* sandy, calcareous-phosphatic nodules, *s* sandy, ferrugineous-phosphatic nodules

No Upper Albian fossils have been found at Mokrzesz, Jaźwiny and Krasice. Nevertheless, the deposits, assigned to this substage underlie the Lower Cenomanian documented faunistically and their mineral and granulometric composition is identical with that of the deposits in which the Upper Albian fossils were found. *Aucellina gryphaeoides* Sowerby occurs at Lusławice (outcrop *84*) in noncalcareous quartz sands with glauconite (in the horizon of phosphatic nodules). This species is known in Poland from the Upper Albian and Lowermost Cenomanian (cf. Cieśliński 1960, 1965). At Lusławice, the deposits with *Aucellina gryphaeoides* Sowerby should be referred to the Upper Albian since higher up there is situated the Lower Cenomanian whose lower boundary is very distinct. At Julianka, *Aucellina gryphaeoides* Sowerby also occurs in the lowermost part of the Lower Cenomanian.

At Julianka and Staropole, neither the bottom nor top of the Upper Albian deposits are visible, and the thickness, observed in outcrops, amounts to ca 6 m. At Mokrzesz, as results from the map and analysis of the distribution of the Jurassic substratum, the thickness of the Upper Albian deposits reaches 10—12 m.

Lower Cenomanian

In the entire area, the Upper Albian noncalcareous deposits are overlaid by strongly calcareous, coarse-grained, quartz-glauconitic sandstones or sands. In these deposits, the roundness and sorting of grains are slight. At Julianka, calcareous-phosphatic quartz conglomerates with glauconite appear in places in which the sediments of this type directly overlie the Upper Jurassic substratum (Fig. 3*A*). The black Jurassic flints have a considerable part in the composition of these conglomerates (Różycki 1937). Conglomerates are overlaid by calcareous sandstones and quartz-glauconitic sands, identically developed with those at Mokrzesz.

At Mokrzesz, calcareous quartz-glauconitic sandstones transgressively overlap the Upper Albian noncalcareous deposits (Figs 3*B*,*C*; 4). The overlapping by these deposits of the Upper Albian ones were also observed by Różycki (1937) at Julianka.

In calcareous conglomerates, sandstones and quartz-glauconitic sands, fauna is very numerous in all outcrops. A sudden appearance of fauna may be observed in the profiles (environs of Jaźwiny, Krasice, Lusławice and Julianka), which differs these deposits from those of the Upper Albian, on the whole poor in fauna. The lack of fauna in the bottom parts of calcareous quartz-glauconitic sandstones of some profiles in the environs of Mokrzesz (set *2*, Fig. 3*B*) is caused by facial conditions. The fauna represents almost all of the invertebrate phyla. Numerous are also remains of vertebrates such as shark teeth, fish vertebrae and crushed bones. The list of fossils is as follows:

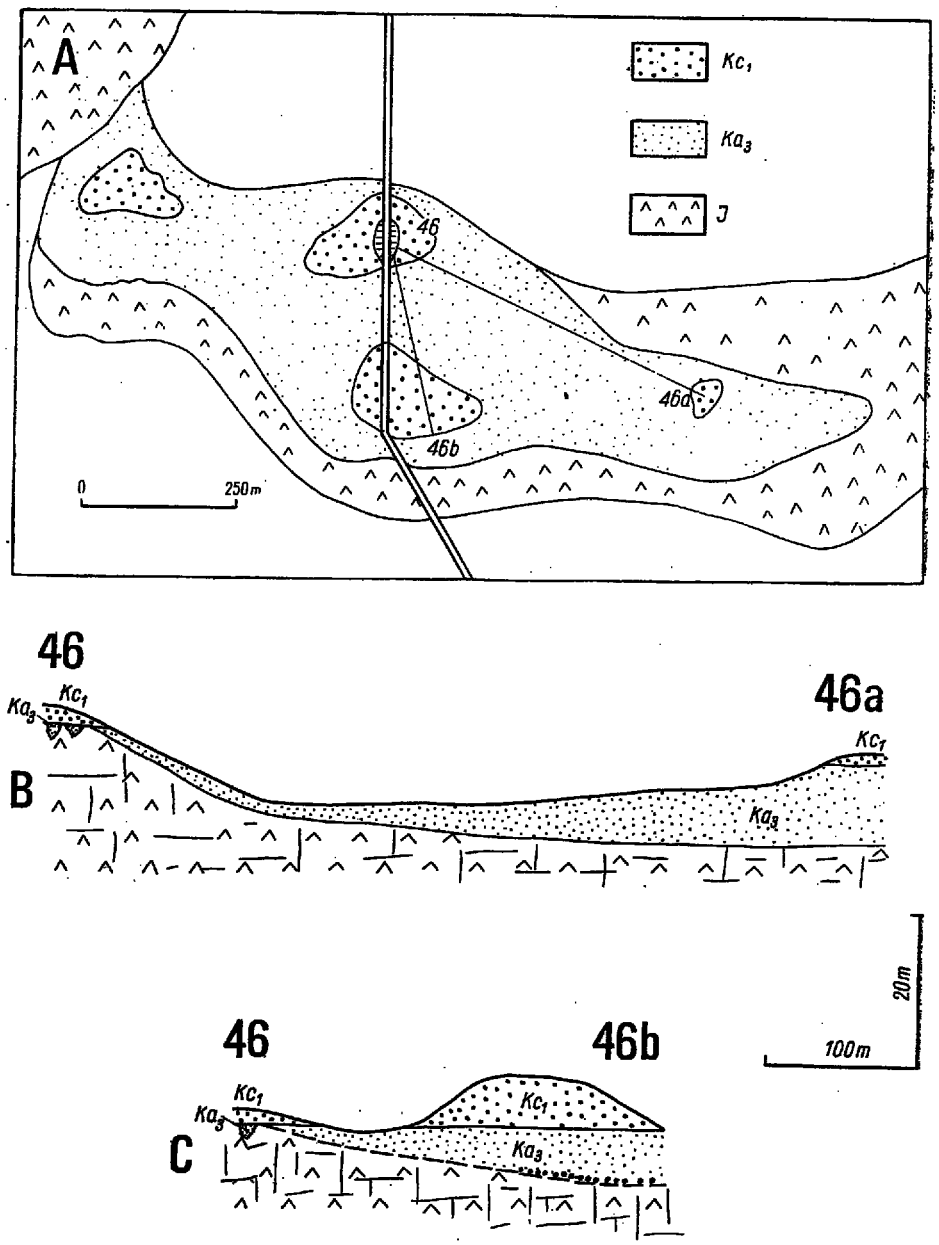

Fig. 4

The Albian and Cenomanian transgressive deposits at Mokrzesz, and their relation to the Upper Jurassic substratum: *A* sketch map of the area rectangled in Fig. 1, showing lines of geological sections, *B* section between outcrops *46* and *46a*, *C* section between outcrops *46* and *46b*

J Upper Jurassic (butten limestones), Ka_3 Upper Albian (sands, with flints gravel at the bottom), Kc_1 Lower Cenomanian (sands and sandstones)

sponge: *Exanthesis (Plococyphia)* sp.;

corals: *Micrabacia coronula* (Goldfuss), ex fam. Caryophyllidae;

polychaetes: *Serpula proteus* J. de C. Sowerby, *Serpula sp.*;

brachiopods: *Lepidorhynchia sigma* (Schloenbach), *Rhynchonella gibbsiana* (J. de C. Sowerby), *Terebratula arcuata* Roemer, *T. disparilis* d'Orbigny, *T. rugulosa* Morris, *Terebratulina chrysalis* (Schlotheim), *Magas* sp., *Kingena* sp., *Concinnithyris* sp., *Lamellaerhynchia* sp., *?Orbirhynchia cuvieri* (d'Orbigny), *O. mantelliana* (J. de C. Sowerby), *Cyclothyris* sp., *Ornatothyris* sp., *?Cretirhynchia minor* Pettitt;

gastropods: *Pleurotomaria* sp., *Trochus* sp., *Mitra* sp., *Natica* sp., *Emarginula althi* Zaręczny;

pelecypods: *Inoceramus bohemicus* Leonhard, *Pecten (Chlamys)* sp., *Lopha colubrina* (Lamarck), *Nucula vibrayeana* (d'Orbigny), *Nucula* sp., *Exogyra* sp., *Ostrea* sp., *Unicardium* cf. *tumidum* Briart & Cornet, *Cyprina (Venilicardia) ligeriensis* d'Orbigny, *Cyprina* cf. *regularis* d'Orbigny, *Cyprina* sp., *Isocardia heintzeli* Wolleman, *Trigonoarca passyana* (d'Orbigny), *Neithea quinquecostata* (Sowerby);

cephalopods (cf. Pls II — VI);

a) nautilids: *Eutrephoceras sublaevigatum* (d'Orbigny), *Cymatoceras deslongchampsianum* (d'Orbigny);

b) ammonites: *Schloenbachia varians* (Sowerby), *?S. varians* var. *trituberculata* Spath, *S. varians* var. *tetrammata* (Sowerby), *S. subvarians* Spath, *S. subtuberculata* (Sharpe), *S. sharpei* Semenow, *S. quadrata* Spath, *S. ventriosa* Stieler, *S. subplana* (Mantell), *S. intermedia* (Mantell), *Paracalycoceras* cf. *wiestii* (Sharpe), *Calycoceras* sp., *Sharpeiceras* sp., *Mantelliceras tuberculatum* (Mantell), *Mantelliceras* sp., *Hamites* sp., *Mariella essenensis* (Geinitz), *M. dorsetensis* (Spath), *M. lewesiensis* (Spath), *Turrilites costatus* Lamarck, *T. scheuchzerianus* Roissy, *T. tuberculatus* Bosc, *T. mantelli* Sharpe, *T. acutus* Passy, *Ostlingoceras bechei* (Sharpe), *Scaphites aequalis* Sowerby, *Sciponoceras subbaculoides* (Geinitz);

c) belemnite: *Neohibolites ultimus* (d'Orbigny);

echinoids: *Salenia* sp., *Polydiadema* aff. *tenue* Agassiz, *Polydiadema* sp., *Holaster subglobosus* Leske, *H. poloniae* Lambert, *H. laevis* Agassiz, *Pyrina ovalis* d'Orbigny, *Discoidea subucula* (Klein), *D. cylindrica* Lamarck;

shark teeth: *Otodus appendiculatus* (Agassiz) and *Oxyrhina angustidens* Reuss.

Such an abundant occurrence of fauna, in particular cephalopods (cf. Pls II—VI) makes possible an accurate recognition of the age of the deposits. The occurrence of the ammonite species *Schloenbachia varians* (Sowerby), *S. varians* var. *tetrammata* (Sowerby), *?S. varians* var. *trituberculata* Spath, *S. sharpei* Semenow, *S. subvarians* Spath, *S. subtuberculata* (Sharpe), *S. quadrata* Spath, *S. ventriosa* Stieler, *S. subplana* (Mantell), *S. intermedia* (Mantell), *Paracalycoceras* cf. *wiestii* (Sharpe), *Sharpeiceras* sp., *Mantelliceras tuberculatum* (Mantell), *Turrilites acutus* Passy, *T. mantelli* Sharpe, *T. tuberculatus* Bosc, *Ostlingoceras bechei* (Sharpe), *Mariella essenensis* (Geinitz), *M. dorsetensis* (Spath), *M. lewesiensis* (Spath) and the acceptance of the twofold division of the Cenomanian into the lower and upper (cf. Wright & Wright 1951; Cieśliński 1959, 1965), give evidence for Lower Cenomanian age of these deposits.

The present writer purposely accepts the twofold division of the Cenomanian since it is easy to relate to the stratigraphy of the Cenomanian deposits in other regions of Poland (cf. Cieśliński 1959, 1965). The

duality of the Cenomanian is expressed in this area in an abundance of various fauna in the lower and its considerable poverty in the upper part of the stage (see below). The fauna, so far collected in the region under study, does not, on the other hand, allow one for the recognition of the zones, recently established by Kennedy (1969) in south-eastern England. According to this author, the Cenomanian of south-eastern England may be divided into three zones, corresponding to the substages (Lower — Mantelliceras mantelli Zone, Middle — Acanthoceras rhotomagense Zone and Upper — Calycoceras naviculare Zone), which, in addition, are marked by a definite sequence of ammonite assemblages of a minor stratigraphic rank. Comparing the ammonite fauna, so far collected from the area in question with the fauna of these assemblages, the conclusion may be drawn that the Lower Cenomanian, distinguished in this area, corresponds to both Mantelliceras mantelli and Acanthoceras rhotomagense zones, that is, according to Kennedy's division (1969), to the Lower and Middle Cenomanian of south-eastern England.

A subdivision of the Cenomanian into three parts (lower — Neohibolites ultimus Zone, middle — Schloenbachia varians Zone and upper — Scaphites aequalis and Holaster subglobosus Zone), used by Różycki (1937) for the area, is not justified since, as shown above, all these species here concur.

In the environs of Jaźwiny (outcrop *53*) and Mokrzesz (outcrop *46*), *Holaster subglobosus* Leske and *H. poloniae* Lambert [1] have been found, for instance, together with *Schloenbachia varians* (Sowerby) and other species of the Lower Cenomanian *Schloenbachia*.

At Julianka, Różycki (1937) mentions *Holaster* cf. *subglobosus* Leske together with *Scaphites aequalis* Sow. and *Schloenbachia coupei* (Brongn.). Until Spath's work (1926), two groups, *„varians"* and *„coupei"*, which included several forms with a considerable variability, were on the whole distinguished within the genus *Schloenbachia*. Spath (1926) separated several new species, of which only *Schloenbachia lymensis* Spath, separated from certain forms of the group *„varians"*, occurs in the Upper Cenomanian (Wright & Wright 1951). Clearly, then, Różycki (1937) had at his disposal a Lower Cenomanian species of *Schloenbachia* and, therefore, *Holaster* cf. *subglobosus* Leske concurring with the last-named species was of the same age. Pożaryski's (1966) opinion on Upper Cenomanian age of the deposits of the environs of Julianka [2], here discussed, is, therefore, also unjustified.

On the basis of the fauna collected it is clear that *Holaster subglobosus* Leske and *H. poloniae* Lambert occur, in the area investigated, in the Lower Cenomanian

[1] In Polish literature, this species was determined after Zaręczny (1878) as *Holaster suborbicularis* Agassiz. According to Dr. S. Mączyńska's oral communication, Lambert (1921) carried out a revision of Zaręczny's determination and erected a new species *Holaster poloniae* Lambert. In addition, *Holaster suborbicularis* Agassiz was mentioned by Zaręczny (1878) from the Lower Turonian, whereas according to Dr. S. Mączyńska, this species occurs in fact in the Upper Cenomanian deposits.

[2] Mazurek (1923) mentions, from Sygątka near Julianka, the species *Acanthoceras* cf. *rhotomagense* Brongn. According to Dr. S. Cieśliński, who examined Mazurek's collections, housed at the Polish Geological Institute, this determination is, however, erroneous and the specimen represents in fact a fragment of a whorl of *Mariella* sp. The species *Acanthoceras rhotomagense* (Brongniart) has not so far been found (Cieśliński 1965) in Central Poland.

and do not play the role of index fossils. A similar situation is recorded in some regions of England where *Holaster subglobosus* Leske occurs (Wright & Wright 1942, Kennedy 1969) together with *Schloenbachia varians* (Sowerby), or even in the Upper Albian (cf. Kennedy 1969, p. 461).

To sum up, it should be emphasized that the Lower Cenomanian deposits in the area under study markedly differ from the Albian ones. Predominant are coarse-grained fractions and the sorting of the clastic material is slighter than that in the Albian. In addition, there is much more glauconite and phosphatic or ferruginous-phosphatic nodules. The fact that the Lower Cenomanian deposits are strongly calcareous represents a very characteristic feature of these deposits. The wirter conventionally puts the lower boundary of the Cenomanian in this area in the places in which calcium carbonate appears in quartz-glauconitic sands or sandstones.

In the environs of Mokrzesz and Jaźwiny, the thickness of the Lower Cenomanian deposits does not exceed 2.5 m and in the area of Julianka it is differentiated and amounts to 2—5 m. The differentiation referred to above which occurs in the last-named region was caused by the existence of pre-Albian depressions in the Jurassic substratum (Różycki 1937).

Upper Cenomanian

In the environs of Mokrzesz, Jaźwiny and Krasice, a rubble of white, noncalcareous gaizes with glauconite and without fauna occurs on hill slopes above the Lower Cenomanian deposits. In the environs of Krasice (outcrop *52*, cf. Fig. 1), where the rubble of gaizes lies between the Lower Cenomanian deposits and Lower Turonian organogenic limestones, containing *Conulus ellipticus* (Zaręczny) and *C. subrotundus* (Mantell), these gaizes should be assigned to the Upper Cenomanian. Due to the lack of fauna, as well as to the impossibility of direct observations, the thickness of the deposits in question cannot be established.

In the western part of the area, a profile of the Upper Cenomanian, passing into the Turonian, is observed at Zalesice (outcrop *74*), where a marly, fine-grained quartz sand occurs together with glauconite. Single, sandy phosphatic nodules are scattered irregularly in the sand. Burrows *Ophiomorpha nodosa* Lundgren are also recorded in this area. *Actinocamax plenus* (Blainville) occurs in the top of the sands. According to some authors this species marks a separate "plenus" subzone which is regarded as belonging either to the Lower Turonian (Spath 1926, Wright & Wright 1951, Jefferies 1963) or as a separate unit from the Cenomanian -Turonian boundary (Kennedy 1969). At Zalesice, *Actinocamax plenus* (Blainville) appears 10 cm below the place of finding *Inoceramus labiatus* Schlotheim, an undoubtedly Lower Turonian form. In this area, the lower boundary of the Turonian is pointed by the writer in the place of the

appearance of this inoceram. Thus, he assigns the deposits, containing *Actinocamax plenus* (Blainville) to the Upper Cenomanian, similarly as accepted by Cieśliński (1965) for other regions of Poland. The thickness of the Upper Cenomanian deposits, observed at Zalesice with their bottom invisible, amounts to ca 4 m.

Lower Turonian

The Lower Turonian deposits are most clearly outcropped in the environs of Zalesice (outcrop 74, cf. Fig. 1). In this locality, marly sands of the Upper Cenomanian are overlaid by marly quartz sandstones with a small admixture of glauconite (5—6%). Burrows *Ophiomorpha nodosa* Lundgren occur in the top of the sandstones. Higher up, these deposits pass into sandy and organodetrital limestones. In these rocks, there is much less clastic quartz, glauconite being still rarer. *Inoceramus labiatus* Schlotheim, *Conulus ellipticus* (Zaręczny), *Orbirhynchia cuvieri* (d'Orbigny) and *Gibbithyris* sp. occur in marly sandstones and sandy or organodetrital limestones. These deposits are overlaid by a white-gray organodetrital limestone with an abundant inoceram and echinoderm detritus, as well as with *Inoceramus lamarcki* Parkinson. Above this limestone the Lower Campanian marls lie directly on the surface of the hardground (Różycki 1937). The stratigraphy of the deposits described was determined by Różycki (1937), who pointed out that the Lower Turonian is here represented by two zones: *I* — Inoceramus labiatus and *II* — Inoceramus lamarcki [3].

Analogously developed Lower Turonian deposits occur SE of Zalesice and at Krasice. The following, rich fauna has been found in the rubble of the Lower Turonian rocks:

brachiopods: *Orbirhynchia cuvieri* (d'Orbigny), *Cretirhynchia* sp., *Gibbithyris* sp.;

pelecypods: *Inoceramus labiatus* Schlotheim, *I. lamarcki* Parkinson, *I. lamarcki* var. *apicalis* Woods;

echinoids: *Discoidea minima* Agassiz, *Conulus ellipticus* (Zaręczny), *C. subrotundus* (Mantell) and *Conulus* sp.

In the entire area, the thickness of the Lower Turonian deposits is not very great, amounting to 1.2 m.

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[3] Since "*Rhynchonella cuvieri*" was found together with *Inoceramus labiatus* Schlotheim, the separation by Różycki (1937) of the Lowermost Turonian in the form of the zone of this brachiopod is unjustified. In addition, *Orbirhynchia cuvieri* (d'Orbigny) is known from the Cenomanian to the Santonian (oral communication of Dr. E. Barczykowa).

REMARKS ON THE SEDIMENTARY ENVIRONMENT

The Albian-Cenomanian transgression, covering the entire epicontinental area of Central Poland (cf. Samsonowicz 1925), entered the investigated region probably in the uppermost Middle Albian. It occurred after a continental regime which persisted since the completion of the Jurassic sedimentation and post-Jurassic uplift of the area. The lack of data makes impossible the deduction on the presence of the marine Neocomian, known farther to the north from the margins of the Holy Cross Mts.

In the uppermost Middle Albian or in the Upper Albian, a marine sedimentation of quartz sands, with an admixture of glauconite and here and there diagonally bedded (cf. Figs 2—4), begins in the places of both larger erosive depressions and smaller clefts on the elevations of the Jurassic substratum.

The amount of glauconite increases in the top of the Albian where also appear the burrows *Ophiomorpha nodosa* Lundgren, formed by shrimps of the genus *Callianassa* Leach. Such burrows, occurring at present under very shallow-marine (sublittoral) conditions, are indicative of a depth which on the whole does not exceed a few meters (cf. Häntzschel 1952; Weimer & Hoyt 1964; Radwański 1967, 1970; Bałuk & Radwański 1968; Kennedy & Macdougall 1969). In the area in question, these burrows are also indicative of temporarily similar environmental conditions in the uppermost Albian. In the entire complex under study, glauconite was probably formed in the zones of shoals, much the same as recently on the western coast of Trinidad (cf. Van Andel 1954).

The Lower Cenomanian deposits have the most abundant fauna. Likewise, they contain the greatest amounts of sandy, ferrugineous-phosphatic nodulus and of glauconite. A precipitation of calcium carbonate, which makes up a permanent admixture in the sediment, also started in the Cenomanian. An extension of sedimentary areas and covering with sediments of still projecting substratal humps also occurred during that period. The state of preservation of organic remains in rich assemblages of the Lower Cenomanian, enables conclusions concerning the sedimentary conditions.

In this area, organic remains are preserved in the sediment as fragments which are either phosphatized, or coated by phosphatic nodules. In ammonites, complete phosphatized specimens are a rarity. Mostly they lack body chambers. The most frequent are phosphatized, crumbled fragments of whorls. Also frequent are single valves of pelecypods, phosphatized or coated by concretions. Hence, we may conclude that after the death of the mollusks under study, their shells were soon broken and crumbled as a result of the destructive activity of hydrodynamic agents. The phosphatization took place later on the sea bottom. Here and there, the organic remains are swept onto the surface of layers in the form of streaks or lenses (Jaźwiny, outcrop *53*), which indicates that the organic material was transported outside the habitat of the animals examined.

Within one and the same species, fauna differs in size. In addition to juvenile forms, adults are met with, which indicates that some of the organic communities were destroyed during the growth of live individuals of a given population, probably as a result of the activity of hydrodynamic agents.

The Lower Cenomanian profiles are characterized by a small thickness and abundance of fauna. As compared with other Cretaceous members of the area, they also contain the greatest amounts of phosphates and glauconite. This allows one for the conclusion that the rate of sedimentation was then rather slow, which caused a condensation of fauna, much the same as in transgressive profiles of the Albian-Cenomanian deposits in the margins of the Holy Cross Mts (cf. Samsonowicz 1925, 1934; Pożaryski 1947; Cieśliński 1959; Hakenberg 1969).

In the Upper Cenomanian, two regions with different sedimentation, during which the gaizes or sandy deposits have developed, may be distinguished in the area under study.

The poverty of fauna in the Upper Cenomanian is a phenomenon characterstic not only of this region but also of all epicontinental (extra--Carpathian) areas of Poland and, therefore, it has to have more profound, regional causes (cf. Cieśliński 1959, 1965).

Burrows *Ophiomorpha nodosa* Lundgren occur in sandy deposits of Zalesice, in which the remaining fauna is very rare. These burrows indicate that the sedimentation of the Upper Cenomanian deposits took place, at least in some places, in a very shallow-marine environment, much the same as in the Upper Albian.

The transition from the Cenomanian to the Turonian is gradual and marked by a decrease in the quartz and glauconite content of deposits and an increase in the amount of calcium carbonate. Since a continued presence of the burrows *Ophiomorpha nodosa* Lundgren is recorded in the lowermost part of the Lower Turonian, in the Inoceramus labiatus Zone (Zalesice, outcrop 74), no considerable deepening of the basin took place during that period.

An increase in the calcium carbonate content is an evidence for the stabilization of the sedimentary conditions which were caused by a considerable expansion of the marine basin and gradual decrease of the supplies of clastic material. The development of the organodetrital facies took place in the lower part of the Lower Turonian (Inoceramus labiatus Zone). Abundant becomes the detritus of benthic forms, accompanied by the appearance of the planktonic material, represented by foraminifers and very numerous incertae sedis forms *Pithonella ovalis* (Kaufmann).

In the higher part of the Lower Turonian (Inoceramus lamarcki Zone), a unification of the carbonate facies, finally concluding the sedimentation of transgressive deposits, takes place in the entire area under study.

DESCRIPTION OF THE LOWER CENOMANIAN CEPHALOPODS

The present chapter contains descriptions of cephalopods of the Lower Cenomanian only (nautilids, ammonites, belemnites). Specimens from the localities with the most abundant fauna and in which the remains are best preserved, that is, Mokrzesz (outcrop *46*, cf. Fig. 1), Jaźwiny (outcrop *53*) and Krasice (outcrop *52*), have been illustrated in Pls II—VI. Photographs of specimens have been taken by Mrs. B. Drozd, M.Sc.

All the specimens figured are preserved as phosphatized cores, which as a rule are preserved incompletely. Completely preserved are only single forms of the genus *Scaphites* (Pl. II, Figs 5—6). The remaining ones are mostly represented by phragmocons. Some of them have a base of body chamber.

The taxonomy, identical with that in Spath (1926, 1937), Wright & Wright (1951) and Arkell, Kummel & Wright (1957) has been applied to the descriptions. In accordance with the International Code of Zoological Nomenclature, the varieties previously separated within a species have not been treated as subspecies. The following features, measured in millimeters and given in tables in an abbreviated form, have been taken into account in the dimensions of the species described:

D — diameter of specimen,
H — height of last whorl of a given specimen,
T — thickness of last whorl of a given specimen,
U — diameter of umbilicus.

In the case of aberrant forms of the genus *Scaphites*, other measurements have been taken, which are explained with the description of this genus.

NAUTILOIDEA

Family **Nautilidae** d'Orbigny, 1840
Genus *Eutrephoceras* Hyatt, 1894
Eutrephoceras sublaevigatum (d'Orbigny, 1850)
(Pl. II, Figs 1a—b, 2)

1840—1842. *Nautilus laevigatus*, d'Orbigny; d'Orbigny, p. 84, pl. 17, figs 1—4.
1853. *Nautilus laevigatus*, D'Orb.; Sharpe, p. 11, pl. 2, figs 1a—b, 2a—b.
1872. *Nautilus sublaevigatus*, d'Orb.; Fritsch, p. 21, pl. 12, fig. 1.
1951. *Eutrephoceras sublaevigatum* (d'Orbigny); Wright & Wright, p. 10.
1959. *Eutrephoceras sublaevigatum* (d'Orbigny); Cieśliński, p. 33, pl. 3, fig. 5a—b.

Dimensions (*mm*):

	D	H	T	U
1)	24	15	18	4
2)	20.5	12	15	3
3)	18	9.5	13	3
4)	15	8.5	12	—

Material. — Six specimens, including four well preserved.

Remarks. — Specimens accurately correspond to the descriptions and illustrations, which have been given by the authors mentioned in synonymy.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*), Lusławice (*84*) and Julianka (*70*) — Lower Cenomanian. In the northern margin of the Holy Cross Mts, the species is known from the Lower and Upper Cenomanian (Cieśliński 1959).

Eutrephoceras sublaevigatum (d'Orbigny) is characterized by a wide stratigraphic range. According to Wright & Wright (1951), it ranges from the Cenomanian till the Lower Senonian. The species is known i.a. from the Cretaceous of England (Sharpe 1853, Wright & Wright 1951), France (d'Orbigny 1842) and Bohemia (Fritsch 1872).

Family **Cymatoceratidae** Spath, 1927
Genus *Cymatoceras* Hyatt, 1884
Cymatoceras deslongchampsianum (d'Orbigny, 1840)
(Pl. II, Fig. 3a—b)

1840—1842. *Nautilus Deslongchampsianus*, d'Orbigny; d'Orbigny, p. 90, pl. 20, figs 1—4.
1853. *Nautilus Deslongchampsianus*, D'Orb.; Sharpe, p. 12, pl. 3, figs 1a—b, 2.
1853. *Nautilus Neocomiensis*, D'Orb.; Sharpe, p. 15, pl. 5, fig. 3a—c.
?1853. *Nautilus radiatus*, Sow.; Sharpe, p. 14, pl. 5, figs 1a—b, 2.
1876. *Nautilus Deslongchampsianus*, d'Orb.; Schlüter, p. 172, pl. 47, figs 7, 8.
1951. *Cymatoceras deslongchampsianum* (d'Orbigny); Wright & Wright, p. 11.
1959. *Cymatoceras deslongchampsianum* (d'Orbigny); Cieśliński, p. 30.

Material. — A fragmentary whorl (H — 21, T — 28).

Remarks. — In the specimen examined, ventral ribs are more strongly deflected posteriorly and consequently a characteristic sinus they form is deeper than that in d'Orbigny's (1842) and Sharpe's (1853) illustrations. The specimen displays the greatest similarity to the specimens presented by d'Orbigny (1842, Pl. 20, Figs 1—4) and Sharpe (1853, Pl. 3, Figs 1a—b, 2). The specimen differs slightly from the remaining illustrations of the authors, mentioned in synonymy, in a somewhat smaller height of the whorl. Besides the ribs, additional, delicate, transverse striae were observed by d'Orbigny, Sharpe and Schlüter on well preserved specimens. The striae cause the formation of a fine reticulation on the surface of a whorl; only ribs are, however, preserved on cores.

Occurrence. — Mokrzesz (46) — Lower Cenomanian. In the northern margin of the Holy Cross Mts, the species occurs in the Lower and Upper Cenomanian (Cieśliński 1959).

Cymatoceras deslongchampsianum (d'Orbigny) is also known i.a. from the Cenomanian of France (d'Orbigny 1842), England (Sharpe 1853, Wright & Wright 1951, Kennedy 1969 [4]) and Germany (Schlüter 1876).

AMMONOIDEA

Family **Scaphitidae** Meek, 1876
Genus *Scaphites* Parkinson, 1811
Scaphites aequalis Sowerby, 1813
(Pl. II, Figs 5a—b, 6)

1822. *Scaphites costatus;* Mantell, p. 120, pl. 22, figs 8, 12.
1840—1842. *Scaphites aequalis,* Sowerby; d'Orbigny, p. 518, pl. 129, figs 1—7.
1851—1852. *Scaphites aequalis* Sow.; Bronn, pt. 5, p. 328, pl. 33, fig. 8a—b.
1872. *Scaphites aequalis,* Sow.; Fritsch, p. 41, pl. 13, figs 5, 6a—b.
1872. *Scapites aequalis,* Sow.; Schlüter, p. 72, pl. 23, figs 1—4.
1911. *Scaphites aequalis* Sow.; Frič, p. 11, fig. 35.
1911. *Holcoscaphites aequalis* Sow.; Nowak, p. 566, pl. 33, fig. 23.
1929. *Scaphites aequalis-obliquus* Sowerby; Collignon, p. 49, pl. 5, figs 1—6.
1951. *Scaphites equalis* J. Sowerby; Wright & Wright, p. 13.
1959. *Scaphites aequalis* Sowerby; Cieśliński, p. 33, pl. 3, fig. 4a—b.

Dimensions (*mm*):

D — length of entire specimen (with body chamber)
H — height of body chamber
T — thickness of body chamber
d — diameter of normally coiled part
h — height of whorl in normally coiled part
t — thickness of whorl in normally coiled part
U — diameter of umbilicus

	D	H	T	d	h	t	U
1)	24	10.5	11.5	14.5	7,5	9.5	3
2)	21.5	9.0	10	10.5	6	7.5	3
3)	—	9.5	12	—	—	—	—
	—	—	—	17.3	7.5	10	2
5)	—	9	13.4	—	—	—	—
6)	—	—	—	13.5	6.5	11	—
7)	—	8.5	9.5	—	—	—	—
8)	—	10	11	—	—	—	—
9)	—	9.5	12.3	—	—	—	—
10)	—	11	14.8	—	—	—	—
11)	—	10	13	—	—	—	—

[4] Citing Kennedy's work (1969) in the present chapter, as the Lower Cenomanian the writer means the Lower and Middle Cenomanian in this author's sense (cf. p. 421).

Material. — Fourteen variously preserved specimens, including two complete.

Remarks. — The specific variability in specimens examined is displayed by some forms having a smaller thickness and less prominent ribs and some others which are thicker and have more prominent ribs. Juvenile development stages of this species, which differ from adults in their appearance, were presented by Nowak (1911). Our specimens do not in principle deviate from the descriptions presented in the papers, mentioned in synonymy.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*), Krasice (*52*), Lusławice (*84*), Julianka (*70, 72*) — Lower Cenomanian. In the northern margin of the Holy Cross Mts, the species occurs in the Lower and Upper Cenomanian (Cieśliński 1959).

Scaphites aequalis Sowerby is also known i.a. from the Cenomanian of England (Mantell 1822, Wright & Wright 1951, Kennedy 1969), France (d'Orbigny 1842), Germany, Switzerland and East India (Schlüter 1872), Bohemia (Fritsch 1872, 1911) and Madagascar (Collignon 1929).

Family **Hamitidae** Hyatt, 1900
Genus *Hamites* Parkinson, 1811
Hamites sp.
(Pl. II, Fig. 4)

1959. *Hamites* sp. B.; Cieśliński, p. 35, pl. 4, fig. 1.

Material. — An incomplete specimen (H — 6.5, T — 5).

Remarks. — The specimen accurately corresponds to the form, described by Cieśliński (1959).

Occurrence. — Mokrzesz (*46*) — Lower Cenomanian.

Family **Baculoidae** Meek, 1876
Genus *Sciponoceras* Hyatt, 1894
Sciponoceras subbaculoides (Geinitz, 1874)
(Pl. II, Fig. 7)

1840—1842. *Baculites baculoides*, d'Orbigny; d'Orbigny, p. 562, pl. 138, figs 6—11.
1872. *Baculites baculoides*, d'Orb.; Fritsch, p. 49, pl. 13, figs 27, 28, 31.
1911. *Baculites baculoides*, d'Orb.; Frič, p. 11, fig. 36.
1959. *Sciponoceras subbaculoides* (Geinitz); Cieśliński, p. 38, fig. 14 (I), pl. 4, fig. 5a—b.

Dimensions (*mm*):

	H	T
1)	13.5	11.5
2)	9.5	7.5
3)	8.5	7.5
4)	7	7
5)	6	6
6)	7	5.5

Material. — A few fragmentary specimens, the largest of them 42 mm long.

Remarks. — The specimens are identical with the forms described by the authors, mentioned in synonymy.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*), Julianka (*70*, *72*) — Lower Cenomanian. In the northern margin of the Holy Cross Mts, the species occurs in the Lower and Upper Cenomanian (Cieśliński 1959).

Sciponoceras subbaculoides (Geinitz) is also known i.a. from the Cretaceous of France (d'Orbigny 1842), Bohemia (Fritsch 1872, 1911) and Germany (Schlüter 1876).

Family **Turrilitidae** Meek, 1876
Genus *Mariella* Nowak, 1915
Mariella essenensis (Geinitz, 1849)
(Pl. III, Figs 2, 3)

1857. *Turrilites Bergeri*, Brongniart; Sharpe, p. 65, pl. 26, fig. 9 (only).
1876. *Turrilites Essenensis*, Gein.; Schlüter, p. 190, pl. 37, figs 3—5.
1915. *Turrilites (Mariella) Bergeri* Brong.; Nowak, p. 10.
1926. *Turrilites essenensis*, Geinitz; Spath, p. 429.
1951. *Paraturrilites essenensis* (Geinitz); Wright & Wright, p. 16.
1959. *Paraturrilites essenensis* (Geinitz); Cieśliński, p. 41, ?pl. 4, fig. 7.

Dimensions (*mm*):

	D	H	T
1)	14.5	7	6
2)	—	11	—

Material. — Two fragmentary whorls.

Remarks. — The subgenus *Mariella* has been erected in 1915 by Nowak for the turrilitids whose first sinus of the lobate line is bipartite. Spath (1937) raised *Mariella* to the generic rank. On the basis of Breistroffer's work (1947), Wright & Wright (1951) use the name *Paraturrilites* to determine the forms, separated by Nowak. Arkell, Kummel & Wright (1957) maintain that the name used by Nowak (1915) should have priority and, like Spath (1937), acknowledge its generic rank (the same opinion is expressed by Kennedy, 1969). According to these authors, *Turrilites bergeri* Brongniart, 1822, mentioned by Nowak (1915) and Spath (1937), is a type species of the genus *Mariella*. The smaller specimen in the material collected is most similar to Sharpe's (1857), and the larger — to Schlüter's (1876) illustrations. The specimen shown by Cieśliński (1959, Fig. 16) does not correspond to the species *M. essenensis*. According to the work by Wright & Wright (1951), mentioned in fact by Cieśliński in synonymy, it should be assigned to the species *Mariella dorsetensis* (Spath),

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*) — Lower Cenomanian. The species is reported from the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

Mariella essenensis (Geinitz) is also known from the Lower Cenomanian of England (Sharpe 1857, Spath 1926, Wright & Wright 1951, Kennedy 1969) and Germany (Schlüter 1876).

Mariella dorsetensis (Spath, 1926)
(Pl. III, Fig. 1)

1857. *Turrilites Bergeri*, Brongniart; Sharpe, p. 65, pl. 26, fig. 11 (only).
1915. *Turrilites (Mariella) Bergeri* Brong.; Nowak, p. 10.
1926. *Turrilites dorsetensis*, nov.; Spath, pp. 429, 431.
1937. *Mariella dorsetensis* (Spath); Spath, p. 513.
1951. *Paraturrilites dorsetensis* (Spath); Wright & Wright, p. 16.

Dimensions (*mm*):

	D	H	T
1)	10.5	6	3.5—4
2)	15.5	10	—

Material. — Two fragments, including a complete whorl with aperture.

Remarks. — This species is very similar to *M. essenensis* (Geinitz), from which it, however, differs in a higher whorl with similar diameters, in a lack of tubercles or their only slightly differentiated size and in a longitudinal flattening of two upper rows of tubercles. In addition, the tendency to a transversal flattening is displayed by the tubercles of the lowermost row only.

Occurrence. — Jaźwiny (*53*) — Lower Cenomanian. The species has not so far been reported from Poland.

Mariella dorsetensis (Spath) is also known from the Lower Cenomanian of England (Wright & Wright 1951).

Mariella lewesiensis (Spath, 1926)
(Pl. III, Fig. 4)

1857. *Turrilites Bergeri*, Brongniart; Sharpe, p. 65, pl. 26, fig. 10 (only).
1926. *Turrilites lewesiensis*, nov.; Spath, pp. 429, 431.
1937. *Mariella lewesiensis* (Spath); Spath, p. 512.
1951. *Paraturrilites lewesiensis* (Spath); Wright & Wright, p. 17.

Dimensions (*mm*):

	D	H	T	U
1)	33	16.5	13	5
2)	—	15	13.5	—

Material. — Two fragmentary whorls.

Remarks. — *Mariella lewesiensis* (Spath) differs from the two species of the genus *Mariella* previously discussed in more convex whorls, stronger transversal flattening of tubercles of the median row and development of lower tubercles in the form of a double listlike swelling.

Occurrence. — Mokrzesz (*46*) — Lower Cenomanian. The species has not so far been reported from Poland.

Mariella lewesiensis (Spath) is also known from the Lower Cenomanian of England (Wright & Wright 1951, Kennedy 1969).

Genus *Turrilites* Lamarck, 1801
Turrilites costatus Lamarck, 1801

1822. *Turrilites costatus*; Mantell, p. 123, pl. 23, fig. 15; pl. 24, figs 1, 4, 5 (non figs 2, 3).
1840—1842. *Turrilites costatus*, Lamarck; d'Orbigny, p. 598, pl. 145, figs 1—5.
1852. *Turrilites costatus* Lmk.; Bronn, pt. 5, p. 335, pl. 33, fig. 7a—b.
1857. *Turrilites costatus*, Lamarck; Sharpe, p. 66, pl. 27, figs 2a—b, 3—5, 16 (non fig. 1).
1870. *Turrilites costatus* Lam.; Roemer, p. 293, pl. 27, fig. 2.
1876. *Turrilites costatus*, Lam.; Schlüter, p. 125, pl. 38, figs 1—5.
1951. *Turrilites costatus* Lamarck; Wright & Wright, p. 17.
1959. *Turrilites costatus* Lamarck; Cieśliński, p. 41.
1959. *Turrilites costatus* Lamarck; Naidin & Shimanski, p. 179, pl. 4, fig. 8.
1969. *Turrilites costatus*; Kennedy, pl. 17, figs 4—5.

Dimensions (*mm*):

	D	H
1)	17.5	9
2)	25	13

Material. — Two fragmentary whorls, one of them slightly deformed.

Remarks. — The specimens collected correspond to the greatest extent to Sharpe's illustrations (1857, Pl. 27, Figs 3 and 4). From the remaining illustrations, presented in synonymy, they differ in an insignificantly smaller elongation of tubercles of the upper row. Attention should, however, be paid to the fact that a change in the shape of tubercles or ribs may occur during the ontogenetic development, much the same as has been observed by, among other authors, Sharpe (1857) and Schlüter (1876) in *Turrilites scheuchzerianus* Roissy (cf. remarks on the last-named species).

Occurrence. — Jaźwiny (*53*) — Lower Cenomanian. The species abundantly occurs in the Lower and Upper Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

Turrilites costatus Lamarck is also known i.a. from France (d'Orbigny 1842), England (Mantell 1822, Sharpe 1857, Wright & Wright 1951, Kennedy 1969), Germany, Switzerland, Spain, North Africa, East India (Schlüter 1876), Caucasus and Crimea (Naidin & Shimanski 1959) and Podolia (Kokoszyńska 1931).

Turrilites scheuchzerianus Roissy
(Pl. III, Figs 11, 12)

1822. *Turrilites undulatus*; Mantell, p. 124, pl. 23, figs 14, 16; pl. 24, fig. 8.
1840—1842. *Turrilites Desnoyersi*, d'Orbigny; d'Orbigny, p. 601, pl. 146, figs 1, 2.

1840—1842. *Turrilites Scheuchzerianus*, Bosc; d'Orbigny, p. 602, pl. 146, figs 3, 4.
1857. *Turrilites Scheuchzerianus*, Bosc; Sharpe, p. 64, pl. 26, figs 1—3.
1876. *Turrilites Scheuchzerianus*, Bosc; Schlüter, p. 123, pl. 36, figs 11—13, 15 (non fig. 14).
1951. *Turrilites scheuchzerianus* Roissy; Wright & Wright, p. 17.
1959. *Turrilites scheuchzerianus* Roissy; Cieśliński, p. 45.

Dimensions (*mm*):

	D	H	T	U
1)	20	13	—	—
2)	26	14.5	10	—
3)	26.5	14	9	—
4)	45	22	19	7.5?
5)	33	15	13.5	—
6)	—	16.5	—	—

Material. — Eight fragmentary and variously preserved whorls.

Remarks. — From the works by Sharpe (1857), Schlüter (1876), Wright & Wright (1951) and Cieśliński (1959) it is clear that both older (upper) and younger (lower) whorls occur in the material under study. Older whorls have characteristic constrictions of ribs, which in younger (lower) whorls disappear near aperture and cause the ribs to be continuous in this place (cf. Pl. 3, Figs 11 and 12). The authors mentioned above emphasize that the variability in ornamentation of particular development stages of a shell induced d'Orbigny to divide this species into two different species, depending on which fragments of the shell were examined.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*), Krasice (*52*) — Lower Cenomanian. The species is abundant in the Lower and Upper Cenomanian of the northern and south-western margin of the Holy Cross Mts (Cieśliński 1959, Hakenberg 1969).

Turrilites scheuchzerianus Roissy is also known from the Cenomanian of England (Mantell 1822, Sharpe 1857, Wright & Wright 1951, Kennedy 1969), France (d'Orbigny 1842), as well as Germany, Switzerland, Saxony and Bohemia (Schlüter 1876).

Turrilites mantelli Sharpe, 1857
(Pl. III, Figs 9, 10)

1857. *Turrilites Mantelli*, Sharpe; Sharpe, p. 63, pl. 25, figs 5, 6a—b.
1876. *Turrilites Mantelli*, Shrp.; Schlüter, p. 134, pl. 38, figs 11, 12 (non pl. 37, fig. 9).
1951. *Turrilites mantelli* Sharpe; Wright & Wright, p. 17.
1959. *Turrilites mantelli* Sharpe; Cieśliński, p. 43.
1959. *Turrilites mantelli* Sharpe var.; Naidin & Shimanski, p. 179, pl. 4, fig. 7.

Dimensions (*mm*):

	D	H	T	U
1)	17	9.5	7	2
2)	23	12	9	3.5
3)	30	14	12.5	4
4)	—	9	8	—

Material. — Six fairly well preserved specimens, including a complete whorl.

Remarks. — The specimens under study are to the greatest extent similar to the description and illustrations, given by Schlüter (1876). They differ from Sharpe's (1857) specimens in a slightly smaller, transversal flattening of tubercles of the second row. The species *T. mantelli* Sharpe has been separated by Sharpe (1857) from the species *T. tuberculatus* Bosc, from which it differs in a smaller size of cardinal tubercles, their greater number and shape of aperture (cf. Sharpe 1857). On the basis of observations of the material available, the conclusion may be drawn that the third (lower) row of tubercles in *T. tuberculatus* Bosc does not take as distinct form of a double, listlike swelling as in the case of *T. mantelli* Sharpe.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*), Krasice (*52*), Julianka (*70*) — Lower Cenomanian. The species is reported from the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

Turrilites mantelli Sharpe is also known from the Lower Cenomanian of England (Sharpe 1857, Wright & Wright 1951, Kennedy 1969) and Germany (Schlüter 1876).

Turrilites tuberculatus Bosc, 1801
(Pl. III, Fig. 6)

1840—1842. *Turrilites tuberculatus*, Bosc; d'Orbigny, p. 593, pl. 144, figs 1, 2.
1857. *Turrilites tuberculatus*, Bosc; Sharpe, p. 61, pl. 25, figs 1, 2, 4 (non fig. 3); pl. 26, figs 15, 16.
1876. *Turrilites tuberculatus*, Bosc, Sow.; Schlüter, p. 132, pl. 37, figs 1, 2; pl. 44, fig. 11.
1951. *Turrilites tuberculatus* Bosc; Wright & Wright, p. 17.
1959. *Turrilites tuberculatus* Bosc; Cieśliński, p. 44.

Dimensions (*mm*):

	D	H	T
1)	33	19	16
2)	20	9	8.5

Material. — Four incomplete, variously preserved specimens.

Remarks. — These specimens are to the greatest extent similar to Sharpe's (1857) illustrations.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*), Krasice (*52*) — Lower Cenomanian. The species is reported from the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

Turrilites tuberculatus Bosc is also known i.a. from the Cenomanian of France (d'Orbigny 1842), England (Sharpe 1857, Wright & Wright 1951, Kennedy 1969), as well as Germany, Switzerland and East India (Schlüter 1876).

Turrilites acutus Passy, 1832
(Pl. III, Figs 7, 8)

1857. *Turrilites Wiestii;* Sharpe, p. 67, pl. 27, figs 8, 9a—b, ?14a—b.
?1857. *Turrilites costatus,* Lamarck; Sharpe, p. 66, pl. 27, fig. 1 (only).
1876. *Turrilites acutus,* Passy; Schlüter, p. 127, pl. 38, figs 15, 16.
1951. *Turrilites acutus* Passy; Wright & Wright, p. 17.
1969. *Turrilites acutus*; Kennedy, pl. 18, fig. 2.

Dimensions (*mm*):

	D	H	T	U
1)	22	12.5	8	5.5
2)	19	11	9	—

Material. — Four fragmentary whorls.

Remarks. — The specimens under study display a certain differentiation. Some of them have tubercles with a rounded (conical) base and to the greatest extent correspond to the specimens determined by Sharpe as *Turrilites wiestii* Sharpe (cf. Sharpe 1857, Pl. 27, Fig. 8), while some others have tubercles flattened somewhat longitudinally and correspond to the specimens, determined as *Turrilites costatus* Lamarck (cf. Sharpe, Pl. 27, Fig. 1 only). The differentiation in the form of tubercles is a symptom of variability within one and the same species, since, according to Wright & Wright (1951), both forms, described by Sharpe (1857), belong to the species *Turrilites acutus* Passy.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*), Krasice (*52*) — Lower Cenomanian. The species is mentioned by Sujkowski (1926) from the Cenomanian of the environs of Wolbrom.

Turrilites acutus Passy is also known from the Lower Cenomanian of England (Sharpe 1857, Wright & Wright 1951, Kennedy 1969), as well as from the Cenomanian of Germany and France (Schlüter 1876) and Podolia (Kokoszyńska 1931).

Genus *Ostlingoceras* Hyatt, 1900
Ostlingoceras bechei (Sharpe, 1857)
(Pl. III, Fig. 5)

1857. *Turrilites Bechei,* Sharpe; Sharpe, p. 66, pl. 26, fig. 13a—b.
1951. *Ostlingoceras bechei* (Sharpe); Wright & Wright, p. 18.

Material. — An incomplete whorl (D — 18, H — 8, T — 7, U — 2.5—3.0).

Remarks. — From the description and illustrations of Sharpe (1857), who had at his disposal a better preserved specimen, it is clear that whorls are ornamented by many, delicate ribs running from the lower suture only for two thirds of the height of whorl, the remaining part of the side of whorl being smooth. The number of ribs on a whorl corresponds to that of tubercles, which occur on these ribs. An almost complete obliteration of ribs on the specimen (a core) under study was probably caused by their original delicate development.

Occurrence. — Mokrzesz (*46*) — Lower Cenomanian. According to Sharpe, the species is very rare in the English Cretaceous and its stratigraphic range is restricted to the Lower Cenomanian (Wright & Wright 1951, Kennedy 1969). Neither the species nor the genus have so far been known from the Cenomanian of Poland.

Family **Schloenbachiidae** Spath, 1925
Genus *Schloenbachia* Neumayr, 1875
Schloenbachia varians (Sowerby, 1817)
(Pl. IV, Fig. 3a—b)

1853. *Ammonites Coupei*, Brong.; Sharpe, p. 23, pl. 8, figs 2, 3 (non figs 1, 4).
1951. *Schloenbachia varians* (J. Sowerby); Wright & Wright, p. 22.
1959. *Schloenbachia varians* (Sowerby); Cieśliński, p. 59.

Dimensions (*mm*):

	D	H	T	U
1)	33.2	15	13.5	11
2)	—	23	22	—

Material. — Four specimens, one of them well preserved.

Remarks. — The specimens accurately correspond to Sharpe's (1853) illustrations.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*), Lusławice (*84*) — Lower Cenomanian. The species is known from the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

In England, *Schloenbachia varians* (Sowerby) frequently occurs in the Lower Cenomanian (Wright & Wright 1951, Kennedy 1969).

Schloenbachia varians var. *tetrammata* (Sowerby, 1828)
(Pl. IV, Fig. 4a—b)

1853. *Ammonites Coupei* var. *tuberculata* Mantell; Sharpe, p. 24, pl. 9, fig. 1 (only).
1951. *Schloenbachia varians* var. *tetrammata* (J. de C. Sowerby); Wright & Wright, p. 22.
1954. *Schloenbachia varians* var. *tetrammata* (J. de C. Sowerby); Donovan, p. 12, pl. 2, fig. 1a—b.

Dimensions (*mm*):

	D	H	T	U
1)	31	13.4	11	9.2
2)	—	9.5	10	—

Material. — Two specimens, one of them well preserved.

Remarks. — This variety differs from typical forms of *S. varians* in having the largest tubercles in the middle row and a smaller number of tubercles and ribs on each whorl.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*) — Lower Cenomanian. The variety has not so far been known from the Polish Cenomanian.

In England, *Schloenbachia varians* var. *tetrammata* (Sowerby) occurs in the Lower Cenomanian (Wright & Wright 1951). The variety is also known from the Lower Cenomanian of Eastern Greenland (Donovan 1954).

?*Schloenbachia varians* var. *trituberculata* Spath, 1926
(Pl. IV, Fig. 1a—b)

1853. *Ammonites Coupei* var. *tuberculata*, Mantell; Sharpe, p. 23, pl. 8, fig. 4 (only).
1926. *Schloenbachia trituberculata*, nom. nov.; Spath, p. 430.
1951. *Schloenbachia varians* var. *trituberculata* Spath; Wright & Wright, p. 22.

Material. — A well preserved specimen (D — 24.5, H — 10.5, T — 11.7, U — 7.5).

Remarks. — In this variety, ribs are indistinct, while conspicuously marked are tubercles arranged in three rows. The latter feature induced Spath (1926) to use the name "trituberculata". *Schloenbachia varians* var. *trituberculata* differs from *S. varians* in a section of whorl (height somewhat smaller than thickness), slightly narrower umbilicus and rounding of its margin. In addition, the umbilical wall is vertical. Single ribs and the presence of intercalary ribs, detaching themselves from siphonal tubercles, make up a fundamental differing feature.

The specimen available corresponds to Spath's (1926) description, but slightly deviates from Sharpe's (1853) illustration, referred to by Spath. On account of the fact that the collection contains one specimen only and that it is impossible to trace the variability, taking place within this variety, the present writer is not certain of his determination.

Occurrence. — Mokrzesz (*46*) — Lower Cenomanian. The variety has not so far been found in Poland.

In England, *Schloenbachia varians* var. *trituberculata* Spath occurs in the Lower Cenomanian (Wright & Wright 1951, Kennedy 1969).

Schloenbachia subvarians Spath, 1926
(Pl. V, Fig. 5)

1853. *Ammonites varians* var. *intermedia* Mantell; Sharpe, p. 23, pl. 8, fig. 7a—b.
1871. *Ammonites varians*, Sow.; Schlüter, p. 10, pl. 4, figs 11, 12 (only).
1885. *Ammonites (Schloenbachia) varians* Sowerby sp.; Noetling, p. 42, pl. 8, figs 5, 5a (non fig. 6).
1926. *Schloenbachia subvarians* var. *aperta*, nov., Spath, p. 430.

1951. *Schloenbachia subvarians* Spath; Wright & Wright, p. 22.
1954. *Schloenbachia subvarians* Spath; Donovan, p. 10—12, fig. 2, pl. 1, figs 1a—b, 2a—b?, 6, 7a—b.
1959. *Schloenbachia subvarians* Spath; Cieśliński, p. 58, pl. 7, figs 3a—b, 4a—b.
1969. *Schloenbachia subvarians* Spath; Hakenberg, p. 106, pl. 2, figs 3, 4.

Dimensions (*mm*):

	D	H	T	U
1)	41	15.5	12.7	14.5
2)	43	17	13	14
3)	26.4	11.5	9	7.5
4)	26	12	8.5	7

Material. — A dozen or so specimens, including four well preserved.

Remarks. — The specimen under study display a certain differentiation, which, however, does not exceed the limits of specific variability, as may be observed on illustrations presented by the authors, who are mentioned in synonymy.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*), Krasice (*52*), Julianka (*70*) — Lower Cenomanian. The species is reported from the Lower Cenomanian of the northern and south-western margins of the Holy Cross Mts (Cieśliński 1959, Hakenberg 1969).

Schloenbachia subvarians Spath is also known from the Lower Cenomanian of England (Sharpe 1853, Wright & Wright 1951, Kennedy 1969), Germany (Schlüter 1871, Noetling 1885) and East Greenland (Donovan 1954).

Schloenbachia subtuberculata (Sharpe, 1853)
(Pl. VI, Fig. 1a—b)

1853. *Ammonites varians* var. *sub-tuberculata*; Sharpe, p. 22, pl. 8, figs 5a—c, 6a—b (non fig. 8).
1899. *Schloenbachia subtuberculata* Sharpe; Semenow, p. 101, pl. 3, fig. 3.
1951. *Schloenbachia subtuberculata* (Sharpe); Wright & Wright, p. 22.
1954. *Schloenbachia subtuberculata* (Sharpe); Donovan, p. 9—10, pl. 1, figs 3a—b, 4, ? fig. 8.
1959. *Schloenbachia subtuberculata* (Sharpe); Cieśliński, p. 58, pl. 8, fig. 2a—b.

Dimensions (*mm*):

	D	H	T	U
1)	37	15.2	13.3	11.3
2)	39	15.5	13	12
3)	17.5	9	7.2	5.5

Material. — Eight specimens, three of them well preserved.

Remarks. — The specimens correspond to Sharpe's (1853) description and illustrations, but have a lesser number of siphonal tubercles on each whorl.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*), Lusławice (*84*) — Lower Cenomanian. The species occurs in the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

Schloenbachia subtuberculata (Sharpe) is also known from the Lower Cenomanian of England (Sharpe 1853, Wright & Wright 1951, Kennedy 1969), Kazakhstan (Semenow 1899) and East Greenland (Donovan 1954).

Schloenbachia sharpei Semenow, 1899
(Pl. V, Fig. 2)

1899. *Schloenbachia Sharpei* n.f.; Semenow, p. 100, pl. 2, fig. 9a—b; pl. 3, figs 1, 2.
1951. *Schloenbachia sharpei* (Semenow); Wright & Wright, p. 22.
1954. *Schloenbachia* cf. *varians* (J. Sowerby); Donovan, p. 12, pl. 2, fig. 2a—b.
1959. *Schloenbachia sharpei* (Semenow); Cieśliński, p. 56, pl. 7, fig. 2a—c.

Dimensions (*mm*):

	D	H	T	U
1)	49.4	20	17	15
2)	19	9	6	4.5
3)	14.4	7	5.8	3.5
4)	—	21.5	15	—
5)	—	17	15.5	—
6)	—	14.4	11.6	—

Material. — Six specimens, three of them well preserved.

Remarks. — The specimens correspond to the greatest extent to the illustrations published by Semenow (1899).

In the specimens with a conspicuous ornamentation, the transverse section of a whorl is heptagonal which has been indicated by Semenow (1899), who, describing this species, mentions four rows of tubercles on the side of a whorl, since he considers short, listlike outer ribs as tubercles.

A specimen, presented by Donovan (1954) under the name *Schloenbachia* cf. *varians* (J. Sowerby) does not correspond to this species. In fact, Donovan himself attracts attention to several features which differ the specimen he described from a typical *S. varians*. Among other characters, he emphasizes that his specimen has swollen outer ribs and presents a transverse section of a whorl (Donovan 1954, Pl. 2, Fig. 2b), which is identical with that in *S. sharpei* Semenow (cf. Semenow 1899, Pl. 3, Fig. 1). Taking into consideration both the shape of outer ribs and a characteristic transverse section of a whorl, Donovan's (1954) specimen discussed should be assigned to *S. sharpei* Semenow. The present writer is in possession of two specimens very similar to those illustrated by Donovan (1954, Pl. 2, Fig. 2a—b).

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*) — Lower Cenomanian. The species is common in the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

Schloenbachia sharpei Semenow is also known from the Lower Cenomanian of Kazakhstan (Semenow 1899), England (Wright & Wright 1951) and Greenland (see remarks).

Schloenbachia quadrata Spath, 1926
(Pl. V, Figs 3a—b, 4)

1851—1852. *Ammonites ?Coupei* Brgn.; Bronn, p. 317, pl. 33, fig. 4a—b.
1926. *Schloenbachia quadrata*, nom. nov.; Spath, pp. 426, 430.
1951. *Schloenbachia quadrata* Spath; Wright & Wright, p. 22.
1959. *Schloenbachia* cf. *quadrata* Spath; Cieśliński, p. 56.

Dimensions (*mm*):

	D	H	T	U
1)	32	13	13.4	10
2)	35	14.5	15.3	11.5
3)	35.6	15	16.4	12.5
4)	14	6	6.5	4

Material. — Four well preserved specimens and a few fragmentary whorls.

Remarks. — The specimens accurately correspond to Bronn's (1852) illustration and Cieśliński's (1959) description.

Occurrence. — Jaźwiny (*53*), Mokrzesz (*46*), Krasice (*52*) — Lower Cenomanian. The species rarely occurs in the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

Schloenbachia quadrata Spath is also known from the Lower Cenomanian of England (Spath 1926, Wright & Wright 1951).

Schloenbachia ventriosa Stieler, 1922
(Pl. IV, Fig. 5a—b; Pl. V, Fig. 1a—b)

1853. *Ammonites Coupei* var. *inflata* Sharpe; Sharpe, p. 24, pl. 8, fig. 1a—b.
1871. *Ammonites Coupei* Brong.; Schlüter, p. 11, pl. 4, figs 15—19 (non figs 13, 14, 21).
1885. *Ammonites (Schloenbachia) Coupei* Brongn., var. *A*; Noetling, p. 41, pl. 8, figs 2, 2a (non figs 1, 1a).
1899. *Schloenbachia Coupei* Brongn.; Semenow, p. 98, pl. 2, fig. 6a—b (only).
1951. *Schloenbachia ventriosa* Stieler; Wright & Wright, p. 22.
1959. *Schloenbachia ventriosa* Stieler; Cieśliński, p. 60, pl. 8, fig. 1a—b.
1969. *Schloenbachia* sp., close to *S. ventriosa*; Kennedy, pl. 17, fig. 3.

Dimensions (*mm*):

	D	H	T	U
1)	34	13.3	15.5	11
2)	26	10	15	8
3)	25.5	10	14	9.5
4)	25	10	13.2	9
5)	22.7	8.7	12.8	8
6)	17.5	7	10.6	5.7
7)	19	7	12	8
8)	18	6.5	9.5	—

Material. — Eighteen species, seven of them well preserved.

Remarks. — The specimens collected accurately correspond to illustrations and descriptions of the authors, mentioned in synonymy.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*), Krasice (*52*), Julianka (*72*) — Lower Cenomanian. The species is abundant in the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

Schloenbachia ventriosa Stieler is also known from the Lower Cenomanian of England (Wright & Wright 1951, Kennedy 1969), Germany (Schlüter 1871) and Kazakhstan (Semenow 1899).

Schloenbachia subplana (Mantell, 1822)
(Pl. IV, Fig. 2a—b)

1822. *Ammonites varians* var. *subplana*; Mantell, p. 116, pl. 21, fig. 2.
1853. *Ammonites varians* var. *sub-plana* of Mantell; Sharpe, p. 23, pl. 8, fig. 10a—b.
1951. *Schloenbachia subplana* (Mantell); Wright & Wright, p. 23.
1954. *Schloenbachia* aff. *subplana* (Mantell); Donovan, p. 9.
1959. *Schloenbachia subplana* (Mantell); Cieśliński, p. 57.

Dimensions (*mm*):

	H	T
1)	13	9.5
2)	8.3	6.5
3)	9	6.5

Material. — Three fragmentary whorls.

Remarks. — The specimens do not display any differences as compared with the forms, illustrated by other authors. Attention should be attracted to the fact that Cieśliński's (1959) inclusion of the specimens, illustrated in Semenow's (1899) work, into the synonymy of the species *Schloenbachia subplana* (Mantell) is erroneous. According to the work by Wright & Wright (1951), which in fact is included by Cieśliński in synonymy, the specimens, determined by Semenow (1899) as *S. subplana* (Mantell), belong to the species *S. dorsetensis* Spath.

Occurrence. — Mokrzesz (*46*) — Lower Cenomanian. The species occurs in the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

Schloenbachia subplana (Mantell) is also known from the Lower Cenomanian of England (Wright & Wright 1951, Kennedy 1969) and East Greenland (Donovan 1954).

Schloenbachia intermedia (Mantell, 1822)
(Pl. VI, Fig. 2a—b)

1822. *Ammonites varians* var. *intermedia*; Mantell, p. 116, pl. 21, fig. 7.
1853. *Ammonites cinctus*, Mantell; Sharpe; p. 25, pl. 9, fig. 2a—b.
1951. *Schloenbachia intermedia* (Mantell); Wright & Wright, p. 23.

Material. — A half of a whorl (D — 29.3, H — 13.5, T — 12, U — 9).

Remarks. — In the specimen under study, a scar and a discontinuity of ribs occur in a certain place on the ventral side. This anomaly in

ornamentation was probably caused by damage of shell in the ammonite's lifetime and which was regenerated by the animal. In addition, the specimen displays a differentiation in ornamentation of individual whorls. A plaster cast, taken from the preceding whorl, has quite a different ornamentation. A keel runs on the inner whorl through the middle of the siphonal side which bears on its edge the tubercles joining with outer ribs. The ornamentation of the inner whorl is similar to Mantell's (1822, Pl. 21, Fig. 7) and of the outer whorl to Sharpe's (1853, Pl. 9, Fig. 2a—b) illustrations. Apart from the question whether or not these two specimens actually belong to one and the same species, it is clear from Mantell's description and illustration that this author was aware of the differences in the ornamentation of these specimens and consider them to be a symptom of a intraspecific variability (cf. Mantell 1822, Pl. 21, Figs 7 and 8).

Wright & Wright (1951) are of the opinion that the specimen, illustrated by Sharpe (1853) under the name *Ammonites cinctus* Mantell is a degenerated form of *Schloenbachia* and therefore they assign it with reservation to the species *Schloenbachia intermedia* (Mantell).

Occurrence. — Mokrzesz (*46*) — Lower Cenomanian. The species has not so far been known from Poland.

According to Wright & Wright (1951), *Schloenbachia intermedia* (Mantell) occurs in the Lower Cenomanian of England.

Family **Acanthoceratidae** de Grossouvre, 1894
Subfamily **Mantelliceratinae** Hyatt, 1903
Genus *Mantelliceras* Hyatt, 1903
Mantelliceras tuberculatum (Mantell, 1822)
(Pl. VI, Fig. 3a—b)

1822. *Ammonites Mantelli* var. *tuberculata*; Mantell, p. 114.
1857. *Ammonites Mantelli*, Sowerby; Sharpe, p. 40, pl. 16, fig. 6a—b (only).
1871. *Ammonites Mantelli*, Sow.; Schlüter, p. 12, pl. 5, figs 1, 2 (only).
1951. *Mantelliceras tuberculatum* (Mantell); Wright & Wright, p. 24.
1959. *Mantelliceras tuberculatum* (Mantell); Cieśliński, p. 64.

Dimensions (*mm*):

	H	T
1)	18	17.5
2)	12	12

Material. — Two fragmentary whorls.

Remarks. — The specimens examined accurately correspond to the description presented by Cieśliński (1959) and to the illustrations of the authors, mentioned in synonymy.

Occurrence. — Mokrzesz (*46*), Jaźwiny (*53*) — Lower Cenomanian. The species is reported from the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

In England, *Mantelliceras tuberculatum* (Mantell) occurs in the Lower Cenomanian (Wright & Wright 1951, Kennedy 1969). According to Schlüter (1871), the forms he describes come from the Cenomanian of Germany and are widely distributed as known i.a. from Switzerland, Hungary, France, Spain and East India.

Mantelliceras sp.

Material. — A fragmentary whorl (H — 14.5, T — 12).

Description. — Whorl high with slightly convex sides and flat siphonal side. Single ribs, thinner near umbilicus and thickening ventrally, occur on the sides of whorl. The upper parts of ribs slightly bent anteriorly, each of the ribs terminating, on the ventral side of whorl, in a small tubercle. The ribs continue on the ventral side where they are, however, less conspicuously marked than on the sides of whorl. Poor state of preservation prevents the writer from a specific determination.

Occurrence. — Julianka (*70*) — Lower Cenomanian. The genus is known from the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959). Its stratigraphic range is probably limited to the Lower Cenomanian (Wright & Wright 1951, Kennedy 1969).

Genus *Sharpeiceras* Hyatt, 1903

Sharpeiceras sp.

Material. — A fragmentary whorl (H — 40, T — 29).

Description. — Whorl high, with flat sides. Single ribs, covered with tubercles, run from umbilicus through the side of whorl. Three rows of tubercles are marked on the side of whorl. Tubercles of the lower row are the smallest and distributed on the margin of umbilicus. The second row of tubercles runs more or less halfway the height of the side of whorl. The third row of tubercles is situated on the margin of the siphonal side and is very distinct. Two rows of tubercles, equal in size to those of the preceding row, occur on both sides of a narrow and depressed ventral part of whorl. In total, on both sides of the whorl, there are six rows of tubercles while two rows of tubercles occur also on the siphonal side.

Remarks. — The specimen under study is similar to the forms presented by Sharpe (1855, Pl. 14, Fig. 1a—b) and Schlüter (1872, Pl. 7, Figs 4—8), which — in the light of Wright's & Wright's (1951) systematics — corresponds to the genus *Sharpeiceras*. Specific determination is rendered impossible by a poor material.

Occurrence. — Mokrzesz (*46*) — Lower Cenomanian. The genus has not so far been known from Poland.

According to Wright & Wright (1951), the genus *Sharpeiceras* occurs in the Lower Cenomanian of England and Germany.

Genus *Calycoceras* Hyatt, 1900
Calycoceras sp.

Material. — Two poorly preserved, fragmentary whorls (H — 29 mm displayed by one of them).

Description. — Whorl thick, slightly convex. Single ribs, running straight, occur on the whorl. They detach themselves from the umbilical margin and run further over a rounded ventral side. On one of the specimens, some of the single ribs do not reach the umbilical margin.

Remarks. — The specimens are most similar to the species *Calycoceras subgenoti* (Spath), illustrated by Sharpe (1857, Pl. 18, Figs 3a—b and 5a—b) and Cieśliński (1959, Pl. 8, Fig. 7a—b). A poor material does not allow the writer for any closer determination.

Occurrence. — Jaźwiny (*53*), Krasice (*52*) — Lower Cenomanian. The genus is reported from the Lower Cenomanian of the northern margin of the Holy Cross Mts (Cieśliński 1959).

In England, the genus *Calycoceras* occurs in the Lower and Upper Cenomanian (Wright & Wright 1951, Kennedy 1969).

Genus *Paracalycoceras* Spath, 1925
Paracalycoceras cf. *wiestii* (Sharpe, 1857)

Material. — A fragmentary whorl (H — 14, T — 13.5).

Remarks. — The specimen is very similar to that illustrated by Sharpe (1857, Pl. 21, Fig. 3a—c), from which it differs, however, in a bend of ribs on the ventral side. In Sharpe's specimen, ribs on the ventral side are bent posteriorly and in the specimen examined — anteriorly (it may well be that on younger whorls, the ornamentation is subject to changes). On account of the difference in the bend of ribs and poor material, the writer is not certain of the determination.

Occurrence. — Jaźwiny (*53*) — Lower Cenomanian. The species has not so far been cited from the area of Poland.

In England, *Paracalycoceras wiestii* (Sharpe) is known from the Lower Cenomanian (Wright & Wright 1951).

BELEMNOIDEA

Family **Belemnopsidae** Naef, 1922
Genus *Neohibolites* Stolley, 1911
Neohibolites ultimus (d'Orbigny, 1847)

1853. *Belemnites ultimus*, D'Orb.; Sharpe, p. 3, pl. 1, fig. 17a—c.
1876. *Belemnites ultimus*, d'Orb.; Schlüter, p. 184, pl.. 52, figs 1—5.
1951. *Neohibolites ultimus* (d'Orbigny); Wright & Wright, p. 9.
1959. *Neohibolites ultimus* (d'Orbigny); Cieśliński, p. 28, pl. 3, fig. 1.
1959. *Neohibolites ultimus* (d'Orbigny); Naidin & Shimanski, p. 200, pl. 19, figs 3a—b — 10.
1960. *Neohibolites ultimus* Orbigny; Kudriavtsev, p. 363, pl. 3, figs 15, 16.
1969. *Neohibolites ultimus* (d'Orbigny); Hakenberg, p. 108, pl. 4, fig. 3a—i.

Material. — An incomplete specimen (length of rostrum — 36.5 mm, maximum thickness — 6 mm).

Remarks. — The specimen under study has a rostrum with slightly flattened sides near alveola. The problem of the similarity of the species *Neohibolites ultimus* (d'Orbigny) and *Neohibolites minimus* (Miller) was discussed by many authors. Many of them consider the flattening of the perialveolar part and larger dimensions of rostrum as features of the species *Neohibolites ultimus*. After analyzing specimens from the Albian of the Tatra Mts, Passendorfer (1930) believes that the shape of the alveolar margin is not a criterion of difference between the two species.

Occurrence. — Mokrzesz (*46*) — Lower Cenomanian. The species is known from the Uppermost Albian and Lower Cenomanian of the northern and south-western margins of the Holy Cross Mts (Cieśliński 1959, Hakenberg 1969).

Neohibolites ultimus (d'Orbigny) is also known from the Lower Cenomanian of England (Wright & Wright 1951), Germany (Schlüter 1876) and Northern Caucasus (Naidin & Shimanski 1959, Kudriavtsev 1960).

General remarks on cephalopods

Among the rich fauna of the Lower Cenomanian cephalopods, found in the area under study in the Polish Jura Chain, there occur varieties of the species *Schloenbachia varians* (Sowerby), which have not so far been known from the territory of Poland, that is, *Schloenbachia varians* var. *tetrammata* (Sowerby) and *?Schloenbachia varians* var. *tritubercu-lata* Spath. The genus *Sharpeiceras* and species *Mariella dorsetensis* (Spath), *M. lewesiensis* (Spath), *Ostlingoceras bechei* (Sharpe), *Schloen-bachia intermedia* (Mantell) and *Paracalycoceras* cf. *wiestii* (Sharpe) have been for the first time found in the Cenomanian of Poland. In the area under study, the same as in England, these forms are very rare.

An average size of all specimens that were examined is much smaller than that of the specimens of these same species occurring in England (cf. dimensions given by Sharpe 1853—1857).

Most species found in the area investigated in the Polish Jura Chain are common with those occurring along the margins of the Holy Cross Mts (cf. Cieśliński 1959, Hakenberg 1969), which indicates that in the Cenomanian, there were no faunal differences between the two areas of the epicontinental sea covering the territory of Poland.

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TRANSGRESYWNE UTWORY KREDY W OKOLICACH MOKRZESZY, LUSŁAWIC I JULIANKI NA JURZE POLSKIEJ

(Streszczenie)

Transgresywne utwory kredy w okolicach Mokrzeszy, Lusławic i Julianki, położonych na wschód od Częstochowy (fig. 1), od wielu lat budzące zainteresowanie szeregu badaczy (Roemer 1870, Koroniewicz & Rehbinder 1913, Mazurek 1923, Różycki 1937), nie były dotąd przedmiotem szczegółowego opracowania. Utwory te leżą na erozyjnie rozciętej powierzchni górnojurajskich wapieni skalistych, a wiek ich zamyka się w granicach środkowy lub górny alb — dolny turon (fig. 2). Najstarsze ogniwa kredy, wykształcone w postaci piasków i piaskowców glaukonitowych (pl. I), wypełniają większe obniżenia w podłożu jurajskim oraz drobne rozpadliny na elewacjach tego podłoża (fig. 2—4; por. także Różycki 1937). Wpływ nierówności podłoża na rozkład stref sedymentacji zanika w dolnym cenomanie (por. fig. 2 i 3), co związane jest ze znacznym rozszerzeniem się transgresji na całym epikontynentalnym obszarze Polski. W osadach pojawia się wtedy materiał węglanowy, którego ilość stopniowo wzrasta w górnym cenomanie i dolnym turonie. Rozważane osady, na co wskazuje bogata i różnorodna fauna, powstawały w warunkach morskich, przy czym obecność nor *Ophiomorpha nodosa* Lundgren, utworzonych przez raki z rodzaju *Callianassa* Leach, wskazuje na okresowo bardzo płytkomorskie warunki sedymentacji (por. Weimer & Hoyt 1964, Kennedy & Macdougall 1969, Radwański 1970). Szczególnie liczne zespoły faunistyczne występują w dolnym cenomanie, co przynajmniej częściowo związane jest z powolnym tempem sedymentacji (wzrost ilości glaukonitu, obecność różnorodnych konkrecji fosforytowych). W części paleontologicznej niniejszej pracy, spośród bogatej fauny dolnego cenomanu szczegółowo opraco-

wane zostały głowonogi (pl. II—VII). Prócz kilku łodzików (*Eutrephoceras, Cymatoceras*) i belemnitów (*Neohibolites*), przedstawiono tu rozmaite formy amonitów z rodzajów *Scaphites, Hamites, Sciponoceras, Mariella, Turrilites, Ostlingoceras, Schloenbachia, Mantelliceras, Sharpeiceras, Calycoceras* oraz *Paracalycoceras*, spośród których szereg zostało stwierdzonych na terenie Polski po raz pierwszy. Przedstawione wyniki badań upoważniają do wniosku, że w obrębie transgresywnych utworów kredy na obszarze Jury Polskiej i sąsiednich części niecki miechowskiej osady dolnego cenomanu zawierają inwentarz faunistyczny, zwłaszcza głowonogów, znacznie bogatszy niż znajdowany w równowiekowych utworach na obrzeżeniu Gór Świętokrzyskich (por. Samsonowicz 1925, 1934; Pożaryski 1947; Cieśliński 1959; Hakenberg 1969).

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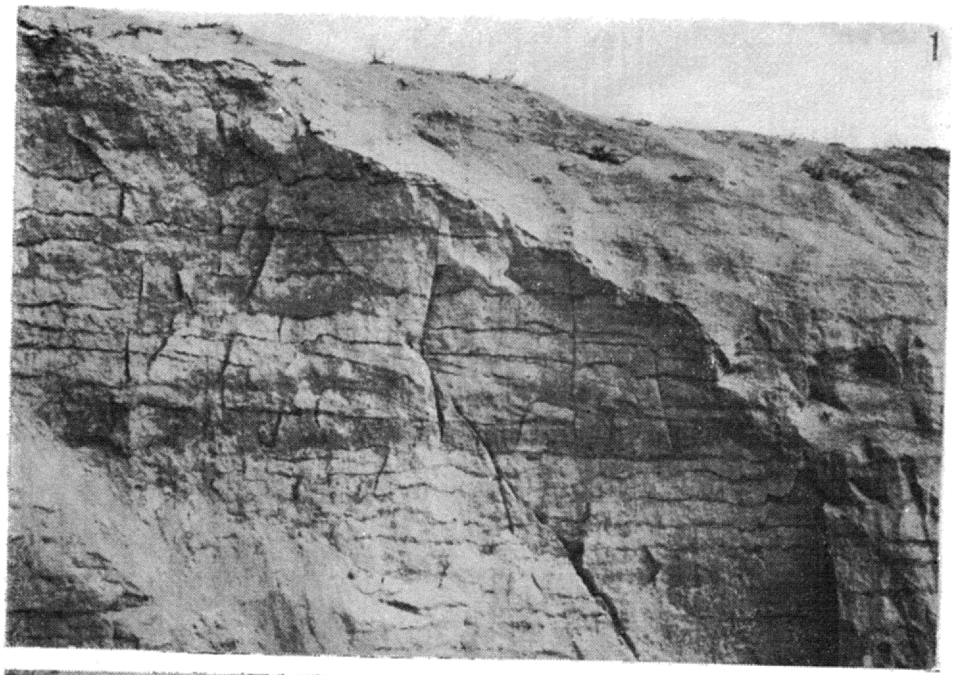
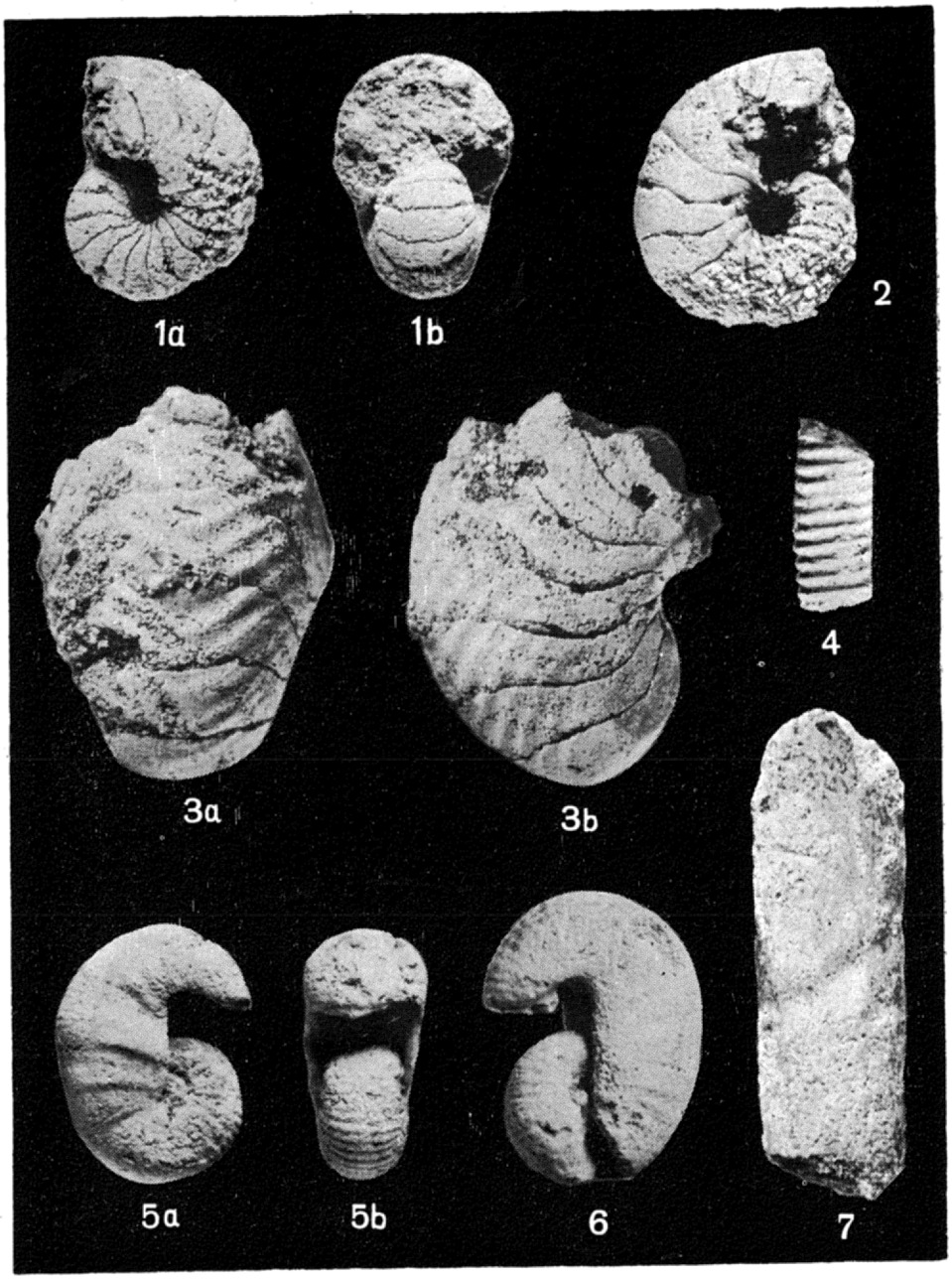
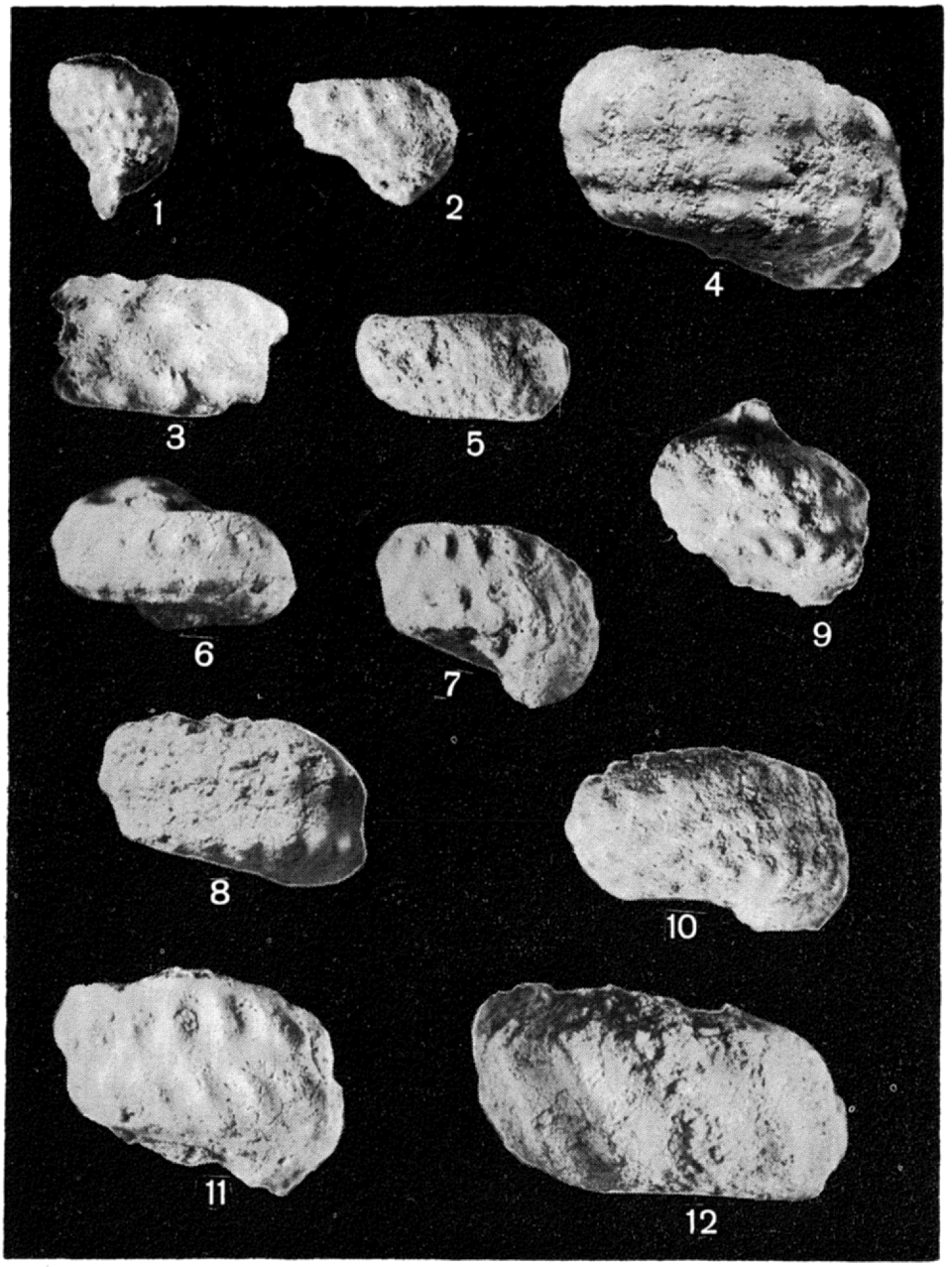


1 — Sand pit at Mokrzesz (outcrop *46a*); visible are the Upper Albian sands of sets *1—4* (cf. Fig. 3*C*).

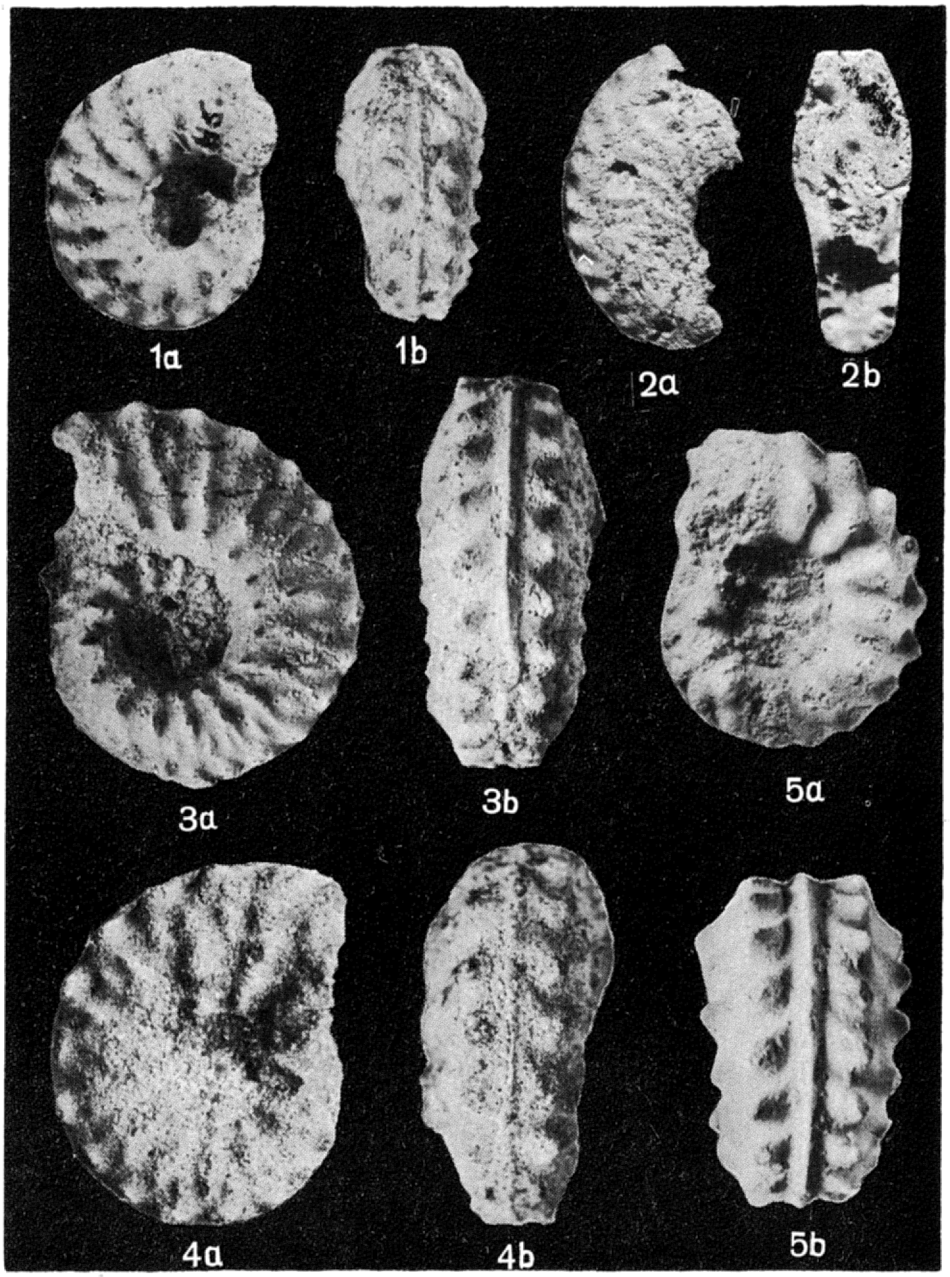
2 — Quarry at Staropole (outcrop *63*); visible are the Upper Albian quartzitic sandstones of sets *1—5* (cf. Fig. 3*D*).



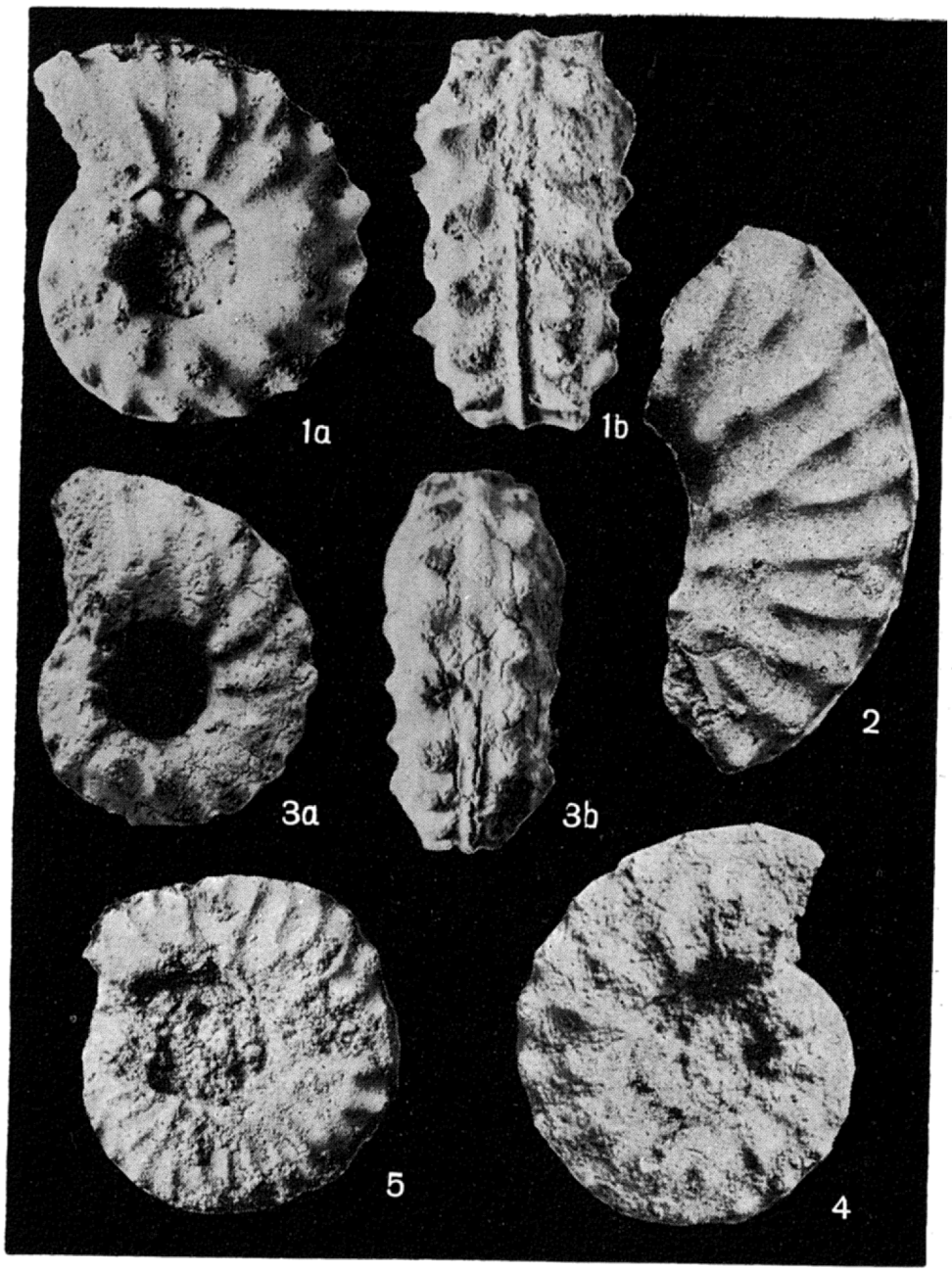
1a, 1b — *Eutrephoceras sublaevigatum* (d'Orbigny); Jaźwiny × 1.5
2 — *Eutrephoceras sublaevigatum* (d'Orbigny); Mokrzesz × 1.5
3a, 3b — *Cymatoceras deslongchampsianum* (d'Orbigny); Mokrzesz × 1.4
4 — *Hamites* sp.; Mokrzesz × 2
5a, 5b — *Scaphites aequalis* Sowerby; Krasice × 1.6
6 — *Scaphites aequalis* Sowerby; Mokrzesz × 1.6
7 — *Sciponoceras subbaculoides* (Geinitz); Jaźwiny × 1.5



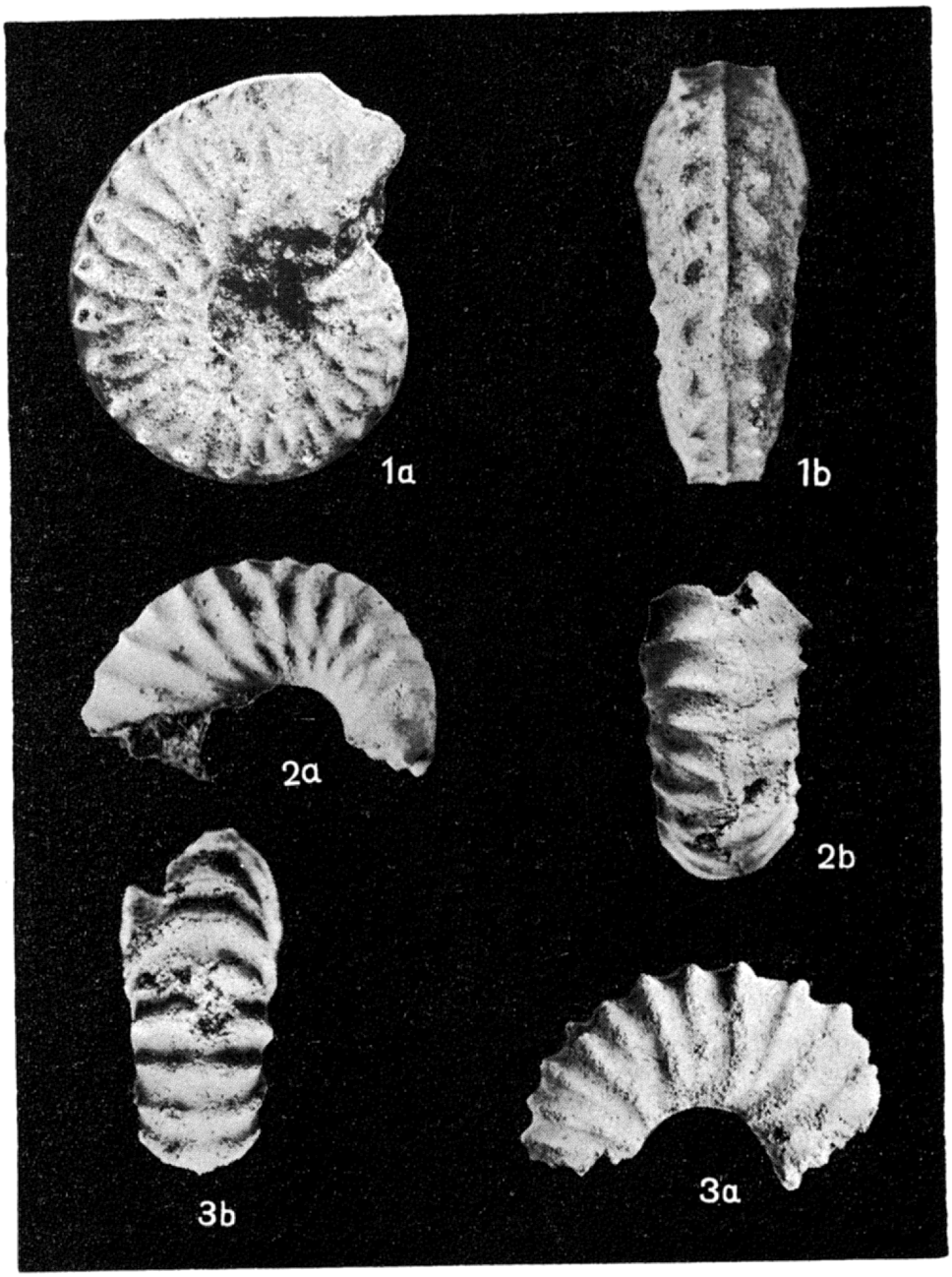
1 — *Mariella dorsetensis* (Spath); Jaźwiny × 1.5
2 — *Mariella essenensis* (Geinitz); Jaźwiny × 1.5
3 — *Mariella essenensis* (Geinitz); Mokrzesz × 1.6
4 — *Mariella lewesiensis* (Spath); Mokrzesz × 1.7
5 — *Ostlingoceras bechei* (Sharpe); Mokrzesz × 1.6
6 — *Turrilites tuberculatus* Bosc; Krasice × 1.5
7 — *Turrilites acutus* Passy; Krasice × 1.5
8 — *Turrilites acutus* Passy; Mokrzesz × 1.6
9 — *Turrilites mantelli* Sharpe; Mokrzesz × 1.7
10 — *Turrilites mantelli* Sharpe; Mokrzesz × 1.6
11 — *Turrilites scheuchzerianus* Roissy; Mokrzesz × 1.5
12 — *Turrilites scheuchzerianus* Roissy; Jaźwiny × 1.8



1a, 1b — *?Schloenbachia varians* var. *trituberculata* Spath; Mokrzesz × 1.6
2a, 2b — *Schloenbachia subplana* (Mantell); Mokrzesz × 1.5
3a, 3b — *Schloenbachia varians* (Sowerby); Jaźwiny × 1.5
4a, 4b — *Schloenbachia varians* var. *tetrammata* (Sowerby); Mokrzesz × 1.6
5a, 5b — *Schloenbachia ventriosa* Stieler; Mokrzesz × 1.6



1a, 1b — *Schloenbachia ventriosa* Stieler; Mokrzesz × 1.3
2 — *Schloenbachia sharpei* Semenow; Mokrzesz × 1.4
3a, 3b — *Schloenbachia quadrata* Spath; Mokrzesz × 1.5
4 — *Schloenbachia quadrata* Spath; Jaźwiny × 1.6
5 — *Schloenbachia subvarians* Spath; Jaźwiny × 1



1a, 1b — *Schloenbachia subtuberculata* (Sharpe); Jaźwiny × 1.5
2a, 2b — *Schloenbachia intermedia* (Mantell); Mokrzesz × 1.6
3a, 3b — *Mantelliceras tuberculatum* (Mantell); Mokrzesz × 1