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*STRATIGRAPHY*

# Oxfordian of the Częstochowa Area. I. Biostratigraphy

by

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ry. An analysis of rich ammonite fauna enabled a subdivision of the Oxfordian of the Częstoarea according to a modified Submediterranean zonal scheme. The Antecedens Subzone Plicatilis Zone is interpreted as a full zone and the Lower-Middle Oxfordian boundary ated at its base. The Bifurcatus Zone is divided into the Stenocycloides and Grossouvrei s and the base of the Bimammatum Zone is accepted as the base of the Upper Oxfordian. wer-Middle and Middle-Upper Oxfordian boundaries accepted here coincide with the begin- subsequent phases of size changes. Moreover, a modified correlation of the Subboreal uropean) and Submediterranean zonal schemes is proposed.

**roduction.** The Częstochowa area is situated in the northern part of the Jura Chain or Kraków-Wieluń Upland [31—32]. The Upper Jurassic rocks area are either gently inclined (by c. 2—3°) to NE, towards the axial part of iechów Basin, or they are locally disturbed owing to block tectonic. The of ammonite fauna and a remarkable number of large quarries situated at rby Częstochowa have for a long time focused attention on this section of pper Jurassic. As a result, the Częstochowa section has been recognized as ence section for contemporaneous rocks from the Polish Jura Chain and even he whole country [31].

e extensive literature on the stratigraphy of the Upper Jurassic of the Częstoarea was recently summarized by Malinowska [20, 22—23]. References in erature show that the Oxfordian ammonite fauna of that area was studied eral authors in the XIX c. but only Pusch [26] and Bukowski [7] have illustrated forms. Collections of Koroniewicz and Rehbinder [17] and Różycki [32] lestroyed during the 1st and 2nd World Wars, respectively. Subsequently, the s on the Oxfordian ammonites from this area were conducted by Malinowska, nonographed the ammonites in the series of papers [20, 22—23]. A large ion of ammonites was gathered in the course of graduate works conducted Institute of Geology of the Warsaw University, under the supervision of Assisrofessor J. Kutek, initiated in 1967 and covering the whole northern and most southern part of the Polish Jura Chain. The Częstochowa area was covered graduate works of Brochwicz-Lewiński (1969MS), Kulesza (1969MS), Haase MS) and Strzelecki (1973MS). Some of the results of studies on the Oxfordian

ammonite faunas by the present author have already been published [2—6]. results of previous studies and remarks in the literature clearly show that the fa from this area are rich and sufficiently preserved to yield a clue to a number of taxonomic, stratigraphic and paleobiogeographic problems.

**Biostratigraphy of the Oxfordian of the Częstochowa Area.** The majorit authors studying the Upper Jurassic of the Częstochowa area accepted Op [24] zonal scheme. The exceptions are here Roemer [29], who followed Quen [27], and Różycki [32], who proposed a stratigraphic subdivision based on fauna of that region, and Malinowska [20, 22—23] who accepted a modified division of Różycki for the Middle Oxfordian and a somewhat modified European zonation for the Upper Oxdordian. The present author accepted a m fied Oppel's Submediterranean zonal scheme. The differences in respect to zonation applied by some Polish authors ([20—23] and references therein) discussed previously [2, 19].

The uppermost Callovian and lowermost Oxfordian strata are missing in Częstochowa area because of a sedimentary gap [25, 32, 20]. Somewhat conde Lower Oxfordian strata are exposed in a number of localities along the q [32]. In the area studied, however, only in two localities near Żarki (localiti and *42*; see map) they are sufficiently exposed for fauna exploitation and the W sowa locality [20] remains a reference point for the biostratigraphic analy

The Lower Oxfordian strata from Żarki yield numerous cardioceratids, i ding *Cardioceras* (*Scarburgiceras*) *bukowskii* Maire, numerous peltoceratids, i ding fragments of giant *Peltoceratoides*, *Peltomorphites* and *Parawedekindia*, *ramelliceras polonicum* Malin., very large *T. pseudooculatum* Buk. and other oppe and perisphinctids of the *Prososphinctes mazuricus-claromontanus* and "*Perisphin matheyi-mairei* (sensu [13]) groups. Such an assemblage appears typical of the datum Zone, the upper zone of the Lower Oxfordian. No forms indicative o lower, Mariae Zone were found. In Poland, the genera *Peltoceratoides*, *Peltomorp* and *Parawedekindia* seem to disappear markedly below the base of the Antece Zone, the basal Zone of the Middle Oxfordian as interpreted here.

A somewhat younger ammonite assemblage was recorded in the strata exp in peasant quarries at Parchowołka and Serbin hills near Żarki (*46* and *48*, resp vely), at the bottom of the Prędziszów quarry (*11*) and in excavations S of the dziszów hill. The assemblage comprises several *Plasmatoceras*, occassional *G thiceras* and *Scoticardioceras*, *Neocampylites* and numerous minute *Otosphin* which disappear or become markedly scarcer in the above Antecedens Zon well as some perisphinctids close to the *Kranaosphinctes promiscuus* gr. or to *sphinctes* (*Dichotomosphinctes*) *rotoides* Ronch. or its allies typical of the above A cedens Zone. No representatives of the genera *Peltoceratoides*, *Peltomorphites Parawedekindia* were recorded here. Such a composition of that assemblage indi that it may be referred to the Tenuicostatum Subzone of the Plicatilis Zon French authors (see [10, 14]). However, any more accurate dating of these s

peded by the fact that some important taxa of cardioceratids, i.e. *Vertebriceras*, *rtebriceras*, *Plasmatoceras* and *Scoticardioceras*, considered as typical of the Middle Oxfordian, occur in these or even older strata along with peltoceratids *Prososphinctes* typical of the Lower Oxfordian, similarly as in the Holy Cross ([45], pp. 141—142). This indicates that this phenomenon cannot be explained e above-mentioned condensed characted of the Lower Oxfordian strata.

he changes in the ammonite fauna appear to be much greater at the Tenuicosta-Antecedens boundary (sensu [10, 14]) than at the Cordatum/Tenuicostatum The former include the disappearance of the peltoceratids, *Prososphinctes*, *ampylites* and other taxa typical of the Lower Oxfordian and the appearance *risphinctes* sensu stricto and the allied subgenera, *Kranaosphinctes* (thanks to urtesy of L. Malinowska the author could state that the Lower Oxfordian forms ed by her to that taxon [20] presumably represent early *Passendorferia* and *Kranaosphinctes*), *Gregoryceras*, *Neoprionoceras* and others. Thus, the Ante- s Subzone is considered here as a full zone and the base of the Middle Oxfor- is delineated at the base of this zone. This interpretation is essentially the as that of Malinowska ([23] and elsewhere), as the Antecedens Zone may be d as the equivalent of her *Perisphinctes chloroolithicus* and *Cardioceras tenuiser-* Zone (see below).

rata referable to the Antecedens Zone are exposed at Zawodzie (*1—5*, beds ), Mirów (*10*), Prędziszów (*11*), Biskupice (*11—23*), Choroń (*32—37*), Janik (*43—45*) and Żarki (*48*). A contact between this subzone and the under- Tenuicostatum? strata is observable at Prędziszów (*11*) and Żarki (*48*). The of that zone is defined by the appearance of first *Kranaosphinctes* of the *K. scuus* group, *Perisphinctes* (*Dichotomosphinctes*) *rotoides* Ronch. and its , *Arisphinctes* and *Neoprionoceras*. Subsequently, there appear first large *Di- mosphinctes* of the *P.* (*Dichotomosphinctes*) *antecedens* group, *Subdiscosphinctes* nd *S.* (*Aureimontanites*), *Perisphinctes* s.s., *Proscaphites anar* (Opp.), *Glochi- subclausum* (Opp.) and *Ochetoceras canaliculatum-hispidum* group. The share rdioceratids (*Subvertebriceras*, *Scoticardioceras* and *Plasmatoceras*) in the onite spectrum markedly decreases, approaching zero in the uppermost Ante- s Zone.

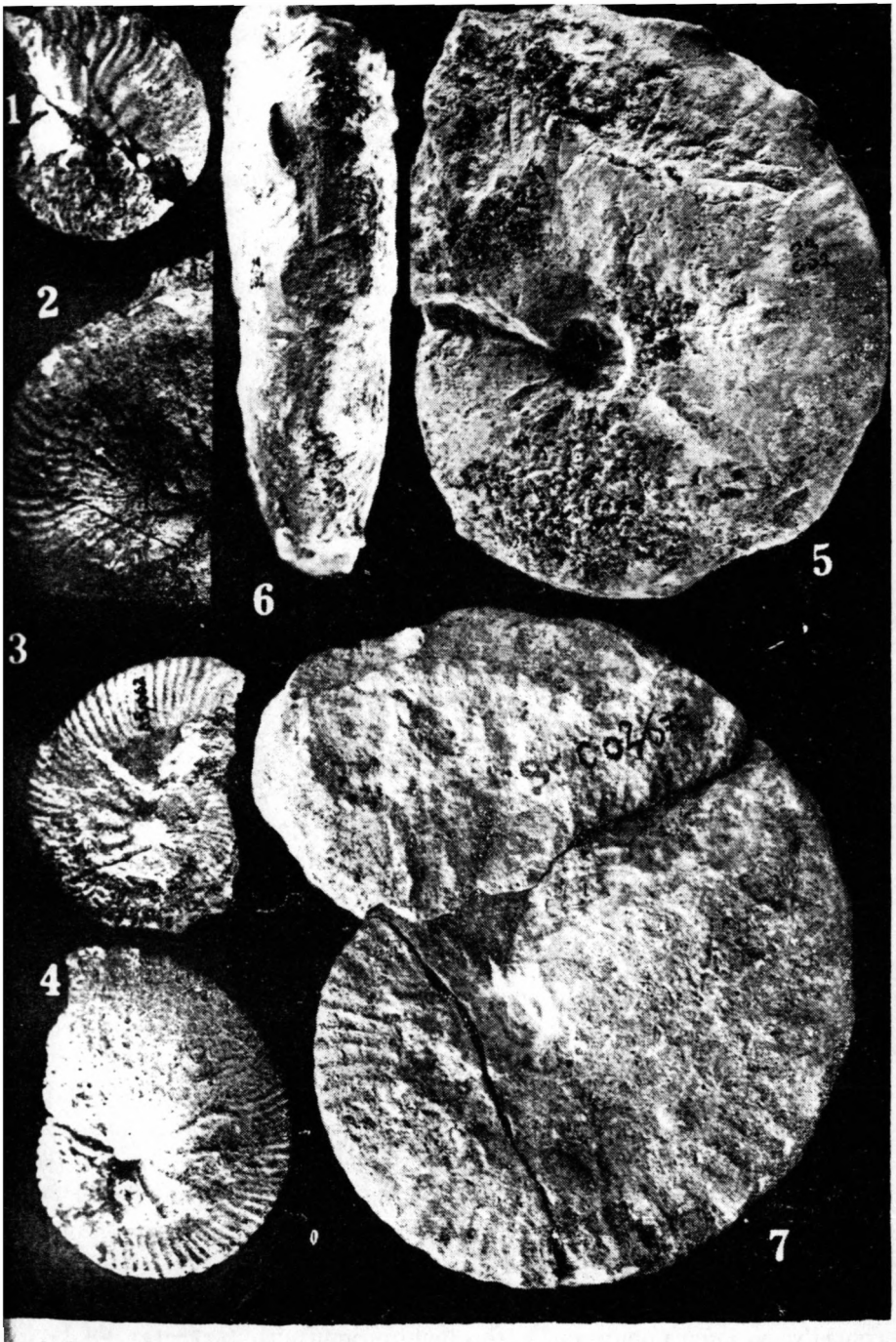
here are distinct differences between the ammonite fauna of the lower and upper of that zone, sufficient for distinguishing two horizons: *Perisphinctes rotoides* ) and *P. buckmani* (upper). The base of the former is defined just as the base t zone (see above), and that of the latter — by the first appearance of *Ochetо-* disappearance of *Kranaosphinctes*, mass occurrence of large *P.* (*Dichotomos- es*) *antecedens* Salf., *P.* (*D.*) *buckmani* Ark. and *P.* (*D.*) *dobrogensis* Sim. and the nderance of *Perisphinctes* s.s. among giant perisphinctids. Moreover, *Sub- phinctes* becomes common, while *Glochiceras* with a lateral furrow, *Glochi- subclausum* (Opp.), seem not to appear below that horizon. The *P. buckmani* n is well-displayed by the Zawodzie (*1—5*) and Mirów (*10*) sections, and the tion to the Transversarium Zone by the former (beds *11—14*).

The Transversarium Zone. Strata referable to this zone are expos Zawodzie (beds (16—23), Olsztyn (*15*), Skrajnica (*18*), Biskupice (*22*), Jar (*31*, beds 1—? 34) and Jaworznik (*51*). Its base is defined by a sudden appea of numerous *P.* (*Dichotomosphinctes*) *wartae* Buk., *P.* (*Perisphinctes*) *martelli* and their allies; what defines the whole zone is the replacement of *Cardiocer Amoeboceras*. It is fairly possible that *P.* (*P.*) *cautisnigrae* Ark. mainly (or occurs here (see below). *Larcheria* seems to be confined to the upper parts o zone (Schilli subzone of French authors [10]).

The Bifurcatus Zone. Two subzones, Stenocycloides and Grossouvrei be distinguished. The lower, Stenocycloides subzone, may be traced at Zaw (*1—5*, beds 24—27), Olsztyn (*14*, *16*), Skrajnica (*18*), Biskupice (*26*), Jar (*31*, beds 35—39) and Jaworznik (*52*). Its base is well-defined by the transitior *Dichotomosphinctes* to *Dichotomoceras* and from *P.* (*P.*) *martelli* (Opp.) a allies to *P.* (*P.*) cf. *panthieri* Enay, characterized by a U-shaped initial part rib-curve [6]. Moreover, *Larcheria* disappears and *Subdiscosphinctes* be scarcer. In euaspidoceratids the giant *Euaspidoceras paucituberculatum* Ar gradually replaced by smaller *E. oegir* (Opp.).

Strata referable to the Grossouvrei Subzone are exposed at Zawodzie ( *5*, beds 28 onwards), Lipówki Dolne (*17*), Skrajnica (*18*), Biskupice (*19*, *26—27*) and Czatachowa (*50*). This subzone is characterized by a gradual cement of the *Perisphinctes* (*Dichotomoceras*) *bifurcatoides-stenocycloides* by the smaller *P.* (*Dichotomoceras*) *bifurcatus* (Qu.) and its allies, and of *P. sphinctes*) cf. *panthieri* Enay by the smaller *P.* (*P.*) *variocostatus* (Buckl.), and, *P.* (*P.*) *malinowskae* Brochwicz-Lewiński. Euaspidoceratids are fairly co including *E. wildenbergense* (Dorn), *E. sublongispinum* (Dorn) as well as some close to *E. depereti* (Collot) or *E.* sp. n. Sequeiros [35], i.e. characterized by a to more distinct costation and to a disappearance of tuberculation. Mo ancestral forms of the taxa typical of the above Bimammatum Zone do ap *Microbiplices* sp. *A* ([6], Pl. I, Fig. 1) and others,? *Orthosphinctes* sp., and *Tar ceras* referable to *T. costatum* (Qu.). This subzone is characterized by a fa reduction in size of the ammonites [6, 11].

The top of the Bifurcatus Zone is delineated by the base of the Bimamm Zone, the basal zone of the Upper Oxfordian [37, 19]. Strata of that age are e at Biskupice (*19*, *21*, ? *27*) where the Bifurcatus-Bimammatum contact m observed, as well as at Kamyk (*7*), Osona (*12*), Olsztyn (*13*) and Biskupi *27*, *18*, ? *29*). The Late Oxfordian age is indicated by numerous *Microb Ringsteadia*, *Orthosphinctes*, *Pseudoorthosphinctes*, *Progeronia*, *Taramellicer costatum* (Qu.) and *T.*(*S.*) *tegulatum* (Qu.), *N.* (*Passendorferia*) *birmensd* (Oppenh. non Moesch), *Euaspidoceras hypselum* (Opp.), *Pseudowaagenia Epipeltoceras* spp. as well as by a complete disappearance of *Perisphinctes* s other Middle Oxfordian taxa. The mas[illegible]ccurrence of the *Amoeboceras alt ovale* group limited to one or two neighbouring layers in the lower part of [illegible] stratigraphic importance as that (? single




te 1. *Taramelliceras* (*Taramelliceras*) *bachianum* (Opp.): 1 — Br 01-028, Zawodzie, (1, bed 18), ansversarium Zone; 2 — Kl 8/*x*/3, Przybynów (37), Antecedens Zone. *T.* (*Strebliticeras*) *externdosum* (Dorn): 3 — Br 05/062, Zawodzie (5, bed 39), Bifurcatus Zone, Grossuvrei Subzone. (*T.*) cf. *callicerum* (Opp.): 4 — Br 05/102, Zawodzie (5), Bifurcatus Zone, ? Grossouvrei Subzone. (*T.*) cf. *costatum* (Qu.): 5—6 — Br 23/002, Olsztyn (16), 7 — Br C 02/075, Zawodzie (2, bed 31), Bifurc Zone, Stenocycloides and Grossouvrei subzones, respectively

All figures ×0.9

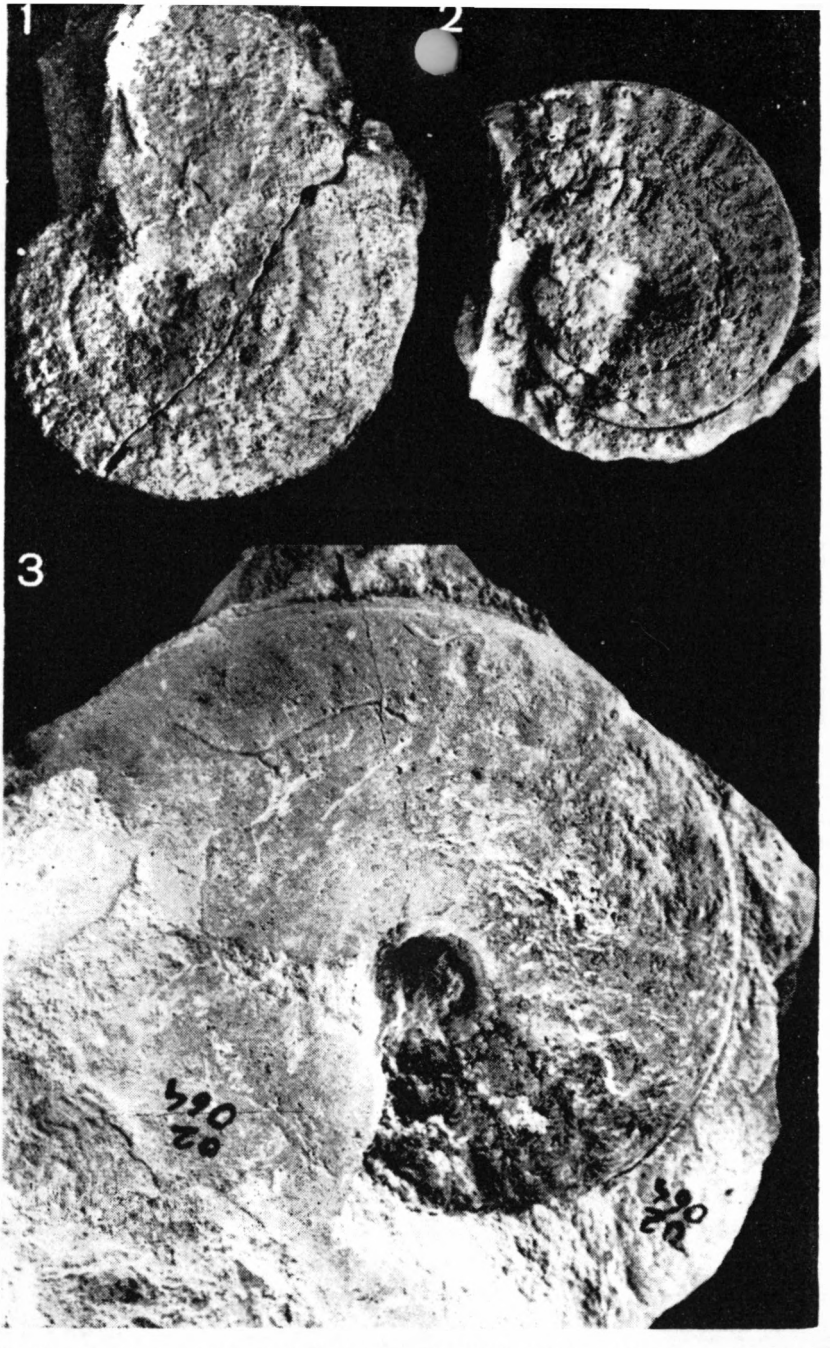
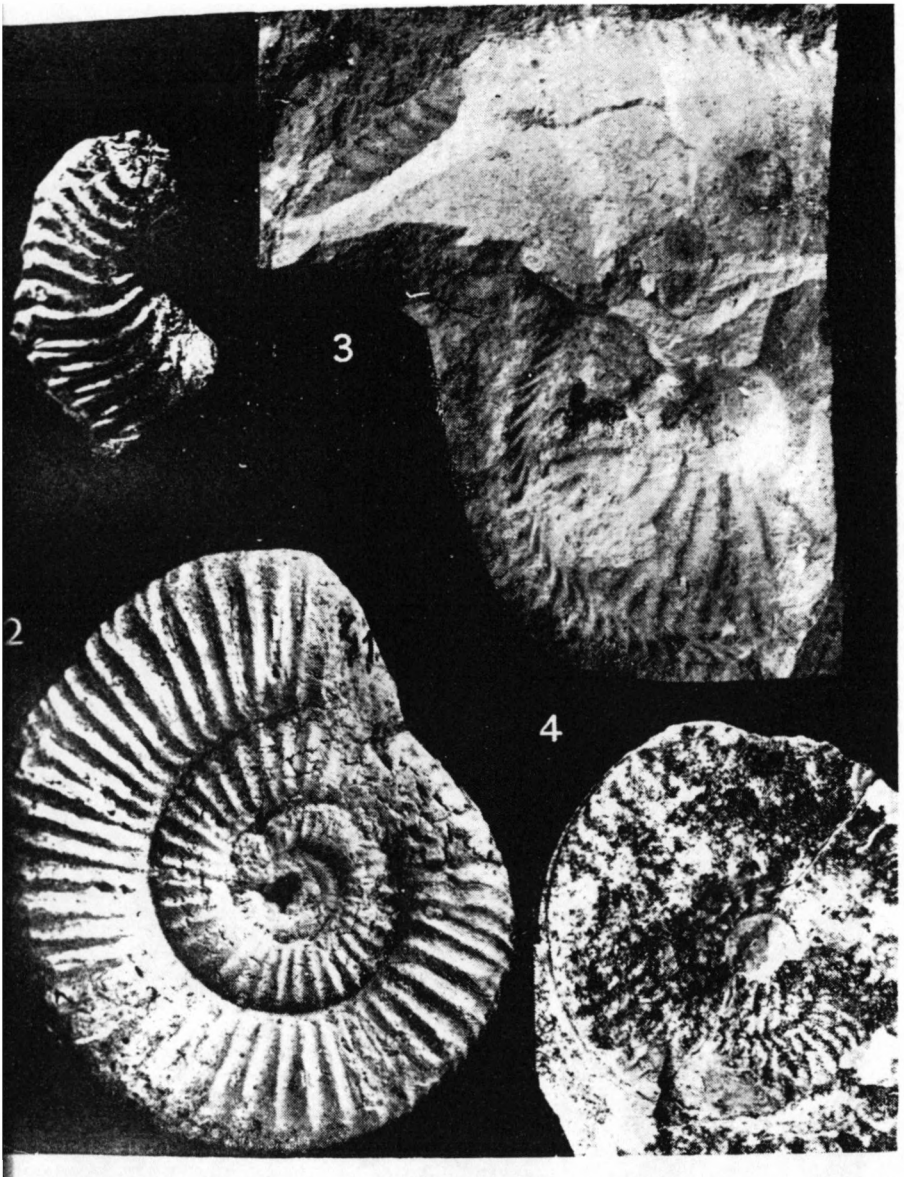



Plate. II. *Neoprionoceras lautlingensis* Roll.: 1 — Br 10/43, Mirów (10), Antecedens Zone; Ha 53/2, Biskupice-Kąty (22), Antecedens or Transversarium Zone, 3 — Br 02/064, Zawo (2, bed 20). Transversarium Zone

All figures of natural size




e III. *Gregoryceras* sp.: 1 — Br 11/010, Prędziszów (11), Antecedens Zone. *Perisphinctes* (*Dimo*sphinctes) *rotoides* Ronch.: 2 — Kl 41/*x*, Żarki (*43* or *44*), Antecedens Zone, Rotoides zon *Cardioceras* (*Scoticardioceras*) cf. *gallicum* Maire: 3 — Sr 40/02, Żarki (48), ? lower part Antecedens Zone. *Neoprionoceras lautlingensis* Roll.: 4 — Ha 22/103, Biskupice (19), ? Bimammatum Zone

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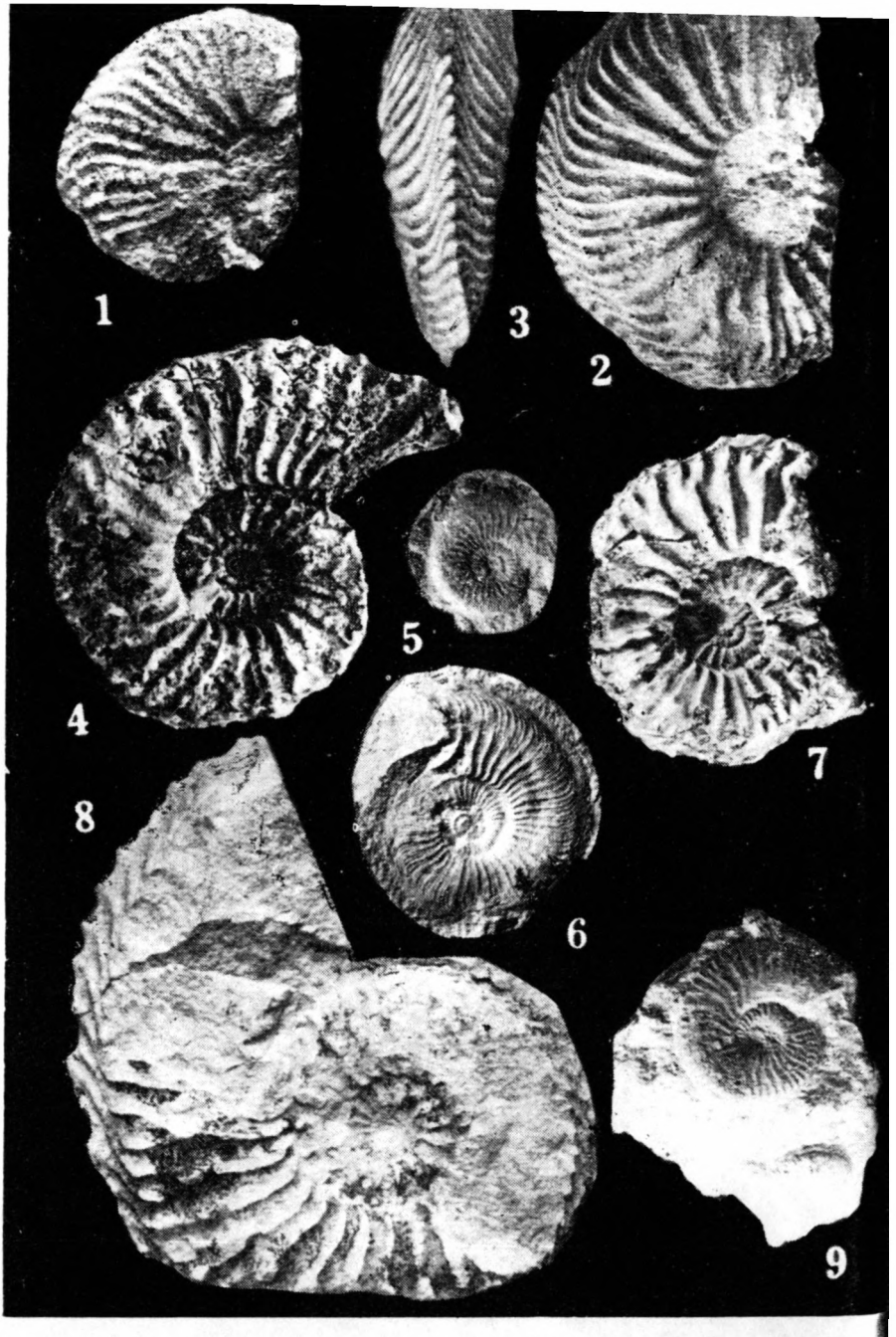
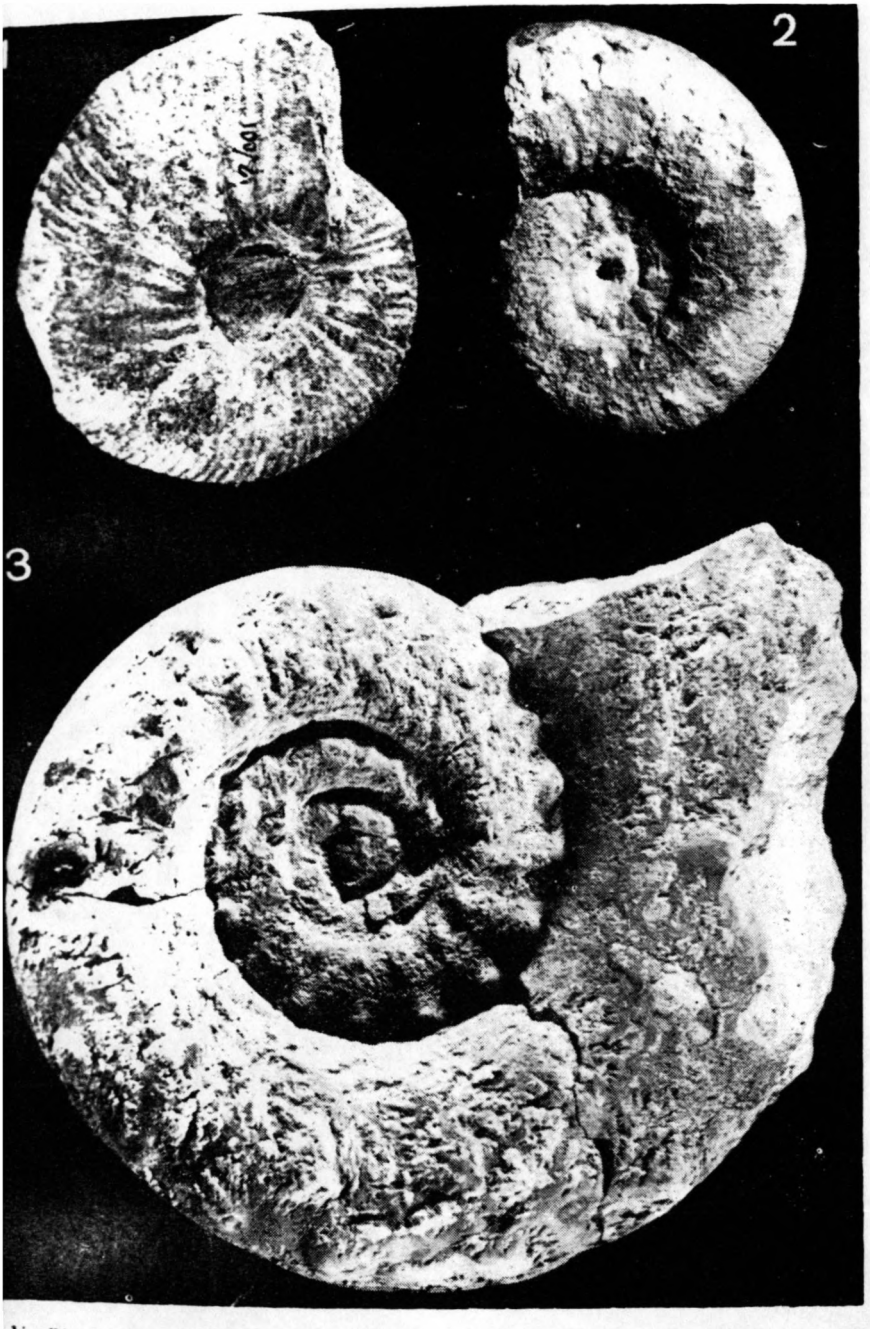



Plate IV. *Goliathiceras* (? *Pachycardioceras*) sp.: 1 — Sr 22/l, Żarki (*48*), ? lower part of Ante Zone. *Cardioceras* (*Scoticardioceras*) cf. *gallicum* Maire: 2—3 — Sr 32/2, same locality. *C. vertebriceras*) *zenaidae* Illov.: 4 — Kl 16/ll, Żarki (*43*), 7 — Br 11/017, Prędziszów (*11*), 8 16/2/32, Żarki (*44*), Antecedens Zone, P. rotoides horizon. *C.* (*Plasmatoceras*) *tenuistriatum* 5 — Kl 16/1/11, Żarki (*44*), age as above. *C.* (*P.*) *tenuicostatum* (Nik.): 6 Kl 16/l/34a, Żark age as above. *Amoeboceras alternans-ovale* gr. : 9 — Br 7/31, Kamyk (7), Bimammatum Hypselu[illegible]ubzone

All figures ×0.9




V. *Ringsteadia salfeldi* Dorn: 1 — Br 12/001, Osona (12), Bimammatum Zone, *Pseudowa-a tietzei* (Neum.) 2 — Ha 22.81, Biskupice (19), age as above. *Euaspidoceras sublongispinum* (Dorn): 3 — Ha 20.55, Biskupice (*21*), Bifurcatus — ? Bimammatum Zone

All figures of natural size

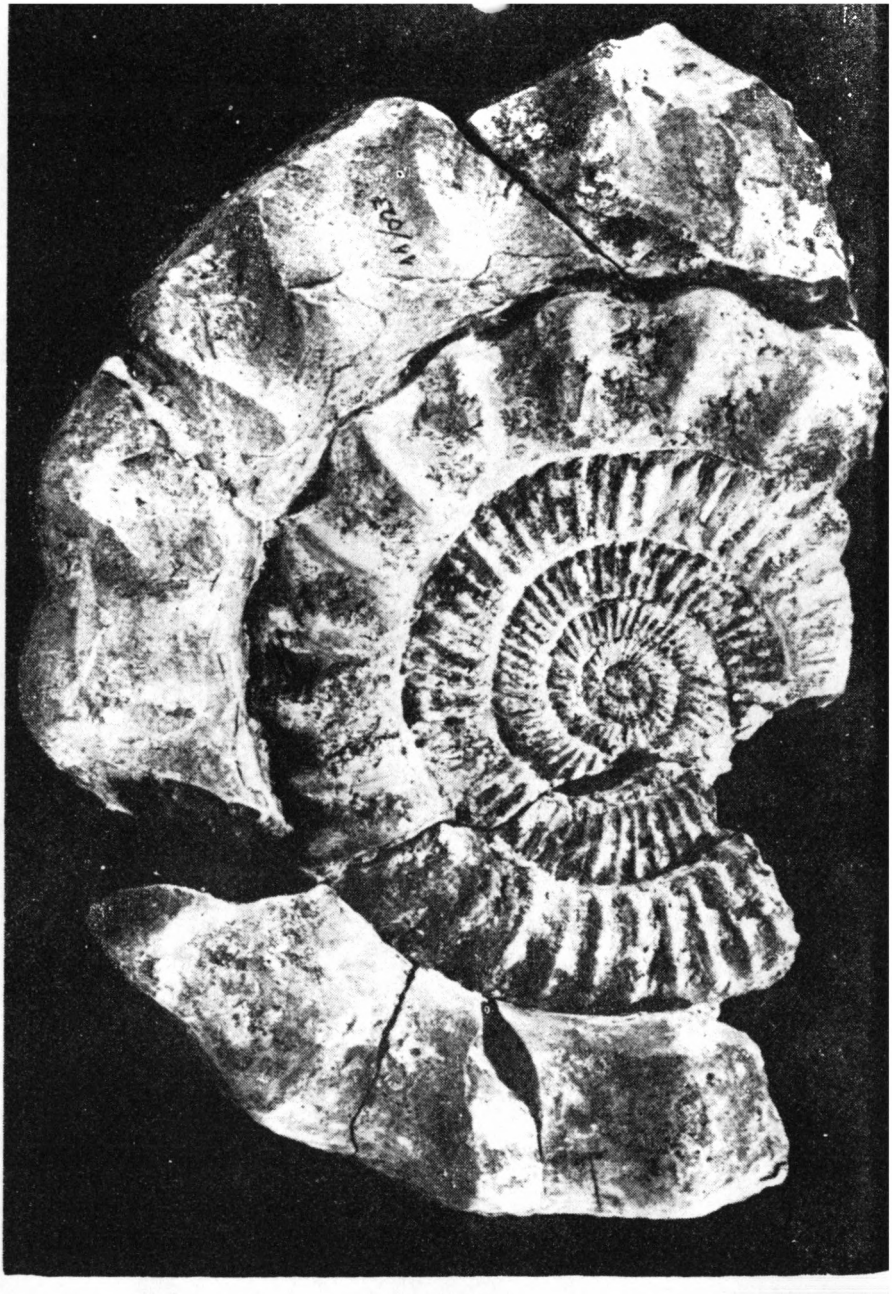
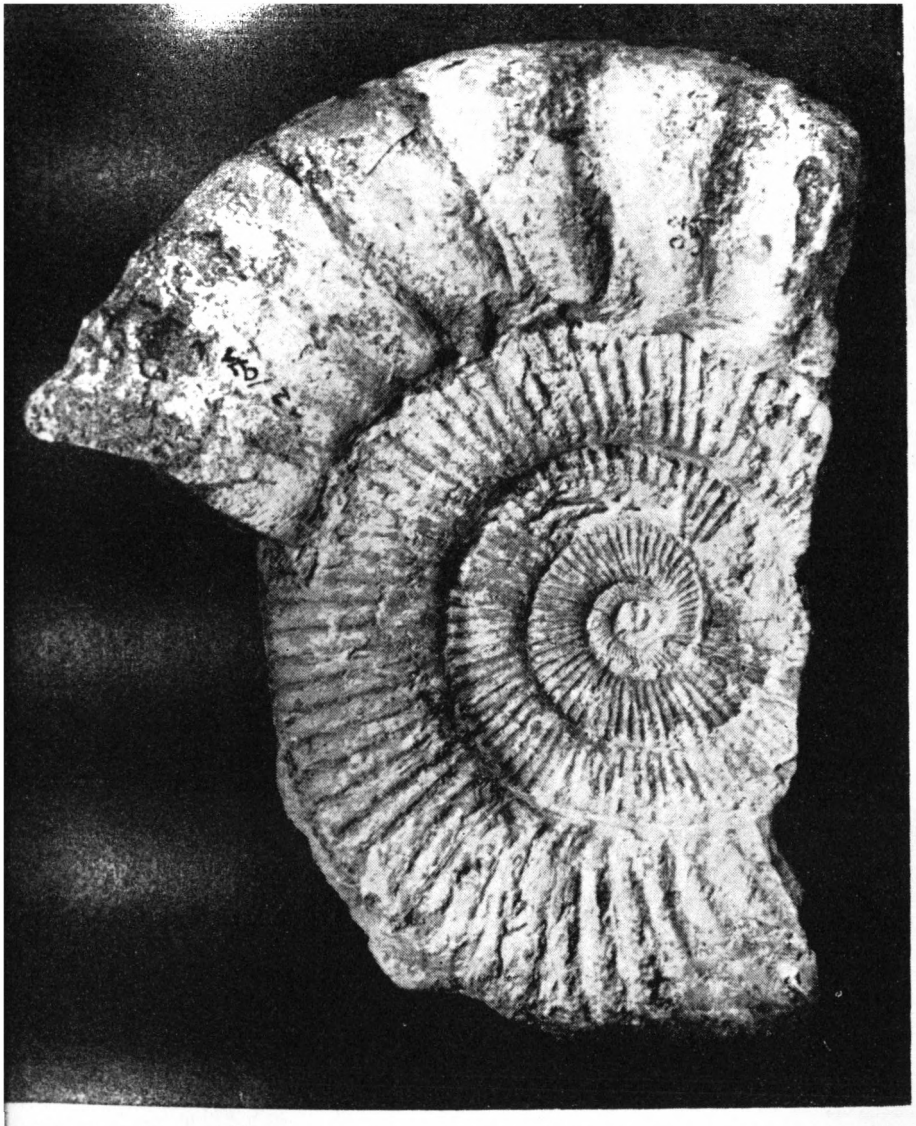


Plate VI. *Perisphinctes* (*Arisphinctes*) *maximus* (Young & Bird), Br 11/027, Prędziszów (*11*), cedens Zone, P. rotoides horizon

×0.75



te VII. *Perisphinctes* (*Perisphinctes*) cf. *panthieri* Enay. Br 02/071, Zawodzie (*5*, bed 24), Bifurcatus Zone, Stenocycloides horizon

×0.75

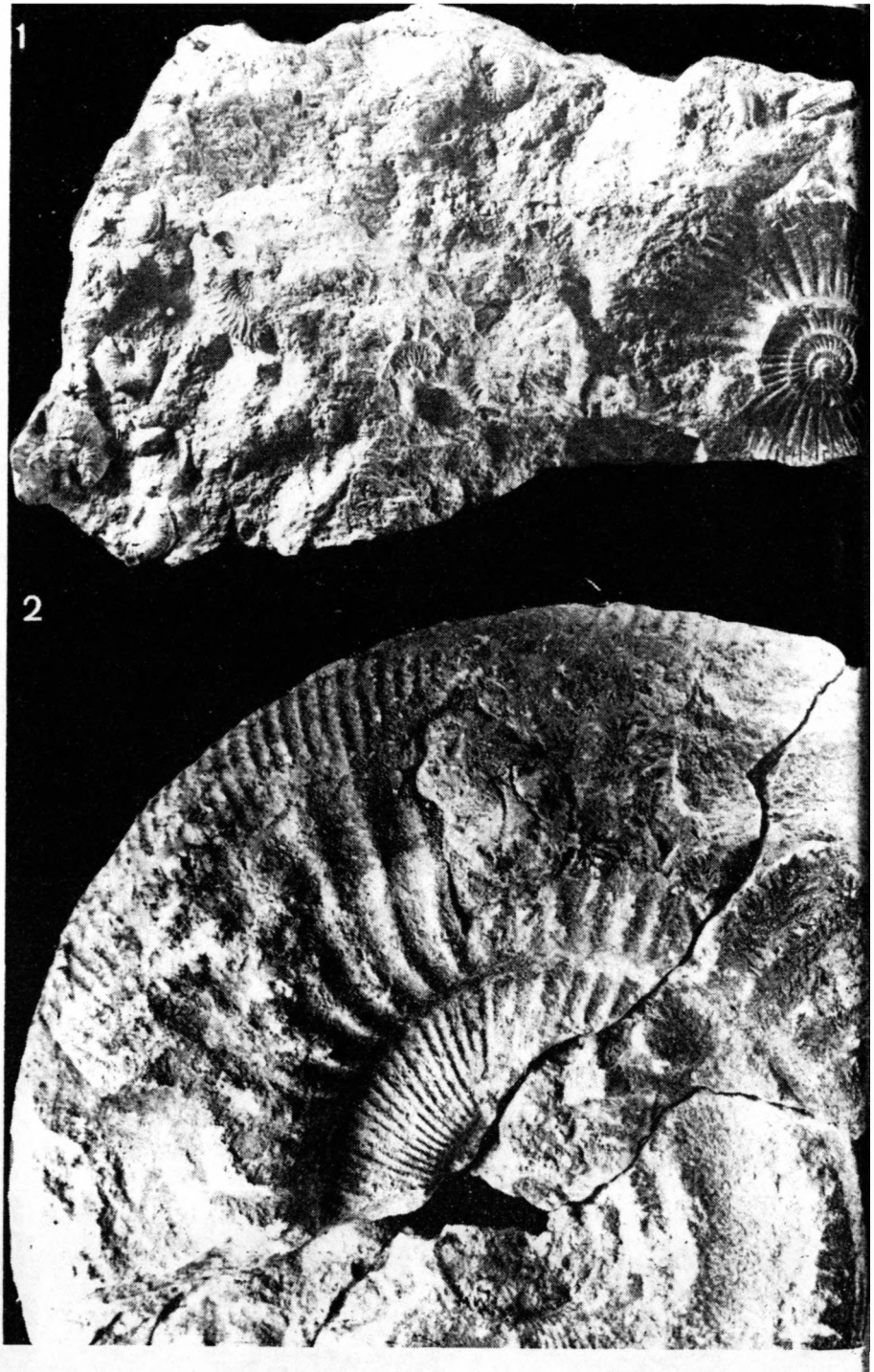
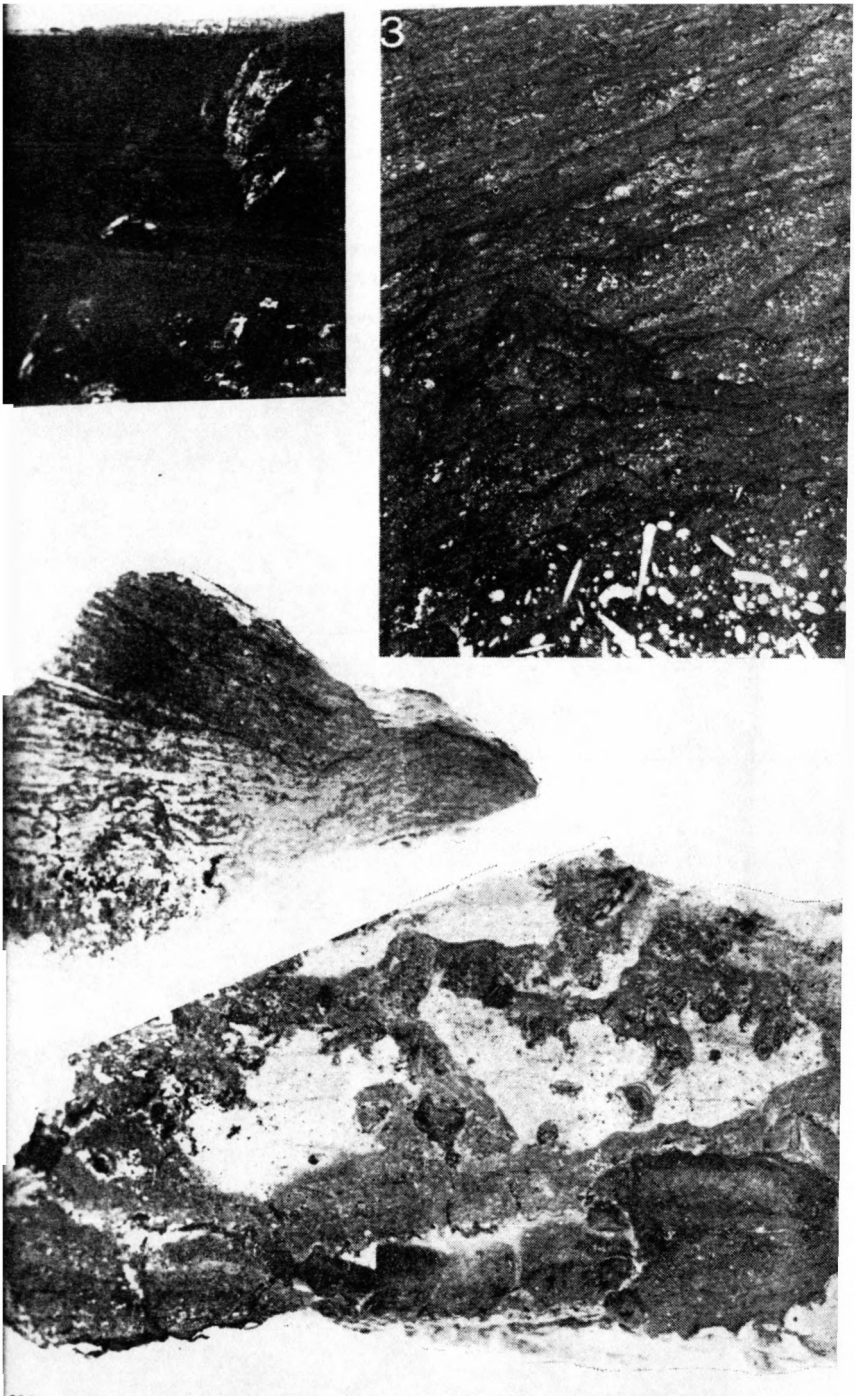



Plate VIII. 1 — limestone slab with about 18 representatives of *Amoeboceras alternans-* group and *Ringsteadia salfeldi* Dorn; Biskupice (27), Bimammatum Zone; ×0.6 *Subdiscosphi* (*Aureimontanites*) sp., Br 01/002, [illegible]odzie (*2*), Transversarium Zone; opposite side of this spec was figured in Brochwicz-Lewiński [illegible], pl. 6 note irregular siliceous concretions penetrating phrag cone; ×0.6




IX. 1 — Massive limestones, northern part of Prędziszów quarry (11). Note large bl
ve limestones fallen from opposite wall of quarry. 2 — Subtidal stromatolite from
tone crag shown in Fig. 1. 3 — Thin section through stromatolite from Fig. 2. 4 –
veloped on perisphinctid shell and various skeletal fragments, Zawodzie (2, bed 2

Plate X. 1 — New quarry at Mirów (*10*); platy limestones exposed on eastern and southern of quarry and massive limestones in front. Arrowhead indicates top of bed 12. 2 — Top of bed 12, with ammonites and overgrowing oysters *Liostrea sorlinensis* (Lor.), burrows traces of corrosion

relation of zo[redacted]schemes recently proposed for the Oxfordian of Submediterranean and Subboreal Europe

| [illegible] | | | Poland [6] France [III, II, II] | | | Poland [illegible] |
|---|---|---|---|---|---|---|
| [illegible] | Subzones | | Horizons | Subzones | Zones | Zones |
| [illegible] | | Ringsteadia / Amoeboceras / Cardioceras / Perisphinctes (Dichotomosphinctes) / P. wartae gr. / P. plicatilis gr. / Virgatosphinctes | | | PLANULA | PSEUDOCORDATA |
| | | | | | BIMAMMATUM | |
| [illegible] | | | | | BIFURCATUS | CAUTISNICRAE sl |
| [illegible] | | | | Schilli Parandieri | TRANSVERSARIUM | P. WARTAE and A. ALTERNANS |
| [illegible] | Nummigt. | | | | | |
| [illegible] | Parandieri | | Buckmani Rotoides | | ANTECEDENS | P. CHLOROOLITHICUS and C. TENUISERRATUM |
| PLICATILIS | Antecedens | | | "Tenuicostatum" | | C. EXCAVATUM |
| | Vertebrale | | | | | |
| CORDATUM | | | | | CORDATUM | C. BUKOWSKII |

re. Oxfordian of Częstochowa area, Polish Jura Chain (outline of outcrops and main lithological types, partly after S. Z. Różycki, Z. Mosoczy, and others)

utcrops of Callovian, 2 — outcrops of Oxfordian; main lithological types: 3 — spongy limestones with marly alations, 4 — platy limestones, 5 — massive limestones, 6 — chalky limestones; 7 — quarries; zones and subzones, xfordian: C — Cordatum Zone, Tn — Tenuicostatum beds, A — Antecedens Zone, T — Transversarium Zone, tenocycloides Subzone of Bifurcatus Zone, G — Grossouvrei Subzone of Bifurcatus Zone, B — Bimammatum Zone

frequency of *Amoeboceras* (over 80% share in ammonite spectrum) was found several localities.

The "acceleration" of evolution of the ammonites at the Bifurcatus-Bimammatum ndary seems to be related to the trend to an increase of shell size, marked from Bifurcatus-Bimammatum junction beds onwards (see [6]). The differentiation he fauna is markedly reduced in the uppermost Oxfordian-Lower Kimmeridgian ng with another phase of shell size reduction.

**Comparison with other ammonite faunas and zonal schemes.** The ammonite se- nce discussed above appears generally similar to that found in SE France 11, 13, 14], southern F.R.G. [42], Switzerland [15], Spain [35], Algeria [34], ldavia [30] and northern Caucasus [18]. The ammonite fauna appears to be of Submediterranean type and it seems that the Submediterranean zonal scheme easily be applied here. It should be noted that the so-called Submediterranean tion is essentially a further elaboration of Oppel's [24] subdivision of the Ju- ic, which was introduced in Poland by Zejszner [43] and accepted by the majority uthors. The subdivision used here is closest to these recently proposed in France 11, 14]. The principal differences between these zonal schemes are connected the position of the Lower-Middle and Middle-Upper Oxfordian boundaries. former boundary is delineated at the base of the Tenuicostatum Subzone of Plicatilis Zone in the scheme proposed by Cariou *et al.* [10] and at the base of Antecedens Zone (the upper subzone of the Plicatilis Zone of French authors ) in the scheme proposed here, i.e. in the same way as in the scheme suggested Malinowska [23]. The Middle-Upper Oxfordian boundary, delineated by Cariou *l.* [10] at the base of the Bifurcatus Zone, is here delineated at the base of the ammatum Zone after Siemiradzki [37]. It should be noted that the boundaries posed here coincide with the beginning of the phases of size changes [6, 11].

The pre-Antecedens strata are here roughly subdivided into the Cordatum Zone the strata bearing an assemblage closer to that of the Tenuicostatum Subzone he Plicatilis Zone of French authors [10] than to that of the Cordatum or Ante- ns Zone. The application of the more detailed subdivisions of these strata 0, 14] is difficult because of the fact that the stratigraphic ranges of the majority rdioceratids on which these subdivisions were based appear to be much wider it had been assumed (see also [45]). It is not excluded that the twofold subdi- n of these strata into the Cardioceras bukowskii and C. excavatum zones of nowska [20] will appear the most suitable.

The Polish material suggests a possibility of further subdivision of the Ante- ns Zone (i.e. Subzone of French authors [10]) into two horizons: Perisphinctes des and P. buckmani horizons. The lower, P. rotoides horizon is characterized he small-sized *Perisphinctes* (*Dichotomosphinctes*) *rotoides* Ronch. and its allies ble to the subgenera *Dichotomosphinctes and Otosphinctes*, such as e.g. *P.* (*O.*) *radzki* Enay, and by *Kranaosphinctes promiscuus* Buk. and other *Kranaosphinctes*, *Arisphinctes* and *Neoprionoceras*. The upper P. buckmani horizon is characteri- by large to gi[redacted] *Dichotomosphinctes* including *P.* (*D.*) *buckmani* Ark., *P.* (*D.*)

*antecedens* Salf. and *P.* (*D.*) *dobrogens*[redacted]im., first *Ochetoceras* and *Gloc*
*subclausum* (Opp.) and *Proscaphites anar* (Opp.) (see also above). The m
available appears insufficient for a subdivision of the Transversarium Zone
[10]) into subzones, not to mention horizons. In turn, it is possible to treat t
horizons of the Bifurcatus Zone [10, 14] as well-established subzones [11].
rences between the faunal assemblages of these two horizons fully justify it.

The similarity of the Oxfordian ammonite faunas of the Polish Jura Cha
those known from the NW-European, Subboreal province ([16] and others
often stressed by Malinowska [23]. This similarity is remarkable during the
and early Middle Oxfordian, but from the early Transversarium times the diff
increase, the correlation of the Submediterranean and Subboreal zonations
debatable and "the zonal scheme by no means final" in the latter province
287]. On the basis of recent Polish, French and English papers [6, 10, 23,
and the author's data the following correlation is possible.

It is highly probable that the lower boundaries of the Pseudocordata a
mammatum zones roughly coincide ([19, 41] and Table II herein). The Par
Subzone sensu Wright [40, 41] yields *Cardioceras* and the first *Amoeboceras* a
in the Nunningtonense Subzone, the upper subzone of the Transversarium
sensu Wright [41]. In turn, in France the first *Amoeboceras* appears in the
gaticeras" doublieri horizon, the basal horizon of the Parandieri Subzone, Tr
sarium Zone [10, p. 20]. In Poland cardioceratids are extremely scarce in thes
("*Cardioceras* gap" [21, 2]), but, nevertheless, the first *Amoeboceras* was fo
the body chamber of *Perisphinctes* (*P.*) *martelli* (Oppel) from the middle
Transversarium Zone — Zawodzie, bed 22, about 6 m above the last *Car*
(bed 12). Although a detailed paleontological study of *Cardioceras* and *Amoe*
is still needed, it seems improbable that the centre of evolution and dispe
the Boreal genus *Amoeboceras* was situated in the Submediterranean prov
rather evolved from *Cardioceras* in all, Boreal, Subboreal and Submediter
regions simultaneously. Therefore it may safely be assumed that the lower
daries of the Nunningtonense Subzone and Parandieri Subzone sensu
*et al.* [10] roughly coincide. Such an interpretation is supported by the fa
the Parandieri Subzone sensu Wight [40, 41] seems to correspond to the upp
(or horizon) of the Antecedens Subzone of French authors or Anteceden
as interpreted herein.

In turn, the Transversarium-Bifurcatus boundary (see Table II) is def
a transition from *Dichotomosphinctes* to *Dichotomoceras*, the latter being ch
rized by a U-shaped initial part of the rib curve. Such a rib curve is also
of *Perisphinctes* (*Perisphinctes*) *variocostatus* (Buckl.) and its allies occurrin
Bifurcatus Zone in France and Poland, but not of *P.* (*P.*) *cautisnigrae* A
index of the Cautisnigrae Zone which has to cover the strata between the
versarium and Pseudocordata zones in England [41, Table I]. There are n
records of the latter species from both the Transversarium and Bifurcatus
the Submediterranean region. However, the records of this species from t
zone are disputable. The specimen from the Bifurcatus Zone, Stenocycloi

of Zawodzie [illegible] eviously identified as *P.* (*P.*) *cautisnigrae* Ark. (see [4], Pl. 5) racterized by a sharp, prominent, loosely spaced ribbing on inner whorls resumably has a U-shaped initial part of the rib curve, typical of other con- praneous perisphinctids, and it seems to be closely related to *P.* (*P.*) *panthieri* Similarly, specimens from the upper Bifurcatus Zone in France, identified ay ([13], p. 390, Pl. 13, Figs. 2, 3) as *P.* (*P.*) *cautisnigrae* Ark., most probably ent a separate species ([23], p. 61) and it may be inferred that Enay himself ot sure about this identification, as they are cited as *P.* (*P.*) aff. *cautisnigrae* n explanation to Text-fig. 109 ([13], p. 389). In turn, *P.* (*P.*) *cautisnigrae* Ark. fied by Malinowska ([23], p. 28, Pl. 11, Figs. 1—3) are actually derived from ransversarium Zone or Transversarium-Bifurcatus junction beds, as it is indi- by the fauna she cited from the corresponding localities. The true *P.* (*P.*) *nigrae* Ark. displays features typical of perisphinctids of the Transversarium including a steeply rising initial part of the rib-curve, relatively densely-spaced ound-crested ribs on inner whorls, large size, highly complex suture line. And seems to be a transition from it to *P.* (*P.*) *martelli* Opp. via forms such as those ed to *P.* (*P.*) *cuneicostatus* Ark. by Malinowska ([22], Pl. XIV). Moreover, ) *cautisnigrae* Ark. may be an ancestor of *P.* (*P.*) cf. *panthieri* Enay, the earliest entative of the *P. variocostatus* group from the base of the Bifurcatus Zone. hinctes (*P.*) *panthieri polonicus* Malin. ([23], Pl. 10) and *P.* (*P.*) *cautisnigrae* in [6], Pl. IV, Fig. 3 may represent a transition between the two species (23], ). It may be concluded that *P.* (*P.*) *cautisnigrae* Ark. and other Transversarium- type perisphinctids are replaced by the *P. variocostatus* group long before the of the Bimammatum (=Pseudocordata) Zone. There is no unequivocal that the former lived longer in the Subboreal province. Thus, similarly as in se of the *Cardioceras-Amoeboceras* change, it may be assumed that the *P. ostatus* group appeared in both Submediterranean and Subboreal areas simul- usly.

o sum up, it may be tentatively assumed that the Transversarium Zone sensu u *et al.* [10] is an equivalent of the English Nunningtonense Subzone of the versarium Zone and the Cautisnigrae Zone, delineated from below by the oceras-*Amoeboceras* boundary and from above by the appearance of the hinctes *variocostatus* group and *Dichotomoceras*. Therefore, the Parandieri one sensu Wright [40, 41] most probably roughly corresponds to the upper of the Antecedens Zone as interpreted here. There remains the problem of lish equivalent of the Bifurcatus Zone. Wright [41] rejected the Decipiens so perhaps the Variocostatus Zone is the best solution? The Cautisnigrae sensu Wrigth [41] is an alternative solution but it should be remembered that bmediterranean equivalent to the *Nunningtonense-Cautisnigrae* boundary is own at present and that these two units, Nunningtonense Subzone and Cautis- e Zone, would then correspond to the Transversarium and Bifurcatus zones heir subzones. Hence the latter solution would create a serious obstacle in lations of events between the two provinces. It should be noted here that t [41] proposing his Caustisnigrae Zone in place of the former Cautisnigrae

and Decipiens Zones sensu Arkell independently followed Malinowska [
Perisphinctes chloroolithicus & Cardioceras tenuiserratum Zone of Ma
may safely be interpreted as an equivalent of the Antecedens Zone and wh
is used is a matter of convention. The situation is more complex in the ca
two upper zones of Malinowska. It follows from the above discussion t
*sphinctes* (*Dichotomosphinctes*) *wartae* Buk. and *Amoeboceras* almost simult
appear at the base of the Transversarium Zone as interpreted here. More
known that *P.* (*Dichotomosphinctes*) *wartae* Buk. most probably evolved
(*Dichotomosphinctes*) *antecedens* Salf. and gave rise to the *P.* (*Dichoto
bifurcatoides-stenocycloides* group, typical of the lower part of the Bifurcat
[6, 11]. Hence, it is possible to carry out the stratigraphical subdivisio
large part of the Oxfordian on the basis of the *Dichotomosphinctes*→*Dichot
evolutionary series. It should be mentioned here that the existence of an evol
series of *P. wartae* was suggested by Różycki ([31], p. 30). Therefore it is
that the Wartae Zone could be distinguished for both paleontological an
graphical reasons. However, the P. wartae & A. alternans Zone, as interp
Malinowska [22, 23], overlaps with the Cautisnigrae Zone herein sensu
and some ammonites typical of the Bimammatum Zone (and thus of the
cordata Zone) were even cited by Malinowska as occurring in the P. wart
alternans Zone ([44] p. 378). It is concluded that the P. wartae Zone wou
excellent stratigraphic unit if it were accepted that its upper boundary is d
the lower boundary of the Bifurcatus Zone, Stenocycloides Subzone. In t
Cautisnigrae Zone should not be distinguished in Poland because its status
disputable, as shown above.

To sum up, there is no trouble with the application of the Submedite
zonal scheme in the Polish Jura Chain, whereas the application of the NW-E
(Subboreal) zonal scheme appears difficult, especially in the case of th
Middle and Upper Oxfordian. This is not surprising, as the latter scheme
a subject of controversy because of the insufficient and still poorly know
material on which it is based.

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**Содержание.** Анализ богатых сообществ аммонитов позволил расчленить оксфорд ностей Ченстоховы согласно модифицированной схеме подразделения оксфорда с терранского типа. Субгоризонт Antecedens горизонта plicatilis считается самостоят горизонтом, и у его основания проведено границу между нижним и средним окс Горизонт Bifurcatus подразделен на два субгоризонта: Stenocycloide и Gros-Seuvrei новлено, что нижний предел этого горизонта совпадает с нижней границей верхнего ок Выделенные здесь границы между нижним и средним, а также средним и верхним окс совпадают с началом последовательных циклов изменений величины аммонитов. того предложено модифицированную корреляцию подразделения оксфорда в субб ной (СЗ-европейской) и субмедитерранской провинциях.