Série des sciences de la Terre
Volume XXVII, No. 4, 1979
Publié en avril

PALEONTOLOGY

Perisphinctids Proper (Ammonoidea) of the Częstochowa Oxfordian. II. Subgenera *Dichtomosphinctes* Buckman, 1926 and *Dichotomoceras* Buckman, 1919

by

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Presented by W. POŻARYSKI on June 22, 1979

Summary. The second part of the paper gives descriptions of the representatives of the subgenera *Dichotomosphinctes* Buckman, 1926, and *Dichotomoceras* Buckman, 1919, of the genus *Perisphinctes* Waagen, 1869, from the Transversarium and Bifurcatus Zones of the Częstochowa Oxfordian. Special attention is paid to specimens representing the transition between the species *P. (Dichotomosphinctes) wartae* Bukowski and the *P. (Dichotomoceras) bifurcatoides-stenocycloides* group and, at the same time, between the two subgenera.

Introduction. The representatives of the subgenera *Dichotomosphinctes* Buckman, 1926, and *Dichotomoceras* Buckman, 1919, of *Perisphinctes* Waagen, 1869, described below, are fairly common, predominating in perisphinctid assemblages of the Transversarium and Bifurcatus Zones of the Częstochowa Oxfordian. Fragmentary specimens of the latter subgenus were also recorded in basal parts of the successive Bimammatum Zone but the upper limit of stratigraphic range of this subgenus is still to be defined.

Previous studies on that fauna made it possible to note the phenomenon of reduction of size of specimens in the evolutionary series *P. (Dichotomosphinctes) antecedens-buckmani*—*P. (D.) wartae* Buk. and *P. (D.) elisabethae* de Riaz—*P (Dichotomoceras) bifurcatoides-stenocycloides* group—*P. (D.) bifurcatus* Qu. (see [7] and [12]). The material described here gives further support to that statement.

The Częstochowa sections made it also possible to trace the transition from *P. (Dichotomosphinctes) wartae* Buk. to the *P. (Dichotomoceras) bifurcatoides-stenocycloides* group, corresponding to the *P. wartae* Buk. evolutionary series reported by Różycki [24]. This gives further support to the transition between the subgenera *Dichotomosphinctes* Buckman and *Dichoto-*

moceras Buckman, recorded by Malinowska ([19], p. 21). The stratigraphic value of that transition is discussed in the Introduction to Part I of this paper.

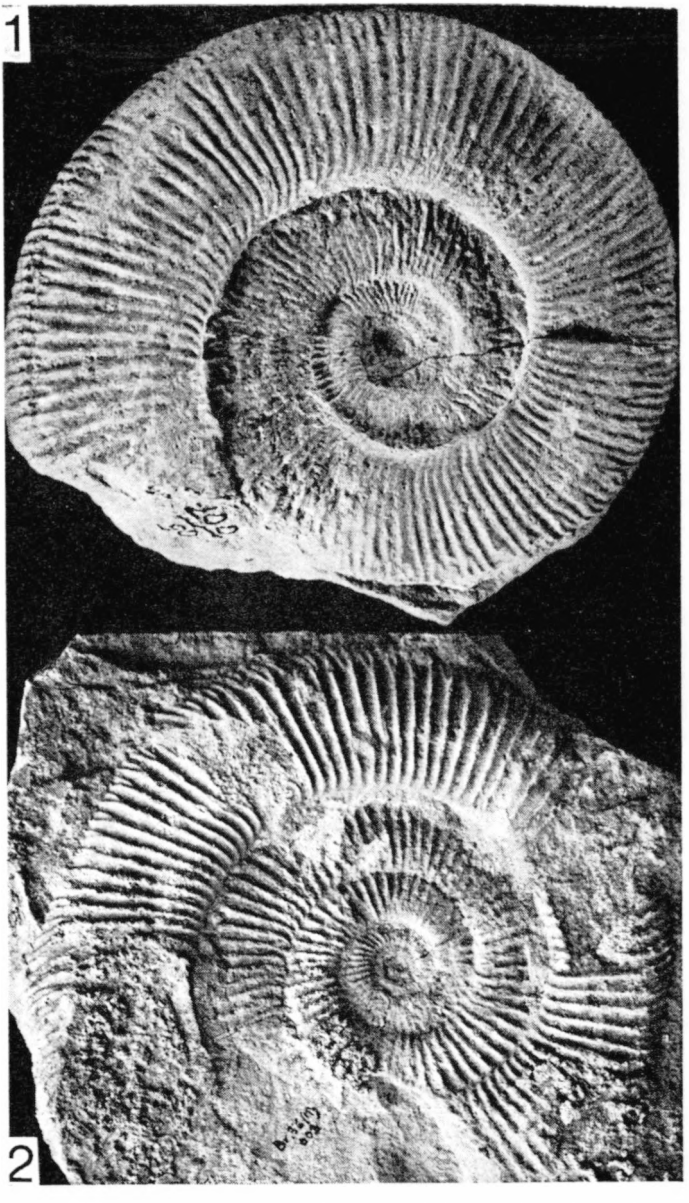
TABLE I

Dimensions of *P.* (*Dichotomsphinctes*) *wartae* Buk.

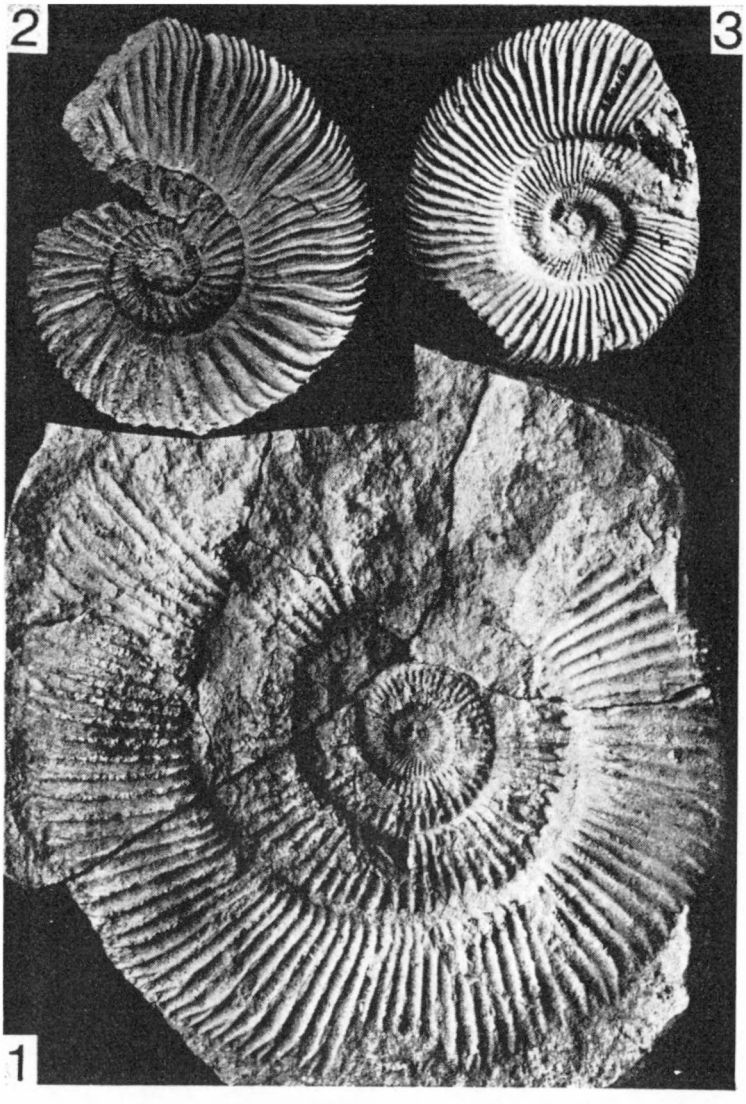
	D	Ph	H	H/D	T	T/D	U	U/D
Br 05/004, Zawodzie (*5*, bed 22), figured in [4], pl. 7	171	108	49	0.29	30	0.18	87	0.52
Br 21/010, Olsztyn (*15*)	85	—	25	0.29	—	—	41	0.49
Br 01/009, Zawodzie (*1*, bed 22)	163	98						
	150		40	0.27	29	0.19	81	0.53
Br 02/065, Zawodzie (*2*, bed 21)	158	—	43	0.27	28	0.18	78	0.49
Br 21/004, Olsztyn (*15*)	151	?99	44	0.29	—	—	77	0.51
	100		27	0.27	—	—	50	0.50
Br 01/001, Zawodzie (*1*, bed 22)	112.5	—	30	—	—	—	58	—
	100		28	0.28	—	—	50	0.50
Ha 49/19, Jaroszów (*31*)	140	—	40	0.28	—	—	71	0.51
	118		34	0.29	—	—	58	0.49
Ha 49/101, Jaroszów (*31*)	(151)							
	140?	100	38	0.27	—	—	73	0.52
	130		35	0.27	—	—	67	0.51
Br 02/214, Zawodzie (*2*)	134	—	40	0.29	—	—	65	0.48
Br 02/070, Zawodzie (*2*, bed 20),	162	94	52	0.31	—	—	73	0.46
figured in [31], pl. 1, fig. 4	140		43	0.31	28	0.20	65	0.47
Br 02/033, Zawodzie (*2*)	138	—	39	0.29	29	0.21	69	0.50
	100		29	0.29	—	—	48	0.48
Br 05/001, Zawodzie (*5*)	129	?90	35	—	—	—	67	—
	100		28	0.28	—	—	50	0.50
Per michalski Buk. in [27] Geol. Mus.	146	96	40	0.27	31.5	0.22	78	0.53
PAN Cracow, *A I/2/233* Regulice	126		34	0.27	—	—	65	0.51
P. wartae Buk. tr. *bifurcatoides-stenocycloides* gr. Br 05/054, Zawodzie (*5*)	143	—	43	0.30	—	—	69	0.49
	100		30	0.30	—	—	49	0.49
Ha 49/34, Jaroszów (*31*)	146	92						
	141		39	0.28	—	—	75	0.53
	114		31	0.29	—	—	59	0.51
Ha 49/5, Jaroszów (*31*)	169	104	48	0.28	—	—	86	0.51

Subgenus *Dichotomosphinctes* Buckman, 1926

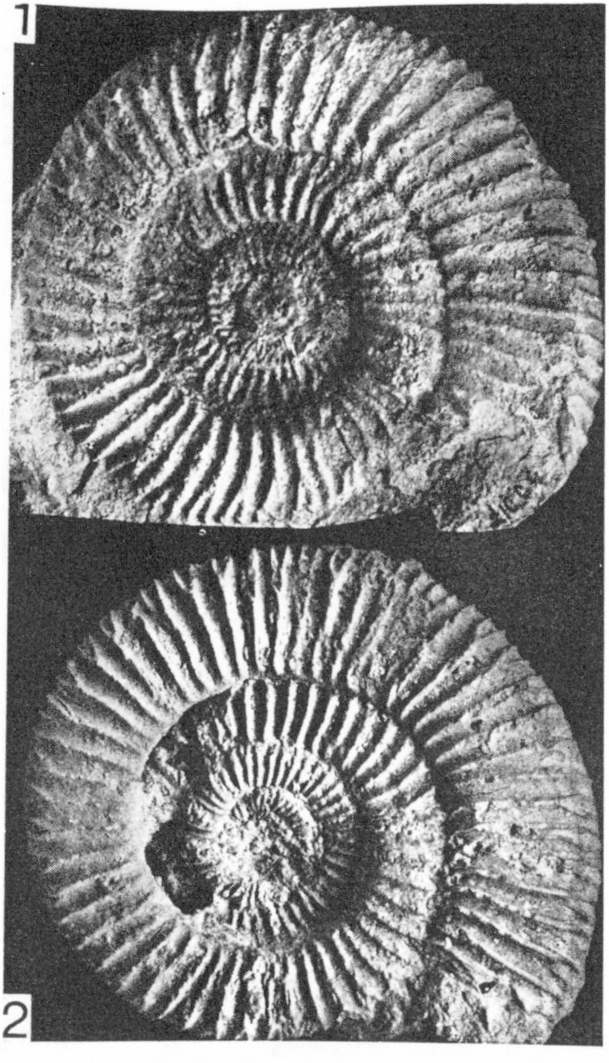
The interpretation of the subgenus *Dichotomosphinctes* Buckman, 1926, accepted here, generally follows that of Enay [13] and Malinowska [18–19]. See the papers of the latter author for descriptions of other species of that subgenus from coeval and older strata of the [redacted]estochowa Oxfordian.



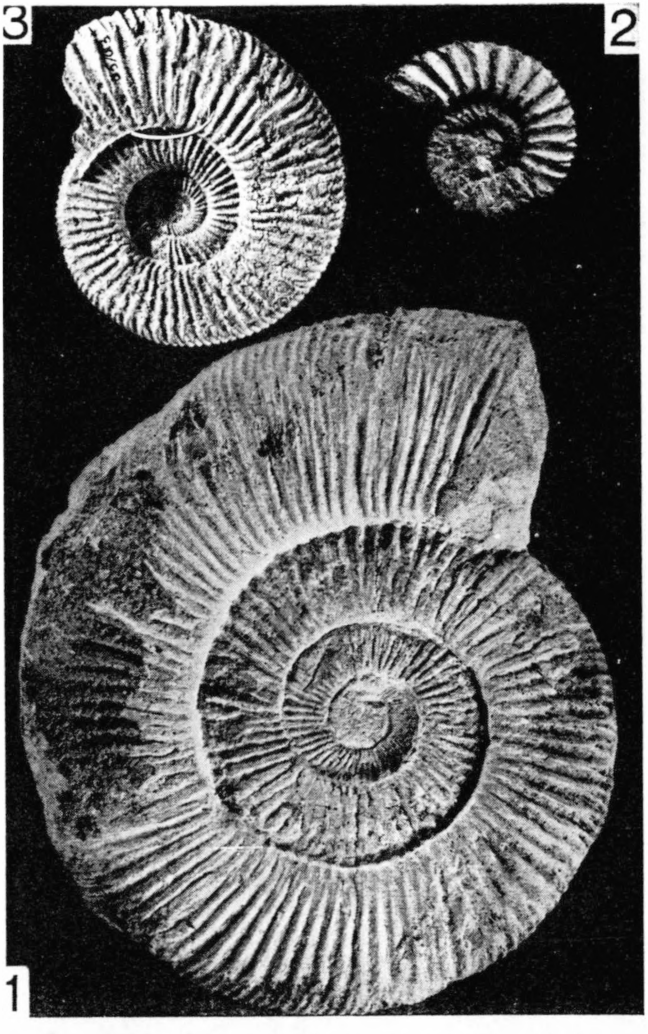
1 — *Perisphinctes (Dichotomosphinctes) elisabethae* de Riaz, Br 05/007, Zawodzie (5), Transversarium Zone; 2 — *Perisphinctes (Dichotomoceras) bifurcatoides-stenocycloides* gr. Br 36/A/003, Biskupice (26), Bifurcatus Zone, Stenocycloides Subzone



1 — *Perisphinctes (Dichotomoceras) bifurcatoides-stenocycloides* gr., Ha 49/5, Jaworznik (*31*), Bifurcatus Zone, Stenocycloides Subzone; 2 — *P. (Dichotomoceras) bifurcatus* (Qu.), Br 02/074, note peculiar ribbing of the outer whorl, Zawodzie (*2*), Bifurcatus Zone, Grossouvrei Subzone; 3 — *P. (Dichotomoceras)* sp. A, Br 05/056, Zawodzie (*5*), Bifurcatus Zone, Grossouvrei Subzone



1 — *P. (Dichotomoceras)* cf. *crassus* Enay, Br 20/017, Olsztyn (*14*), Bifurcatus Zone, Stenocycloides Subzone; 2 — *P. (Dichotomoceras)* cf. *crassus* Enay, K 2Bp3, Biskupice, Bifurcatus Zone, ? Stenocycloides Subzone



1 — *Perisphinctes (Dichotomoceras) bifurcatoides-stenocycloides* gr., Br 25/003, Skrajnica (*18*), Bifurcatus Zone, Stenocycloides Subzone; 2 — *P. (Dichotomoceras) bifurcatus* (Qu.), Ha 20/35, Piskupice (*24*), Bifurcatus Zone, Stenocycloides Subzone; 3 — *P. (Dichotomoceras)* sp. *B*, Br 05/013, Zawodzie (*5*), ? Bifurcatus Zone

All figures in natural size, otherwise stated

Perisphinctes (Dichotomosphinctes) wartae Bukowski, 1887
(Text-fig. 2)

1966. *Perisphinctes (Dichotomosphinctes) wartae* Bukowski; Enay, p. 483, pl. 30, figs 1–3, text-figs 140, 146–147 (cum synonymy).

1970. *Perisphinctes (Dichotomosphinctes) wartae* Buk.; Brochwicz-Lewiński, pl. 7.

1974. *Perisphinctes (Dichotomosphinctes) wartae* Buk.; Brochwicz-Lewiński and Różak, pl. 2, fig. 1.

Material. Over 20 specimens, some more or less complete.

Dimensions. See Table III.

TABLE II

Dimensions of *P.* (*Dichotomoceras*) *bifurcatoides-stenocycloides* group

	D	Ph	H	H/D	T	T/D	U	U/D
P. waehneri Siemiradzki (1899) Mus.	137	82	36	—	—	—	72	—
Geol. PAN Cracow, A-I/28, ?Kozlowie,	120		35	—	—	—	62	—
refigured in [7], pl. 2, figs 2–3	111		32	0.29	22	0.22	56	0.50
	85		24	0.28	19	0.22	43	0.50
P. (*D.*) *bifuracatoides* Enay, holotype,	139	c. 90	41	0.29	—	—	68	0.48
after Enay ([14], p. 510) Meussia (Jura)	110		33.5	0.30	21.5	0.19	51.5	0.46
Br A05/054, Zawodzie (*5*, bed 23)	143	—	43	0.30	—	—	69	0.49
	100		30	0.30	—	—	49	0.49
Ha 21/10, Biskupice (*26*)	120	—						
	100		30	0.30	—	—	48	0.48
Br 20/009, Olsztyn (*14*)	133	—						
	130		40	0.31	—	—	60	0.46
	105		32	0.30	—	—	48	0.46
Br 02/068, Zawodzie (*2*)	94	—	28	—	—	—	46	—
	75		23	—	—	—	33	—
Br 04/002, Zawodzie (*4*)	95	—	24	0.29	—	—	45	0.47
	80		24	0.30	—	—	38	0.48
Br 38/C/002, Biskupice (*22*)	80	—	23	0.29	—	—	38	0.48
Br 05/014, Zawodzie (*5*)	77	—	23	0.30	18	0.23	34	0.44
	60		19.5	0.32	16	0.26	25	0.42
Ha 21/8, Biskupice (*26*)	80	—	23	0.29	—	—	38	0.48
W/B20/1, Olsztyn (*14*)	128	—	39	0.30	23	0.20	59	0.46
Br 25/003, Skrajnica (*18*) figured in [7],	145	90	44	0.30	—	—	69	0.48
pl. 1, fig. 3, and here, pl. 4, fig. 1	120		37	0.31	26	0.22	58	0.48
Br 36/A/003, Biskupice (*22*) figured in	109		33	0.30	21	0.20	51	0.47
pl. 1, fig. 2	(175)	—						
	160		41	0.26	—	—	88	0.55
	135		36	0.27	—	—	70	0.51
	57		17	0.30	—	—	26	0.46
Ha/49/5, Biskupice (*3*) figured in pl. 2,	171	104						
fig. 1	169		48	0.28	—	—	86	0.51
Ha 20/70, Biskupice (*20*)	127							

TABLE III

Dimensions of *P. (Dichotomoceras) bifuracatus* (Qu.)

	D	Ph	H	H/D	T	T/D	U	U/D
Br 02/026, Zawodzie (*2*, bed 31)	66	37	24	0.36	17	0.26	28	0.42
figured in [4], pl. 6, fig. 1	50		17	0.34	15	0.30	22	0.44
Br 02/074, Zawodzie (*2*, bed 32),	85	33	32	0.37	21	0.25	35	0.41
figured in pl. 2, fig. 2	50		17	0.34	16	0.32	22	0.44
Br A04/010, Zawodzie (*A4*)	51		17	0.33	—	—	23	0.45
Br 05/040, Zawodzie (*5*, bed 39)	53		18	0.34	—	—	22	0.41
Br 05/042, Zawodzie (*5*, bed 39)	46		15	0.33	14	0.30	20	0.43
Br 05/066, Zawodzie (*5*, bed 38)	83		31	0.37	—	—	33	0.40
	50		17	0.34	16	0.32	21	0.42
Br 05/068, Zawodzie (*5*, bed 38)	57		20	0.35	—	—	23	0.42
	50		18	0.36	—	—	20	0.40
Br 22/001, Lipówki Dolne (*17*)	66		23	0.35	—	—	29	0.44
Br 25/010, Skrajnica (*18*)	78		24	0.31	21	—	36	—
	50		16	0.32	17	0.34	23	0.46
Br B25/014, Skrajnica (*18*)	55.5		17.8	0.32	—	—	24	0.43
	50		16	0.32	—	—	21	0.42
Ha 20/35, Biskupice (*24*)	53		18	0.34	14	0.26	24	0.45
figured in pl. 4, fig. 2								
Ha 20/36, Biskupice (*24*)	43		14	0.33	—	—	19.5	0.45
Ha 20/10, Biskupice (*24*)	39		13	0.33	12.5	0.32	16	0.41
Ha 24/7a, Biskupice (*19*), figured in [7],	48	24	17	0.35	—	—	19.5	0.41
pl. 3, fig. 3								

Description. Microconchs usually about 160–170 mm in size, sometimes larger, evolute to markedly evolute. Whorls subovate to subrectangular in cross-section, thickest close to the mid-height. Umbilicus shallow, with broadly rounded margin; umbilical wall usually covered with ribs. Secondaries, almost equally strong as primaries, passing the venter with a strong forward sweep. Close to the peristome, ribs become somewhat wavy. Constrictions sometimes numerous, particularly on the final body chamber. Body chamber 3/4 of whorl long. Peristome with small lappets.

Remarks. The bulk of the material described here is derived from the Zawodzie quarries, the type locality of this species ([24], p. 9). Variation high, primarily concerning whorl outline and height, as well as number of ribs (see text-fig. 1.). The type specimen ([9], pl. 27, fig. 1) appears to be extremely evolute. There are also some markedly more involute forms, at least in the case of the outermost whorls, but there is a marked predominance of intermediate, medium-involute ones (see dimensions given in Table III).

Fragmentary specimens indicate that some representatives of *P. (D.) wartae* Buk. or very closely affined ones could reach more than 200 mm in size. A specimen 184 mm in size and with all the features very close to *P. (D.) wartae* Buk. was previously figured ([4], pl. 2, fig. 1). Malinowska

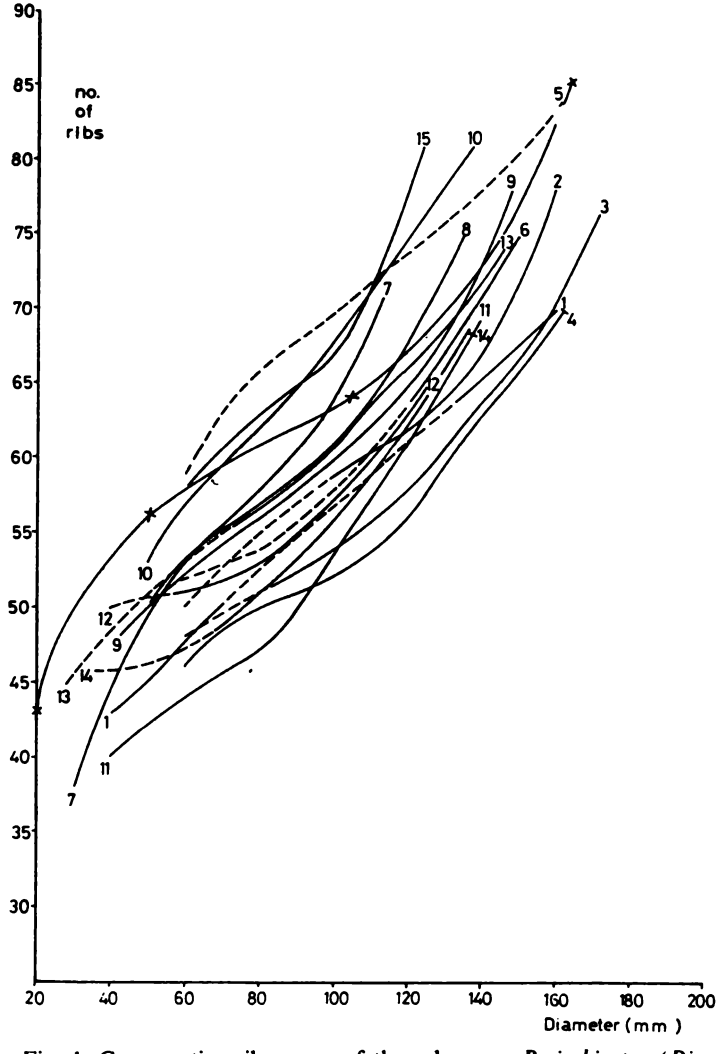


Fig. 1. Comparative rib curves of the subgenera *Perisphinctes (Dichotomosphinctes)* and *P. (Dichotomoceras)*

Perisphinctes (Dichotomosphinctes) wartae Buk.: ×—holotype (after [13]). 1—Br 02 208. 2—Br 02 065. 3—Br 05 004. 4—Br 02 070. 5—Br 01 009. 6—Br 21 004. 7—Br 01 001. 8—Br 02 214. 9—Ha 31 49 101. 10—Br 02 003. 11—Br 02 043; 12—type specimen of *P. waehneri* Siem. (Mus. PAN. A-I 2 39. Cracow). 13—*P. michalski* Siem., paratype (Mus. PAN. A-I 2 233. Cracow) *P. (D.) wartae* Buk.; *Perisphinctes (Dichotomosphinctes)* cf. *elisabethae* de Riaz: 15—KI 6 51

([18], p. 188, pl. 7) described a microconch measuring about 250 mm in diameter from Zawodzie, the type locality of *P. wartae* Buk., as *Perisphinctes (Dichotomosphinctes) wartae bedoensis* Collignon. The actual position of the Madagascar specimen on which Collignon's subspecies is based remains disputable, whereas that figured by Malinowska [18] seems to represent an extremely large representative of *P. wartae* Buk. It should be noted that recently Enay ([13], p. 857) noted a trend to increase

of microconchs of the subgenera *Otosphinctes* and *Dichotomosphinctes* (see [4, 30]). In the traced evolutionary series *P. (Dichotomosphinctes) rotoides* (up to 100 mm in size) gave rise to *P. (D.) antecedens* (150–180 mm in size). The last species is accompanied by other giant microconchs, *P. (D.) buckmani* and *P. (D.) dobrogensis*, attaining about 200 mm in size or even more. As it was stated above, the representatives of *P. (D.) wartae* usually attain 160–170 mm in size, reflecting a reverse trend which finally resulted in the appearance of dwarfish fauna of the base of Bimammatum Zone [4]. The exact position of the giant specimens displaying features of *P. (D.) wartae* Buk. is not known but it is highly probable that they, and especially that assigned to *P. (D.) wartae bedoensis* Collignon, represent a final "product" of the trend to increase the final shell size.

Klebelsberg ([15], pp. 172–4) noted a remarkable similarity of three species: *P. wartae* Buk., *P. waehneri* Siem. and *P. stenocycloides* Siem. Analysis of the holotype and paratype of *P. waehneri* Siem. showed that the latter species and *P. stenocycloides* Siem. belong to the *P. (Dichotomoceras) bifurcatoides-stenocycloides* group, differing from *P. (Dichotomosphinctes) wartae* Buk. by the U-shaped initial part of rib-curve and a somewhat sharper sculpture. There are several forms in the author's collection, which have some features of *P. (Dichotomoceras) bifurcatoides-stenocycloides* group and some of *P. (Dichotomosphinctes) wartae* Buk. They are derived from the uppermost Transversarium-Bifurcatus strata and they reflect transition from *Dichotomosphinctes* to *Dichotomoceras* fauna. Their transitional character is evidenced by rib curves intermediate in character between steeply rising curves of *Dichotomosphinctes* and U-shaped ones of *Dichotomoceras*. The specimen identified as *Perisphinctes (? Dichotomosphinctes)* sp. *A*, intermediate between *P. (Dichotomosphinctes) luciae* de Riaz and *P. (Dichotomoceras) bifurcatus* (Qu.), by Malinowska ([19], p. 20) is an excellent example of this transition. It should be admitted here that the species *P. (Dichotomoceras) wartae* Buk. as a whole may be treated as transitional between the two subgenera on account of the specific course of the initial part of the rib curve (see Text-fig. 2).

Occurrence. Zawodzie (numbers of localities as given in [6]: *1–2, 5*, beds 16–23), Olsztyn (*14–15*), Skrajnica (*18*), Biskupice (*22*), Jaroszów (*31*), Transversarium Zone. The forms transitional to *P. (Dichotomoceras) bifurcatoides-stenocycloides* group were found at Zawodzie (*2, 5*, beds *23–24*), Jaroszów (*31*) and Jaworznik (*52*), the uppermost Transversarium–lowermost Bifurcatus Zone.

Perisphinctes (Dichotomosphinctes) elisabethae de Riaz, 1898

(Pl. 7, fig. 1, text-fig. 2)

1966. *Perisphinctes (Dichotomosphinctes) elisabethae* de Riaz; Enay, p. 490, p. 30, figs 4–5, pl. 31, figs 2–6, text-figs 148–150 (cum synonymy).

Material. Six specimens.

Dimensions. See Table III.

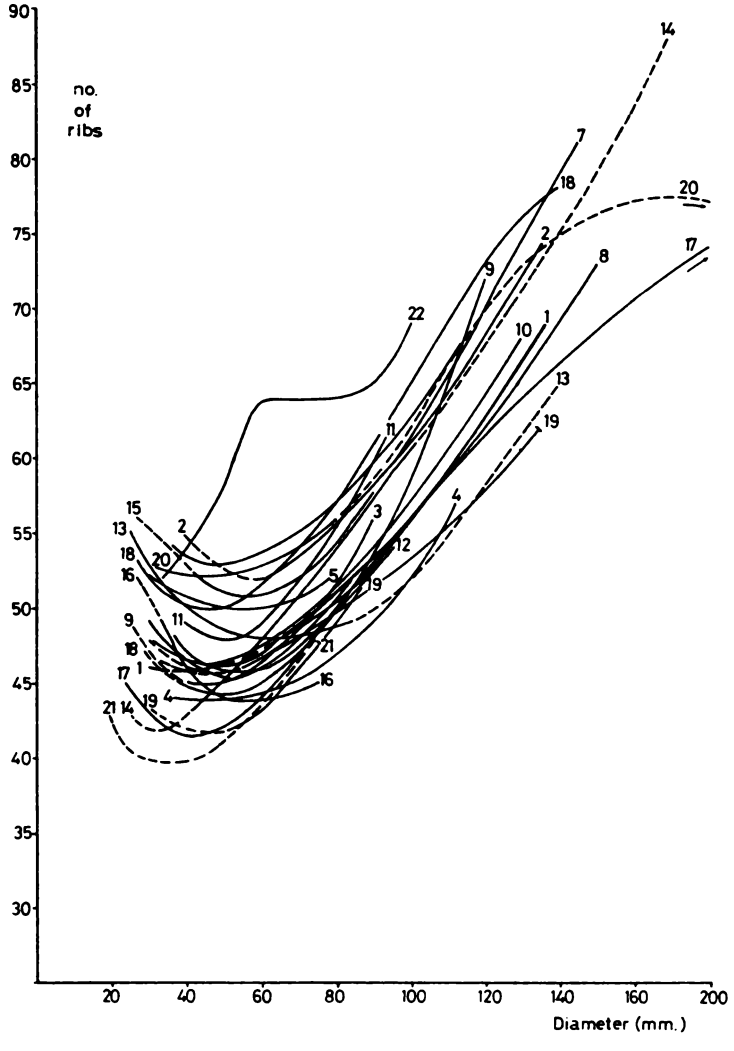


Fig. 2. Comparative rib curves of the subgenera *Perisphinctes (Perisphinctes)*; *P. (Dichotomosphinctes)* and *P. (Dichotomoceras)*

Perisphinctes (Dichotomoceras) bifurcatoides-stenocycloides group: 1—*P. waehneri* Siem., type specimen (Mus. PAN, A-I 2 39, Cracow), 2—Br 02 028, 3—Br 20 019, 4—Br 20/008, 5—Br 23 005, 7—Br 2 003, 9—Ha 21/19, 10—Br 20/009, 11—Br 02/068, 12—Br 04/002, 13—*P. (D.) bifurcatoides* Enay, holotype (after [13]), 14—Br 36/A/003, 15—Ha 20/37, 16—Br 25 011; *P. (Perisphinctes)* cf. *punthieri* Enay: 17—Br 02/219, 18—Br 02 033, 20—20/007; *P. (Dichotomoceras) stenocycloides* Siem.: 21—type specimen (from figure); *P. (D.)* cf. *crassus*: 19—Br 20/017; *P. (D.)* sp. n. *A*: 22—Br 05 056

Description. Microconchs moderately evolute, with high, subelliptical and somewhat compressed whorls. Umbilical area low, covered with ribs. Ribs crowded, moderately thick; secondaries passing through the venter with slight forward sweep.

Remarks. Differs from *P. wartae* Buk. in more numerous and finer ribs, more involute coiling, as well as in a far less distinct forward sweep of secondaries.

Occurrence. Zawodzie (*5*, bed 22), Mirów (*8*), Skrajnica (*18*) and Jaworznik (*51*), ? upper Antecedens Zone—Transversarium Zone. Several further specimens from Zawodzie (*2*), Mirów (*11*) and Przybynów (*36*) are assigned to this species with reservation because of their fragmentary preservation precluding identification with certainty.

. Subgenus *Dichotomoceras* Buckman, 1919

The interpretation of the subgenus *Dichotomoceras* Buckman, 1919, accepted here, generally follows that of Enay [13] and Malinowska [18–19].

Perisphinctes (Dichotomoceras) bifurcatoides-stenocycloides group
(pl. 7, fig. 2, pl. 8, fig. 1, pl. 10, fig. 1, text-figs 1–3)

Material. About 35 specimens.

Dimensions. See Table IV.

Description. Large microconchs, 140–180 mm in size, moderately evolute. Whorls somewhat compressed, subovate- to subrectangular in cross-section. Umbilical area steeply inclined, covered with ribs or, occasionally, smooth. Primaries initially rectiradiate, becoming prorsiradiate on outer whorls, sharp-crested or smooth-crested depending on the preservation. Secondaries slightly weaker than primaries, with distinct forward sweep on the venter. Constrictions occasional.

Rib curve U-shaped, with the lowermost point (ribs 40–53 in number per whorl, 46 on the average) marked at 40–65 mm diameter. Rib curve thereafter steeply rises along with shell growth up to 75–85 ribs per whorl at 150–160 mm diameter.

Remarks. After reexamination of Bukowski's [9] specimens, Siemiradzki ([28], p. 253) proposed a new specific name, *Perisphinctes Waehneri*, for two his specimens misidentified as *Perisphinctes michalski* Buk. in his previous paper ([27], p. 62). Klebelsberg ([15], p. 172–4) found that *P. waehneri* Siem. appears close to both *P. wartae* Buk. and *P. stenocycloides* Siem. Later Dorn ([11], p. 133) placed *P. waehneri* Siem. in the synonymy of *P. stenocycloides* Siem.

Reexamination of the holotype of *P. waehneri* Siem. showed that it belongs to the *P. (Dichotomoceras) bifurcatoides-stenocycloides* group, predominating in the perisphinctid assemblage of the Bifurcatus Zone of the Polish Jura Chain and represented by at least 35 specimens in the collection of the author. This group appears highly variable, particularly in whorl height (H/D varying from 0.26 to 0.32), umbilical diameter (U/D—from 0.44 to 0.55) and number of ribs (see Text-fig. 2). It appears that Klebelsberg ([15], p. 172) was right in suggesting affinity of *P. wartae* Buk., *P. stenocycloides* Siem. and *P. Waehneri* Siem.—actually the two latter species represent

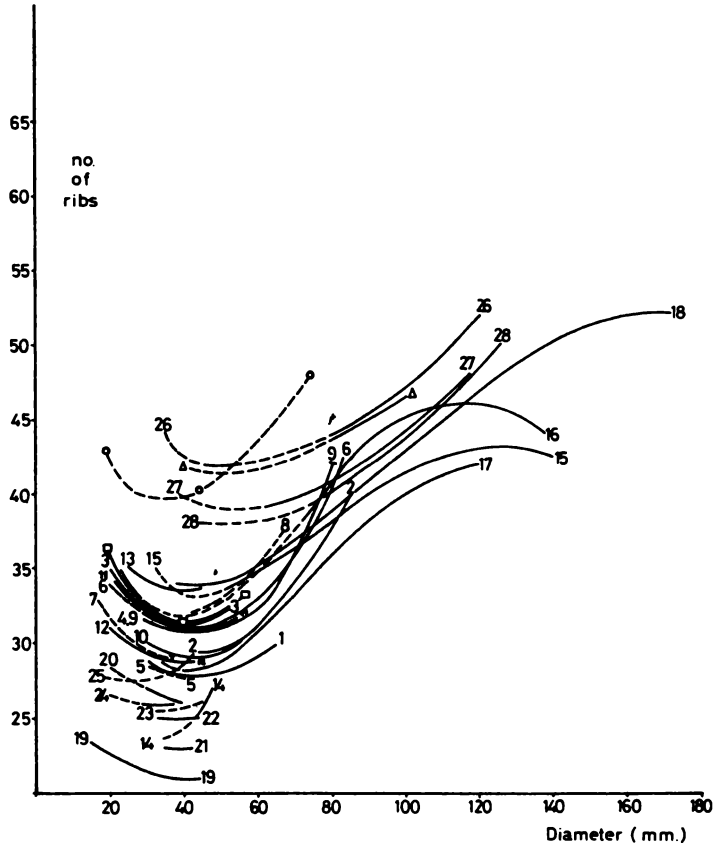


Fig. 3. Comparative rib curves of *Perisphinctes (Dichotomoceras)*, *P. (Perisphinctes)* and *Microbiplices*

Perisphinctes (Dichotomoceras) bifurcatus (Qu.): ×—lectotype (after [13]), 1—Br 02 026, 2—Br 02 074, 3—Br 04 010, 4—Br 05 040, 5—Ha 21 4, 6—Br 05 066, 7—Ha 20 105, 8—Br 22 001, 9—Br 25 010, 10—Br 25 014, 11—Ha 20 35, 12—Ha 20 36, 13—Br 05 076, 14—Ha 24 7, dwarf; *P. (Perisphinctes) malinowskae* Brochwicz-Lewiński, 15—Br 02 017, 16—Br 02 003, holotype, 17—Ha 20c 1, 18—Ha 20 101; *Microbiplices* sp.: 19—Ha 22 8; *Microbiplices microbiplex* (Qu.): 20—Ha 24 2, 21—Ha 22 030, 22—Ha 22 71, 23—Ha 22 74, 24—Ha 47 28, 25—Br 18 001; *Perisphinctes (Dichotomosphinctes)* cf. *crassus* Enay: 26—K 2Bp3, 27—Br 20 017, 28—Ha 21 7, *P. (D.) stenocycloides* Siem.: ○—holotype, *P. (?D.) gallarum* Dacqué: Δ—holotype (rom figure)

descendants of the former, and the differences are primarily related to a change in the density of ribbing on innermost whorls, the resulting difference in the trend of rib curve, and a somewhat sharper and stronger ribs.

Reconstruction of the lacking part of the outer whorl of the holotype of *P. stenocycloides* Siem. shows that this specimen is very similar to *P. Waehneri* Siem. in the style of ribbing and dimensions, differing by a slightly lower number of ribs. Thus these specimens may be regarded as conspecific.

Enay ([13], p. 509) described a number of slightly more involute forms as *P. (Dichotomoceras) bifurcatoides* n. sp. The specimens figured by him and subsequently Malinowska [19] and reported by the present author [4, 6] form a population which may be divided into two species, *P. (D.) stenocycloides-waehneri* and *P. (D.) bifurcatoides* only on the basis of differences in suture line (Cariou, pers. inf.). Two types of suture line may be differentiated here: one closer or almost identical with that of *Dichotomosphinctes*, and other, markedly simplified and of the *P. (Dichotomoceras) bifurcatus* Qu. type. The difference may be attributed to those in ultimate shell size of particular specimens as those with suture of the *bifurcatus* type are generally smaller than those with *Dichotomosphinctes*-like one (about 145 mm or less and 160–180 mm in size, respectively). This would be in accordance with the observation made by Makowski ([16], p. 335) that the smaller the ultimate shell size the simpler the suture. Until a more detailed analysis of the original Polish and French material has been made, it seems safer to treat all these forms as a single group (or species).

The specimen assigned to *P. stenocycloides* Siem. by Dorn [11], is somewhat less densicostate, especially on inner whorls, than those described herein and it may represent a separate species.

The specimens described here differ from those of the species *P. (Dichotomoceras) bifurcatus* (Qu.) in a markedly larger size, less coarse and denser-spaced ribs and dimensions.

Occurrence. Zawodzie (*2, 4, 5,* beds 24–29, and from fallen blocks, possibly coming from higher beds), Olsztyn (*14*), Skrajnica (*18*), Biskupice (*26*), Jaroszów (*31*), the uppermost Transversarium—Bifurcatus Zone. Moreover, several specimens from the Bifurcatus Zone of Olsztyn were assigned to this species with reservation. Also known from Wapiennik, Zawady, NW of Częstochowa ([19], p. 23), and the Mieczyn quarry in the SW margin of the Holy Cross Mts ([21], pl. 8, fig. 9).

Perisphinctes (Dichotomoceras) bifurcatus (Quenstedt, 1847)
(Pl. 8, fig. 2, Pl. 10, fig. 2, text-fig. 3)

1970. *Perisphinctes (Dichotomoceras) bifurcatus* (Qu.); Brochwicz-Lewiński, pl. 6, fig. 1, pl. 8, fig. 1.
1974. *Perisphinctes (Dichotomoceras) bifurcatus* (Qu.); Brochwicz-Lewiński and Różak, pl. 3, fig. 3.
1979. *Perisphinctes (Dichotomoceras) bifurcatus* (Qu.); Sapunov, p. 84, pl. 20, figs 1–3, text-figs 5/4, 9 (cum synonymy).

Material. Approximately 30 specimens.

Dimensions. See Table IV.

Description. Medium-sized microconchs, 100 to 48 mm in size, slightly evolute, with whorls subrectangular to subovate in cross-section. Umbilical area steeply inclined, smooth. Umbilical margin broadly rounded. Primaries markedly sharp-crested, beginning at umbilical margin. Point of furcation

TABLE IV

Dimensions of *Dichotomoceras*

	D	Ph	H	H/D	T	T/D	U	U/D
P. (*Dichotomoceras*) sp. A.; Br 05/56,	95	—	32	0.35	—	—	39	0.41
Zawodzie (*5*) figured in pl. 2, fig. 1	80		28	0.35	18	0.22	31	0.39
P. (*D.*) sp. B; Br 05/013 Zawodzie (*5*)	75	60	—	—	—	0.27	—	—
figured in pl. 4, fig. 3	70		25	0.36	18.5	0.27	28.5	0.41
P. (*D.*) sp. C ; KZw 2/1, Zawodzie (*2*)	125	78						
	120		41.5	0.35	—	—	55	0.46
	100		35	0.35	—	—	45	0.45
P. (*D.*) sp. D; Br 02/221 Zawodzie (*2*)	135	—	44	0.33	—	—	60	0.44
	115		36	0.31	28	0.24	53	0.46
P. (*D.*) cf. *crassus* Enay; K 2Bp 3,	122	—						
Biskupice (*21*), figured in pl. 3, fig. 2	119		35	0.29	—	—	63	0.52
	100		28	0.28	20	0.20	52	0.52
Br 20/017, Olsztyn (*14*), figured in pl. 3,	117	—						
fig. 1	100		28	0.28	—	—	51	0.54
	110		30	0.27	22	0.20	59	0.54
Ha 21/9, Biskupice (*26*)	108	70	32	0.30	—	—	56	0.52
	100		29	0.29	—	—	52	0.52
Ha 21/7, Biskupice (*26*)	121	116	40	0.33	31	0.26	62	0.51
	100		28	0.28	23	0.23	52	0.52

situated somewhat above the mid-height. Secondaries, almost equally strong as primaries, passing the venter with strong forward sweep. Rib curve strongly U-shaped, with the lowermost point (ribs 27–35 in number, 30 on the average) marked at 40–60 mm diameter and later rapidly rising.

Remarks. The Polish specimens from the Częstochowa area do not differ from those described from Germany, France [13], Spain [26], or Bulgaria [25]. The exception is here the specimen shown in pl. II, fig. 1, displaying a somewhat untypical ornamentation of the final body chamber, as well as another specimen from the Grossouvrei Subzone of the Bifurcatus Zone of Zawodzie, displaying single and biplicate ribbing finer than that of the accompanying *Dichotomoceras* fauna, and assigned to this species with reservation.

Occurrence. Zawodzie (*2, 4, 5, A4*, beds 28 onwards), Olsztyn (*17–18*), Biskupice (*19, 24, 26*), Żarki (*49–50*), the Bifurcatus zone, Grossouvrei Subzone–basal Bimammatum Zone. Also known from the southern margin of the Holly Cross Mts and Bałtów in north-eastern margin of the Holy Cross Mts.

Perisphinctes (Dichotomoceras) cf. *crassus* Enay, 1966

(Pl. 9, figs 1–2, text-fig. 3)

1979. *Perisphinctes (Dichotomoceras) crassus* Enay; Sapunov, p. 86, pl. 20, figs 6–9, text-figs 5/5, 10 (cum synonymy).

Material. Fo[redacted] specimens.

Dimensions. See Table V.

Description. Incomplete evolutely-coiled microconchs about 160 mm in size, septate to 116 mm (specimen *Ha 21/7*). Whorl section rounded subrectangular, thickest close to the umbilical margin. Umbilical area inclined, covered with ribs. Primaries projected, sharp-crested, generally loosely-spaced; secondaries somewhat less prominent. Initial twist of primaries well marked; forward sweep of secondaries insignificant on inner whorls, well marked on the outer.

Remarks. The specimens apper close to *P. (Dichotomoceras) crassus* Enay ([13], p. 507), somewhat differing in trend of rib curves. There is some similarity to inner whorls of the macroconchs assigned to *P. (Perisphinctes) malinowskae* sp. n. but the differences include trend of rib-curves, less strong ornamentation at comparable diameters, forward sweep of secondaries and whorls less depressed at comparable diameters.

The specimens assigned to *P. (D.) crassus* Enay by Malinowska ([19], p. 23) may represent immature *P. (P.) variocostatus* (Buckland).

Occurrence. Olsztyn [14, 20] and Biskupice [21], the Bifurcatus Zone, Stenocycloides–? Grossouvrei Subzone.

Perisphinctes (Dichotomoceras) sp. n. **A**
(Pl. 8, fig. 3, text-fig. 2)

Material. A single specimen.

Dimensions. See Table V.

Description. Slightly evolute microconch, 95 mm in size, with high, compressed, subtrapezoidal whorls. Umbilical area almost vertical, smooth. Umbilical margin broadly rounded. Ribs markedly sharp-crested, biplicate. Initial twist of primaries and forward sweep of secondaries well marked. Rib curve rapidly rising to become flat laying in the 60–85 mm interval, and subsequently once more rapidly rising. Separation ceases at 47 mm diameter.

Remarks. Sculpture and dimensions of that specimen are typical of *Dichotomoceras* whereas its rib-curve is quite peculiar, different of those of the remaining species of this subgenus. It seems to be close to *P. (D.) bifurcatoides-stenocycloides* group, differing in higher whorls and narrower umbilicus, not to say about the rib-curve.

Occurrence. Zawodzie, quarry 5, fallen block, ? Bifurcatus Zone.

Perisphinctes (Dichotomoceras) sp. **B**
(Pl. 10, fig. 3)

Remarks. A single specimen from a fallen block of Zawodzie (quarry 5, ? Bifurcatus Zone, specimen Br 05/013), 75 mm in size and septate to c. 60 mm. It somewhat resembles *P. (D.) bifurcatus* (Qu.), differing in higher number of ribs. It differs from *P. (D.) bifurcatoides-stenocycloides* group in more wavy rib curve and in being more involute. Umbilical area steeply inclined, smooth, similar to that of the representatives of the latter group.

Perisphinctes (Dichotomoceras) sp. C

Remarks. A single specimen from a fallen block of Zawodzie (quarry 5, ? Bifurcatus Zone, specimen K Zw 2/1), 125 mm in size, septate up to 78 mm, initially evolute, becoming almost involute later. The last whorl high, compressed; earlier whorls seem to be somewhat depressed, thickest close to the umbilicus. Umbilical area low, smooth. Initial twist of primaries and forward twist of secondaries well-marked. Increasing inter-rib space towards the aperture (? final) results in change of rib curve trend.

It is most similar to *P. (D.) bifurcatus* (Qu.), differing in size and modification of sculpture on the outer whorl.

Perisphinctes (Dichotomoceras) sp. E

Remarks. A single form from a fallen block of Zawodzie (quarry 2, Bifurcatus Zone, specimen no. Br 02/221), moderately involute, 135 mm in size, with somewhat inflated, subovate whorls. Umbilical wall high, almost vertical, covered with ribs. Primaries very slightly prorsiradiate, bifurcating somewhat above two-thirds of whorl height. Secondaries passing through the venter with a weak forward sweep. Peristome formed by prominent single rib preceded by constriction.

It is very close to the representatives of the *P. (D.) bifurcatoides-stenocycloides* group in rib-curve trend, differing in the style of ribbing, whorl outline and dimensions.

Perisphinctes (Dichotomoceras) spp.

This subgenus comprises also several other specimens found in the strata of the Bifurcatus Zone of the Częstochowa area which, however, are insufficiently preserved for specific identification (Br 04/003, Br 04/008, Ha 20/9, Ha 24/22, Kl 26/56 and others).

Warm thanks are due to R. Enay, E. Cariou, J. H. Callomon, J. Kutek, J. Liszkowski, W. C. Kowalski, L. Malinowska, L. Sequeiros, I. G. Sapunov and other colleagues for fruitful discussions, valuable comments and help.

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В. Брохвич-Левински, Собственно *Perisphinctes* фауна (Ammonoidea) оксфорда Ченстоховы. Часть II. Подроды *Dichotomosphinctes* Buckman, 1926, *Dichotomoceras* Buckman, 1919

Резюмé. Во второй части статьи описаны представители подродов *Dichotomosphinctes* Buckman, 1926, *Dichotomoceras* Buckman, 1919 рода *Perisphinctes* Waagen, 1869, из горизонтов Transversarium и Bifurcatus оксфорда Ченстоховы. Особое внимание обращается на переходные формы от вида *P. (Dichotomosphinctes) wartae* Buk. к группе *P. (Dichotomoceras) bifurcatoides-stenocycloides* и тоже между этими двумя подродами.