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Cuban Oxfordian Aspidoceratids: Their Relation to the European Ones and Their Stratigraphic Values

by

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Summary. The trend to develop prominent umbilical spines directed inwards over the umbilicus and to compress the outer whorls, which is typical of Oxfordian aspidoceratids (Ammonoidea) of Cuba, is also traceable in European aspidoceratids. Though the status of Cuban aspidoceratids is still discussed there is growing evidence of their close affinity with the European ones. Aspidoceratids displaying the above trends seem to give further support to the connections between the Western Tethys and Cuba, and possibly Chile, in the Oxfordian.

From the Oxfordian of Pinar del Rio province, western Cuba, Myczyński [16] described a new ammonite assemblage comprising representatives of a new genus *Cubaspidoceras* Myczyński, 1976, and some *Euaspidoceras* characterized by a trend to develop prominent spines directed inwards over the umbilicus. These ammonites were immediately used in attempts to date the strata bearing them as well as the underlying classic ammonite-bearing strata of Cuba, i.e. those of the Jagua Formation [16, 22], which Arkell ([2], p. 569) considered to be baffling to geologists. The representatives of the genus *Euaspidoceras* described by Myczyński [16] were interpreted as surprisingly similar to those known from the lowermost Bimammatum Zone in Europe whilst those of *Cubaspidoceras* Myczyński, 1976, as related to troublesome European taxa such as *Clambites* Rollier, 1922 and *Aspidoceras tietzei* Neumays, 1873, and its allies by Kutek *et al.* [13] and Wierzbowski [22], and to *Pseudowaagenia* Spath, 1931, and others by Myczyński [16]. In result of these comparisons, the Cuban specimens were assumed to be indicative of the upper parts of the Bifurcatus Zone and possibly the lower Bimammatum Zone by Myczyński [16].

Subsequent studies have shown that the trend to develop prominent umbilical spines oriented inwards over the umbilicus is more common than it had been assumed. It is also displayed in some older aspidoceratids such as those figured as *Euaspidoceras oegir* (Oppel) from the G. transversarium and O. canaliculatum Zone of Switzerland by Maubeuge ([14] p. 305), *E. (Euaspidoceras) catena* (Sowerby) from the Middle Plicatilis Zone of France by Bourseau [4] and others. Moreover, intense field works carried out on the Oxfordian of Częstochowa area in Poland [7] made it possible to gather *Pseudowaagenia tietzei* (Neumayr) and several specimens comparable with *Euaspidoceras* figured from Cuba by Myczyński [16]. The Polish specimens were mainly found at Kamyk hill and Biskupice, in strata dated at the lower Hypselum Subzone of the Bimammatum Zone [6–8] on the basis of records of *Epipeltoceras semimammatum* (Qu.), *Euaspidoceras hypselum* (Oppel), numerous *Ringsteadia* and other time-sensitive species. These records as well as newly published data from other European countries cast some light on the evolution of aspidoceratids during the Oxfordian and on the relations between aspidoceratids from Cuba and from Europe and, thus, on the stratigraphic value of the former.

The relation between Cuban aspidoceratids and those from the Upper Oxfordian of Europe. As stated elsewhere (see Myczyński [16]), Cuban aspidoceratids are surprisingly similar to the European ones. Specimens identified as *Euaspidoceras (Euaspidoceras)* aff. *costatum* (Dorn) are hardly distinguishable from European *E. (E.) costatum* (Dorn). The same is the case of Cuban *E. (E.) striatocostatiformis* Myczyński, 1976, and presumably other Cuban specimen figured as *E.* sp. *? vignalense* by Wierzbowski ([22] pl. 8, fig. 12) and European *E. (E.) striatocostatum* (Dorn). Cuban *E. (E.) imlayi* Myczyński, 1976, appears very similar to the above-mentioned specimens recently found in Poland and here figured as *E. (E.)* cf. *imlayi* Myczyński. Moreover, the specimen figured as *E. (E.) oconellae* (S. Roig) by Wierzbowski ([22] pl. 8, fig. 11) is very similar to *E. (E.) hypselum* (Oppel), especially its representative originally figured as *Ammonites perarmatus* by Quenstedt ([17] pl. 96, fig. 1; see [18]). It would follow that the representatives of *Euaspidoceras* from the classic and new faunas of the Jagua and Francisco Formations in Cuba are very similar to the European ones, especially those of lower parts of the Bimammatum Zone and possibly the top parts of the Bifurcatus Zone.

Cuban specimens allocated in the genus *Cubaspidoceras* Myczyński, 1976, were interpreted as possibly closest to the European *Clambites* Rollier, 1922, especially *C. schwabi* (Oppel), and the species *"Neaspidoceras" tietzei* (Neumayr) and *"N." radisense* (d'Orb.) (see [22, 13]) or *Pseudowaagenia* Spath, 1931, and other taxa [16]. These European taxa are troublesome, especially from the point of view of taxonomy as they are represented

PLATE 1

Euaspidoceras (Euaspidoceras) imlayi Myczyński, holotype (Academy of Sciences, Havana, no. 2529), supplemented with outer whorl freed from rock (see [16], p. 275, pl. 7, fig. 1a—b, text-figs 10—11), ? lowermost Upper Oxfordian, Mogote la Mina II, Sierra de los Organos, Pinar del Rio province, Cuba, about 240 mm in size.

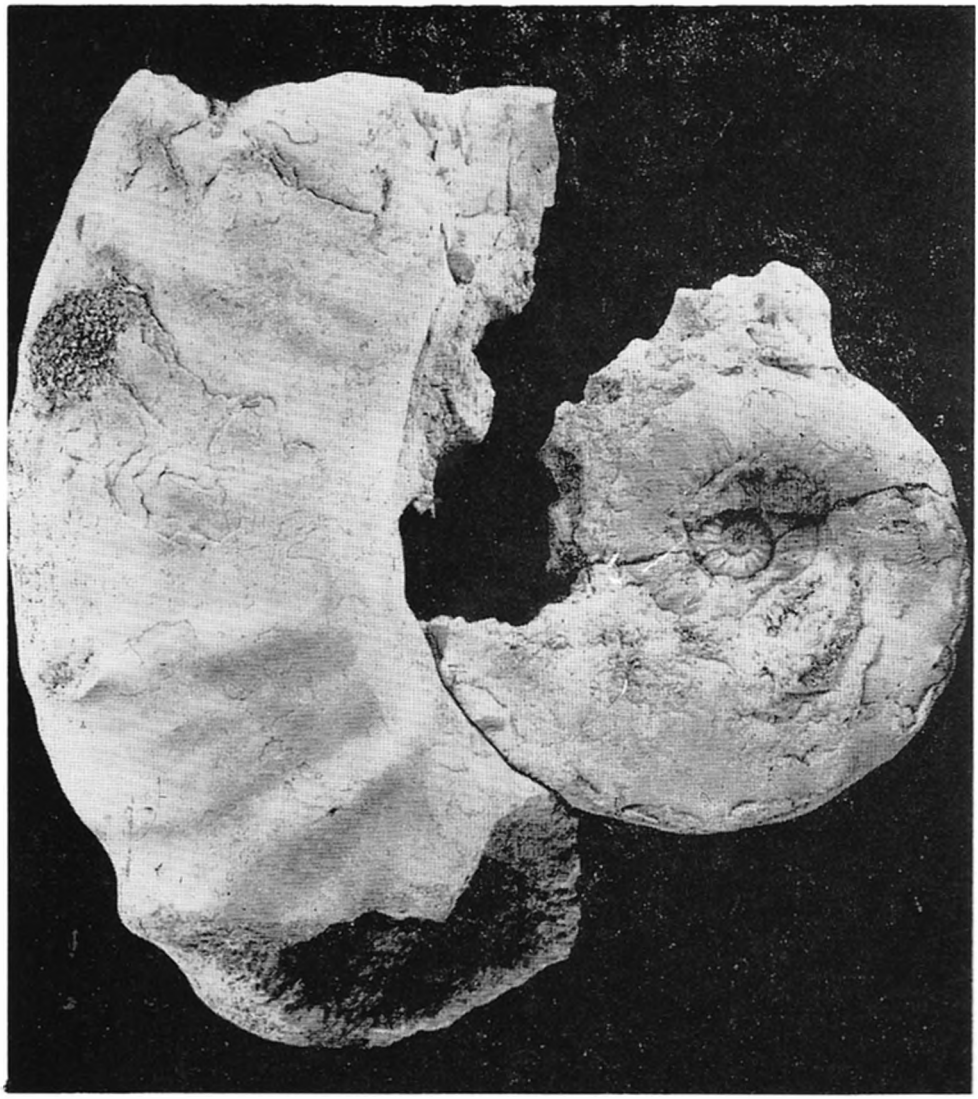

PLATE 2

Euaspidoceras (Euaspidoceras) sp., collections of Institute of Earth Sciences, Polish Academy of Sciences, Warsaw, MR—220, ? lowermost Upper Oxfordian, Sierra de los Organos, Pinar del Rio province, Cuba, about 220 mm in size.

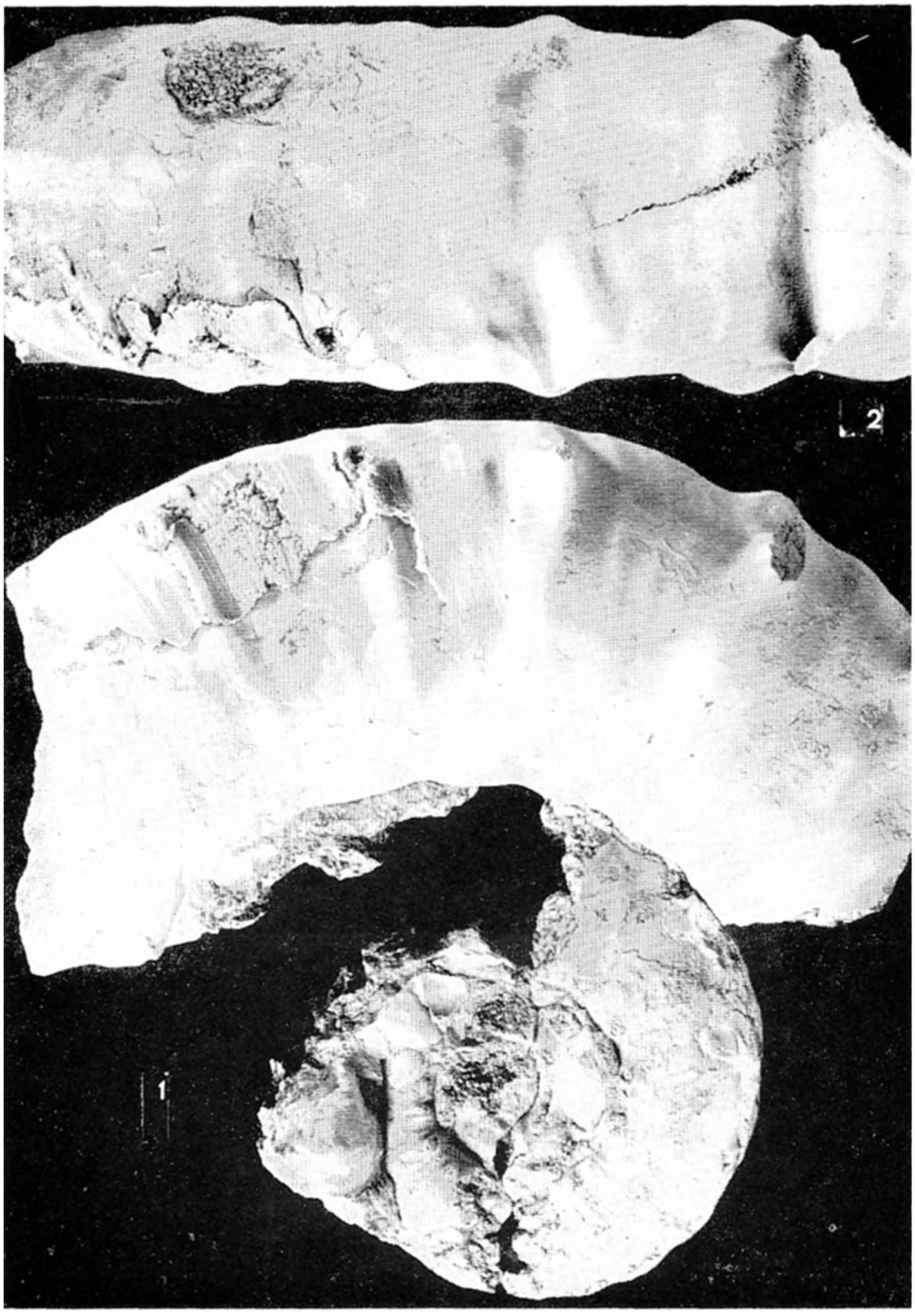

PLATE 3

Figs 1—2. Other side and venter of the specimen shown in Pl. 2.

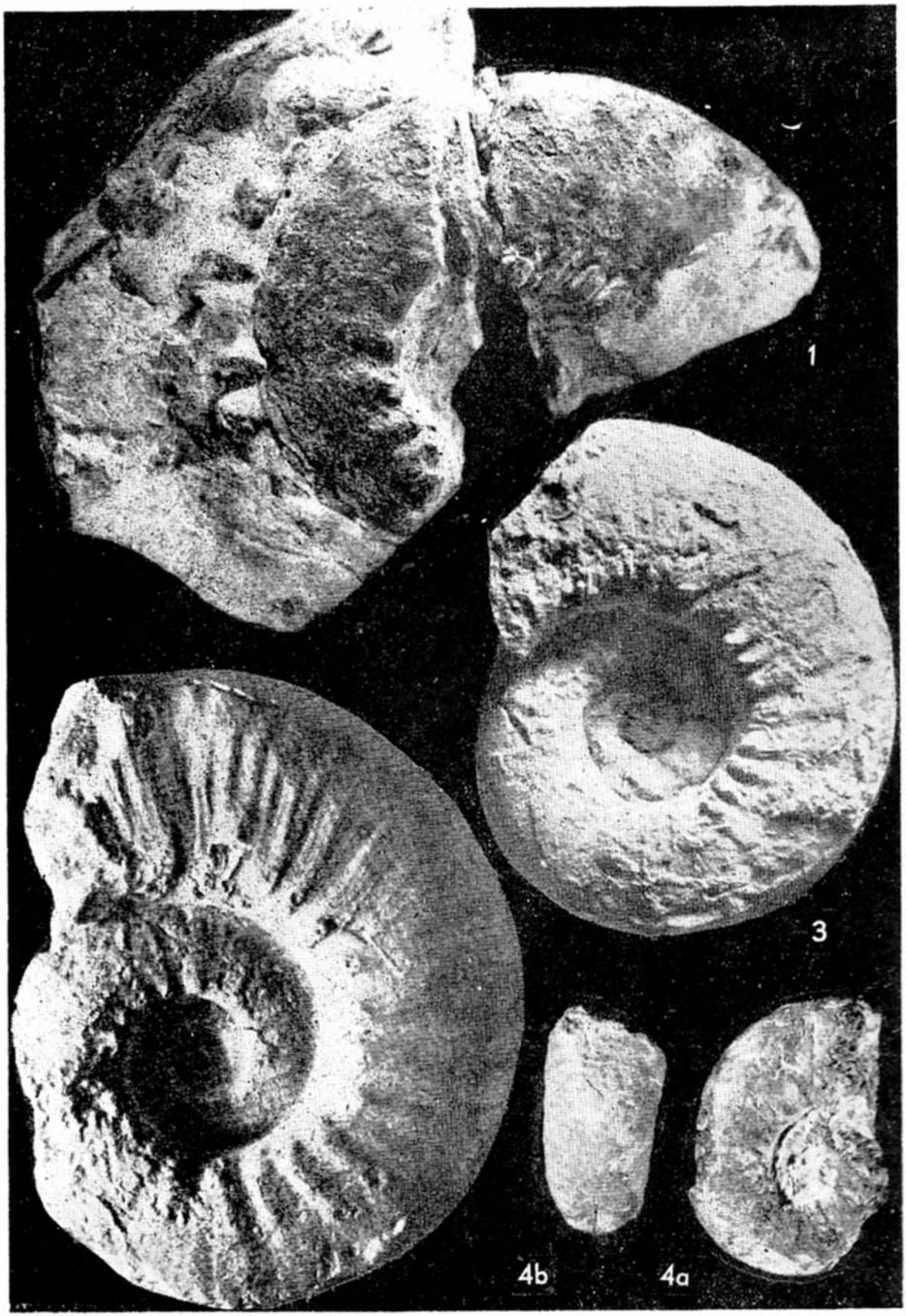

PLATE 4

Fig. 1. *Cubaspidoceras* sp., collections of Institute of Earth Sciences, Polish Academy of Sciences, Warsaw, MR—219, displaying prominent umbilical tubercles directed inwards over the umbilicus, ? lowermost Upper Oxfordian, Sierra de los Organos, Pinar del Rio province, Cuba, nat. size. Fig. 2: *Ammonites radisense* d'Orbigny, gypsum cast of the holotype (Mus. natl. hist. natur., Paris, Coll. d'Orbigny no. 3983), refigured from Miller ([15] pl. 6, fig. 5) × 2/3. Fig. 3: *Aspidoceras tietzei* Neumayr, lectotype (Bayer. Staatsslg. Paläont. u. hist. Geol., München, AS III 140), refigured from Miller ([15] pl. 6, fig. 6), Middle Oxfordian, Stankówka near Maruszyna, Poland, nat. size. Fig. 4a—b: *Pseudowaagenia* sp., Br. 07/108, Bimammatum Zone, Hypselum Subzone, Kamyk near Częstochowa, Poland, side and ventral views, nat. size

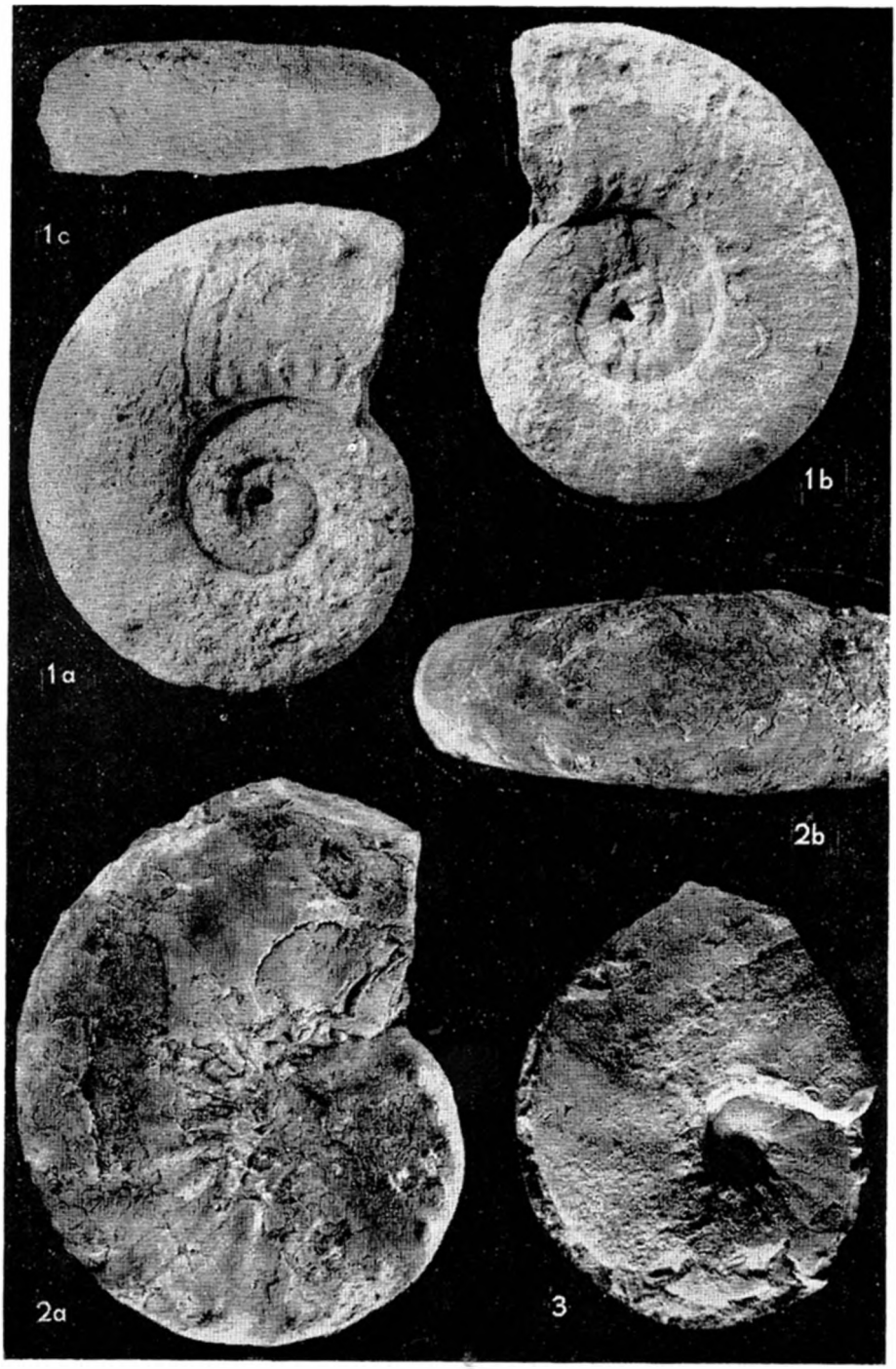

PLATE 5

Fig. 1a—c: *Pseudowaagenia tietzei* (Neumayr), Ha 22/81, Bimammatum Zone, Hypselum Subzone, Biskupice near Częstochowa, Poland, side and ventral views, nat. size. Fig. 2a—b: *Cubaspidoceras kuteki* Myczyński, holotype (Cuban Academy of Sciences, Havana, no. 2692a), lowermost Upper Oxfordian, Macagua locality, Sierra del Rosario, Pinar del Rio province, Cuba, refigured from Myczyński ([16] pl. 10, fig. 1a, c), nat. size. Fig. 3: *C. carribeanus* Myczyński, holotype (Cuban Academy of Sciences, Havana, no. 2503), lowermost Upper Oxfordian, Esquito hill north of Brujito, Sierra del Rosario, Pinar del Rio province, Cuba, refigured from Myczyński ([16] pl. 11, fig. 4), nat. size

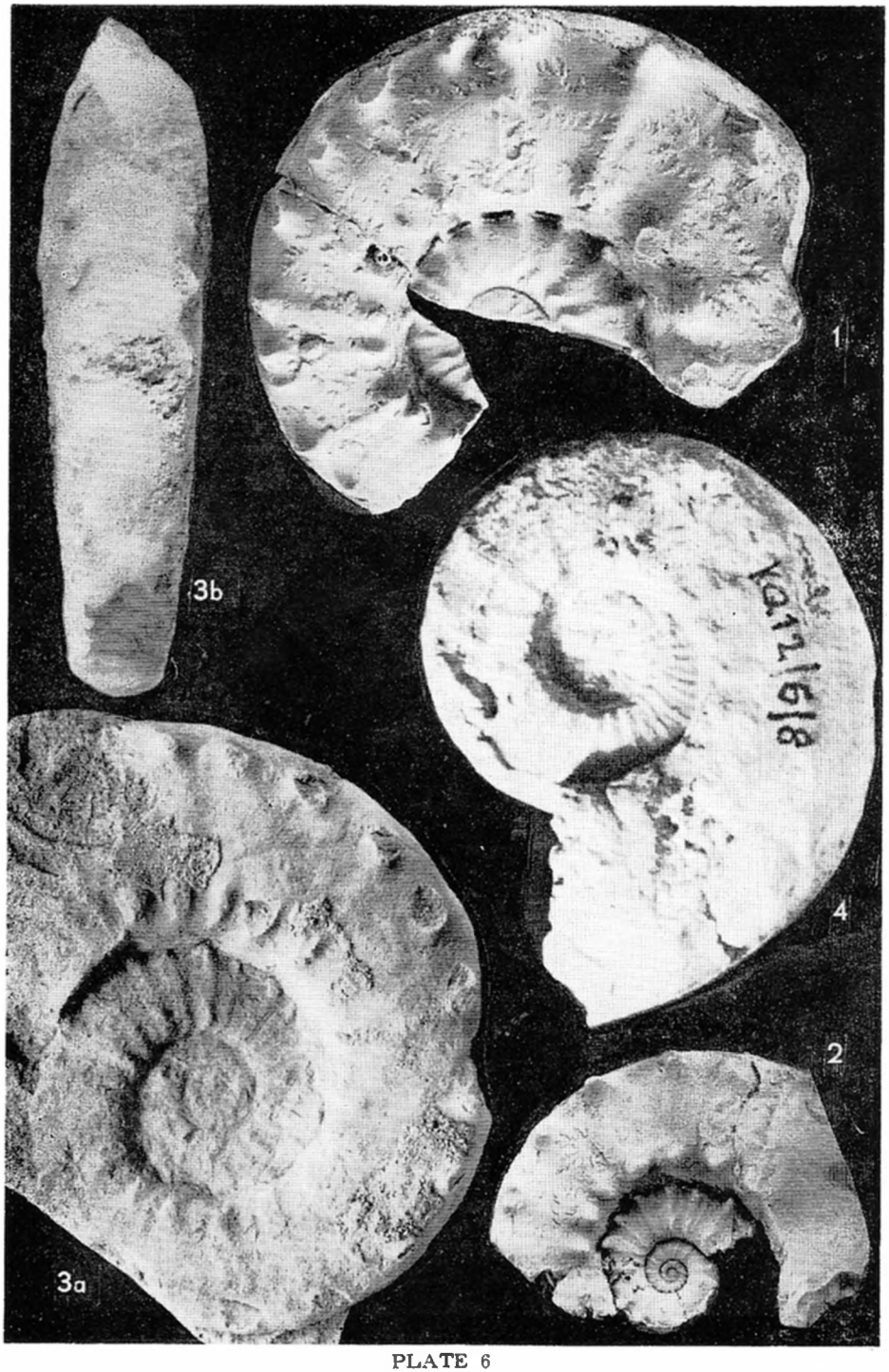

PLATE 6

Figs 1—2: *Euaspidoceras (Euaspidoceras) catena* (Sowerby), Middle Oxfordian, Plicatilis Zone, „Terres noires", Beavoisin (Drôme), France, refigured from Bourseau ([4] pl. 7, figs 2—3, respectively), nat. size. Fig. 3a—b: *E. (E.)* sp., Middle Oxfordian, lower part of Antecedens Zone, Jaworznik near Częstochowa, Poland, side and ventral views, nat. size. Fig. 4: Spanish specimen originally identified as *Clambites (Neaspidoceras) tietzei* (Neumayr) by Sequeiros ([19] pl. 27, fig. 2), referrable to *Cubaspidoceras* Myczyński, 1976, Middle Oxfordian, Bifurcatus Zone, Sierra Gorda, Granada, Spain

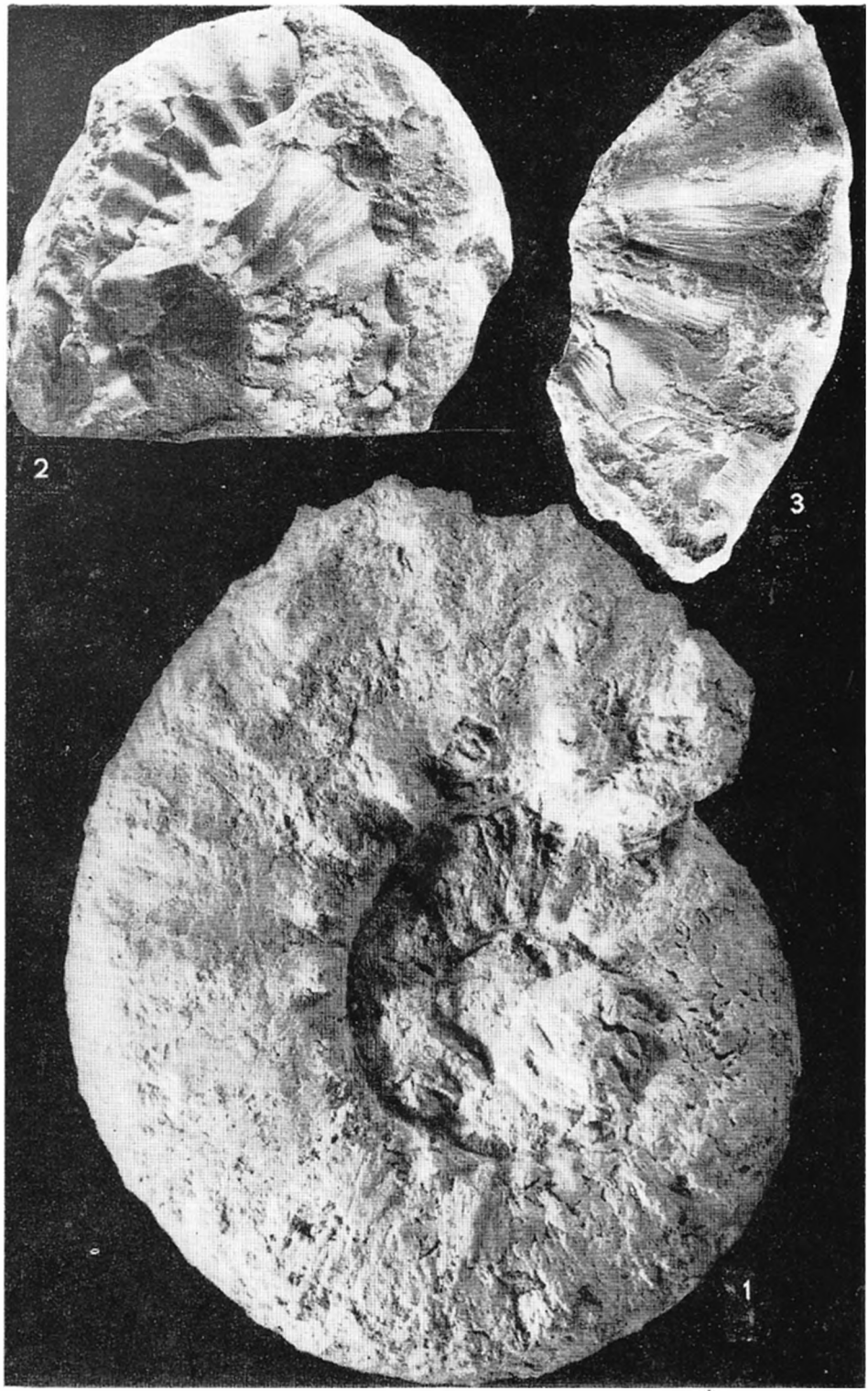

PLATE 7

Fig. 1: *Euaspidoceras (Euaspidoceras)* cf. *imlayi* Myczyński, Upper Oxfordian, Bimammatum Zone, lower part of Hypselum Subzone, Kamyk near Częstochowa, Poland, nat. size. Fig. 3: ? *Cubaspidoceras* sp., Oxfordian (presumably Upper Oxfordian), Caracoles area, Chile, nat. size, Fig. 3: *Euaspidoceras* sp. with very well developed umbilical spines, Oxfordian (presumably Upper Oxfordian), Caracoles area, Chile, nat. size

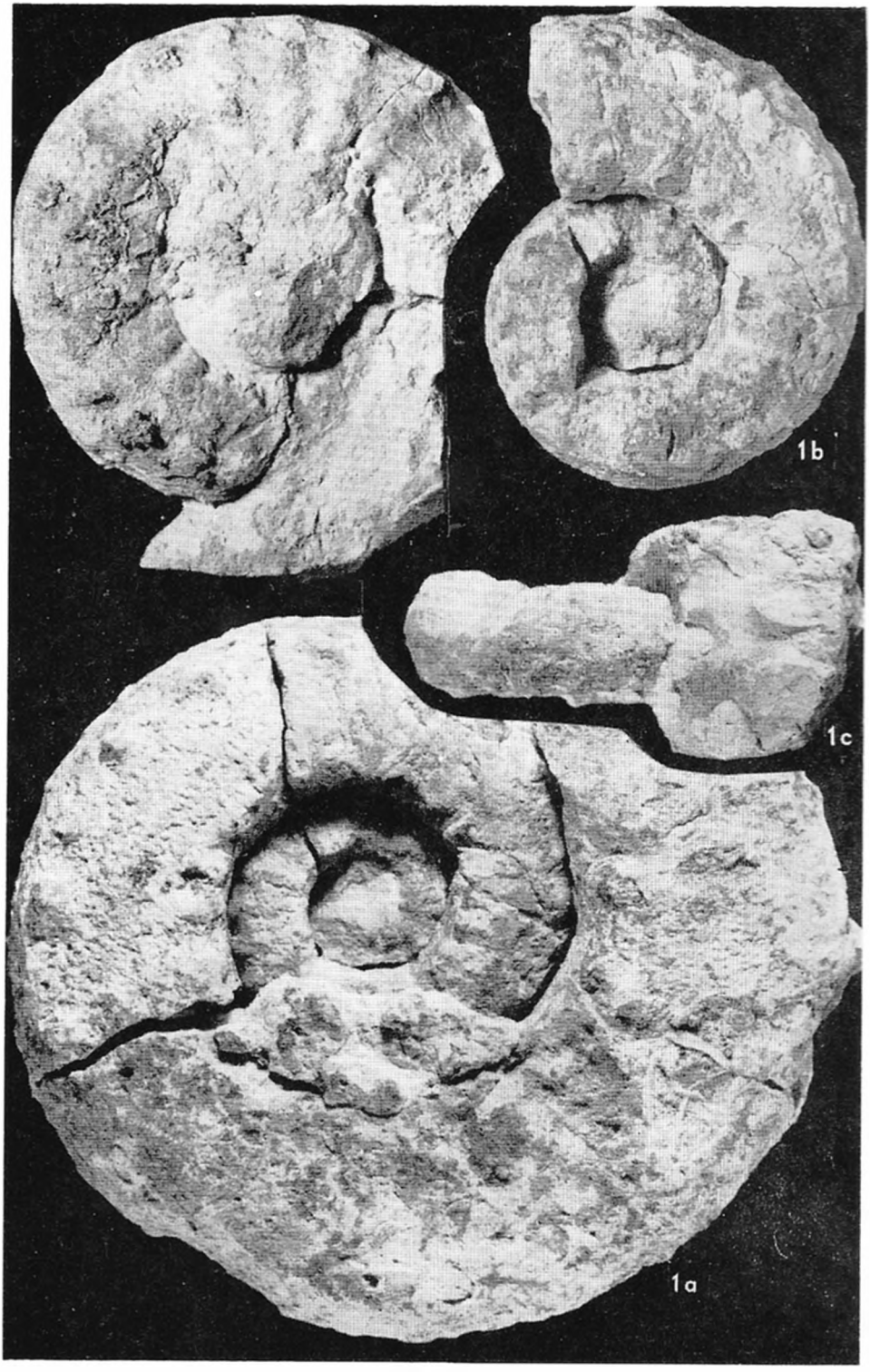

PLATE 8

Fig. 1a—c: *Euaspidoceras (Euaspidoceras)* cf. *imlayi* Myczyński, Upper Oxfordian, Bimammatum Zone, lower part of Hypselum Subzone, Kamyk near Częstochowa, Poland, side view of the specimen and side and apertural views on inner whorls. Fig. 2: *E. (E.)* cf. *costatum* (Qu.), age and locality as above, nat. size

by rather innumerous, usually poorly dated and insufficiently preserved material. This is especially the case of the genus *Clambites* the type specimen of which has a worn-out sculpture and inner whorls damaged presumably in the course of freeing it from rock (see photo in Miller [15], pl. 6, fig. 1). The type specimen shows some trend to obliteration of sculpture but not the development of umbilical spines typical of the Cuban fauna as the translocation of umbilical tubercles is much less advanced.

The type specimens of *Aspidoceras tietzei* Neumayr and *Ammonites radisense* d'Orbigny (refigured here in pl. 4, fig. 3, and pl. 4, fig. 2, respectively) are essentially similar to that of the genus *Cubaspidoceras* in sculpture and compression of the outer whorl as well as in the moderately involute coiling, differing in tubercles of the inner row set perpendicular to whorl sides and not directed inwards over the umbilicus. Moreover, the type specimens of these European taxa are too poorly dated to be recognized as sufficient from the standpoint of current requirements. That of *Ammonites radisense* is said to be derived from the Canaliculatus Zone, and that of *Aspidoceras tietzei* from the Transversarium Zone, that is from the intervals which would correspond to the Antecedens, Transversarium, Bifurcatus and possibly even lower parts of the Bimammatum Zone in the modern zonal schemes. Other specimens close to the type of *A. tietzei* are known from the Bifurcatus and Bimammatum Zones [3, 19, 9] but also from the Lower Oxfordian [14], and those close to *Ammonites radisense* from the Lower Bimammatum Zone [11] and possibly older strata. These European specimens may be easily placed in the genus *Pseudowaagenia* Spath, 1931, as it was formerly suggested by Andrusov [1] and Brochwicz-Lewiński [5]. The type species of that genus, *Ammonites haynaldi* Neumayr, 1873, is considered to be of Kimmeridgian age which suggests that we deal here with a fairly conservative line. The differences between *Cubaspidoceras* and *Pseudowaagenia* are mainly connected with much more involute coiling, more compressed whorls, and heavier umbilical spines and their orientation in the former. Some specimens formerly allocated in *Pseudowaagenia* may, therefore, be transferred to *Cubaspidoceras*. This is the case of *Pseudowaagenia bathori* Herbich figured from the Upper Oxfordian or Lower Kimmeridgian of Portugal by Geyer ([12] pl. 17, fig. 1) as well as the specimen figured as *Clambites (Neaspidoceras) tietzei* (Neumayr) from the Bifurcatus Zone of Spain by Sequeiros ([19] pl. 27, fig. 2). It follows that specimens referrable to *Cubaspidoceras* are occasionally found in the Bifurcatus and higher zones in Europe. The former and fragments recorded in these and younger strata indicate that the stratigraphic range of that genus may also cover the uppermost Oxfordian and perhaps the lowermost Kimmeridgian, too.

What is worth stressing is the similarity of *Cubaspidoceras* Myczyński,

1976, and *Physodoceras* Hyatt, 1900, in involute coiling, prominent spines directed inwards over the umbilicum and disappearance of external tubercles. The differences are limited to markedly more compressed and flat-sided whorls and relic external tubercles still present on penultimate and sometimes even ultimate whorl of the former. Should the occurrence of *Cubaspidoceras* in higher parts of the Bimammatum Zone be confirmed it would mean that this genus may comprise ancestors of *Physodoceras*, the forerunners of which are known from the uppermost parts of that zone.

In the light of the data concerning the stratigraphic ranges of European specimens closely resembling or related to Cuban *Euaspidoceras* and *Cubaspidoceras*, the Cuban strata bearing them may be correlated with the lower parts of the Bimammatum Zone and/or Bimammatum/Bifurcatus junction beds in Europe. This is further supported by the record of *Mirosphinctes* Schindewolf, 1926, regarded hitherto as an index of pre-Bimammatum age of the Cuban faunas, in the Bimammatum Zone of Spain [23]. However, this is not the only admissible solution.

Older aspidoceratids with prominent umbilical spines and the problem of the recurrence of such morphotypes. An alternative correlation is suggested by the records of similar specimens with prominent inwards directed umbilical spines in markedly older strata. This is the case of *Euaspidoceras (Euaspidoceras)* cf. *catena* (Sowerby) found in the middle Plicatilis Zone in France ([4] see also pl. 6, fogs 1–2 here), and other specimens (see pl. 6, fig. 3a–b) from coeval strata in Poland. These specimens suggest that we may be dealing here with the recurrence of some morphotypes (see [6]). Ammonite fauna from the base of the Antecedens Zone (or Antecedens Subzone of the Plicatilis Zone) appears to be dwarfish in relation to that from higher horizons and overlying the Transversarium Zone [6, 4], similarly as that from the turn of the Bifurcatus and Bimammatum times. Reduction in size of the *Euaspidoceras* fauna during the Bifurcatus times [6, 19] has resulted in the origin of dwarfish individuals, less than 15 cm or even 10 cm in size, typical of the Bifurcatus/Bimammatum juction beds. This dwarfish assemblage primarily comprises *E. (Euaspidoceras) hypselum* (Oppel), characterized by very heavy ornamentation and depressed, subrectangular whorl shape, as well as the *E. (E.) costatum-striatocostatum* group with less depressed whorls, much weaker ribbing and tuberculation, and the above-mentioned trend to develop inward-directed spines in place of umbilical tubercles perpendicular to whorl sides.

The specimens from the basal parts of the Antecedens Zone and the underlying strata in France and Poland appear to be also affected by an advanced reduction in size. The assemblage of that age comprises individuals similar to those typical of those mentioned above: the specimens

described and figured as *E. (E.) catena* (Sowerby) by Bourseau [4] and *E. (E.)* sp. *A* here (pl. 6, fig. 3a–b) are similar to those of the *E. (E.) costatum-striatocostatum* group and some others resemble those of the *E. (E.) hypselum* group.

It follows that aspidoceratids with spines directed inwards over the umbilicus appeared twice during the Oxfordian in Europe: at first at the turn of the Episcopalis/Paturattensis and Antecedens times and, after fairly long break, at the turn of the Bifurcatus and Bimammatum times. Not much is known about aspidoceratids from upper parts of the Bimammatum and Planula Zones but it may be stated that small-sized aspidoceratids with prominent umbilical spines became once more common in the corresponding time interval (*Physodoceras* and possibly other taxa). Further material is necessary for stating whether these occurrences are continuous or not. Should discontinuity be observed, that would mean that the trend to develop prominent umbilical spines is determined by a decrease in ultimate shell size, i.e. that it is size dependent. If this is the case it will be necessary to look for missing links of this evolutionary series among normal- or even large-sized aspidoceratids.

It should also be noted here that the possible dependence of the development of prominent umbilical spines on the ultimate size of ammonite shell would imply the limited stratigraphic value of such feature.

Biogeographic comments. The available data suggest that the trends to develop prominent spines directed inwards over the umbilicus and to compress the outer whorl are either typical of European (western-Tethys) aspidoceratids or at least they seem to be displayed for the first time in the lower Middle Oxfordian (Antecedens Zone or even lower horizons) fauna in Europe. The status of Cuban aspidoceratids displaying the above features may be still unclear but there is more and more evidence of their close affinity with the European ones. The trends are also traceable in the newly obtained coeval aspidoceratid fauna from Chile (kindly made available by G. Chong Diaz and at present studied by the authors) but not in hitherto figured representatives of the Indo-Malgasian fauna. If this is the case. the Cuban (and possibly Chilean) aspidoceratids displaying the above-discussed trends would give further support for the connections between the western Tethys and Cuba and other parts of Central and South Americas in the Oxfordian. For evidence of faunal exchange between these regions along roughly the same seaway in the Middle Jurassic see Westermann and Riccardi [20] and Westermann [21].

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REFERENCES

[1] D. Andrusov, *Étude géologique de la zone des Klippes internes des Carpathes Occidentales*, Geol. Prace Slov. Akad. Vied a Úm., **34** (1951), Bratislava.

[2] J. W. Arkell, *Jurassic geology of the world*, Edinburg–London, 1956.

[3] A. Barbulescu, *Stratigrafia jurasicului din vestul Dobrogei centrale*, Edit. Acad. Republ. Soc. Roman., Bucuresti, 1974, 1–159.

[4] J.-P. Bourseau, Nouv. Arch. Mus. Hist. Natur. Lyon, **15** (1977), 1–116.

[5] W. Brochwicz-Lewiński, Bull. Ac. Pol.: Terre, **24** (1976), 37–46.

[6] W. Brochwicz-Lewiński, Z. Różak, ibid., **22** (1974), 113–125.

[7] W. Brochwicz-Lewiński, Z. Różak, Przegląd Geol., **24** (1976), 659–660.

[8] W. Brochwicz-Lewiński, Z. Różak, Bull. Ac. Pol.: Terre, **28** (1978), 47–51.

[9] P. Dorn, Palaeontographica, **74** (1931), 1–92.

[10] D. M. Duong, *L'Oxfordien Moyen et Supérieur à Facies Grumeleux de la Cluse de Chabrièrss (Basses-Alpes): milieu de sédementation, biostratigraphie, paleontologie*, D. Sc. thesis no. 384, Université Claude Bernard, Lyon, 1974, p. 140.

[11] R. Enay, Haliotis, **6** (1976), 97–118.

[12] O. F. Geyer, N. Jb. Paläont. Abh., **118** (1963), 182–196.

[13] J. Kutek, A. Pszczółkowski, A. Wierzbowski, Acta Geol. Polon., **26** (1976), 299–319.

[14] P. L. Maubeuge, Tätber. naft. Ges. Basell, **29** (1975), 40–338.

[15] A. Miller, *Die subfamilie Euaspidoceratinae Spath (Ammonoidea); Morphologie, Taxionomie, Stratigraphie, Phylogenie*, D. Sc. thesis Eberhard-Karls-Universität, Tübingen, 1968, p. 169.

[16] R. Myczyński, Acta Geol., Polon., **26** (1976), 261–297.

[17] F. A. Quenstedt, *Die Ammonites des schwäbischen Jura. III. Der Weiss Jura*, E. Schweizerbart, Stuttgart, 1888, 816–1140.

[18] *Revision der Gattungsnamen und Untergattungsnamen (Die Ammoniten des Schwäbischen Jura)*, bearbeitet von der Deutschen Subkommission für Jura-Stratigraphie, E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, 1974, p. 52.

[19] L. Sequeiros, *Paleobiogeografia del Calloviense y Oxfordense en le sector central de la Zona Subbetica*, Thesis Doctorales de la Universidad de Granda no. 65, Granda, 1974, p. 536.

[20] G. E. G. Westermann, A. C. Riccardi, *Middle Jurassic ammonite distribution and the affinities of the Andean faunas*, Primer Congreso Geologico Chileno, vol. I, Santiago de Chile, 1976, 23–39.

[21] G. E. G. Westermann, *Ammonite biochronology and biogeography of the Circum-Pacific Middle Jurassic*, Cephalopod Newsletter, **4** (1980), 10–11 (to be published in extenso in proceedings of Symposium on the Ammonoidea, York, England, 24-30 August, 1979, Pergamon Press, Cambridge, 1981).

[22] A. Wierzbowski, Acta Geol. Polon., **26** (1976), 137–260.

[23] L. Sequeiros, Acta Geol. Hispan., **12** (1977), 35–37.

Р. Мычиньски, В. Брохвич-Левиньски, **О соотношении кубинских и европейских оксфордских аспидоцерас и их стратиграфическое значение**

Тенденцию развития больших желваков, направленных внутрь пупка, а также сплющивания внешнего витка, типичную для аспидоцерас (*Ammonoidea*) оксфорда Кубы, можно прободить и в европейской фауне. Позиция кубинских оксфордских аспидоцерас до сих пор остаётся в некотором роде спорной, тем не менее растёт число доказательств их близкого родства с европейскими. Аспидоцерасы, отличающиеся вышеупомянутыми свойствами дают всё больше доказательств тому, что в оксфорде мог происходить обмен фауной между западной частью Тетиды и Кубой, а возможно и Южной Америкой.