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A new ammonite fauna from the Oxfordian of the Pinar del Rio province, western Cuba

ABSTRACT: The paper deals with ammonite fauna recorded for the first time from the Oxfordian of the Pinar del Río province in western Cuba. The ammonites found in the Jagua Fm. (Pimienta Member) in the Sierra de los Organos, and the Francisco Fm. in the Sierra del Rosario belong to the genera: *Ochetoceras* Haug, 1885, *Glochiceras* Hyatt, 1900, *Euaspidoceras* Spath, 1931, *Cubaspidoceras* gen. n., and *Mirosphinctes* Schindewolf, 1926. Seven new species and three new subspecies are described and the possibility of distinguishing several other new species is suggested. The ammonite-bearing strata are assumed to be of late Middle Oxfordian and possibly earliest Late Oxfordian age.

INTRODUCTION

In Cuba up to the present the Oxfordian ammonites were known from the Jagua Formation of the Sierra de los Organos in the Pinar del Río province (Text-fig. 1), or more precisely, the strata assigned to the Jagua Vieja member by Herrera (1961). The Jagua Vieja Member comprises limestones with clay shale intercalations and calcareous concretions (*"quesos"*). The concretions yield numerous well-preserved ammonites which were the subject of studies by O'Connell (1920), Sánchez-Roig (1920, 1951), Jaworski (1940), Judoley & Furrazola-Bermúdez 1968) and recently by Wierzbowski (1976).

The ammonites described here belong to a younger Oxfordian ammonite assemblage recently discovered in Sierra de los Organos and Sierra del Rosario in Pinar del Río province, western Cuba (*cf.* Text-fig. 1). In Sierra de los Organos the ammonites were found in the Pimienta Member of the Jagua Fm., and in Sierra del Rosario — in the Francisco Fm. (*cf.* Pszczółkowski *in*: Kutek & al. 1976). Moreover, in the latter region the older ammonite assemblage corresponding to that known from the Jagua Fm. in Sierra de los Organos was found for the first time (*cf.* Myczyński & Pszczółkowski 1973). The investigated ammonites were found during the fieldworks connected with preparation of the Geological Map of Pinar

del Río Province by the Polish-Cuban team of the Polish Academy of Sciences and Cuban Academy of Sciences. In the course of these works the present author found a new ammonite fauna in the Jagua Fm. (R. Myczyński — "Nueva fauna de

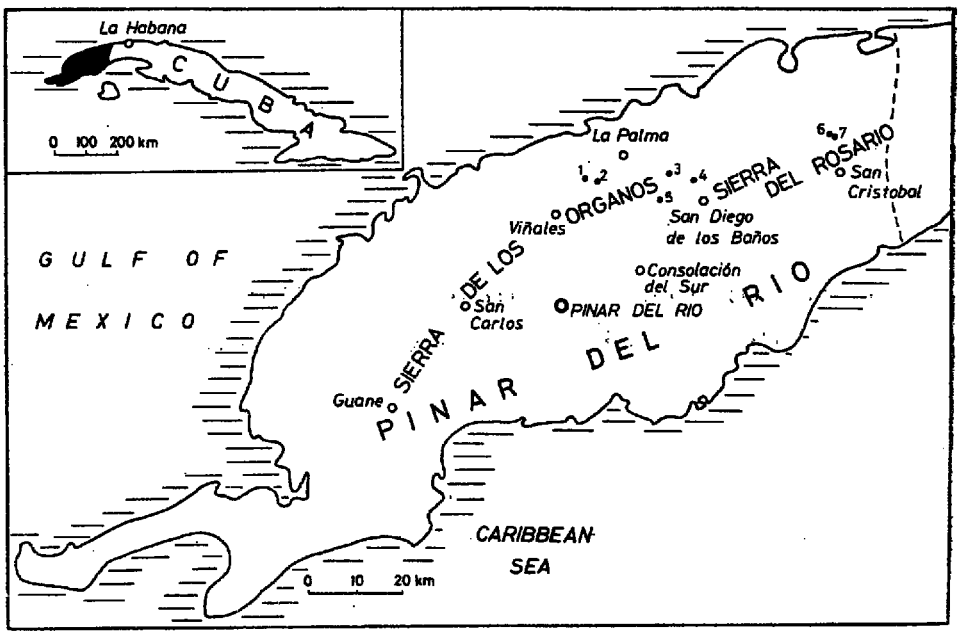

Fig. 1. Investigated faunistic localities (*1—7*) in the Pinar del Río province (inset shows its position in Cuba)

1 Mogote La Mina *I* & La Mina *II*, *2* Mogote Pancho Luis, *3* Galalón, *4* Macagual, *5* Hoyo de Sierra, *6* Loma Calabrote, *7* Brujito

ammonites de la formacion Jagua colectada en la region Viñales" — communication presented at the *Vth* Scientific Session of the Cuban Academy of Sciences in Havana, May 31st, 1973). The ammonites were found in the vicinity of Viñales. Similar fauna was subsequently stated nearby Brujito NW of Soroa in Sierra del Rosario by A. Pszczółkowski (*cf.* Myczyński & Pszczółkowski 1973), in shaley-carbonate series with calcareous concretions and sometimes with sandstone intercalations, that separates the strata of San Cayetano and Artemisa formations. These strata, originally described as "transitional beds" by Pszczółkowski (1971), were subsequenty interpreted as a separate lithostratigraphic unit, the Francisco Fm. (Pszczółkowski *in*: Kutek & al. 1976).

In discussion of the stratigraphy of the Jurassic of Sierra de los Organos the author accepted (Text-fig. 2) somewhat modified lithostratigraphic schema proposed by Herrera (1961), whose Pan Formation (= Azucar Fm. of Hatten, 1957) is here called as the lower member of the Jagua Fm. In order to avoid the existing confusion connected with the use of that name, this lithostratigraphic unit is here named as the Pan

Azucar Member (Wierzbowski 1976). Red shales with numerous ammonites, known from Sierra de los Organos (de la Nuez 1972, 1974), were

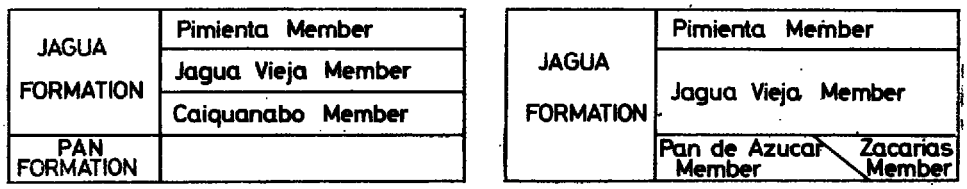

Fig. 2. Lithostratigraphic subdivision of the Jagua Formation used by Herrera (1961), and by the present writer (at right)

recently interpreted as the lower part of the Jagua Fm. by Wierzbowski (1976).

Acknowledgements. Thanks are due to the Chief of the Institute of Geology and Paleontology of the Cuban Academy of Sciences in Havana for the loan of the ammonites described in the paper. Thanks are also due to Dr. A. Pszczółkowski for rendering the amonites found in Sierra del Rosario and for discussion on some geological problems of that region. Warm thanks are due to Professor J. Znosko, Professor H. Makowski, Docent L. Malinowska, Docent J. Kutek, Dr. A. Wierzbowski, Dr. W. Brochwicz-Lewiński for fruitful discussions on some paleontological problems and help in gathering the literature, and to Professor R. Enay for helpful comments concerning the paleontological and stratigraphic interpretation of the ammonites investigated. Thanks are also due to the staff of the Institute of Geology and Paleontology of the Cuban Academy of Sciences, and especially to Esteban Diaz Montesino and the late Bernardo Marcin for the help during the field works. Photographs of ammonites were taken by Miss E. Mulawa of the Institute of Paleozoology of the Polish Academy of Sciences, and the drawings of ammonites by J. Dzik, M. Sc. of the same Institution.

AMMONITE-BEARING SECTIONS IN SIERRA DE LOS ORGANOS

In the Sierra de los Organos (*cf.* Text-fig. 1) the ammonites were found in two regions: Mogote La Mina (Text-fig. 3) and Caiguanabo (Text--fig. 4).

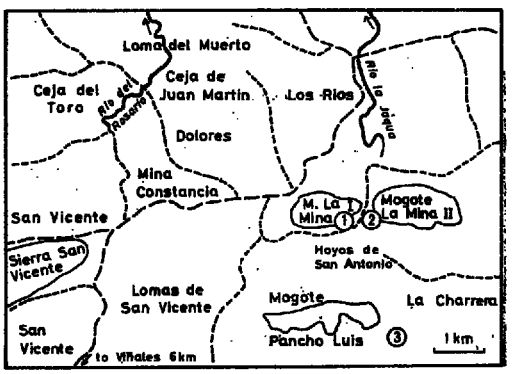

Fig. 3
Location of the exposures: (1) Mogote La Mina *I*, (2) Mogote La Mina *II*, (3) Mogote Pancho Luis

MOGOTE LA MINA *I*

Mogote La Mina *I* section begins with shelly limestones of the Pan Azucar Member (Text-fig. 5) of the Jagua Fm. They are represented by thin-bedded grey-bluish limestones with thin sandstone and cocquina intercalations, about 5 m thick. They are overlied by gray-bluish thin-bedded limestones with clay shale intercalations and with numerous calcareous concretions (*"quesos"*) up to 30 cm in diameter; the limestones, shales and concretions yield numerous ammonites. These strata, about 40 m thick, belong to the Jagua Vieja Member. Above the Jagua Vieja Member there occur gray-bluish, sometimes spotty limestones with not numerous intercalations of clay-marly shales about 5 m thick. In these limestones there were found the following ammonites: *Euaspidoceras (Euaspidoceras)* cf. *costatum* (Dorn), E. (E.) *striatocostatiforme* sp. n., *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n., *M. pinarensis torrei* sp. n., subsp. n., *M. pinarensis choffati* sp. n., subsp. n. Above there occurs 25-meter series of grey-bluish pelitic limestones passing upwards into dark-blue thick-bedded, sometimes strongly silicified limestones. The limestones occurring above the Jagua Vieja member are assigned to the Pimienta Member. They are overlied by massive limestone of the San Vicente Member of the Guasasa Formation (Viñales Limestones of Herrera, 1961).

MOGOTE LA MINA *II*

Mogote La Mina *II* section (Text-fig. 6) begins with red and brown shales bearing numerous poorly preserved ammonites and representing the Zacarías Member of the Jagua Fm. (*see* Wierzbowski 1976). The contact with the overlying limestones and shales with concretions (Jagua Vieja Member) is of tectonic nature. The latter deposis are strongly tectonically squeezed out attaining merely 3 m thickness. Above occur strata of the Pimienta Member of the Jagua Fm., represented by grey-bluish, medium-bedded limestones with not numerous shaly intercalations and yielding: *Euaspidoceras (Euaspidoceras) imlayi* sp. n., *E. (E.)* cf.

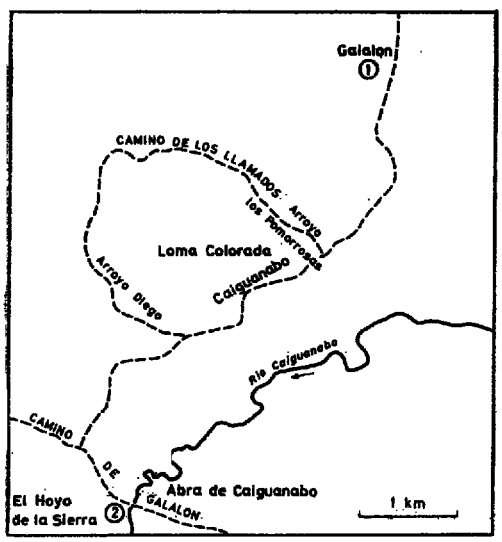

Fig. 4
Location of the exposures: (1) Galalón, and (2) Hoyo de la Sierra

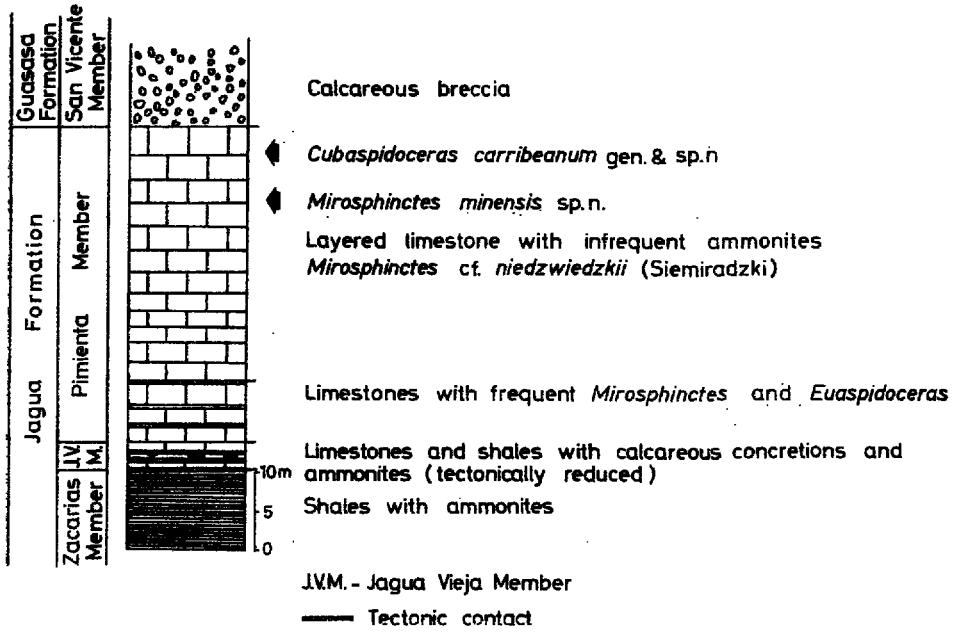

Fig. 5. Lithostratigraphic column of the Jagua Formation at the exposure Mogote La Mina *I*

costatum (Dorn), *Mirosphinctes* spp. and aptychi identified as *Lamellaptychus* sp. (Pl. 20, Fig. 7). The thickness of these strata is about 10 m. Upwards there occur dark-blue thick-bedded limestones with not numerous ammonites. In the middle part of that series the ammonite described here as *Mirosphinctes minensis* sp. n. and, somewhat below, *Mirosphinctes* cf. *niedzwiedzkii* (Siemiradzki) were collected. The specimen assigned to *Cubaspidoceras carribeanum* gen. n., sp. n. was found in the upper part of the limestones (*cf.* Text-fig. 6). The section ends with limestone breccia and massive limestones of the San Vicente Member of the Guasasa Fm.

PANCHO LUIS

This locality is situated about 2.5 km SW of Mogote La Mina (Text-fig. 3) and 4 km NE of Viñales. The section begins with limestones and shales of the Jagua Vieja Member and grey-bluish limestones of the Pimienta Member resting on the former along a tectonic contact. Both the Jagua Vieja and Pimienta members are markedly tectonically reduced, being 10 and 8 m thick, respectively. The ammonites are very scarce and poorly preserved in the Pimienta Member; the best preserved specimen is determined as *Mirosphinctes* cf. *niedzwiedzkii* (Siemiradzki).

GALALÓN

The Galalón locality is situated NE of Caiguanabo (*cf.* Text-figs 1 and 4). The strata here exposed are heavily tectonically disturbed. The section begins with sandstones and shales of the San Cayetano Fm. These are overlied by limestones

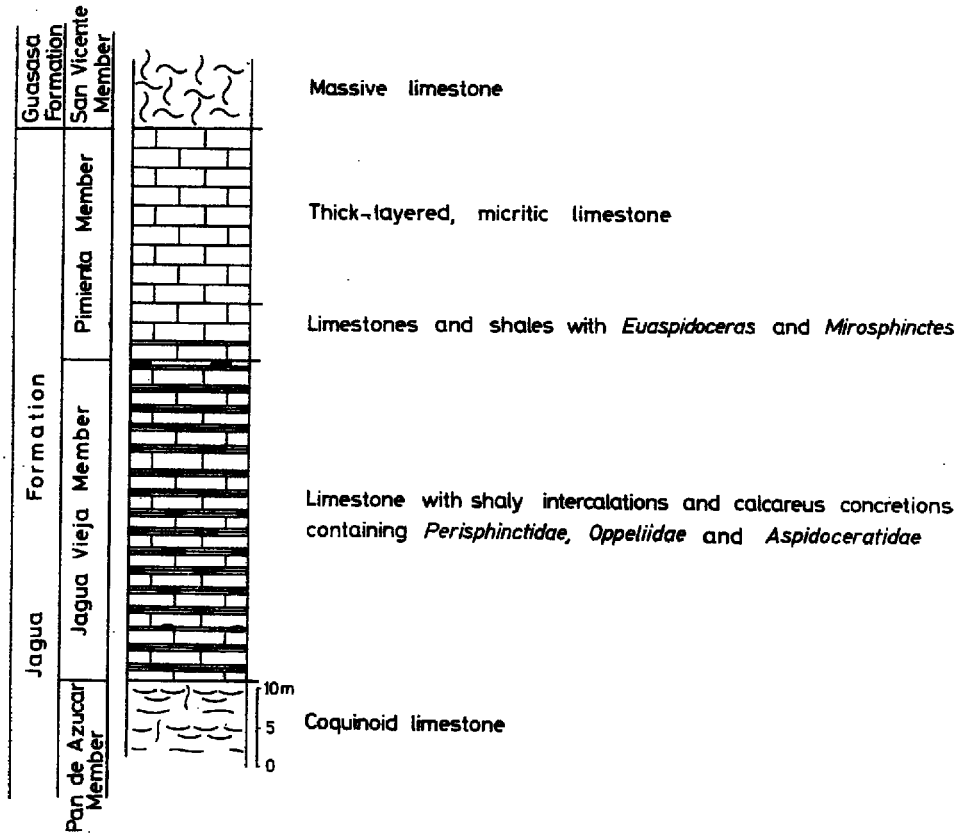

Fig. 6. Lithostratigraphic column of the Jagua Formation at the exposure Mogote La Mina *II*

and shales of the Jagua Vieja Member about 35 m thick, along a tectonic contact. The stratigraphically younger Pimienta Member is represented by 30 m series of thick-bedded dark-blue limestones and it seems that the lowermost part of the member has been tectonically squeezed out. A single, incomplete specimen identified as *Cubaspidoceras carribeanum* gen. n., sp. n. was found in the upper part of the member close to its contact with limestone breccia. The section ends with massive limestones of the Guasasa Fm. beginning with limestone breccia with cherts (San Vicente Member).

HOYO DE LA SIERRA

This locality is situated about 3 km SW of Caiguanabo (Text-fig. 4). The strata of the Jagua Fm. are here strongly tectonically disturbed which makes recognition of the sequence difficult. The strata of the Pimienta Member, overyling the Jagua Vieja limestones and shales with calcareous concretions about 50 m in thickness, begin with dark-blue limestones yielding the following ammonites: *Glochiceras (?Lingulaticeras)* sp., *Cubaspidoceras carribeanum* gen. n., sp. n., *Euaspidoceras (Euaspidoceras)* sp., *?Mirosphinctes* sp. *D.* These limestones pass upwards into dark-blue, strongly silicified limestones with very poorly preserved fauna. The Pi-

mienta Member attains about 45 m in thickness. The section ends with limestone breccia and massive limestones with cherts of the San Vicente Member of the Guasasa Fm. (Text-fig. 7).

OTHER LOCALITIES

The specifically unidentifiable *Mirosphinctes* were found in the vicinity of Guane in silicified limestones of the Pimienta Member of the Jagua Fm. cropping out along the road cut between Guane and Tumbadero. A single *Mirosphinctes* sp. was found in limestones of the Pimienta Member, c. 2 m above the Jagua Vieja Member in the Luis Lazo Valley.

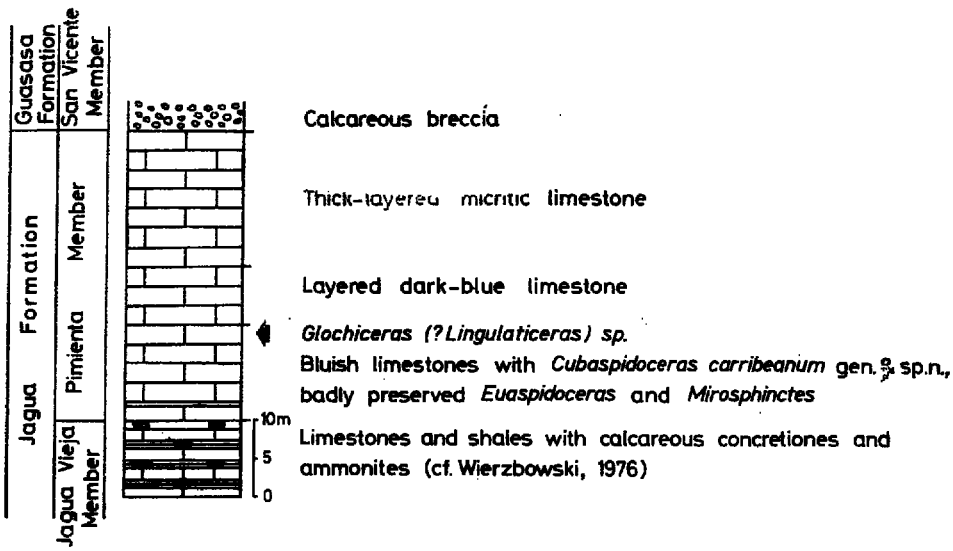

Fig. 7. Lithostratigraphic column of the Pimienta Member, Jagua Formation, at the exposure Hoyo de la Sierra

AMMONITE-BEARING SECTIONS IN SIERRA DEL ROSARIO

In Sierra del Rosario the ammonite fauna was found in the Francisco Fm. cropping out at Loma Esquina, Loma Calabrote and Macaqual (Text-figs 8 and 9) by Dr. A. Pszczółkowski. The Francisco Fm. is here developed as shales with calcareous concretions.

At Loma Esquina (Brujito; Text-fig. 8) the Francisco Fm. attains c. 20 m in thickness (Pszczółkowski *in:* Kutek & al. 1976). The ammonites collected from calcareous concretions occurring in the waste are represented by: *Ochetoceras* sp., *Glochiceras (Glochiceras)* aff. *subclausum* (Oppel), *G. (?Glochiceras)* aff. *carinatum* Aguilera & Castillo, *Euaspidoceras (Euaspidoceras)* cf. *costatum* (Dorn), *E. (E.)* sp. *A*, *Cubaspidoceras carribeanum* gen. n., sp. n., *Perisphinctes (?Otosphinctes) wierz-*

bowskii sp. n., *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n., and *M. pinarensis choffati* sp. n., subsp. n.

On south-western slopes of the Loma Calabrote hill, c. 1.5 km NW of Loma Esquina (Brujito) occur small ammonite-bearing calcareous concretions that contain *Euaspidoceras (Euaspidoceras)* cf. *costatum* (Dorn).

The Macaqual locality is situated along the road from San Diego de los Baños to Las Mill Cumbres, east of Macaqual (Text-fig. 9). Here crop out strongly tectonically disturbed strata of the Francisco Fm. represented by clay shales and

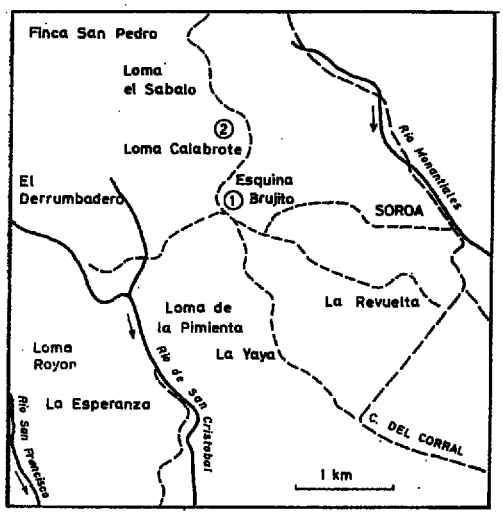

Fig. 8
Location of the exposures: (1) Brujito, and (2) Loma Calabrote

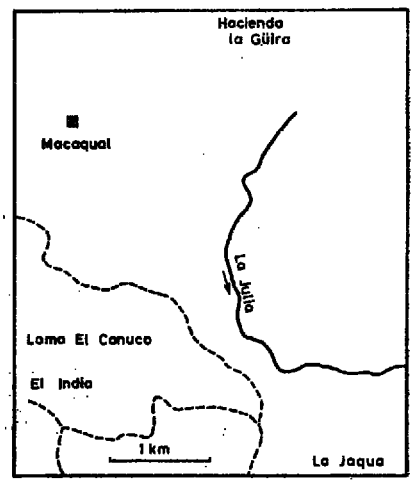

Fig. 9
Location of the exposure Macagual

marly limestones with calcareous concretions bearing not numerous ammonites. The thickness of the Francisco Fm. is estimated here at about 15—20 m. The contact of these strata and sandstones of the San Cayetano Fm. is tectonic. There were found the ammonites of the genera *Euaspidoceras*, *Cubaspidoceras* gen. n. (including the holotype of *Cubaspidoceras kuteki* gen. & sp. n.) and Mirosphinctes.

THE AMMONITE SUCCESSION

The field studies have shown the following succession of the ammonites in the Pimienta Member of the Jagua Fm. (Sierra de los Organos).

In the lowermost part there occur: *Euaspidoceras (Euaspidoceras)* cf. *costatum* (Dorn), *E. (E.) imlayi* sp. n., *E. (E.) striatocostatiforme* sp. n., *E. (E.)* sp., *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n., *M. pinarensis torrei* sp. n., subsp. n., *M. pinarensis choffati* sp. n., subsp. n., and *Cubaspidoceras carribeanum* gen. n., sp. n.

In the middle part there occur: *Mirosphinctes minensis* sp. n. and *M.* cf. *niedzwiedzkii* (Siemiradzki); and in the upper part: *Glochiceras (?Lingulaticeras)* sp., *Cubaspidoceras carribeanum* gen. n., sp. n. and *?Mirosphinctes* sp. *D.*

In the lowermost strata of Francisco Fm. (Sierra del Rosario) there were found: *Ochetoceras* sp., *Euaspidoceras (Euaspidoceras)* cf. *costatum* (Dorn), *E. (E.)* sp. *A*, *Cubaspidoceras kuteki* gen. n., sp. n., *Perisphinctes (?Otosphinctes) wierzbowskii* sp. n., *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n., *M. pinarensis torrei* sp. n., subsp. n., and *M. pinarensis choffati* sp. n., subsp. n. In upper part of that formation there were found: *Cubaspidoceras carribeanum* gen. n., sp. n., and *Glochiceras (Glochiceras)* aff. *subclausum* (Oppel).

The fauna gathered in the Jagua Fm. (Pimienta Member) in Sierra de los Organos, and in Francisco Fm. in Sierra del Rosario comprises:

Ammonite taxa	OUTCROPS: Jagua Fm. – Pimienta Member: La Mina I	La Mina II	Galalón	Hoyo de la Sierra	Pancho Luis	Francisco Fm.: Esquina Brujito	Loma Calabrote	Macagual
Ochetoceras sp.						+		
Glochiceras /?Lingulaticeras/ sp.				+		+		
Glochiceras /G./ aff. subclausum /Oppel/		+						
Euaspidoceras /Euaspidoceras/ imlayi sp. n.	+	+				+	+	
Euaspidoceras /Euaspidoceras/ striatocostatiforme sp. n.	+					+		
Euaspidoceras cf. costatum /Dorn/						+		+
Euaspidoceras sp. A								
Euaspidoceras sp.								+
Cubaspidoceras kuteki gen. & sp. n.		+	+	+		+		
Cubaspidoceras carribeanum gen. & sp. n.						+		
Perisphinctes /?Otosphinctes/ wierzbowskii sp. n.	+					+		
Mirosphinctes pinarensis pinarensis sp. & subsp. n.	+					+		
Mirosphinctes pinarensis torrei sp. & subsp. n.	+					+		
Mirosphinctes pinarensis choffati sp. & subsp. n.		+						
Mirosphinctes minensis sp. n.		+			+			+
Mirosphinctes of. niedzwiedzkii /Siemiradzki/						+		
Mirosphinctes sp. A				+		+		
Mirosphinctes sp. B						+		
Mirosphinctes sp. C						+		
?Mirosphinctes sp. D								
?Mirosphinctes sp. E								

SYSTEMATIC DESCRIPTIONS

The ammonites described in this paper are generally well-preserved, usually being represented by moulds sometimes with shell fragments. The most abundant and best preserved ammonite fauna was gathered in Loma Esquina (Brujito), La Mina *I* and La Mina *II* localities.

All the dimensions are given in mm, and the following measurements were taken: *D* — shell diameter, *H* — whorl height, *b* — thickness of the last whorl, *u* — umbilical diameter, *Wh* — ratio of the height of the last whorl to diameter, *Wb* — ratio of the thickness of the last whorl to diameter, *Ud* — ratio of umbilical diameter to diameter of the specimen, *NR* — number of umbilical ribs per whorl, $NR_{1/2}$ — number of umbilical ribs per half of whorl, NS — number of external ribs per whorl, $NS_{1/2}$ — number of external ribs per half of whorl.

The numbers under which the specimens are listed refer to the collections of the Paleontological Museum of the Institute of Geology and Paleontology of the Cuban Academy of Sciences in Havana.

Family **Oppeliidae** Bonarelli, 1894
Genus *OCHETOCERAS* Haug, 1885
Ochetoceras sp.
(Pl. 2, Fig. 1)

Material. — A single, small, somewhat deformed specimen (No. 2510t).

Specimen No.	D mm	h mm	u mm	Wh	Ud	$NR_{1/2}$
2510t	25.0	11.0	4.5	.44	.18	≈17

Discussion. — The specimen displays unicarinate venter typical of the genus *Ochetoceras* Haug, 1885. However, it is deformed and too small for specific identification.

Occurrence. — Francisco Fm. strata exposed at Esquina hill N of Brujito, Sierra del Rosario

Family **Haploceratidae** Zittel, 1884
Genus *GLOCHICERAS* Hyatt, 1900
Subgenus *GLOCHICERAS* Hyatt, 1900
Glochiceras (Glochiceras) aff. *subclausum* (Oppel, 1862)
(Pl. 2, Figs 3—6)

Material. — Five specimens (No. 2673a, b, c, d, e).

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud
2673a	18.0	8.0	5.5	5.0	.44	.30	.17
2673b	17.5	7.8	5.0	4.0	.44	.29	.22
2673c	19.0	9.0	6.0	5.0	.47	.31	.26
2673d	≈16.5	7.2	–	7.5	–	–	–
2673e	10.0	5.0	–	2.4	.50		.24

Description. — Whorls weakly convex, thickest at the mid-height. Spiral furrow passing somewhat below the mid-height, becoming markedly deeper at the body

chamber. Umbilicus moderately wide, and deep; umbilical margin somewhat rounded. Ventral side narrow. Peristome accentuated with constriction; peristomal margin concave in ventrolateral part, directly obliquely backward in dorsolateral part; lappets small.

Remarks. — The specimens are very close to *Glochiceras (Glochiceras) subclausum* (Oppel) and its representatives described and illustrated by Ziegler (1958) and Malinowska (1963), differing in furrow situated somewhat lower on whorl side and in slightly narrower ventral side. They differ from *G. (G.) amplicanaliculatum* of Wierzbowski (1976) in spiral furrow narrower and disappearing earlier and in rounded ventral side.

Occurrence. — Francisco Fm., Esquina hill N of Brujito, Sierra del Rosario.

Glochiceras (?Glochiceras) aff. *carinatum* Aguilera & Castillo, 1895 (Pl. 3, Figs 1–2)

Material. — Two specimens (No. 2513a, b).

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud
2513a	19.0	8.0	6.0	5.0	.42	.31	.26
2513b	10.5	5.0	3.8	3.0	.47	.36	.28

Description. — Coiling involute; whorl sides convex. Peristome with lappets; peristomal margin poorly preserved, presumably obliquely inclined backward in dorsolateral part. Ventral side rounded, narrow. Umbilicus narrow, deep; umbilical margin steep; umbilical wall steep. Spiral furrow wide, shallow, passing somewhat below the mid-height.

Remarks. — The specimens resemble *Glochiceras (Coryceras) carinatum* Aguilera & Castillo, known from the Lower Kimmeridgian of Mexico, differing in narrower and not so steep circum-umbilical area and in the development of dorsolateral part of the peristome; the latter species belongs to the subgenus *Coryceras* (cf. Ziegler 1958) whereas the Cuban specimens rather belong to the subgenus *Glochiceras.*

Occurrence. — The specimens were found together with *Mirosphinctes* and *Euaspidoceras* in the Francisco Fm. at Esquina hill N of Brujito, Sierra del Rosario.

Glochiceras (?Lingulaticeras) sp. (Pl. 2, Fig. 2)

Material. — A single poorly-preserved specimen.

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud
2522	27.0	11.0	–	7.0	.40	–	.25

Description. — Whorl sides slightly convex. Umbilical wall vertical; umbilicus wide, shallow. Inner whorls smooth. Wavy, as a rule biplicate ribs appear from

the middle of the last whorl; point of furcation situated at the mid-height; the ribs become somewhat swollen and slightly priorsiradiate near ventral margin and close to the peristome. Peristome lappeted; peristomal margin somewhat inclined towards the posterior in the dorsolateral part, concave in ventrolateral part.

Remarks. — The specimen resembles *Glochiceras (Lingulaticeras) nudatum* (Oppel) in shape and dimensions of the shell, differing from the type specimen and specimens assigned to that species by Ziegler (1958, p. 133, Pl. 12, Figs 6—11, Text-figs 44—46) in ribs less wavy and not so prorsiradiate near the venter. The specimen is, however, unsufficiently preserved for any unequivocal specific identification.

Occurrence. — Below the beds yielding *Mirosphinctes*, Pimienta Member, Jagua Fm., Hoyo de la Sierra locality, Sierra de los Organos.

Family **Aspidoceratidae** Zittel, 1895
Subfamily **Euaspidoceratinae** Spath, 1931
Genus *EUASPIDOCERAS* Spath, 1931
Euaspidoceras (Euaspidoceras) aff. *costatum* (Dorn, 1923)
(Pl. 3, Figs 3a—b, 4; Pl. 4, Figs 1—4; Pl. 5, Figs 1—7)

Material. — About 20 specimens (see Table) and some fragments (No. 2516b, 2506, 2511h, 2682e—2513l).

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	NR	$NR_{1/2}$
2517a	17.5	7.0	6.9	5.9	.40	.39	.33	–	–
2517b	36.0	14.0	13.3	13.2	.38	.37	.37	–	≈10
2517e	41.0	16.5	18.0	16.0	.40	.43	.39	18	–
2511a	16.0	6.0	–	5.2	.37	–	.32	–	9
2511b	14.2	6.0	–	5.2	.42	–	.31	–	–
2507h	15.2	6.0	6.1	5.0	.39	.42	.32	–	9
2507j	15.8	6.1	≈6.0	4.9	.38	.38	.31		7–8
2508a	?	15.0	14.5	15.0	–	–	–	–	≈10
2508b	31.0	12.0	≈11.5	11.5	.38	.37	.37	–	≈9
2517f	22.0	9.0	8.5	7.5	.40	.40	.34	–	9
2682	15.0	5.0	7.0	6.0	.43	.46	.40	–	9
2682a	16.5	6.1	6.0	6.5	.36	.36	.39	–	9
2682b	11.0	4.5	4.5	4.5	.40	.40	.40	–	–
2682d	5.0	1.9	–	1.8	.38	–	.37	–	–
2682e	24.5	9.5	–	10.0	.38	–	.40	–	9
2516a	13.5	6.0	6.1	5.0	.44	.42	.32	–	–
2506	73.0	23.0	–	≈30.0	.34	–	≈.41	–	≈9
2516b	–	16.5	–	–	–	–	–	–	–
2511h	–	27.0	–	–	–	–	–	–	–
2513l	–	42.0	–	–	–	–	–	–	–

Description. — Coiling evolute; whorl section subrectangular; whorls weakly overlapping. Whorl sides flattened; maximum whorl thickness somewhat above umbilical wall. Umbilicus wide, deep; umbilical margin somewhat rounded; umbilical wall almost vertical. Inner whorls ornamented with numerous fine riblets united in bunches at the umbilical margin. First thicker ribs with characteristic swellings at umbilical margin appear at about 9 mm diameter of whorl. External tubercles of the type of parabolic nodes appear at about 10 mm diameter, and umbilical tubercles

at about 16–18 mm diameter. The ornamentation consists of strong ribs somewhat bent downwards and fine riblets at about 15 mm diameter, and blunt, poorly visible internal tubercles situated at the umbilical margin and blunt, external tubercles situated at the ventral margin and somewhat extending towards the anterior, connected with the former with somewhat priorsiradiate ribs weakening at the mid-height; the venter is almost smooth at about 40 mm diameter. At larger diameters the internal tubercles and ribs are poorly marked whereas the external tubercles become sharper and elongate.

Remarks. — The specimens mostly represent inner whorls which makes difficult their specific identification. They resemble *Euaspidoceras (Euaspidoceras) costatum* (Dorn) (*cf.* Dorn 1931, pp. 22, 25) in the type of sculpture and whorl section, differing in somewhat smaller strength of the sculpture and dimensions. Numerous fine riblets from the innermost whorls and, partly, whorl section and dimensions bring these specimens close to *Euaspidoceras (E.) douvillei* Collot (*cf.* Collot 1917, p. 1, Fig. 3; Arkell 1940, p. 281, Pl. 63, Figs 3–4, Text-figs 96–98; Jeannet 1951, p. 211, Pl. 92, Fig. 4, and especially Pl. 98, Fig. 3, Pl. 100, Figs 1–2, Text-figs 496–498; Haas 1955, p. 178, Pl. 28, Figs 46–50 and especially Fig. 47) differing from the holotype of that species (Collot 1917, p. 9, Pl. 1, Fig. 3) in more flattened whorl sides, deeper umbilicus and earlier onset of tubercles. The specimens appear also somewhat similar to *E. (E.) biarmatum* Zieten, especially those figured by Dorn (1931, p. 12, Pl. 17, Figs 1, 2a–c, 3 and especially 6) and Jeannet (1951, p. 217, Pl. 103, Figs 1–2, Text-fig. 509) differing from the latter in more prorsiradiate ribs and more elongate internal tubercles. They differ from Cuban species "*E. o'connelli*" of Sánchez Roig (1920, p. 30, Pl. 13, Figs 1, 1a; 1951, p. 70, Pl. 13, Figs 1–2) in narrower umbilicus, whorl section and weaker ribs and tubercles and from *E. (E.) vignalense* Spath, described by Spath (1931, p. 592) and Sánchez Roig (1951, pp. 69–70), in sculpture, diamensions and whorl section. However, the comparison is limited to the diagnosis of that species given by Spath, as the holotype is poorly illustrated. According to Wierzbowski (1976), the specimens assigned to the latter species by Judoley & Furrazola-Bermúdez (1968, Pls 72–76) belong to another species.

Occurrence. — Francisco Fm., Esquina hill N of Brujito, and Loma Calabrote (specimens No. 2682, 2682a–b, 2682d–e, 2513), Sierra del Rosario.

Euaspidoceras (Euaspidoceras) striatocostatiforme sp. n.
(Pl. 8; Pl. 9, Fig. 1a–c)

Holotype: specimen No. 2260, figured in Pl. 8, Fig. 1a–c; housed in the Paleontological Museum of the Institute of Geology and Paleontology, Cuban Academy of Sciences, Havana.

Type horizon: Pimienta Member of Jagua Fm., Oxfordian.

Type locality: Mogote La Mina I locality, Sierra de los Organos, Pinar del Río province, Cuba.

Derivation of the name: from the similarity to the species *Euaspidoceras (Euaspidoceras) striatocostatum* (Dorn).

Paratypes: specimens No. 2258, 2266, 2262, 2265, 2260a.

Diagnosis. — Coiling evolute; whorl section subrectangular. Inner whorls ornamented with numerous fibrous riblets; and outer whorls with weaker umbilical, and stronger external tubercles connected by weak ribs; numerous fine strale parallel to the ribs. External tubercles somewhat obliquely elongated, about 13 per a half of whorl at 30 mm diameter. Long spines directed towards the umbilicus extend from the umbilical tubercles.

Material. — Six more complete (No. 2260, 2262, 2266, 2260a, 2265a, 2258) and four fragmentary (No. 2268, 2251, 2255a, 2265b) specimens.

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	$NR_{1/2}$
2260 holotype	48.7	19.7	≈15.0	17.0	.40	.31	.34	15
2258	27.0	11.0	9.0	9.0	.40	.33	.33	14
2266	12.2	5.4	4.5	4.2	.44	.36	.34	–
2260a	23.0	9.5	–	8.0	.41	–	.34	–
2265a	30.0	12.5	≈11.0	10.3	.41	≈.36	.37	13
2262	51.0	19.0	18.0	≈17.0	.37	.35	≈.33	14
2265b	14.0	6.0	6.2	4.8	.42	.44	.34	–
2255a	≈23.0	8.5	–	8.5	≈.37	–	≈.37	–
2251	–	29.0	–	–	–	–	–	–
2268	–	21.0	≈46.5	–	–	–	–	–

Description. — Coiling evolute; whorl section subrectangular; whorls weakly overlapping one another. Umbilical wall steeply inclined; umbilicus wide, moderately deep. Inner whorls ornamented with numerous fibrous riblets connected in bunches (consisting of 3 or 4 riblets) and often comma-shaped close to umbilical margin. Outer whorls ornamented with wavy ribs and two rows of tubercles; tubercels of inner whorl poorly marked, ending with spines; tubercles of outer whorl stronger than the former.

First umbilical tubercles appear at about 20 mm diameter, and first external tubercles — at about 13—15 mm diameter. The external tubercles, situated at ventral margin, are obliquely elongated towards the posterior; some of them, and especially those occurring at smaller diameters, achieve the shape of parabolic nodes. Wavy ribs begin at umbilical margin, reach the external tubercles and enter the ventral side where they become markedly prorsiradiate and weaker; ribs about 15 in number per half of whorl at 45 mm diameter. Numerous fine strae parallel to the ribs occur between them.

Remarks. — The specimens resemble the representatives of *E. (E.) striatocostatum* (Dorn) (*cf.* Dorn 1931, p. 37, Figs 4—7 and especially Figs 4, 5 and 7; Christ 1960, p. 112, Pl. 7, Fig. 6) in the style of sculpture, coiling and somewhat in dimensions. One of the specimens assigned to this species by Dorn (1931, Pl. 20, Figs 6a, b) differs from the remaining ones (Dorn 1931, Pl. 20, Figs 4—5, 7a, b) as well as from those figured by Christ and these described here in inner whorls ornamented with strong ribs and strong external tubercles and not fine riblets. The Cuban specimens differ from those assigned to *E. (E.) striatocostatum* (Dorn) in thinner whorls and their more regularly subrectangular section, steeper umbilical wall, umbilical tubercles situated lower on whorl side and in some other details of sculpture (ribs more wavy and more prorsiradiate on the venter).

The sculpture of inner whorls (numerous, commonly fine riblets set in bunches) is very close to that of inner whorls of forms assigned here to *Mirosphinctes pinarensis torrei* sp. n., subsp. n. One representative of that subspecies (specimen No. 2267) was found together with the holotype of *E. (E.) striatocostatiforme* sp. n. (specimen No. 2260). Moreover, *E. (E.) striatocostatiforme* sp. n. display external tubercles of the parabolic node type on its inner whorls. The similarity of sculpture of inner whorls of ammonites belonging to the genera *Mirosphinctes* and *Euaspidoceras* is widely known (Haas 1955, p. 152; Arkell 1957; Barthel 1957; Christ 1960). The similarity of inner whorls, the development of parabolic nodes and a joint occurrence of the genera *Mirosphinctes* Schindewolf, and *Euaspidoceras* Spath, indicate that these genera may comprise sexual dimorphs.

Occurrence. — Pimienta Member of Jagua Fm. in Sierra de los Organos, Mogote La Mina *I* locality. The species *E. (E.) striatocostatum* (Dorn), to which these specimens are somewhat similar, is known from the Euaspidoceras hypselum Subzone (Upper Oxfordian) of the Franconian Alb (Dorn 1931) and the Oxfordian of Sicily (Christ 1960).

Euaspidoceras (Euaspidoceras) imlayi sp. n.
(Text-figs 10—11; Pl. 7, Fig. 1a—b)

Holotype: specimen No. 2529, figured in Pl. 7, Fig. 1a—b; housed in the Paleontological Museum of the Institute of Geology and Paleontology, Cuban Academy of Sciences, Havana.

Type horizon: Pimienta Member of Jagua Fm., Oxfordian.

Type locality: Mogote La Mina *II* locality, Sierra de los Organos, Pinar del Río province, Cuba.

Derivation of the name: in honour of E. W. Imlay, the student of Cuban ammonites.

Diagnosis. — An *Euaspidoceras* characterized by subtrapezoidal whorl section, weakening of sculpture on outer whorls and umbilical tubercles situated very low at umbilical margin.

Material. — A single specimen.

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	NR
2529	150.0	61.0	57.0	64.0	.40	.38	.42	17

Description. — Coiling evolute; whorls very weakly overlapping, thickest at the umbilical margin; whorl section subtrapezoidal, with rounded ventral side. Umbilical wall almost vertical; umbilicus deep. Whorl sides flattened. Inner whorls ornamented with strong ribs, blunt umbilical tubercles situated very low at the umbilical margin and rounded external tubercles. Ribs disappear at ventral margin. On outher whorls the ribs and external tubercles become weaker and less distinct and the location of umbilical tubercles does not change.

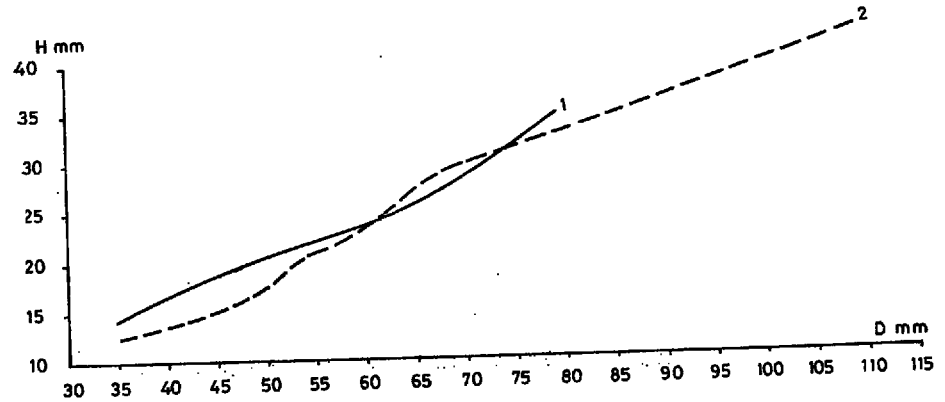

Fig. 10. Ratio of whorl height (*H*) to diameter (*D*) in (1) *Euaspidoceras (Euaspidoceras) imlayi* sp. n. (specimen No. 2529), and (2) *Euaspidoceras (Euaspidoceras)* sp. (specimen No. DD-1)

Remarks. — The specimen markedly differs from the representatives of *Euaspidoceras oconnellae* (Sánchez Roig) figured by Sánchez Roig (1920, p. 30, Pl. 13, Figs 1, 1a; 1951, p. 70, Pl. 13, Figs 1—2) and Judoley & Furrazola-Bermúdez (1968, p. 114), in more numerous ribs, whorl section and umbilical tubercles

situated lower on whorl side. It differs from *E. vignalense* Spath (see also remarks on that species) in whorl section, somewhat less numerous ribs and location of umbilical tubercles on the whorl side. The specimen resembles those

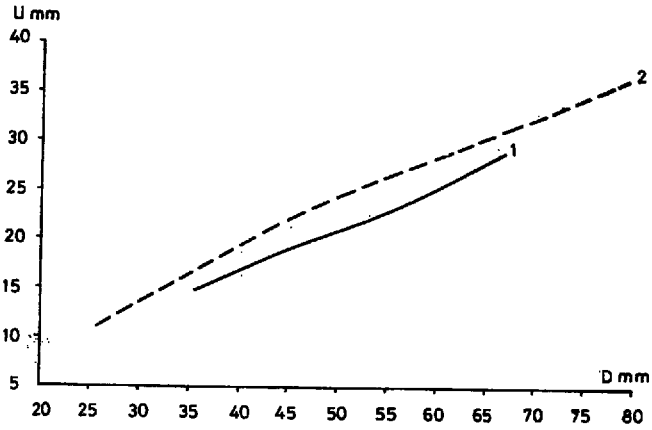

Fig. 11. Ratio of umbilical diameter (*U*) to diameter (*D*) in (1) *Euaspidoceras (Euaspidoceras) imlayi* sp. n. (specimen No. 2529), and (2) *Euaspidoceras (Euaspidoceras)* sp. (specimen No. DD-1)

assigned here to *Cubaspidoceras* gen. n. in the weakening of ornamentation on outer whorls, differing in subtrapezoidal whorl section, stronger ornamentation on inner whorls and more evolute coiling. Its inner whorls somewhat resemble *Euaspidoceras (Euaspidoceras) costatum* of Dorn (1931, p. 25, Pl. 22, Fig. 7) from which it differs in umbilical tubercles situated lower on whorl side, subtrapezoidal whorl section, dimensions as well as in the trend to weakening of sculpture on outer whorls.

Occurrence. — As the type locality.

Euaspidoceras (Euaspidoceras) sp. *A*
(Pl. 3, Figs 5—6)

Material. — Two specimens (No. 2673 and 2682c).

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	$NR_{1/2}$
2673	36.0	13.0	14.5	14.7	.36	.40	.40	≈15
2682c	12.0	5.0	4.5	4.5	.41	.39	.39	–

Description. — Coiling evolute; whorls weakly overlapping one another; whorl section subrectangular; whorl sides flattened; ventral side slightly rounded; umbilicus wide. Ornamentation consisting of two rows of tubercles connected by ribs; the ribs fine and numerous on inner whorls, converge in bunches close to umbilical margin.

Remarks. — The specimens are somewhat close to those described here as *Euaspidoceras (Euaspidoceras)* aff. *costatum* (Dorn) and *E. (Euaspidoceras)* sp., differing however in ornamentation and dimensions.

Occurrence. — Francisco Fm., Esquina hill N of Brujito (specimen No. 2673) and Loma Calabrote (specimen No. 2682c), Sierra del Rosario.

Euaspidoceras (Euaspidoceras) sp.
(Text-figs 10—11; Pl. 7, Fig. 2a—b)

Material. — A single well-preserved specimen (DD-1).

Specimen No.	D mm	h mm	u mm	Wh	Ud	NR
DD-1	75.0	27.5	29.0	.36	.38	24

Description. — Coiling evolute; whorls weakly overlapping; whorl section subrectangular; ventral side somewhat rounded, smooth; whorl sides weakly convex. Umbilical margin rounded; umbilical wall steep; umbilicus wide, deep. Inner whorls ornamented with riblets varying in strength. First umbilical tubercles appear close to the umbilical margin at about 15 mm diameter. External tubercles in the form of spines set parallel to whorl side presumblay appear earlier than the umbilical ones. The umbilical and external tubercles are connected by numerous weakly marked ribs. Shell surface covered with numerous fine striae.

Remarks. — The specimen somewhat resembles those assigned here to *Euaspidoceras (Euaspidoceras)* aff. *costatum* (Dorn), differing in the sculpture of inner whorls, ribs more numerous on outer whorls, more convex whorl sides and, partly, in dimensions. It differs from *Euaspidoceras oconnellae* (Sánchez Roig) in more numerous and finer ribs, and in dimensions (*cf.* Sánchez Roig 1951, Judoley & Furrazola-Bermúdez 1968), and from *Euaspidoceras vignalense* Spath in whorl section, weaker and somewhat denser ribbing, and dimensions (*cf.* Spath 1931, p. 592; Sánchez Roig 1951, pp. 69—70). It presumably represents a new species of the genus *Euaspidoceras* Spath, 1931.

Occurrence. — Oxfordian strata of Jagua Fm., Sierra de los Organos.

Genus *CUBASPIDOCERAS* gen. n.
Type species: *Cubaspidoceras kuteki* sp. n.

Derivation of the name: from Cuba.

Diagnosis. — Inner whorls *Euaspidoceras*-like; outer whorls markedly involute, strongly compressed. Umbilical tubercles in the form of long spine directed towards the umbilicus. External tubercles disappearing at larger diameters. Whorl sides ornamented with fine striae deverging fom umbilical spines.

Species assigned: — *Cubaspidoceras kuteki* sp. n., *C. carribeanum* sp. n.

Occurrence. — Oxfordian, Sierra de los Organos and Sierra del Rosario, Pinar del Río provonce, Cuba.

Discussion. — The specimens allocated in *Cubaspidoceras* gen. n. essentially differ from all the hitherto known representatives of the subfamily Euaspidoceratinae Spath, 1931. Their inner whorls appear similar to those of the genera *Euaspidoceras* Spath, 1931, and *Neaspidoceras* Spath, 1931, in the development of two rows of tubercles linked with flattened ribs, the outer of which is situated close to ventral margin. The genus *Cubaspidoceras* gen. n. differs from *Euaspidoceras* Spath, 1931, in whorl section (high-ovate, narrow, with markedly rounded ventral side), more involute coiling and ornamentation of outer whorls (replacement of umbilical tubercles by long spines directed towards the umbilicus and disappearance of ribs and external tubercles). The genus *Cubaspidoceras* gen. n. differs from *Neaspidoceras* Spath (*cf.* Spath 1931, p. 613; Arkell 1940, Jeannet 1951) in high-ovate section of outer whorls, involute coiling, and ornamentation consisting of fine striae diverging in

bunches from umbilical spines and characterized by disappearance of external tubercles at larger diameters, whereas some large *Neaspidoceras* bear external tubercles (*cf.* Choffat 1893, p. 66, Pl. 15, Figs 1—3; Spath 1931, p. 613).

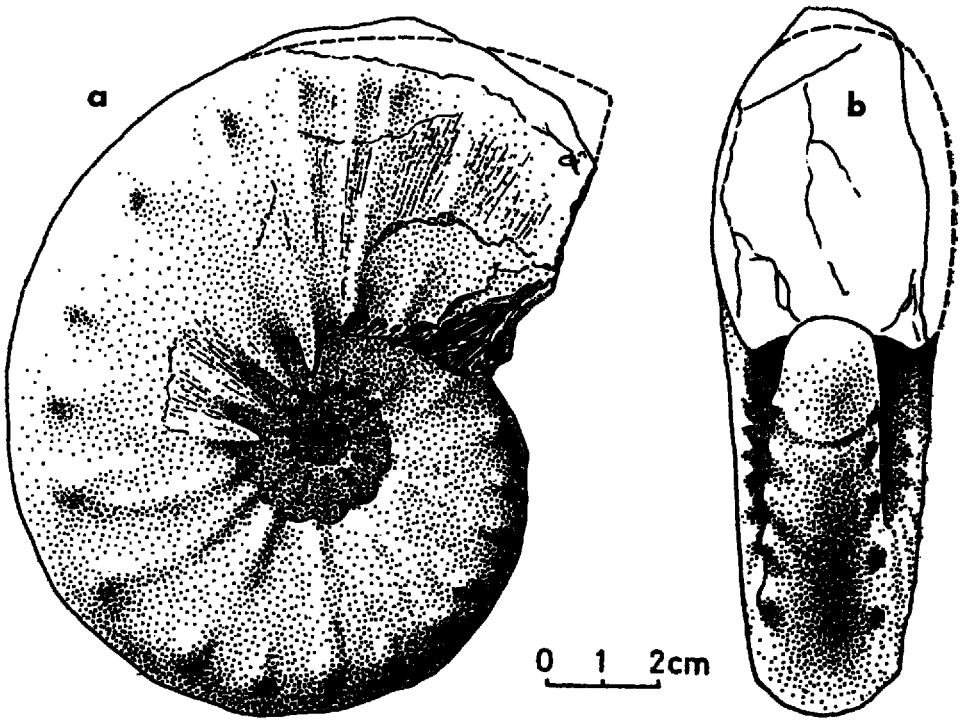

Fig. 12. *Cubaspidoceras kuteki* gen. n., sp. n.; specimen No. 2692ca (holotype)
a side view, *b* front view

The genus *Cubaspidoceras* gen. n. differs from *Glabrophysodoceras* Scott (*cf.* Scott 1943, p. 82; Arkell 1957, p. L 338) in umbilical tubercles situated lower on whorl sides, less involute coiling and in inner whorls ornamented and not smooth. It differs from *Aspidoceras* Zittel, 1868, in the mode of coiling, whorl section, and *Euaspidoceras*-like external tubercles situated much higher on sides of inner whorls. The Cuban specimens somewhat resemble *Physodoceras* Hyatt, 1900 (*cf.* Arkell 1957, p. L 338) in the sculpture of outer whorls consisting of umbilical spines and bunches of fine striae spreading from the spines, differing in markedly compressed whorl section and less involute coiling. The specimens here assigned to *Cubaspidoceras* gen. n. seem to display features transitional between those of the genera *Euaspidoceras* Spath, 1931, and *Physodoceras* Hyatt, 1900.

It should be noted that *Cubaspidoceras* gen. n. somewhat resembles *Aspidoceras (Pseudowaagenia) haynaldi* Neumayr, 1873, the type species of the subgenus *Pseudowaagenia* Spath, 1931, as well as some specimens assigned to that subgenus, e.g. *Pseudowaagenia* sp. figured by Brochwicz-Lewiński (1976, Pl. 5, Fig. 2) or other taxa, e.g. *Neaspidoceras tietzei* (Neumayr) presented by Miller (1968, Pl. 6, Fig. 6) in the development of outer whorls, differing in more *Euaspidoceras*-like inner whorls, external tubercles situated somewhat higher on whorl side, at the ventral margin, and much more compressed and higher outer whorls. Although umbilical tubercles

are poorly preserved on these representatives of *Pseudowaagenia* and their possible allies, it may be stated that they were not developed in the form of long spines partly obscuring the umbilicus, which are typical of *Cubaspidoceras* gen. n.

Cubaspidoceras kuteki sp. n.
(Text-fig. 12; Pl. 10; Pl. 11, Figs 1–3)

Holotype: specimen No. 2692ca, figured in Pl. 10, Fig. 1a—c, housed in the Paleontological Museum of the Institute of Geology and Paleontology, Cuban Academy of Sciences, Havana.

Type horizon: Francisco Fm., Oxfordian.

Type locality: Macagual locality, Sierra del Rosario, Pinar del Río Province, Cuba.

Derivation of the name: in honour of Docent J. Kutek, the student of the Upper Jurassic of Poland and Cuba.

Paratypes: specimens No. 2518, 2692cc, 2692cd.

Diagnosis. — Inner whorls *Euaspidoceras*-like; whorl section slightly compressed, high-ovate from c. 65 mm diameter; umbilical tubercles are replaced by long spines directed towards the umbilicus, external tubercles disappear, and ribs are replaced by fine striae spreading from umbilical spines and fading out higher on whorl side from about 40 mm diameter.

Material. — Four more complete (No. 2692ca, 2518, 2692cc, 2692cd) and five fragmentary (No. 2528, 2521, 2692cf, 2692ch, 2692ci) specimens.

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	$NR_{1/2}$
2692ca holotype	74.0	32.0	26.0	23.0	.43	.35	.31	11
2518	55.0	27.5	–	19.5	.40	–	.35	≈12
2692cc	29.0	13.0	12.0	9.0	.44	.41	.31	≈12
2692cd	54.2	21.5	24.0	19.2	.38	.45	.35	11
2692cf	–	21.0	21.0	14.0	–	–	–	–
2692ch	–	23.0	–	14.0	–	–	–	–
2692ci	–	19.0	–	–	–	–	–	–
2528	–	≈17.0	–	–	–	–	–	–
2521	–	–	≈17.0	–	–	–	–	–

Description. — Coiling initially evolute, later involute; whorl section subrectangular becoming finally high-ovate; whorl sides flattened, becoming convex from the middle of the last whorl; ventral rounded. Umbilical margin overhanging; umbilicus moderate in size, deep. Inner whorls ornamented with feeble umbilical and stronger external tubercles directed towards the posterior; umbilical and external tubercles connected with slightly prorsiradiate ribs, about 11 in number at 54.0 mm diameter. Umbilical tubercles situated at umbilical margin, and external — at ventral margin. The ornamentation changes on outer whorl: ribs are replaced by fine striae, external tubercles become less distinct and presumably disappear at larger diameters, and umbilical tubercles are replaced by spines about 6.5 mm in length, directed towards the umbilicus. Wide, weak constrictions seem to be marked on inner whorls.

Discussion. — The species *Cubaspidoceras kuteki* sp. n. differs from *C. carribeanum* sp. n. in more ovate and thicker whorls, not so early replacement of ribs by striae, and somewhat wider umbilicus. It somewhat resembles the specimen described as *Aspidoceras (Intranodites) spathi* by Collignon (1959, Pl. 94, Fig. 362; Pl. 95, Fig. 363), differing in trend to disappearance external tubercles, development of ribs, dimensions and coiling.

Occurrence. — Francisco Fm., Macagual Locality (specimens No. 2692ca, 2692cc, 2692cd, 2692cf, 2692ch, 2692ci), Sierra del Rosario; Jagua Fm. (Pimienta Member), Hoyo de la Sierra locality (specimens No. 2518, 2528, 2521; accompanied by the genera *Euaspidoceras* and *Mirosphinctes*), Sierra de los Organos.

Cubaspidoceras carribeanum sp. n.
(Text-fig. 13a—b; Pl. 9, Figs 2a—b, 3; Pl. 11, Figs 4—5)

Holotype: specimen No. 2502, figured in Pl. 9, Fig. 2a—b, housed in the Paleontological Museum of the Institute of Geology and Paleontology of the Cuban Academy of Sciences, Havana.

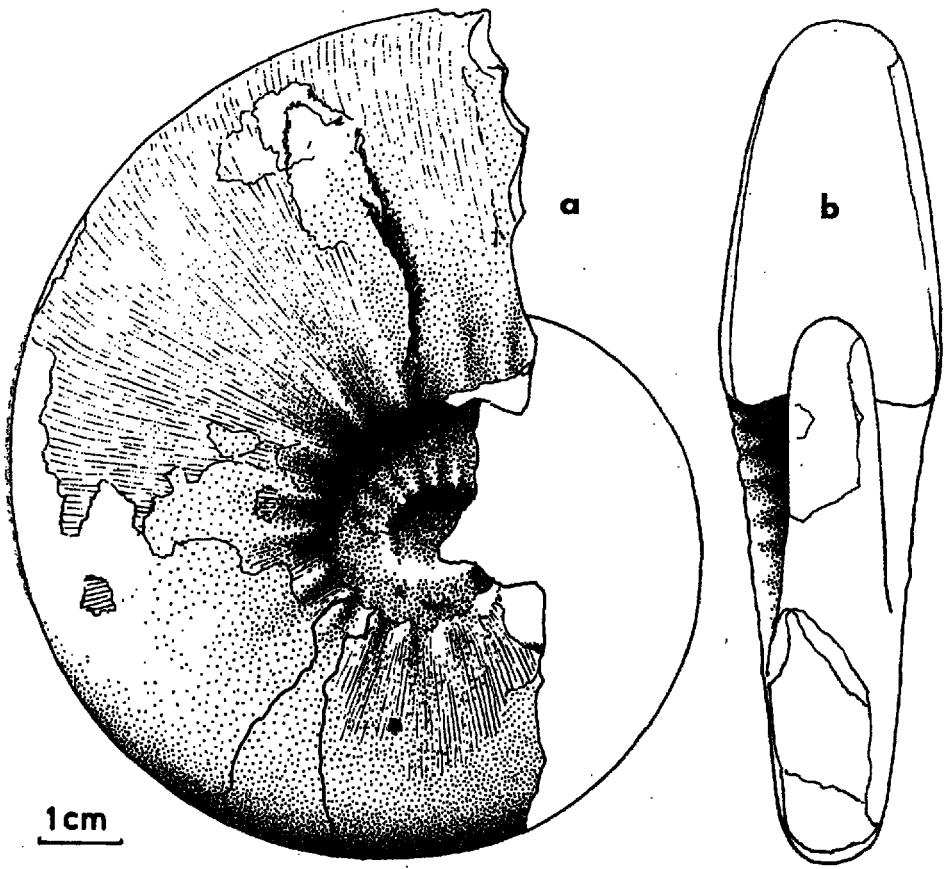

Fig. 13. *Cubaspidoceras carribeanum* gen. n., sp. n.; specimen No. 2502 (holotype)
a side view, *b* front view

Type horizon: Pimienta Member of Jagua Fm., Oxfordian.

Type locality: Mogote La Mina *II* locality, Sierra de los Organos, Pinar del Río province, Cuba.

Derivation of the name: from the Caribbean Sea.

Paratypes: specimens No. 2503, 2415, 2428.

Diagnosis. — Inner whorls with feebly tuberculation and ribbing; outer whorls high-ovate, compressed in cross-section, ornamented with umbilical spines and fine striae; ribs and external tubercles disappearing very early.

Material. — Eight specimens (No. 2502, 2503, 2415, 2428, 2421, 2419, 2676; 2544).

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud
2502 holotype	111.1	50.7	26.5	31.6	.45	.23	.28
2503	59.0	26.4	≈18.0	16.0	.44	≈.30	.27
2428	60.0	30.0	16.0	16.0	.50	.26	.26
2421	–	40.0	31.0	–	–	–	–
2415	46.0	–	–	–	–	–	–
2419	–	≈40.0	–	–	–	–	–
2676	–	52.0	–	–	–	–	–
2544	–	22.0	–	–	–	–	–

Description. — Coiling involute; whorl section high-ovate, compressed; whorl sides slightly convex; ventral side rounded, narrow. Umbilical margin slightly rounded, overhanging; umbilicus narrow and deep. Inner whorls ornamented with feeble ribs beginning with small swellings at umbilical margin, reaching fine ventrolateral tubercles situated at the margin of the ventral side, and disappearing at the venter. The ribs and ventrolateral tubercles disappear on outer whorls which are ornamented with long umbilical spines and fine striae.

Discussion. — Differences in respect to *Cubaspidoceras kuteki* sp. n. as given above.

Occurrence. — Jagua Fm., Pimienta Member, Mogote, La Mina *II* locality (specimen No. 2502), Hoyo de la Sierra (specimens No. 2415, 2421 and 2428) and Galalon (specimen No. 2544), Sierra de los Organos; Francisco Fm., Esquina hill N of Brujito (specimens No. 2503, 2676), Sierra del Rosario.

Family **Perisphinctidae** Steinmann, 1890
Genus *PERISPHINCTES* Waagen, 1869
Subgenus *OTOSPHINCTES* Buckman, 1926
Perisphinctes (?Otosphinctes) wierzbowskii sp. n.
(Text-figs 14—15; Pl. 11, Fig. 6a—b)

Holotype: specimen No. 2674 figured in Pl. 11, Fig. 6a—b; housed in the Paleontological Museum of the Institute of Geology and Paleontology of the Cuban Academy of Sciences, Havana.

Type horizon: Francisco Fm., Oxfordian.

Type locality: Esquina hill N of Brujito, Sierra del Rosario, Pinar del Río province, Cuba.

Derivation of the name: in honour of Dr. A. Wierzbowski, the student of the Oxfordian of Poland and Cuba.

Diagnosis. — A *Perisphinctes* characterized by almost rectangular whorl section and parabolic nodes.

Material. — The holotype only.

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud
2674 holotype	28.0	8.0	7.9	13.0	.28	.28	.46

Description. — Coiling evolute; whorl section almost rectangular (Text-fig. 14); whorls weakly overlapping; whorl sides and venter weakly flattened. Umbilical

wall steep, umbilicus wide and shallow. Ribs numerous, prorsiradiate; point of furcation covered by the successive whorl. Outer whorl ornamented with biplicate and, occasional, simple ribs. Simple ribs, directed backwards, sometimes diverge from the biplicate at umbilical margin. From the middle of the last whorl the ribs become more regular, slightly prorsiradiate, passing the venter with a forward twist; a weak siphonal furrow sometimes visible. Parabolic nodes small. Narrow, moderately deep constrictions, about 8 in number per whorl, marked on all the whorls.

Fig. 14
Whorl section of *Perisphinctes (?Otosphinctes) wierzbowskii* sp. n.; specimen No. 2674 (holotype)

Discussion. — The specimen resembles *Perisphinctes (Otosphinctes) siemiradzkii* of Enay (1966, p. 458, Pl. 26, Figs 1—3) in ornamentation of inner whorls, differing in almost rectangular whorl section, smaller thickness of the outer whorl and narrower umbilicus. The sculpture of the venter of *P. (?Otosphinctes) wierzbowskii* sp. n. is very similar to that of the specimen described as *P. (Otosphinctes) crotalinus* Siemiradzki by Enay (1976, Pl. 26, Figs 5c—d); the latter species is, however, characterized by stronger and less numerous ribs. The investigated specimen is somewhat close to those described as *Perisphinctes (Otosphinctes) birmensdorfensis* (Moesch) by Enay (1976, p. 463, Pl. 27, Figs 1—6; Text-figs 134—136) and recently allocated by Brochwicz-Lewiński (1973, Pl. 14, Figs 1—2) in the subgenus

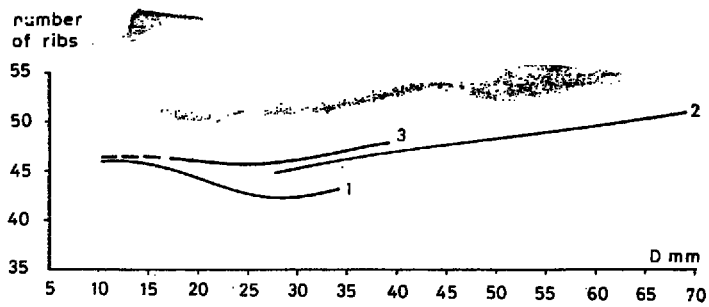

Fig. 15. Rib-curves of *Perisphinctes (?Otosphinctes) wierzbowskii* sp. n.
1 *Perisphinctes (?Otosphinctes) wierzbowski* sp. n.; specimen No. 2674 (holotype), 2 specimen illustrated by Enay (1966, pl. 26, fig. 2), 3 another specimen illustrated by Enay (1966, pl. 26, fig. 1)

Passendorferia of *Nebrodites,* differing in whorl section, less dense ribbing and less evolute coiling.

Occurrence. — Francisco Fm., Esquina hill N of Brujíto, Sierra del Rosario.

Genus *MIROSPHINCTES* Schindewolf, 1926
Mirosphinctes pinarensis pinarensis sp. n., subsp. n.
(Text-figs 16—17; Pls 12—15)

Holotype: specimen No. 2507a, figured in Pl. 12, 1a—c, housed in the Paleontological Museum of the Institute of Geology and Paleontology, Cuban Academy of Sciences, Havana.
Type horizon: Francisco Fm., Oxfordian.

Type locality: Esquina hill N of Brujito, Sierra del Rosario, Pinar del Río province, Cuba.

Derivation of the name: from Pinar del Río province where the holotype was found.

Paratypes: specimens No. 2674b, 2510, 2280b, 2256, 2507c, 2513, 2674m, 2516, 2677, 2675b, 2507b, 2507d, 2509g, 2692b, 2675, 2678, 2680, 2692c, 2509a.

Diagnosis. — Whorl section high-ovate; whorl sides strongly flattened; ventral side somewhat flattened, sometimes with shallow siphonal furrow. Inner whorls ornamented with coarse and some finer ribs. Primary ribs crescent-like, bent towards the posterior, moderately thick.

Material. — Twenty specimens (No. 2507a, 2674b, 2510, 2513, 2280b, 2256, 2507c, 2674m, 2516, 2677, 2675b, 2507b, 2507d, 2509g, 2678, 2692b, 2675, 2680, 2692c, 2509a) including three fragmentary.

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	NR	$NR_{1/2}$	NS	$NS_{1/2}$
2507a holotype	27.0	8.7	8.9	11.0	.32	.33	.40	28	14	16	34
2674b	24.5	8.0	8.2	10.0	.30	.33	.40	27	–	–	30
2510	25.2	8.0	8.0	10.0	.31	.31	.39	–	16	–	–
2280b	23.0	8.4	8.4	9.0	.36	.36	.39	–	16	–	–
2256	29.0	9.0	8.5	9.0	.32	.29	.32	–	15	–	32
2507c	14.5	5.5	6.0	5.5	.37	.41	.37	–	14	–	–
2513	17.5	6.5	6.8	6.0	.37	.38	.34	–	–	–	–
2516	20.0	6.6	7.2	7.6	.33	.36	.38	–	15	–	30
2507b	24.6	8.2	8.2	9.4	.33	.33	.38	–	15	–	31
2507d	21.0	7.5	7.4	7.5	.35	.35	.35	–	14	–	–
2678	24.3	7.5	8.5	9.5	.30	.34	.39	–	≈16–17	–	–
2680	22.3	7.5	7.5	8.5	.33	.35	.36	–	16	–	–
2509a	24.0	8.2	8.2	9.5	.34	.34	.39	–	15	–	31
2692b	22.0	7.7	7.5	8.0	.35	.35	.36	–	12	–	–
2675	18.0	6.5	–	7.2	.36	–	.40	–	15	–	–
2692c	27.5	9.0	–	11.0	.32	–	.38	–	≈14	–	–
2675b	10.5	3.7	4.5	4.0	.35	.35	.38	–	–	–	–
2677	–	5.0	6.2	–	–	–	–	–	≈16	–	–
2674m	≈22.5	8.5	9.0	8.0	≈.37	≈.39	≈.37	–	–	–	–
2509g	–	–	6.2	–	–	–	–	–	–	–	–

Description. — Coiling evolute; whorl section high-ovate to, sometimes, subrectangular; whorls overlapping to a quarter of their height, thickest somewhat above umbilical margin. Umbilicus wide, moderately deep; umbilical wall almost vertical. Ventral side slightly flattened. Inner whorls ornamented with strong, sometimes comma-shaped, slightly prorsiradiate ribs, sometimes accompanied by finer ribs; on inner whorls the ribs sometimes unite in pairs at the umbilical margin.

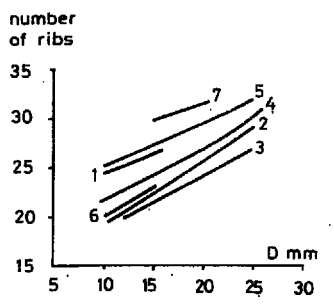

Fig. 16. Rib-curves of *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n.
1 specimen No. 2507a (holotype), 2 No. 2674b, 3 No. 2516, 4 No. 2507c, 5 No. 2510, 6 No. 2513, 7 No. 2680

From the middle of the last whorl the ornamentation becomes more regular and heavier, consisting of bi- or sometimes triplicate, crescent ribs; the trend of ribs to unite in pairs at the umbilical margin is here displayed by some primary ribs. The point of furcation is situated close to the ventral margin; the secondaries,

weakly prorsiradiate, passing across the venter with some weakening; shallow siphonal furrow is sometimes marked at the venter. The number of primaries and secondaries variable, ranging from 14 to 16 and 30 to 37 per a half of the last whorl, respectively. Distinct parabolic nodes are marked somewhat above the point

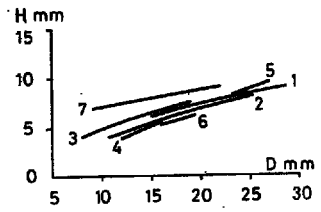

Fig. 17
Ratio of whorl height (*H*) to diameter (*D*) in *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n.

1 specimen No. 2507a (holotype), *2* No. 2674b, *3* No. 2516, *4* No. 2507c, *5* No. 2510, *6* No. 2513, *7* No. 2680

of furcation up to the middle of the last whorl; one parabolic node occurs per every 2 to 4 secondary ribs. The ornamentation becomes weaker in subumbilical zone. Peristome with lappet 5–8 mm long. Weak constrictions, 6 in number per whorl, are sometimes visible. Suture line close to that of *Mirosphinctes bukowskii* (Choffat).

Discussion. — The species *Mirosphinctes pinarensis* sp. n. is close to some representatives of *Mirosphinctes bukowskii* (Choffat). Choffat (1893) did not however select the type specimen of *M. bukowskii*, and the specimens assigned by him to that species are so variable in shell morphology that he distinguished two "mutations", α and β and one "variety", *cabritoensis*. Choffat (1893, p. 61) also noted certain variability in values of whorl height/shell diameter and umbilical/shell diameter ratios for this species. Therefore it appears that this species shows a remarkable intraspecific variability. Enay (1966) rejected the varietes and all the specimens assigned to the species *Mirosphinctes bukowskii* (Choffat). The representatives of *M. pinarensis* sp. n. somewhat resemble those described as the latter species by Choffat (1893, p. 60; Pl. 6, Figs 19–31; and especially Figs 21–23, 25, 28 and 31), Siemiradzki (1899, p. 122; Pl. 20, Fig. 10), and Enay (1962, p. 26, Pl. 4, Fig. 16a–b; 1966, p. 574, Pl. 40, Figs 11–13) in sculpture, shape and dimensions of shell, markedly differing from them in more subrectangular whorl section, somewhat thicker whorls, more flattened whorl sides and weaker and denser ribbing. The differences seem sufficient for treating the Cuban forms as representatives of a separate species.

The Cuban specimens differ from those figured as *Mirosphinctes regularis* (Noetling) by Haas (1955, p. 158; Pl. 25, Figs 14–40; Pl. 26, Figs 1–19) in more flattened whorl sides, smaller number of ribs per whorl and somewhat narrower umbilicus. They differ from the holotype of *Mirosphinctes frickensis* (Moesch) refigured by Enay (1966, p. 160, Fig. 4) in more flattened sides and the style of sculpture. The differences in relation to the specimens described as *M. syriacus* (Noetling) by Haas (1955, p. 153; Pl. 24, Figs 19–45; Pl. 25, Figs 1–13) and *M. kobyi* (de Loriol) (*cf.* Haas 1955, p. 162; Pl. 26, Figs 20–47) are also remarkable.

The variability in morphology of the specimens here referred to the species *Mirosphinctes pinarensis* sp. n. appears so high as in the case of those from the Mostejunto Beds of Portugal, assigned to the species *Perisphinctes bukowskii* by Choffat (1893). The differentiation is sufficient for distinguishing three subspecies of *M. pinarensis* sp. n.: *M. pinarensis pinarensis* subsp. n., *M. pinarensis torrei* subsp. n. and *M. pinarensis choffati* subsp. n. The subspecies markedly differ in coiling, sculpture and whorl section. The occurrence of specimens displaying some transitional features supports the view that we are not dealing here with different species but different subspecies.

The nominative subspecies differs from *M. pinarensis torrei* subsp. n. and *M. pinarensis choffati* subsp. n. in whorl section, ornamentation of the outer whorl and coarser ribbing on inner whorls.

Occurrence. — Pimienta Member of Jagua Fm., Mogote La Mina *I* locality in Sierra de los Organos (specimens No. 2280b and 2256); Francisco Fm., Esquina hill N of Brujito in Sierra del Rosario (all the remaining specimens).

Mirosphinctes pinarensis torrei sp. n., subsp. n.
(Text-figs 18—19, Pls 16—17)

Holotype: specimen No. 2267, figured in Pl. 16, Fig. 1a—c; housed in the Paleontological Museum of the Institute of Geology and Paleontology, Cuban Academy of Sciences, Havana.

Type horizon: Pimienta Member of Jagua Fm., Oxfordian.

Type locality: Mogote La Mina *I* locality, Sierra de los Organos, Pinar del Río province, Cuba.

Derivation of the name: in honour of Dr. A. de la Torre, the Cuban paleontologist.

Paratypes: specimen No. 2280t, 2270, 2280c, 2281, 2675d, 2509e, 2577a.

Diagnosis. — Whorl section high-ovate, rounded; whorl sides and venter flattened; ribbing fine and dense on inner whorls; a marked trend to the development of siphonal furrow on the venter.

Material. — Four more complete (No. 2281, 2509e, 2280c and 2675d) and four fragmentary specimens.

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	NR	$NR_{1/2}$	$NS_{1/2}$
2267 holotype	29.1	9.7	8.6	11.5	.33	.29	.39	–	≈14	≈28
2280t	27.5	8.0	8.0	≈12.3	.28	.28	≈.44	–	16	33
2280c	≈23.0	8.5	8.5	9.0	–	–	–	–	15	–
2270	23.7	7.5	7.5	9.3	.31	.31	.39	–	15	31
2675d	16.8	5.5	5.7	5.9	.32	.33	.35	≈22	–	–
2677a	?19.0	7.0	–	6.5	–	–	–	–	–	–
2509	21.2	6.9	7.0	7.8	.32	.33	.36	–	15	–
2281	–	9.5	10.0	–	–	–	–	–	–	–

Description. — Coiling evolute; whorl section high-ovate, rounded; whorl sides somewhat convex; whorls the thickest at one-third of their height. Ventral side with rounded margins, somewhat flattened, narrow. Umbilicus wide, shallow.

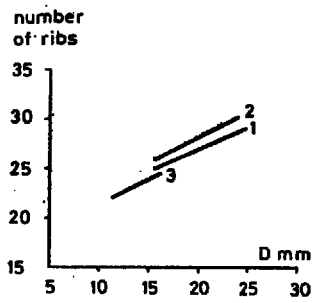

Fig. 18
Rib-curves of *Mirosphinctes pinarensis torrei* sp. n., subsp. n.
1 specimen No. 2267 (holotype), *2* No. 2270, *3* No. 2675d

Inner whorls ornamented with numerous fine ribs united in pairs or fours at umbilical margin; some ribs are stronger than the remaining ones. Coarser, wavy ribs first appear at the last whorl; they begin at umbilical margin, often attain comma-like shape, shift backwards in the middle of the whorl and divide into two or,

sometimes, three secondary ribs close to the ventral margin. One of secondaries follows the course of the parent primary rib whereas others are bend backwards. The secondary ribs pass the venter with some weakening. A distinct siphonal furrow is sometimes marked on the venter. Parabolic nodes occur along ventral margin up to the middle of the last whorl. Ornamentation disappears close to the peristome provided with small lappets.

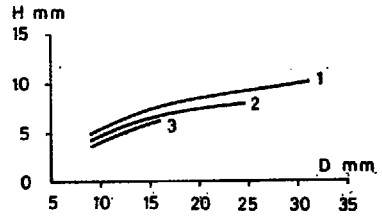

Fig. 19
Ratio of whorl height (*H*) to diameter (*D*) in *Mirosphinctes pinarensis torrei* sp. n., subsp. n.
1 specimen No. 2267 (holotype), *2* No. 2270, *3* No. 2675d

Discussion. — The characteristic fine, fibrous ribbing of inner whorls of the specimens asigned to *M. pinarensis torrei* sp. n., subsp. n. brings them close to the specimen described as *Perisphinctes* cf. *mirus* by Bukowski (1887, Pl. 28, Fig. 10a) and subsequently allocated in *Mirosphinctes bukowskii* (Choffat) by Enay (1966, p. 576). The Cuban specimens differ from the latter somewhat in dimensions, flattened whorl sides and venter, as well as in ornamentation of the last whorl. It should be mentioned that Bukowski's specimen seems to be mature, characterized by ornamentation not disappearing nearby peristome.

The Cuban specimens somewhat resemble *Mirosphinctes interrogationis* of Siemiradzki (1898, p. 117; Pl. 21, Figs 16—17) in comma-shaped ribs, differing in less distinct ornamentation and less convex sides of the last whorl. They differ from *M. kobyi* (de Loriol) presented by Haas (1955, p. 162; Pl. 26, Figs 20—47), characterized by weak ornamentation of inner whorls, in stronger ornamentation of both inner and outer whorls. The differences in respect to *M. pinarensis pinarensis* sp. n., subsp. n., as given above.

The subspecies *Mirosphinctes pinarensis torrei* subsp. n. differs from *M. pinarensis choffati* sp. n., subsp. n. in whorl section, ornamentation of inner whorls, a marked disappearance of ornamentation near the peristome and weakening of ornamentation on the ventral side.

Occurrence. — Jagua Fm. (Pimienta Member), Mogote La Mina *I* locality (specimens No. 2280c, 2280t, 2267, 2270 and 2281), Sierra de los Organos; Francisco Fm., Esquina locality (specimens No. 2675d, 2509e), Sierra del Rosario.

Mirosphinctes pinarensis choffati sp. n., subsp. n.
(Text-figs 20—21; Pl. 18, Figs 1—3; Pl. 19, Figs 1—4)

Holotype: specimen No. 2275, figured in Pl. 18, Fig. 1a—c; housed in the Paleontological Museum of the Institute of Geology and Paleontology, Cuban Academy of Sciences, Havana.

Type horizon: Pimienta Member of Jagua Fm., Oxfordian.

Type locality: Mogote La Mina *I* locality, Sierra de los Organos, Pinar del Río province, Cuba.

Derivation of the name: in honour of P. Choffat, the student of ammonite faunas of Portugal.

Paratypes: specimens No. 2255a, 2255b, 2273, 2274, 2508, 2507f, 2272, 2692.

Diagnosis. — Whorl section subrectangular; numerous ribs broken somewhat above the middle of whorl side.

Material. — Nine specimens including four fragmentary.

Description. — Coiling evolute; whorls weakly overlapping; whorl section almost rectangular, ventral side weakly rounded. Umbilicus wide, shallow. Whorl

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	$NR_{1/2}$	NS	$NS_{1/2}$
2275	25.0	9.5	8.2	10.4	.37	.32	.40	.15	–	37
2255a	25.0	8.3	–	9.2	.33	–	.36	≈15	–	–
2273	21.0	7.8	8.0	8.0	.37	.38	.38	–	–	–
2274	23.5	8.3	7.5	8.0	.35	.31	.34	≈20	–	34
2507f	20.0	6.0	6.0	7.5	.30	.30	.37	≈18	–	–
2508	21.5	7.1	7.5	8.0	.33	.34	.37	15	–	–
2272	23.0	9.0	8.0	8.0	.39	.34	.34	15	–	–
2692	–	7.8	8.0	–	–	–	–	–	–	–
2255b	–	7.0	7.2	–	–	–	–	–	–	–

sides flattened; whorls thickest at the umbilical margin. Inner whorls ornamented with finer and coarse ribs. Outer whorl ornamented with wavy ribs sharply broken somewhat above the mid-height. Above the break the ribs divide into two, three or sometimes four secondary ribs bent forward in crescent-like manner. Numerous fine ribs sometimes occur between primary ribs in subperistomal whorl part. Peristome lappeted.

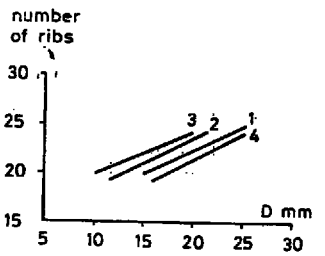

Fig. 20
Rib-curves of *Mirosphinctes pinarensis choffati* sp. n., subsp. n.
1 specimen No. 2275 (holotype), *2* No. 2508, *3* No. 2273, *4* No. 2255a

Discussion. — The subspecies *Mirosphinctes pinarensis choffati* subsp. n. is close to *M. pinarensis pinarensis* subsp. n. in whorl section. The development of numerous fine ribs between primary ribs in subperistomal zone, noted on some specimens of *M. pinarensis choffati* subsp. n. were also found on the specimens described as *Grossouvria? (Mirosphinctes)* cf. *interrogationis* (Siemiradzki) by Christ (1960, p. 94; Pl. 6, Fig. 3) and *G.? (M.)* sp. cf. *kobyi* (Loriol) by the same author

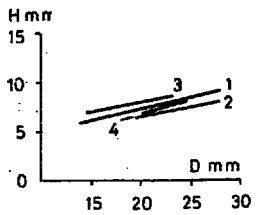

Fig. 21
Ratio of whorl height (*H*) to diameter (*D*) in *Mirosphinctes pinarensis choffati* sp. n., subsp. n.
1 specimen No. 2275 (holotype), *2* No. 2508, *3* No. 2273, *4* No. 2255a

(Christ 1960, p. 95; Pl. 6, Fig. 4a—b). The two Christ's specimens differ from those from Cuba in some morphological details and whorl section. The differences between *M. pinarensis choffati* subsp. n. and other subspecies proposed here are discussed above.

Occurrence. — Jagua Fm. (Piemienta Member), Mogote La Mina *I* locality (specimens No. 2275, 2255a, 2255b, 2207f, 2208, 2274); Mogote La Mina *II* locality (specimens No. 2272 and 2273), Sierra de los Organos; Francisco Fm., Esquina locality (specimen No. 2692), Sierra del Rosario.

Mirosphinctes minensis sp. n.
(Pl. 20, Fig. 2a—b)

Holotype: specimen No. 2252, figured in Pl. 20, Fig. 2a—b; housed in the Paleontological Museum of the Institute of Geology and Paleontology, Cuban Academy of Sciences, Havana.

Type horizon: Jagua Fm. (Pimienta Member), Oxfordian.

Type locality: Mogote La Mina *II* locality, Sierra de los Organos, Pinar del Rio province, Cuba.

Derviation of the name: from the name of the type locality, Mogote La Mina.

Diagnosis. — A *Mirosphinctes* with flat-sided whorls initially ovate and later rectangular in cross-section and with numerous bidischizotomous ribs.

Material. — The holotype only.

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	$NR_{1/2}$	$NS_{1/2}$
2252	30.0	9.5	≈7.0	12.0	.31	≈.23	.40	17	36

Description. — Coiling evolute; whorls weakly overlapping; whorl section initially rounded, becoming rectangular close to the peristome; whorl sides initially somewhat convex, later markedly flattened; venter flat. Ubilical wall vertical; umbilicus wide, shallow. Primary ribs beginning at umbilical margin, initially comma-shaped, fairly numerous and arcuately bent backward from the middle of the last whorl; the ribs are sometimes united in pairs at umbilical margin, which is accentuated by some swelling. The primary ribs initially slightly prorsiradiate, later gently bent backward in the crescent-like manner. The primaries divide into two or, sometimes, three secondaries at ventral margin; the secondaries pass across the venter with some forward twist and certain weakening. Small conical tubercles sometimes found on the mould at the point of furcation correspond to long (about 3 mm long) parabolic nodes observable on preserved shell fragments. The ornamentation becomes slightly weaker near the peristome. Constrictions moderately deep, about 5 in number per whorl. Peristome with lappets about 4 mm long.

Discussion. — The specimen differs from the representatives of all the species of *Mirosphinctes* hitherto known in whorl section, very flat whorl sides and peculiar, more irregular ornamentation on the body chamber. At the same time some features such as comma-shaped ribs, common bidischizotomous division of ribs, inner whorls with rounded sides and venter and the shape of parabolic nodes bring it close to other Cuban representatives of this genus.

Occurrence. — As the type locality.

Mirosphinctes cf. *niedzwiedzkii* (Siemiradzki, 1891)
(Pl. 20, Fig. 6)

Material. — Two poorly preserved specimens (No. 2250, 2283).

Specimen No.	D mm	h mm	u mm	$NR_{1/2}$
2250	≈39.0	13.5	≈15.0	≈18
2283	–	12.0	–	–

Remarks. — The specimens somewhat resemble that of Bukowski (Bukowski 1887, p. 150; Pl. 28, Fig. 7) selected as the lectotype of the species *M. niedzwiedzkii* (Siemiradzki) by Enay (1966) in ornamentation of the outer whorl, whorl section and dimensions, but they are insufficiently preserved for any unequivocal identification.

Occurrence. — Jagua Fm., Pimienta Member, Mogote La Mina *II* (specimen No. 2250) and Pancho Luis (specimen No. 2283) localities, Sierra de los Organos.

Mirosphinctes sp. *A*
(Pl. 18, Fig. 4; Pl. 20, Fig. 3a—b)

Material. — A single specimen (No. 2692a).

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	NR	$NS_{1/2}$
2692a	27.5	9.5	10.0	9.5	.34	.36	.34	27	30

Remarks. — The specimen is characterized by a combination of features such as: subrectangular whorl section, weakly convex whorl sides and weakly flattened ventral side, deep, narrow umbilicus, ornamentation strong and irregular on inner whorls and more regular on outer whorl, which differs it from all the species of this genus hitherto known. The primary ribs bent crescent-like backward and the irregular ornamentation of inner whorls bring it close to *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n. from which it differs in some other morphological details and wider whorls.

Occurrence. — Francisco Fm., Macagual locality, Sierra del Rosario.

Mirosphinctes sp. *B*
(Pl. 19, Fig. 6a—c)

Material. — A single specimen (No. 2578a).

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	$NR_{1/2}$
2578a	18.0	7.8	7.0	5.3	.43	.38	.29	≈12

Remarks. — The specimen is characterized by whorls ovate in cross-section, thickest close to umbilical margin and with flattened ventral side, umbilicus narrow, deep and with vertical wall, inner whorls ornamented and a half of the outer whorl ornamented with numerous fine ribs converging in bunches at umbilical margin and

the remaining part of the outer whorl — with strong, wavy, sometimes bidischizotomous ribs as well as strong tubercles of the parabolic node type and moderately strong constrictions. This combination of features brings it somewhat close to *Mirosphinctes bukowskii* (Choffat) presented by Enay (1962, p. 26, Pl. 4, Fig. 18a—b; 1966, p. 574, Pl. 40, Figs 11—13), from which it differs in stronger and more wavy ribs, higher and more flattened whorls, and narrower umbilicus. The specimen also somewhat resembles *Mirosphinctes pinarensis torei* sp. n., subsp. n., differing in dimensions and heavier ornamentation on outer whorl.

Occurrence. — Francisco Fm., Esquina locality, Sierra del Rosario.

Mirosphinctes sp. C
(Pl. 20, Fig. 1)

Material. — A single specimen (No. 2425).

Specimen No.	D mm	h mm	u mm	Wh	Ud	$NR_{1/2}$	$NS_{1/2}$
2425	31.0	11.5	12.0	.37	.38	14	30

Description. — The specimen is characterized by moderately evolute coiling, weakly convex whorl sides, wide and shallow umbilicus with slightly rounded margin and outer whorl ornamented with short, slightly crescent primary ribs dividing into two, three or sometimes four secondaries, and tubercle-like swollen point of their furcation. This combination of features brings it somewhat close *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n. from which it differs in whorl section, dimensions and some morphological details. The ornamentation of inner whorls is obliterated which makes specific identification difficult.

Occurrence. — Jagua Fm (Pimienta Member), Hoyo de la Sierra locality, Sierra de los Organos.

?*Mirosphinctes* sp. D
(Pl. 20, Fig. 5a—b)

Material. — A single specimen (No. 2515).

Specimen No.	D mm	h mm	b mm	u mm	Wh	Wb	Ud	$NR_{1/2}$
2515	19.9	6.5	6.9	6.5	.32	.35	.32	13

Remarks. — The specimen is characterized by high-ovate, flat-sided whorls, wide and shalow umbilicus, inner whorls ornamented with finer and coarser ribs and outer whorls with weakly arcuate, bi- and triplicate ribs and weak parabolic nodes. It somewhat resembles *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n. differing in dimensions, stronger primary ribs and orientation of secondaries on the venter.

Occurrence. — Francisco Fm., Esquina hill N of Brujito, Sierra del Rosario.

?*Mirosphinctes* sp. *E*

Material. — A single poorly preserved specimen (No. 2652).

Specimen No.	D mm	h mm	u mm	Wh	Ud
2652	27.0	10.0	10.0	.37	.37

Remarks. — The specimen is characterized by ribbing initially irregular, becoming more regular, dischizotomous or bidischizotomous later. The ornamentation appears somewhat similar to that of *Mirosphinctes pinarensis pinarensis* sp. n., subsp n., but the preservation of the specimen is insufficient for any unequivocal identification.

Occurrence. — Found together with a representative of *Cubaspidoceras* gen. n. in a loose boulder derived from the Francisco Fm. S of Brujito, Sierra del Rosario.

STRATIGRAPHY

Accepted in this paper (*cf.* Text-fig. 22) is the subdivision of the Oxfordian stage into: Lower (Quenstedticeras mariae and Cardioceras cordatum zones), Middle (Perisphinctes plicatilis, Gregoryceras transversarium and Perisphinctes bifurcatus zones) and Upper (Epipeltoceras bimammatum and Idoceras planula zones).

The strata of the Pimienta Member of the Jagua Formation from the Sierra de los Organos were assigned to the Upper Oxfordian by Herrera (1961) taking into account their superposition to the Jagua Vieja Member from which ammonites dated at the Late Oxfordian or more precisely early E. bimammatum Zone were known (*cf.* Arkell 1956, Judoley & Furrazola-Bermúdez 1968). The newly gathered ammonites seem to cast some light on the age of the Pimienta Member.

Ammonites of the genus *Mirosphinctes* Schindewolf were reported from the Lower Oxfordian of Poland, Syria, Tanganyka and Japan (*cf.* Yokoyama 1904, Haas 1955, Arkell 1956, Malinowska 1963), Middle Oxfordian (upper part of the Gregoryceras transversarium Zone) of France (Enay 1962, 1966; Korvé-Corvinius 1966), and uppermost Middle Oxfordian of Poland (Dr. W. Brochwicz-Lewiński, *pers. inf.*), as well as from the Montejunto Beds of Portugal (Choffat 1893, Ruget-Perrot 1961) also dated at the late Middle Oxfordian, the Perisphinctes bifurcatus Zone (Professor R. Enay, *pers. inf.*), and the Middle Oxfordian of Chile (Hillebrandt 1970). It seems therefore that the strata of the Jagua Fm. from the Sierra de los Organos and the corresponding strata of the lower and middle parts of the Francisco Fm. from the Sierra del Rosario, occurring below the beds with *Mirosphinctes*, are not younger than the Perisphinctes bifurcatus Zone of the Middle Oxfordian (*cf.* also Wierzbowski 1976).

In Europe, the lower part of the Upper Oxfordian, the Epipeltoceras bimammatum Zone, is characterized by the genus *Epipeltoceras* Spath, which evolved from *Mirosphinctes* according to Enay (1966). Up to date,

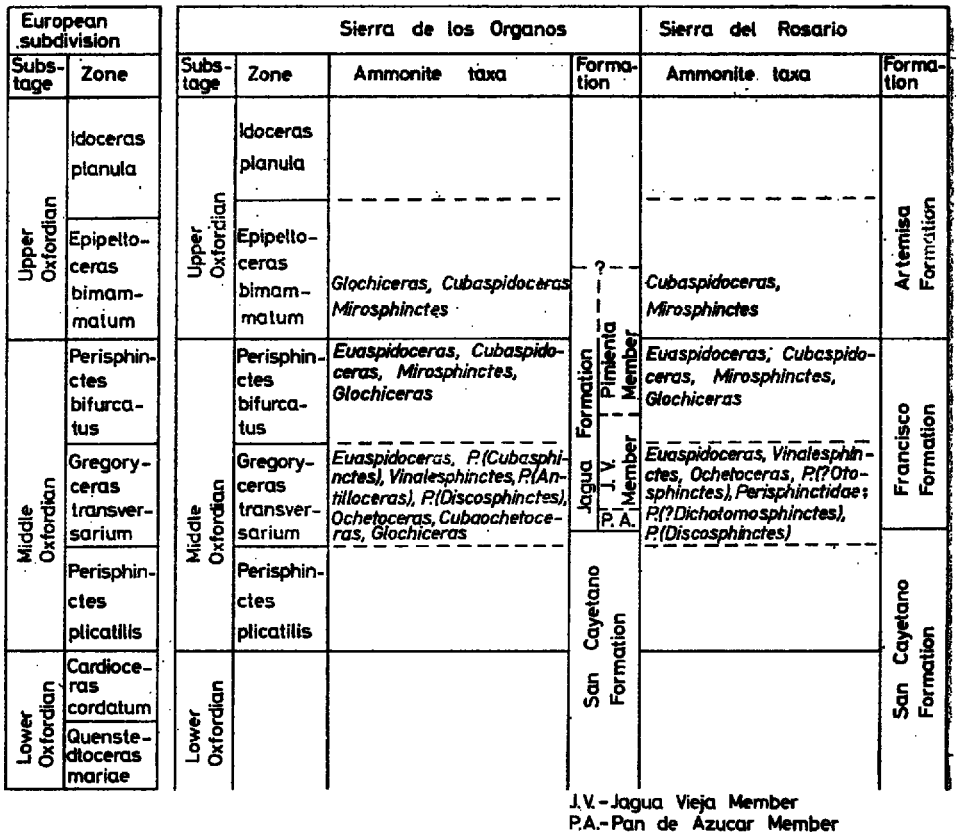

Fig. 22. Tentative correlation of the Oxfordian strata of western Cuba with the European standard subdivision

the genus *Epipeltoceras* is known neither from Cuba nor any other regions of America. It may be mentioned that some *Mirosphinctes* display certain features in common with those of *Epipeltoceras* (e.g. slight siphonal furrow on the ventral side) but, nevertheless, it is difficult to interpret them as forerunners of the latter.

In Cuba, the Oxfordian strata with paleontological record are up to the present known from the Pinar del Río province only. The Cuban *Mirosphinctes* apper to be morphologically close to those reported from the Oxfordian of France (cf. Enay 1962, 1966) and Portugal (cf. Choffat 1893). Such ammonite assemblage as described here is not known from Mexico, and the youngest Oxfordian fauna from that country appears to be close to the older Oxfordian assemblage from the Jagua Vieja Member in Cuba

(*cf.* Wierzbowski 1976). The early Kimmeridgian ammonite assemblage of Mexico (*cf.* Burckhardt 1906, 1912), comprising the genera *Glochiceras, Streblites, Aspidoceras, Idoceras, Nebrodites* and *Sutneria,* is on the whole clearly younger that the investigated one. It should be stated, however, that the specimens described as *Sutneria* aff. *cyclodorsata* (Moesch) from the Lower Kimmeridgian of Mexico by Burckhardt (1906, Pl. 4, Figs 3—4, 8—12) seem to be very close to the Cuban specimens assigned to the genus *Mirosphinctes,* and especially to those assigned to *M. pinarensis torrei* sp. n., subsp. n. The Mexican specimens differ from European representatives of *Sutneria cyclodorsata* (Moesch) and they do not match the diagnosis of the genus *Sutneria* (cf. Hölder & Ziegler 1959, Hölder 1964, Geyer 1969).

In the lower part of the Pimienta Member there occur ammonites close to the species *Euaspidoceras (Euaspidoceras) striatocostatum* (Dorn) and *E. (E.) costatum* (Dorn) which are known from the lower Upper Oxfordian of Europe (Enay 1966), and which suggest Late Oxfordian age of upper parts of that member.

The stratigraphic implications of *Cubaspidoceras* gen. n. are limited nowadays. This genus is not characterized by *Aspidoceras*-like but rather *Euaspidoceras*-like inner whorls and it may be considered as an off-shoot of the genus *Euaspidoceras* Spath. This would mean that its stratigraphic range does not overpass the early Late Oxfordian as it is the case of *Euaspidoceras* and its allies, which is consistent with the above dating.

It therefore appears that the deposits of the Pimienta Member from the Sierra de los Organos and those of the Francisco Fm., characterized by the occurrence of the genera *Mirosphinctes, Euaspidoceras* and *Cubaspidoceras* gen. n. belong to upper Middle Oxfordian (Perisphinctes bifurcatus Zone), and possibly lower Upper Oxfordian (Epipeltoceras bimammatum Zone). The strata of the Francisco Fm. are overlied by those of the Artemisa Fm., yielding *Mirosphinctes* and *Cubaspidoceras* gen. n., and they are considered as not younger than early Late Oxfordian (Epipeltoceras bimammatum Zone) by Kutek & al. (1976).

The ammonite fauna discussed here is of some importance for the stratigraphy of the Oxfordian from both the Sierra de los Organos and Sierra del Rosario, and other regions of America, as it seems to cast some light on the problems connected with distinguishing the Upper Oxfordian substage and the Middle/Upper Oxfordian boundary in these regions (*cf.* Text-fig. 22).

The records of the genus *Mirosphinctes* Schindewolf from the Oxfordian of Cuba and of Central and South America (*cf.* Hillebrandt 1970) indicate much wider geographic distribution of that genus than hitherto assumed. Further studies may cast some light on the evolution, sexual dimorphism, and stratigraphic and paleobiogeographic distribution of that

genus. It is also hoped that further studies will allow to reconstruct the history of the genera *Euaspidoceras* and *Cubaspidoceras* gen. n. and elucidate their mutual relationship.

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NUEVA FAUNA DE LOS AMMONITES DEL OXFORDIANO DE LA PROVINCIA DE PINAR DEL RÍO, CUBA OCCIDENTAL

(Resumen)

En le trabajo fueron descritos los ammonites no conocidos enteriormente en los despositos del Oxfordiano de Cuba. La fauna de los ammonites fue encontrada en la provincia de Pinar del Río en dos regiones geologicas: Sierra de los Organos y Sierra del Rosario (Fig. 1 y Lam.1). En la Sierra de los Organos la fauna fue encontrada por el autor en los depositos del miembro Pimienta de la Formación Jagua (Fig. 2). En la Sierra del Rosario los ammonites fueron encontrados por el Dr. A. Pszczółkowski en los depositos de la Formación Francisco. En la Sierra de los Organos los ammonites fueron colectados en los afloramientos (*comp.* Fig. 3—7) La Mina *I* y *II*, Mogote Pancho Luis, Hoyo de la Sierra y Galalón, en la Sierra del Rosario en los afloramientos (*comp.* Fig. 8—9), Loma Calabrote, Loma Esquina (Brujito) y Macagual. Los ammonites descritos (Fig. 10—21 y Lam. 2—20) pertenecen a los géneros *Ochetoceras* Haug, *Glochiceras* Hyatt, *Euaspidoceras* Spath, *Cubaspidoceras* gen. n., y *Mirosphinctes* Schindewolf. En este conjunto fueron establecidas siete nuevas especies y tres nuevas subspecies. Algunos ejemplares representan probablemente otras nuevas especies.

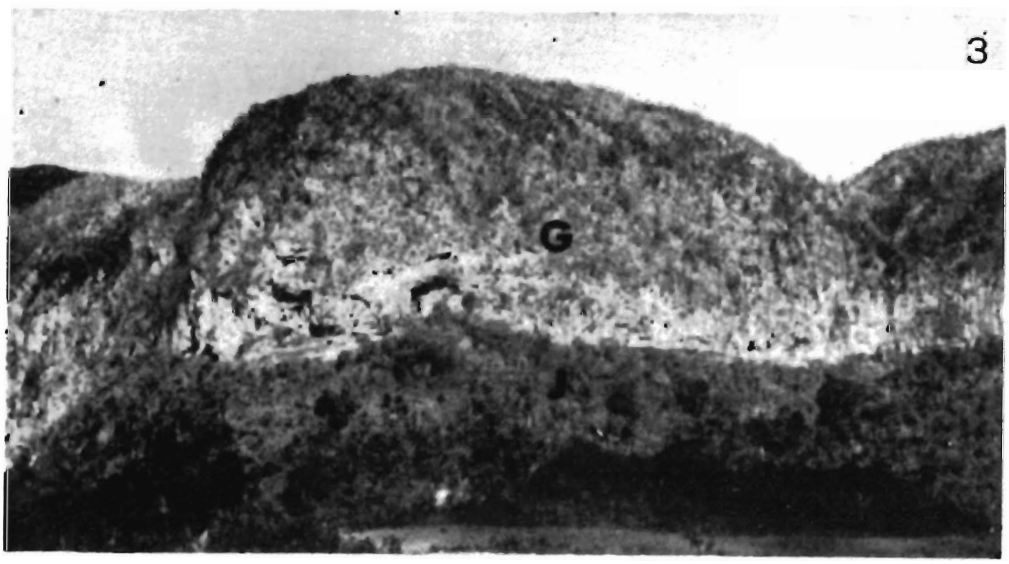
En el trabajo también se describe los depósitos que contienen la fauna estudiada. Los ammonites permitierón definir la edad de estos depósitos como la parte superior del Oxfordiano Medio y probablemente también la parte inferior del Oxfordiano Superior (Fig. 22). Anteriormente la edad de estos depósitos en la Sierra de los Organos fué considerada como Oxfordiano Superior. En la Sierra del Rosario los depósitos del Oxfordiano no fueron conocidos.

R. MYCZYŃSKI

NOWA FAUNA AMONITOWA OKSFORDU Z PROWINCJI PINAR DEL RIO, ZACHODNIA KUBA

(Streszczenie)

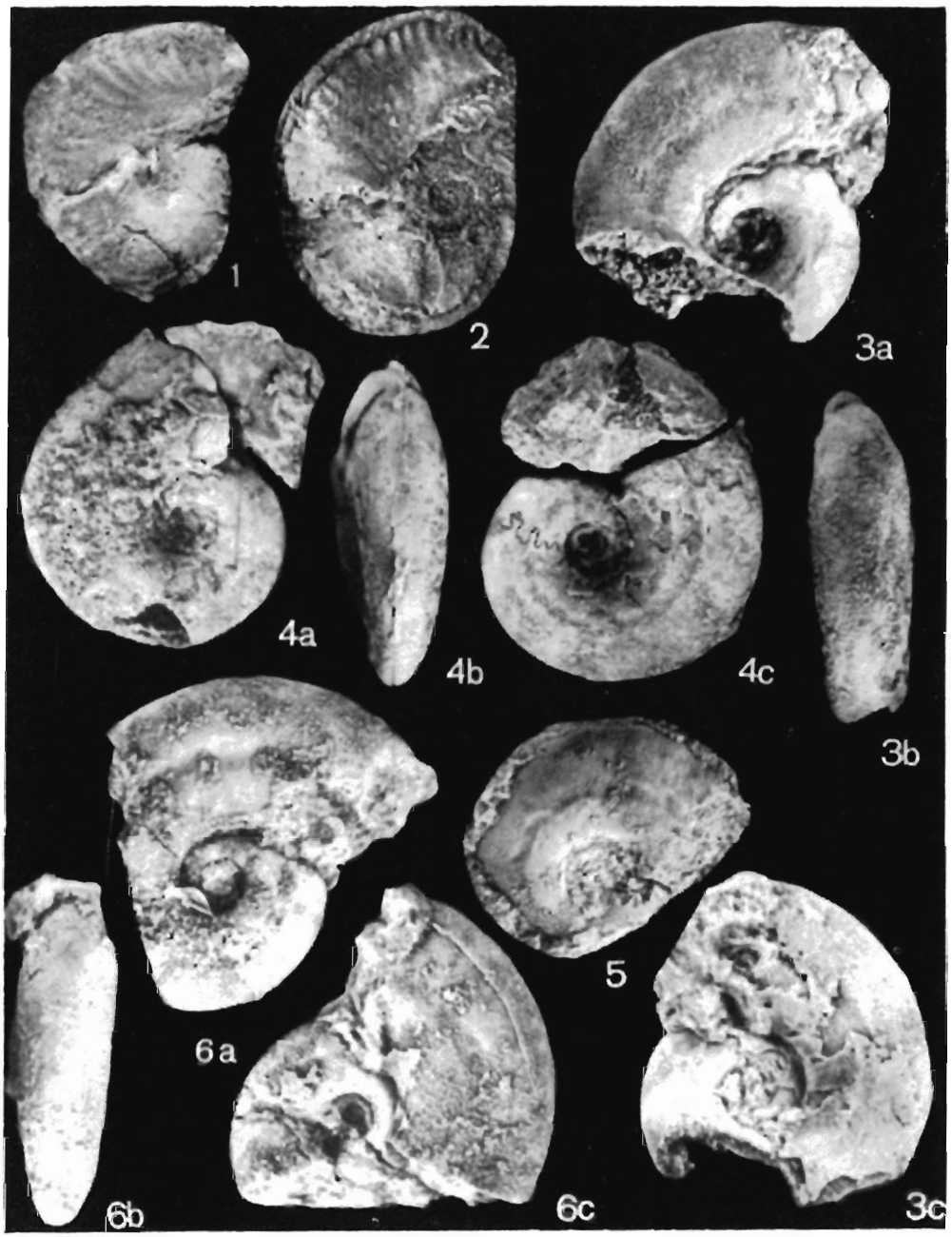
Przedmiotem pracy jest opis fauny amonitowej z prowincji Pinar del Rio zachodniej Kuby (*por.* fig. 1—9 oraz pl. 1). W Sierra de los Organos faunę tę autor znalazł w utworach ogniwa Pimienta formacji Jagua, zaś w Sierra del Rosario została ona stwierdzona przez Dr. A. Pszczółkowskiego w utworach formacji Francisco. Opisane amonity (*por.* fig. 10—21 oraz 2—20) należą do rodzajów *Ochetoceras* Haug, *Glochiceras* Hyatt, *Euaspidoceras* Spath, *Cubaspidoceras* gen. n., oraz *Mirosphinctes* Schindewolf. W badanym zespole wyróżniono siedem nowych gatunów i trzy nowe podgatunki, wskazując także, iż kilka okazów reprezentuje prawdopodobnie jeszcze inne gatunki nowe. W pracy podano ponadto opis utworów zawierających badaną faunę. Zebrane amonity pozwoliły określić wiek tych utworów na górną część oksfordu środkowego i ewentualnie dolną część oksfordu górnego (*por.* fig. 22). Dotychczas rozważane utwory odnoszone były w Sierra de los Organos do oksfordu górnego, natomiast w Sierra del Rosario nie były w ogóle znane.



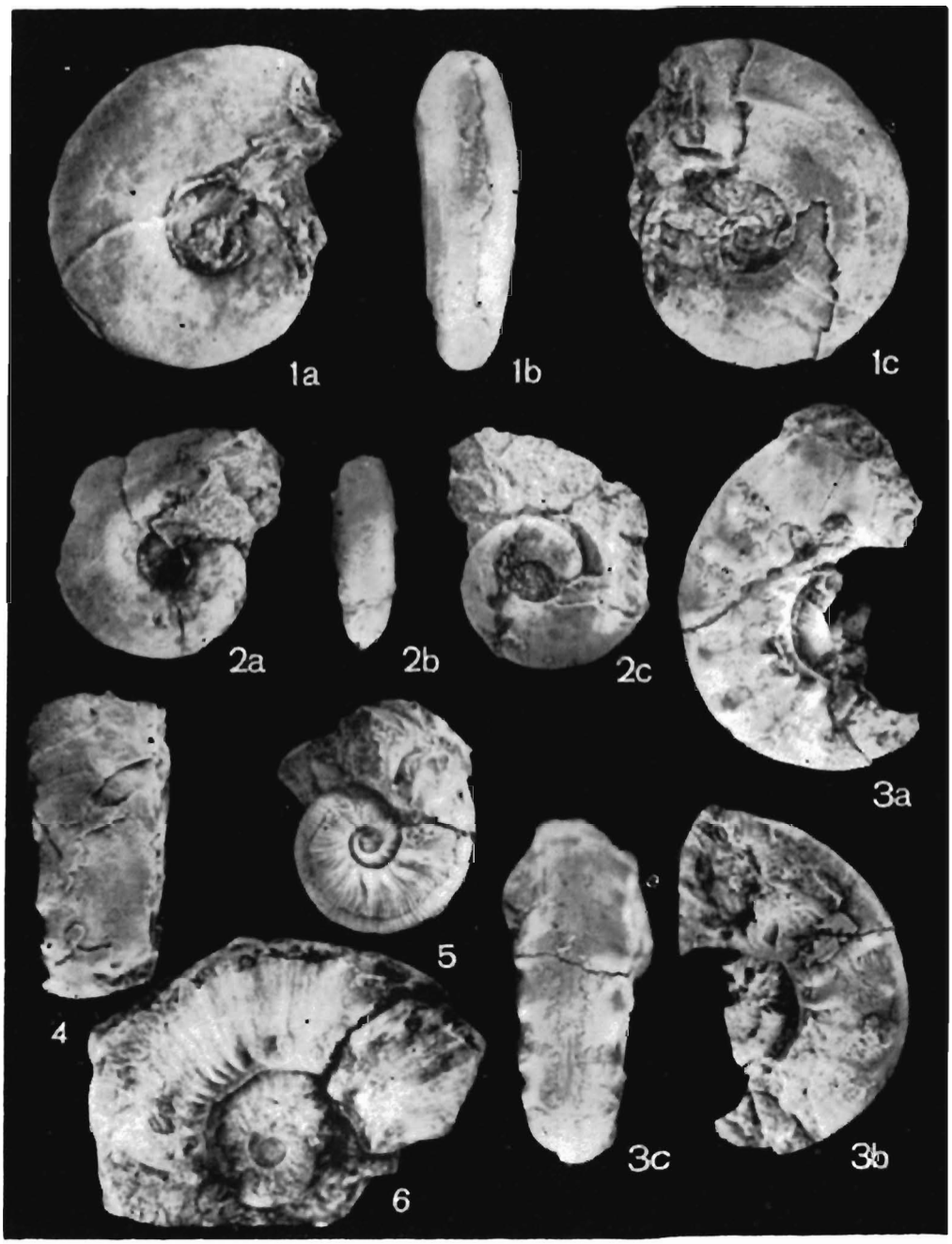
1 — Mogote landscape in the eastern part of the Viñales Valley

2 — A mogote cut off the Guasasa Formation, San Vicente Member; situated at Sumidero-Guane highway

3 — Mogote range Sierra de Viñales, situated north of the Viñales Valley: *J* Jagua Formation, *G* Guasasa Formation (San Vicente Member)



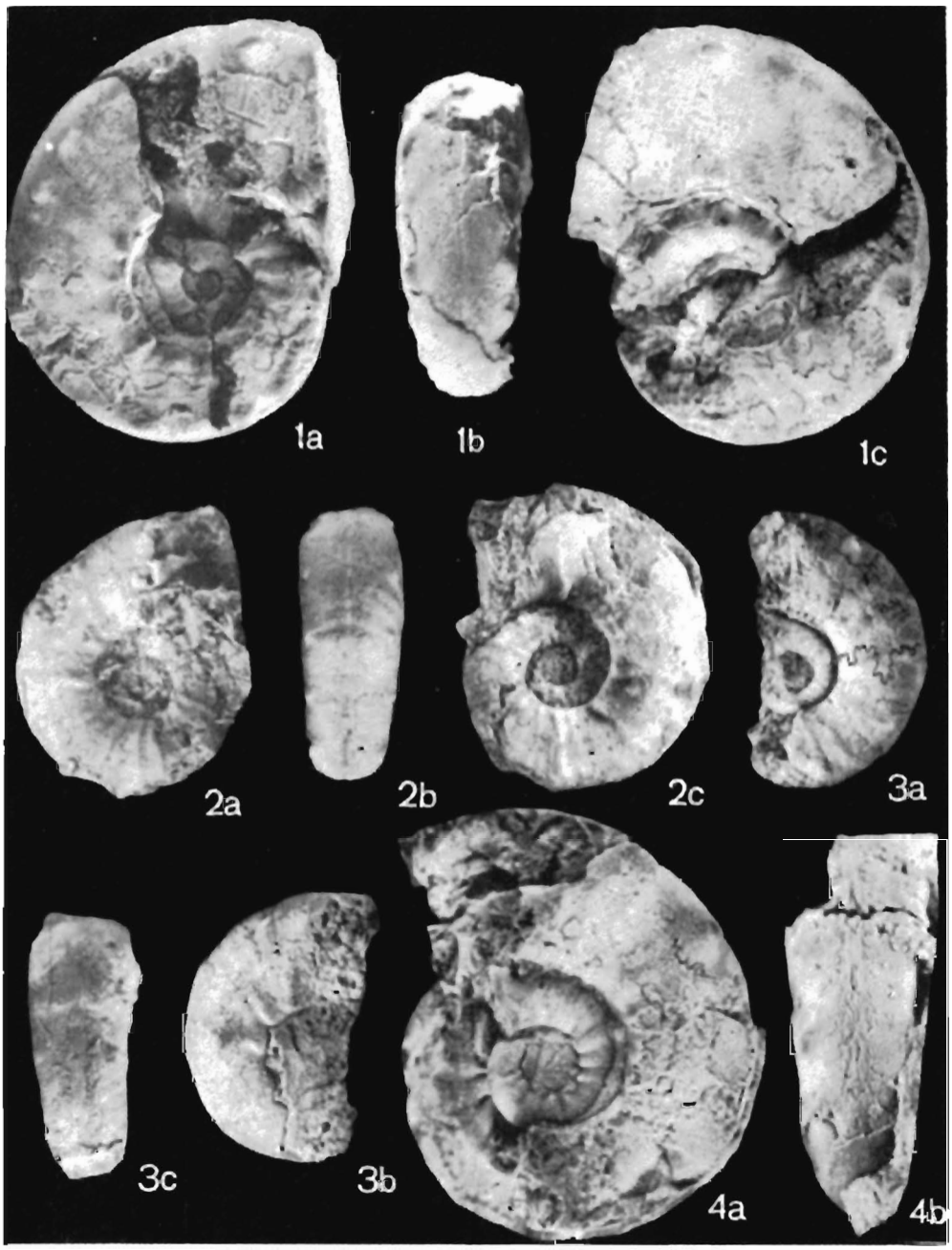
1 *Ochetoceras* sp.: specimen No. 2510t, × 1.5
2 *Glochiceras* (*?Lingulaticeras*) sp.; specimen No. 2522, × 1.5
3–6 *Glochiceras (Glochiceras)* aff. *subclausum* (Oppel): *3a–c* specimen No. 2673b, *4a–c* No. 2673a, *5* No. 2673d, *6a—c* No. 2673c; all specimens × 2.5



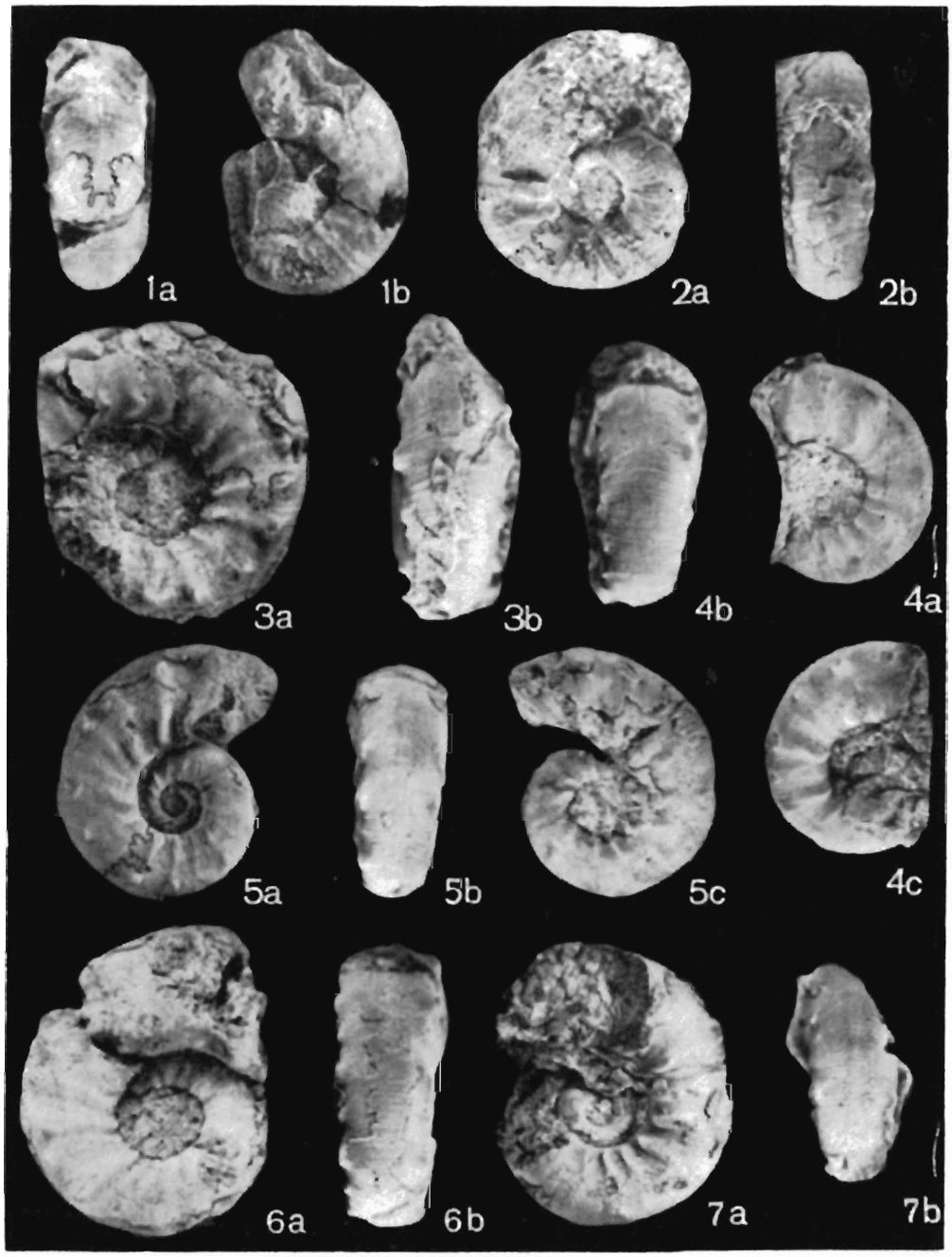
1–2 *Glochiceras* (?*Glochiceras*) aff. *carinatum* Aguilera Castillo: *1a–c* specimen No. 2513a, *2a–c* No. 2513b; both specimens × 2.5

3–4 *Euaspidoceras (Euaspidoceras)* aff. *costatum* (Dorn): *3a–c* specimen No. 2682c, *4* No. 2516a; both specimens × 2

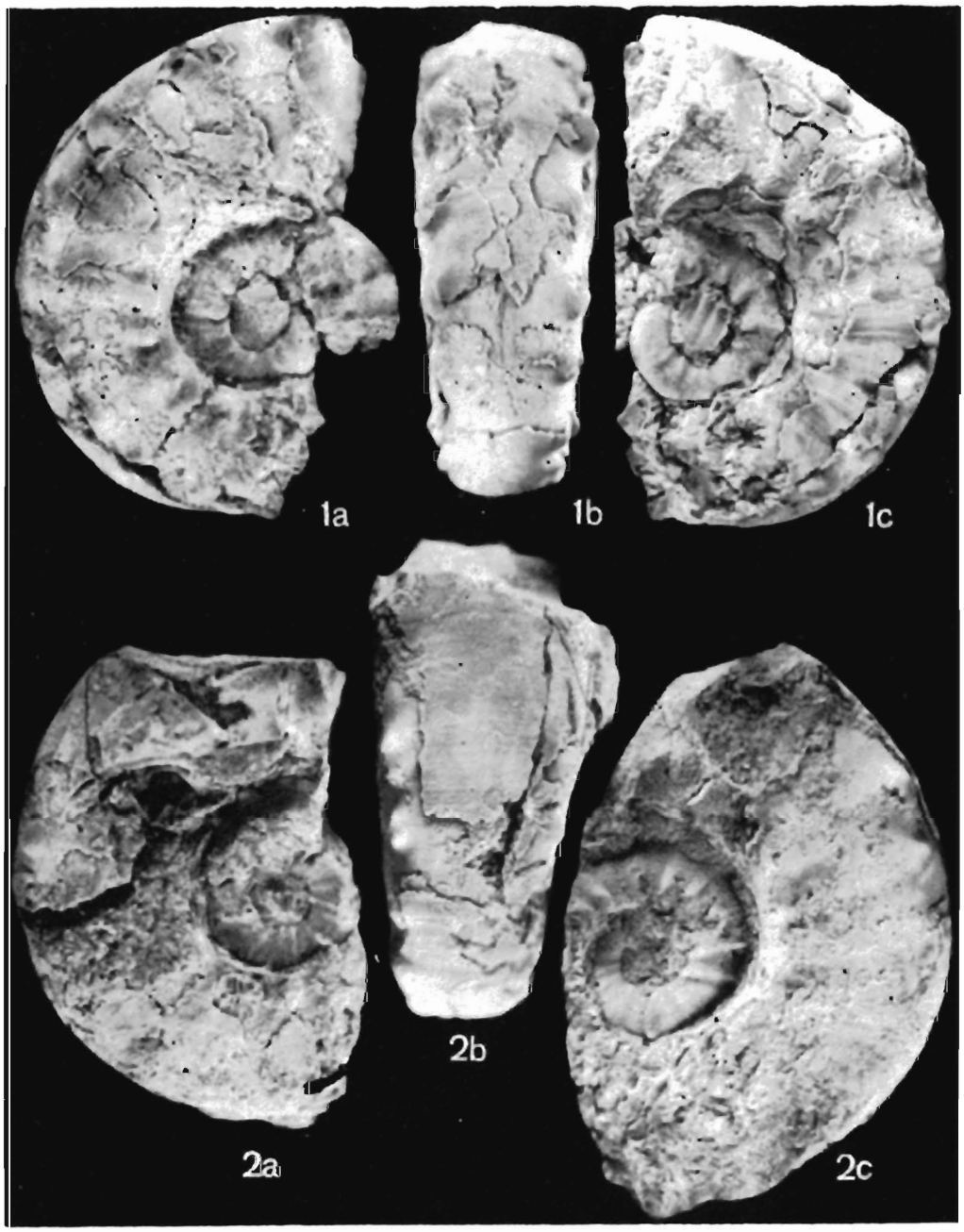
5–6 *Euaspidoceras (Euaspidoceras)* sp. *A*: *5* specimen No. 2682c, × 2.5; *6* No. 2673, × × 1.5



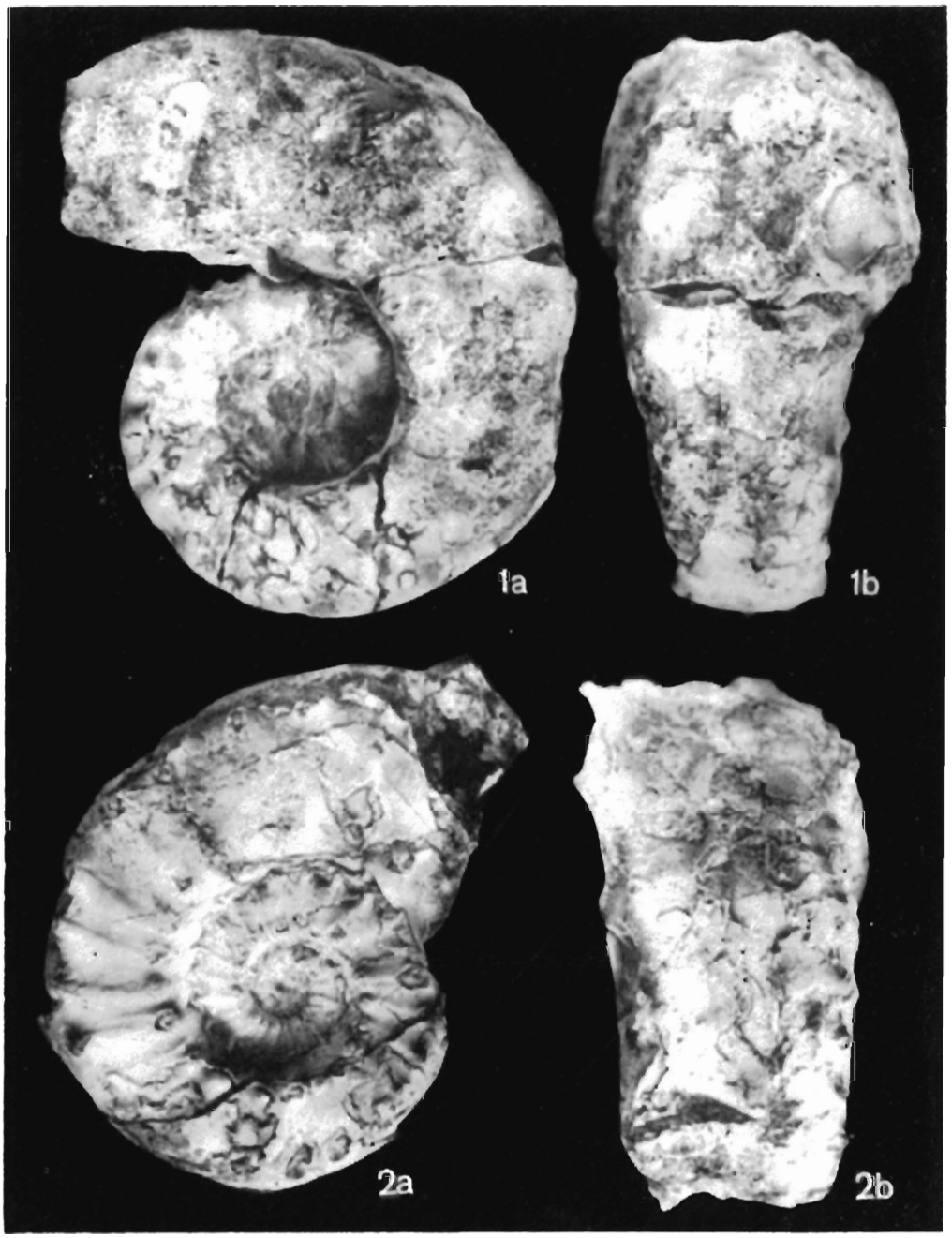
1–4 *Euaspidoceras (Euaspidoceras)* aff. *costatum* (Dorn)
1a–c specimen No. 2516b, × 1.5; *2a–c* No. 2507h, × 2.5; *3a–c* No. 2507j, × 2.5; *4a–b* No. 2508b, × 2



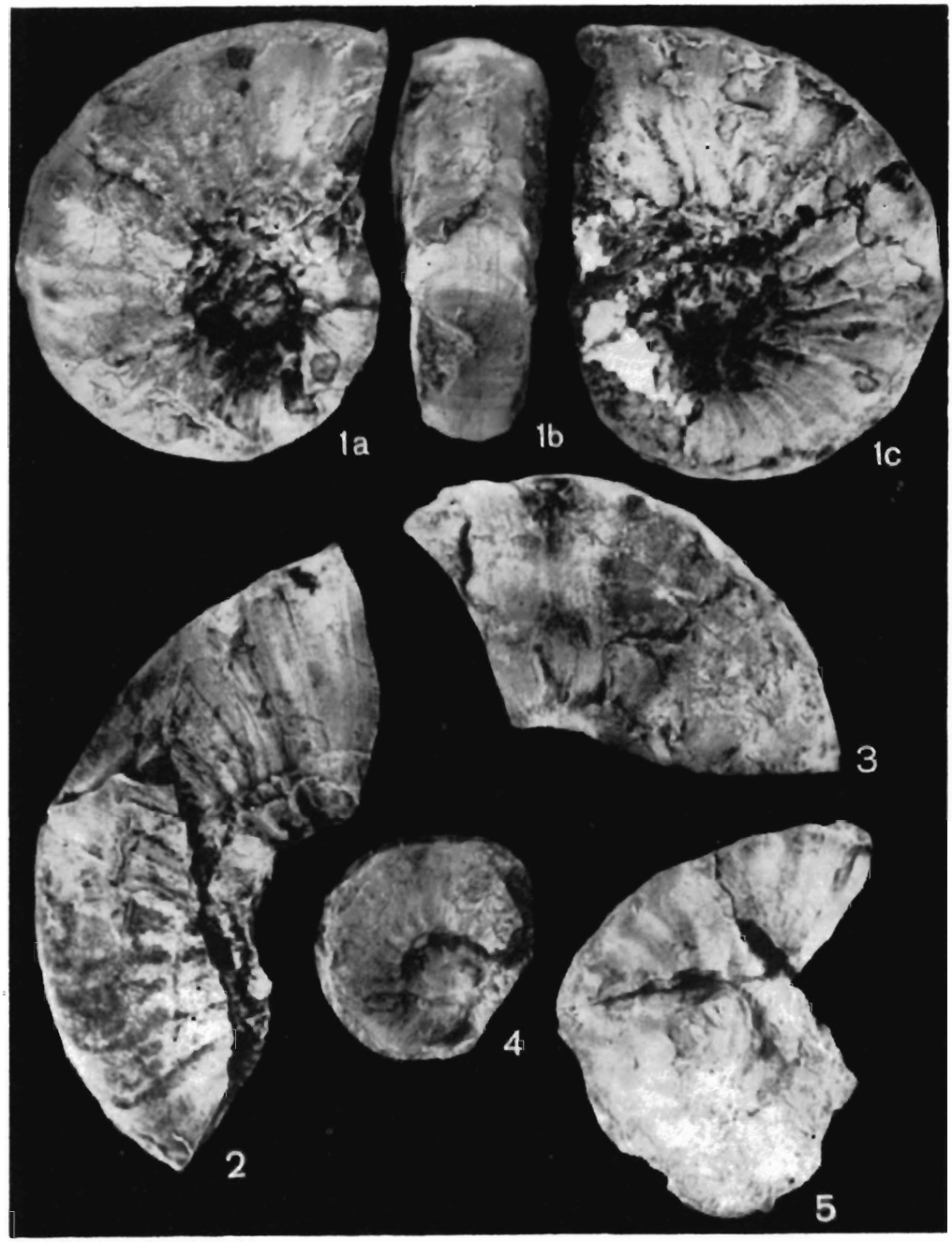
1–7 *Euaspidoceras (Euaspidoceras)* aff. *costatum* (Dorn)
1a–b specimen No. 2511b, *2a–b* No. 2511a, *3a–b* No. 2682c, *4a–c* No. 2682, *5a–c* No. 2682a, *6a–b* No. 2527f, *7a–b* No. 2682b; Figs 1–2 and 7 × 2.5, Figs 3–6 × 2



1–2 *Euaspidoceras (Euaspidoceras)* aff. *costatum* (Dorn)
1a—c specimen No. 2517a, *2a*—c No. 2508a; both specimens × 2

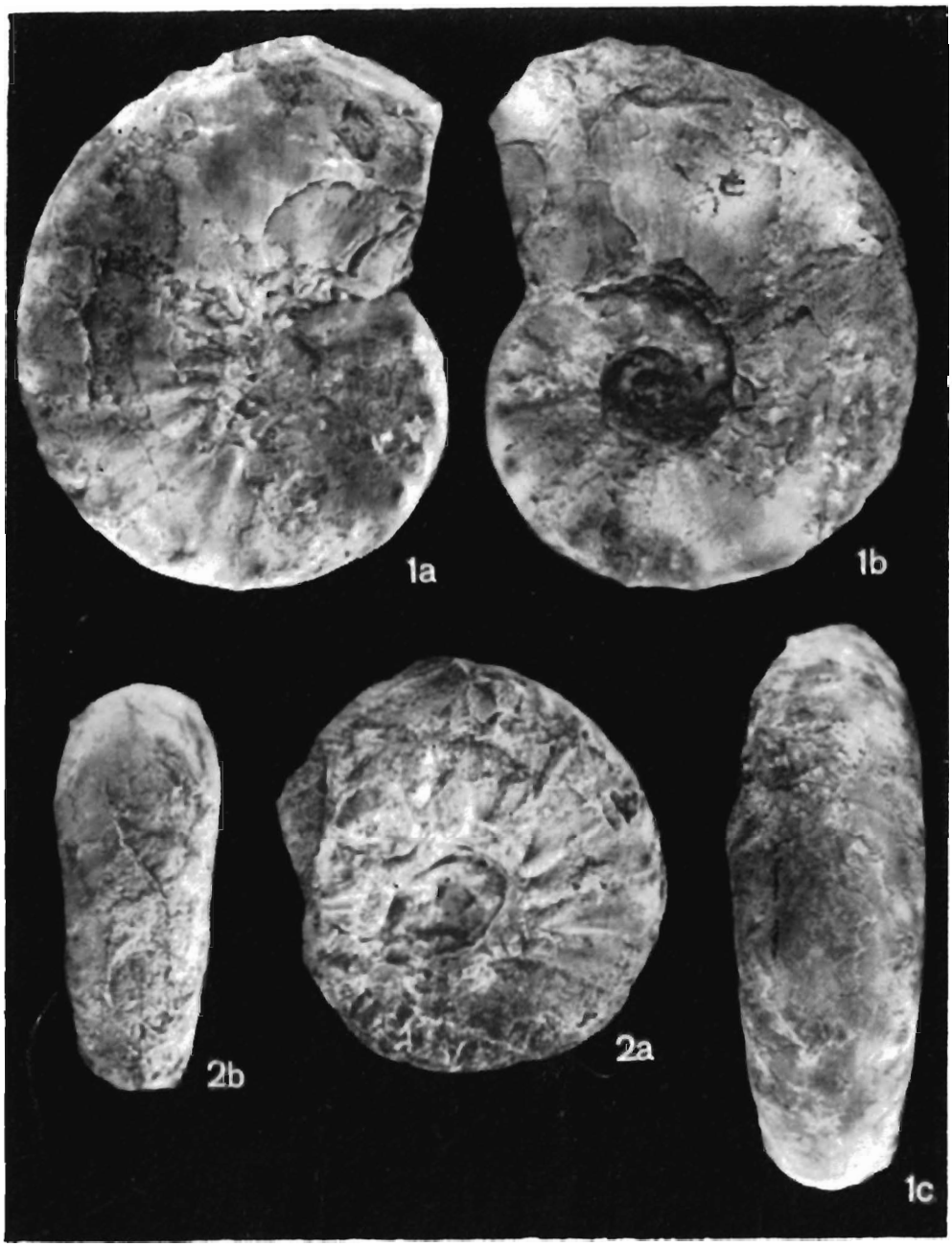


1a—b *Euaspidoceras (Euaspidoceras) imlayi* sp. n.; specimen No. 2529 (holotype), nat. size
2a—b *Euaspidoceras (Euspidoceras)* sp.; specimen No. DD-1, nat. size

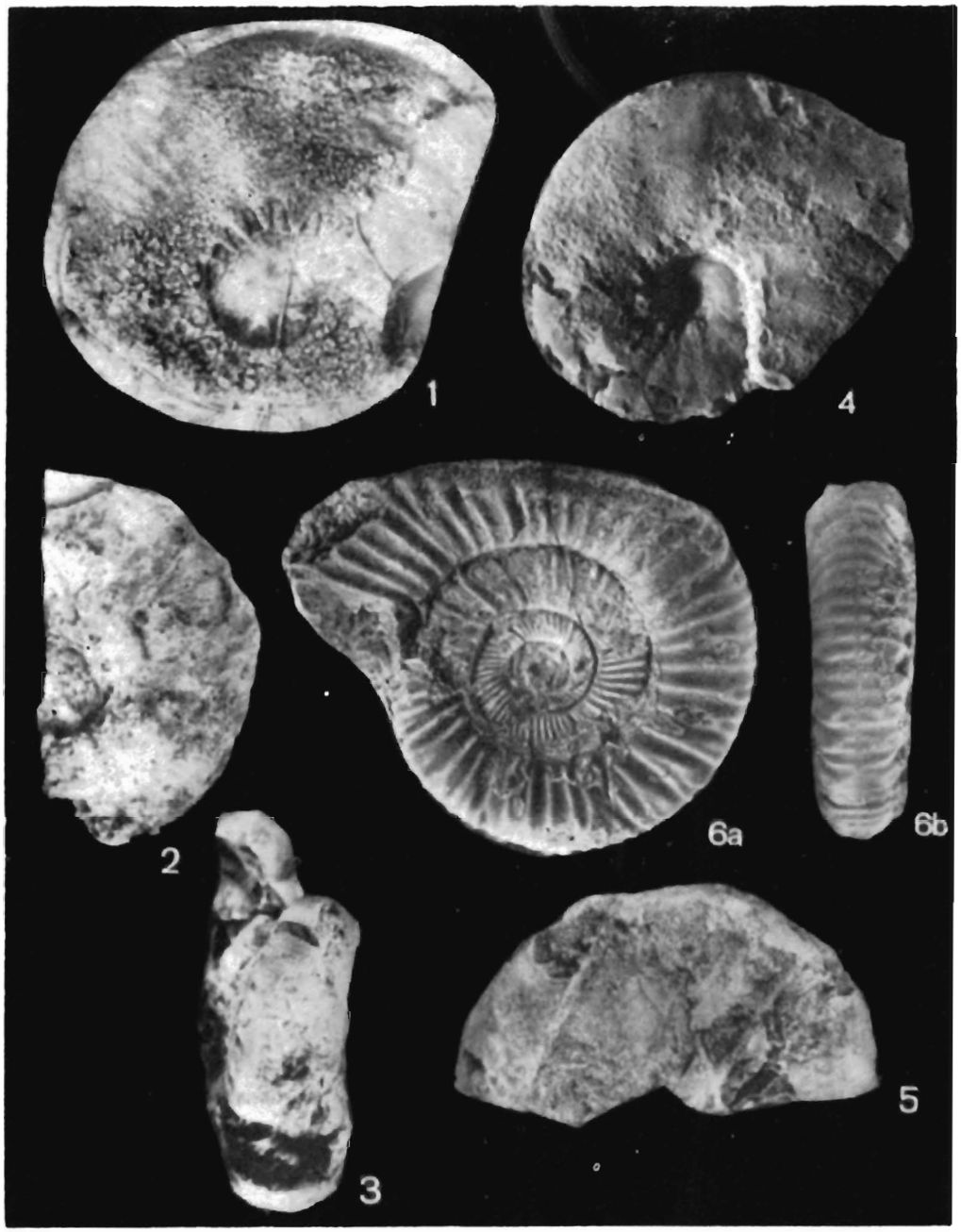


1–5 *Euaspidoceras (Euaspidoceras) striatocostatiforme* sp. n.
1a—c specimen No. 2260 (holotype), × 2; 2 No. 2260a, × 2; 3 No. 2268, × 1.5; 4 No. 2265, × 2; 5 No. 2262, nat. size

1a–c *Euaspidoceras (Euaspidoceras) striatocostatiforme* sp. n.; specimen No. 2258, × 2
2–3 *Cubaspidoceras carribeanum* gen. n., sp. n.: *2a–b* specimen No. 2502 (holotype), nat. size; *3* No. 2544 × 2



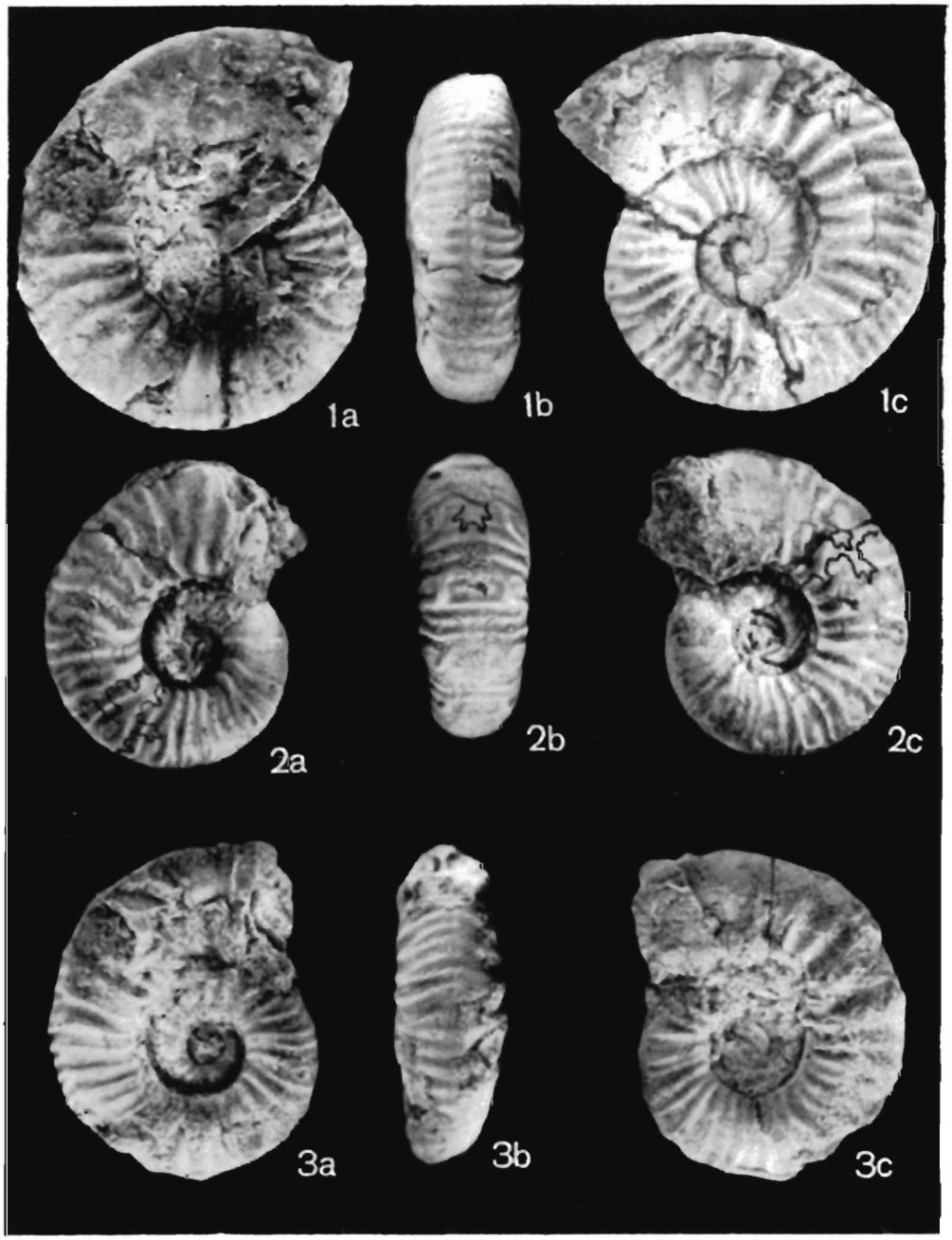
1–2 *Cubaspidoceras kuteki* gen. n., sp. n.
1a—*c* specimen No. 2692ca (holotype), nat. size; *2a*—*b* No. 2692cc, × 2



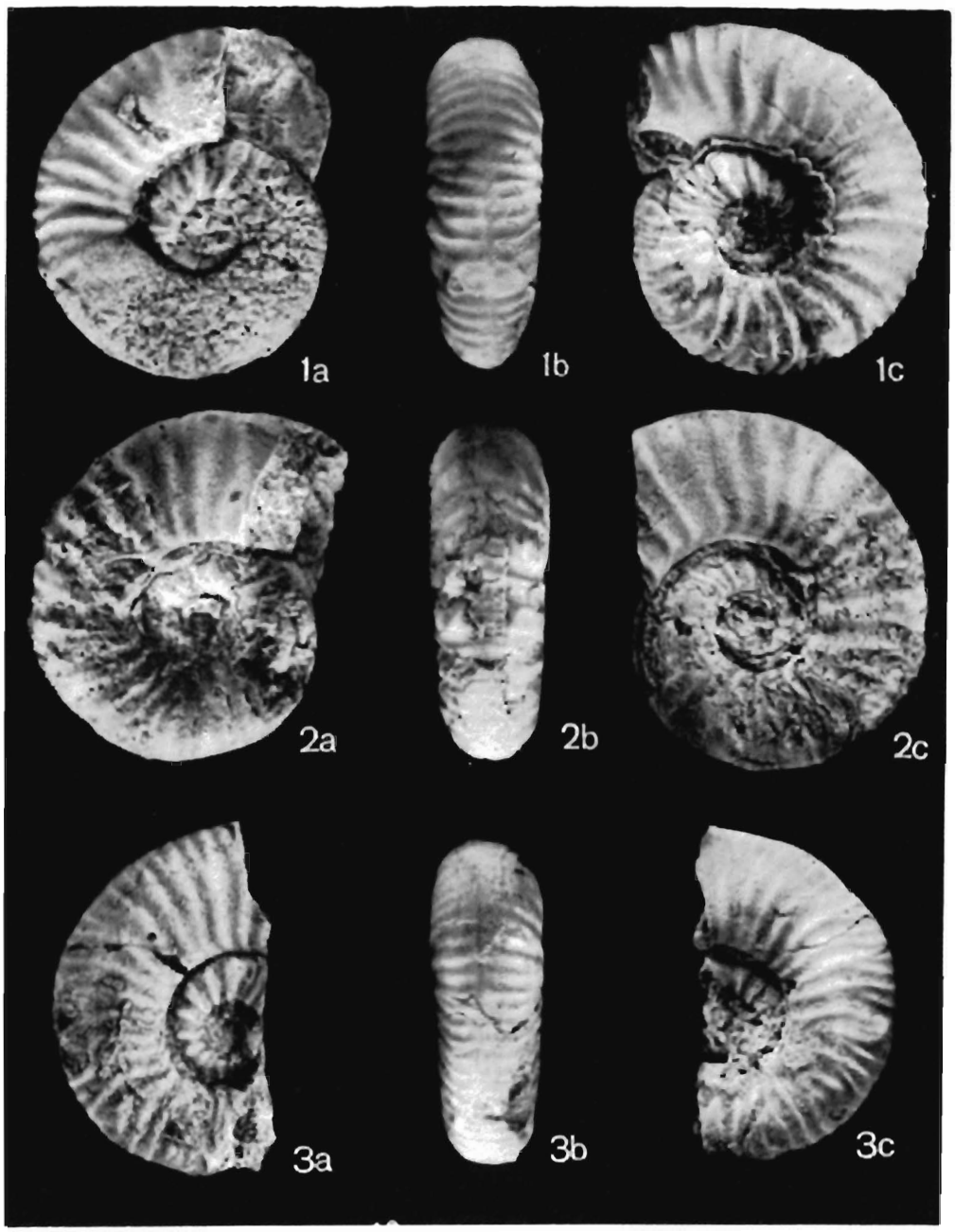
1–3 *Cubaspidoceras kuteki* gen. n., sp. n.; *1* specimen No. 2518, *2* No. 2692cf, *3* No. 2692cd; all specimens of nat. size

4–5 *Cubaspidoceras carribeanum* gen. n., sp. n.; *4* specimen No. 2503, *5* No. 2428; both specimens of nat. size

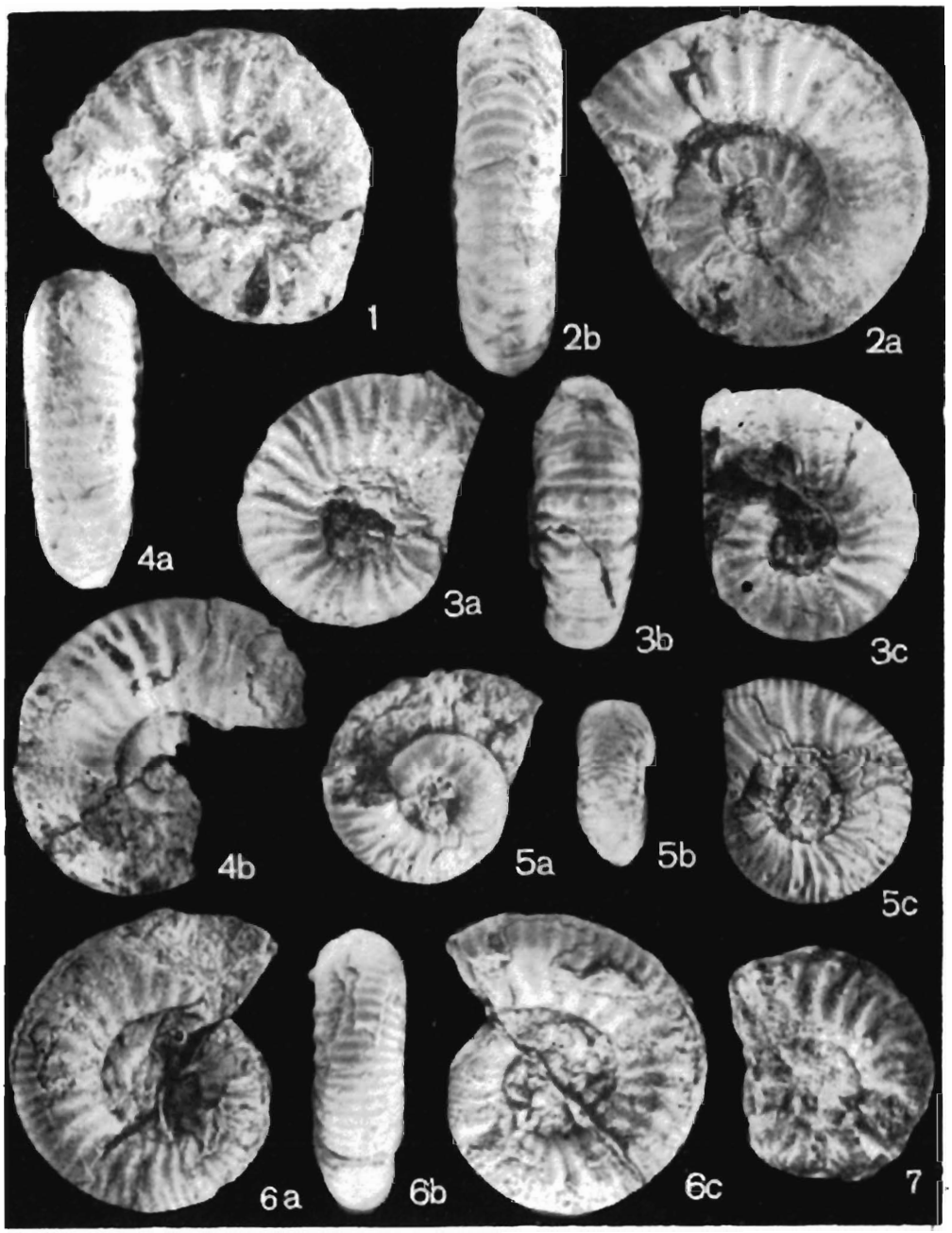
6a–b *Perisphinctes (?Otosphinctes) wierzbowskii* sp. n.; specimen No. 2674 (holotype), × 2



1–3 *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n.
1a—c specimen No. 2507a (holotype), *2a*—c No. 2513, *3a*—c No. 2680; all specimens × 2

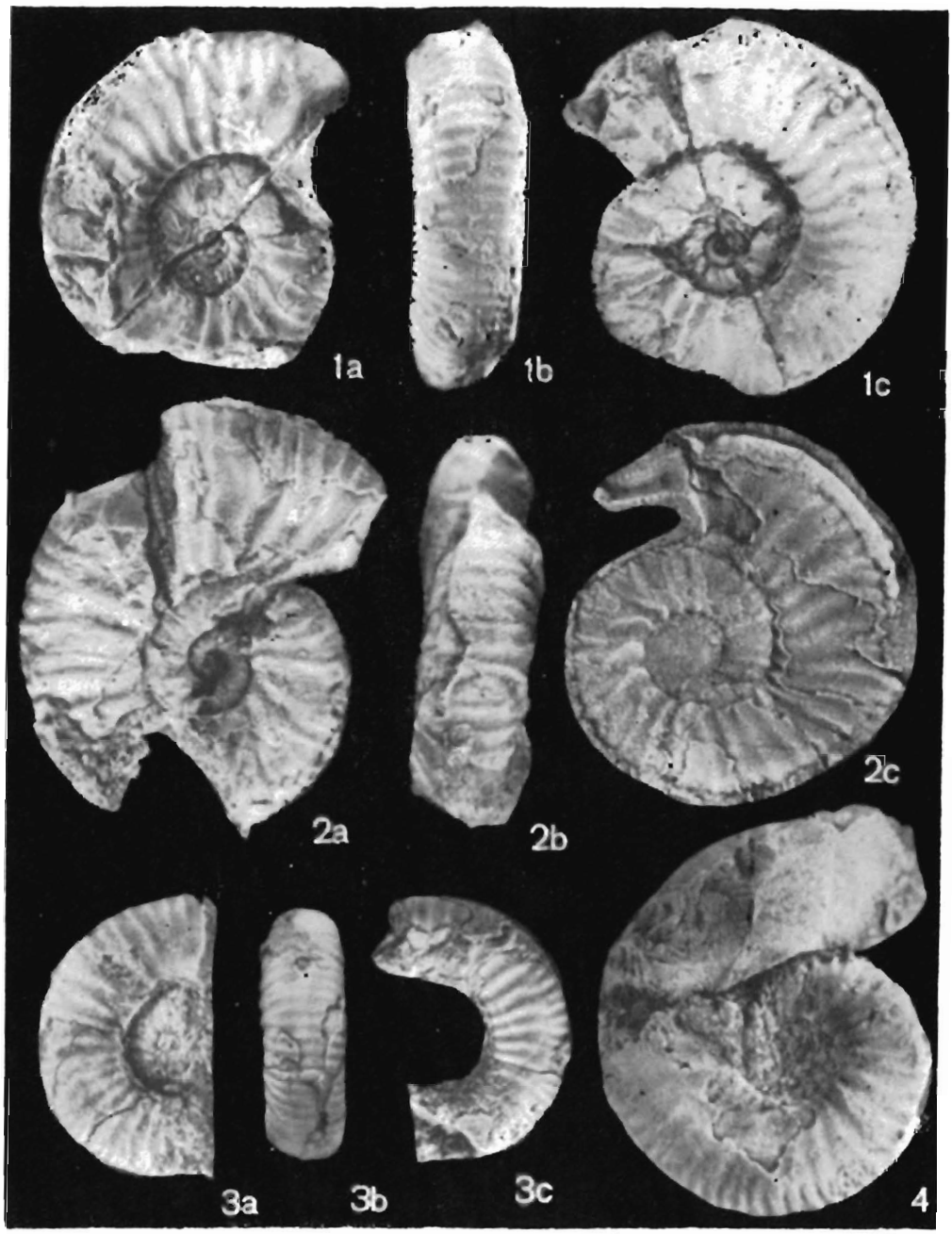


1–3 *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n.
1a—c specimen No. 2516, × 2.5; *2a—c* No. 2570d, × 2; *3a—c* No. 2509a, × 2



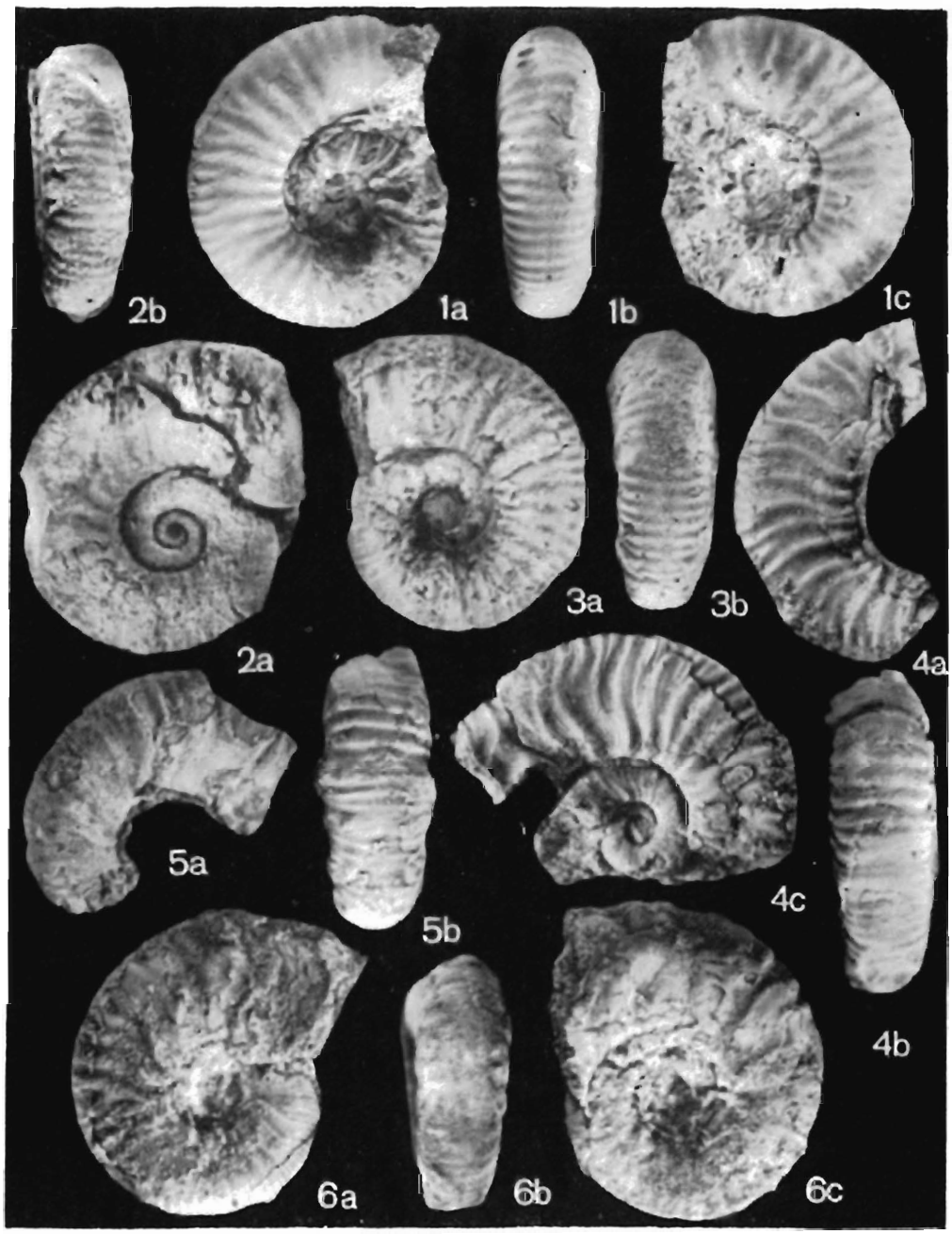
1–7 *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n.
1 specimen No. 2692b, *2a—b* No. 2674b, *3a—c* No. 2507c, *4a—b* No. 2674, *5a—c* No. 2675b, *6a—c* No. 2675, 7 No. 2692c; all specimens × 2.5

1—7 *Mirosphinctes pinarensis pinarensis* sp. n., subsp. n.
1a—c specimen No. 2570b, *2a—c* No. 2280b, *3a—b* No. 2516a, *4* No. 2509g, *5* No. 2510; all specimens × 2



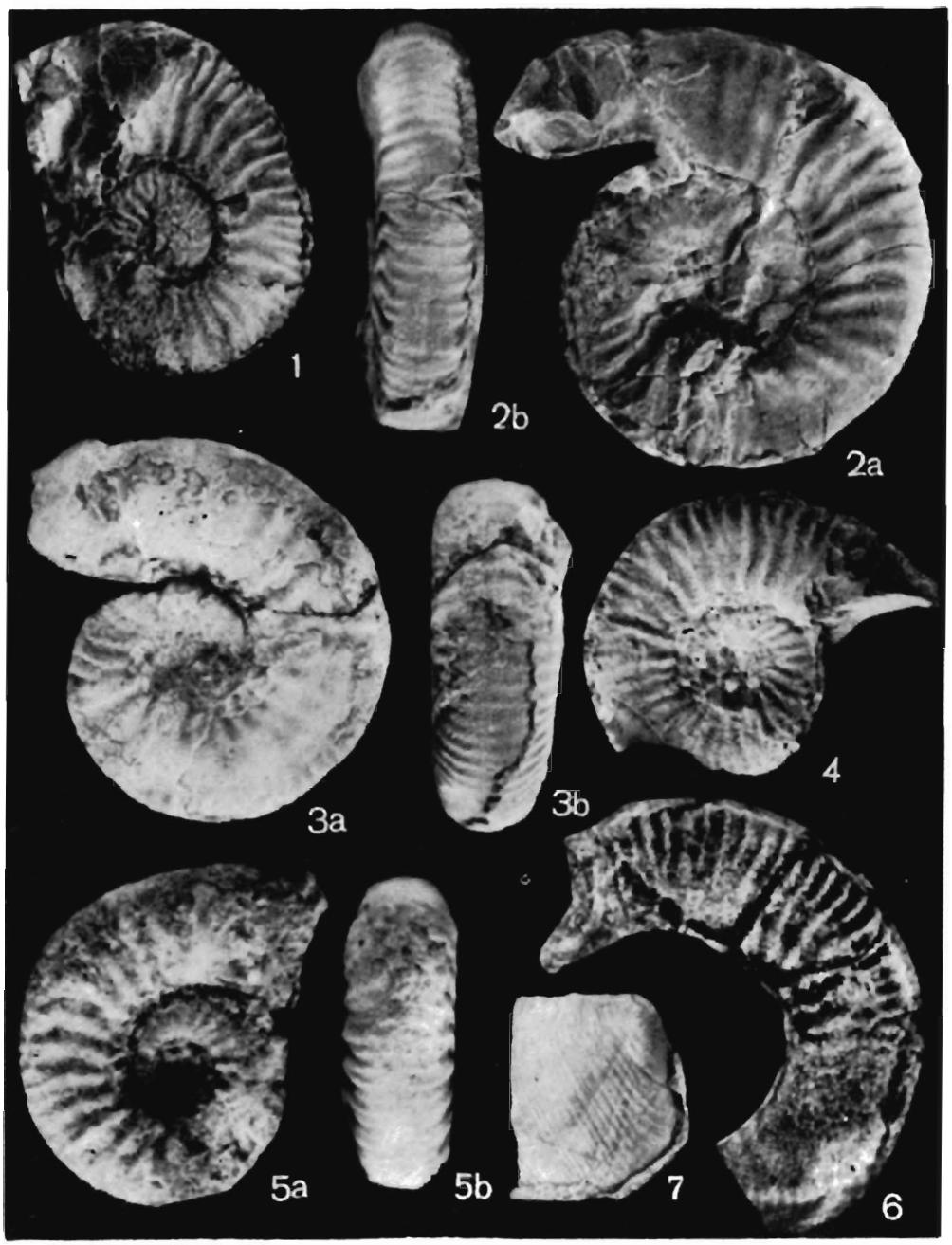
1–3 *Mirosphinctes pinarensis choffati* sp. n., subsp. n.
1a—*c* specimen No. 2275 (holotype), *2a*—*c* No. 2255a (*c* plasticine cast), *3a*—*c* No. 2507f; all specimens × 2

4 *Mirosphinctes* sp. *A*; specimen No. 2692a, × 2



1–5 *Mirosphinctes pinarensis choffati* sp. n., subsp. n.
1a–c specimen No. 2508, 2a–b No. 2272, 3a–b No. 2273, 4a–c No. 2274, 5a–b No. 2255b; all specimens × 2

6a–c *Mirosphinctes* sp. *B*; specimen No. 2578a, × 2.5



1 *Mirosphinctes* sp. *C*; specimen No. 2425, × 1.5
2a–b *Mirosphinctes minensis* sp. n.; specimen No. 2252 (holotype), × 2
3a–b *Mirosphinctes* sp. *A*; specimen No. 2692a, × 2
4 ?*Mirosphinctes* sp. *E*; specimen No. 2657, × 1.5
5a–b ?*Mirosphinctes* sp. *D*; specimen No. 2515, × 2.5
6 *Mirosphinctes* cf. *niedzwiedzkii* Siemiradzki; specimen No. 2280, × 1.5
7 *Lamellaptychus* sp.; specimen No. A-1, × 1.5; locality Mogote La Mina *II*, Jagua Formation (Pimienta Member)