

HEMIOPLITID AMMONOIDS FROM THE LOWER CRETACEOUS OF SOUTHERN PATAGONIA

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ABSTRACT. The genus *Hemihoplites* Spath is locally common in the Hauterivian-Barremian of the Austral Basin, southern Patagonia, Argentina. The taxonomic status of *Hemihoplites* is discussed, and the new species *H. varicostatus* and *H. ploszkiewiczi* are described. Extensive intraspecific variation occurs, and sexual dimorphism is reported for the first time within this genus. This is the first record of the Hemihoplitidae in the Southern Hemisphere.

THE marine Cretaceous of southern Patagonia is poorly fossiliferous. Tithonian-Berriasian strata with a rich but badly preserved ammonite fauna are overlain by a thick pelitic sequence containing mostly *Favrella* R. Douvillé, 1909 and *Hatchericeras* Stanton, 1901. Ammonites become diverse again in the Aptian and Albian (see Riccardi 1988).

The apparent absence of ammonites and the endemism of *Favrella* and *Hatchericeras* have been used as evidence for a Valanginian-Barremian biostratigraphic hiatus and unconformity (Leanza 1963). However, studies carried out in the last two decades have shown that ammonite faunas, even if rare or poorly preserved, are present also between the Berriasian and Aptian faunas. They document the Valanginian, Hauterivian, and Barremian, and the late early-late Hauterivian and Barremian ages of *Favrella* and *Hatchericeras* respectively (see Riccardi 1984a, b, 1988; Aguirre Urreta and Klinger 1986; Riccardi *et al.*, 1987). Some ammonites of these levels have already been described or figured, and others will be described in the near future. This paper deals with a very distinctive family, the Hemihoplitidae Spath, 1924, which, however, is rather rare even in the Northern Hemisphere.

The ammonoids studied here were collected by one of us (A. C. R.) in 1972, V. A. Ramos and M. A. Palma in 1979, G. Marin and M. B. Aguirre Urreta in 1981, and J. V. Ploszkiewicz and V. A. Ramos in 1982, from three different localities (text-figs. 1 and 2; Table 1). They were found in outcrops of the Rio Mayer Formation, immediately below, above, and within levels with *Favrella* spp., and in association with *Hatchericeras* spp.

The material contained in Table 1 is important in documenting the range of variation and the existence of dimorphism in the Hemihoplitidae, as well as their presence in the Southern Hemisphere. It also gives additional support to the previously reported age of *Favrella* and *Hatchericeras* (see above).

FOSSIL ASSEMBLAGES AND AGE

Within the zonal scheme proposed by Riccardi (1984a, b) for the Cretaceous of southern Patagonia, the hemihoplitids studied here occur in the following zones, in ascending sequence:

1. *F. americana* Assemblage Zone. *Hemihoplites ploszkiewiczi* sp. nov. has been collected (text-fig. 2; Table 1) 5 m below levels with *F. americana* (Favre) and is here included in the same zone. *F. americana* is usually associated with *Aegocrioceras* sp. and *Belemnopsis patagoniensis* (Favre), and has also been recorded immediately above *Acanthodiscus* sp. (Olivero 1982). The age of this zone is late early to early late Hauterivian (*inversum* Zone).

TABLE 1. Occurrences of ammonoids at Rio Belgrano, Chorrillo Rivera, and Veranada de la Vinca; samples collected *in situ* at levels indicated in text-fig. 2.

Taxa	Locality														
	Rio Belgrano						Chorrillo Rivera						Veranada de la Vinca		
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3
<i>Hemihoplites varicostatus</i>				+					+						
<i>H. ploszkiewiczii</i>													+		
<i>Hatchericeras</i> spp.					+	+		+	+	+	+	+			
<i>Cryptocrioceras yrigoyeni</i>											+				
<i>Sanmartinoceras africanum</i>											+				
<i>Protaconec. patagoniense</i>		+		+											
<i>Favrella wilckensi</i>		+													
<i>F. americana</i>	+													+	
<i>Crioceratitinae</i> indet.			+		+										
<i>Ancyloceratitinae</i> indet.							+	+	+						+

2. *F. wilckensi* Assemblage Zone. *H. varicostatus* sp. nov. has been found (text-fig. 2; Table 1) alone, and associated with *Protaconeceras patagoniense* (Favre), or with earliest *Hatchericeras* (see below). The occurrence of *P. patagoniense* in the late Hauterivian (*gottschei* Zone) of Europe establishes the age of this zone in Patagonia.

3. *H. patagonense* Assemblage Zone. *Hemihoplites varicostatus* sp. nov. occurs (text-fig. 2; Table 1) with *Hatchericeras* sp. This latter genus is widespread in the area, and is associated with *Cryptocrioceras yrigoyeni* (Leanza), and *Sanmartinoceras africanum insignicostatum* Riccardi *et al.* The stratigraphic position of this assemblage, above the *F. wilckensi* Assemblage Zone and below the *Colchidites* Assemblage Zone, suggests Lower-Middle Barremian.

SYSTEMATIC PALAEOLOGY

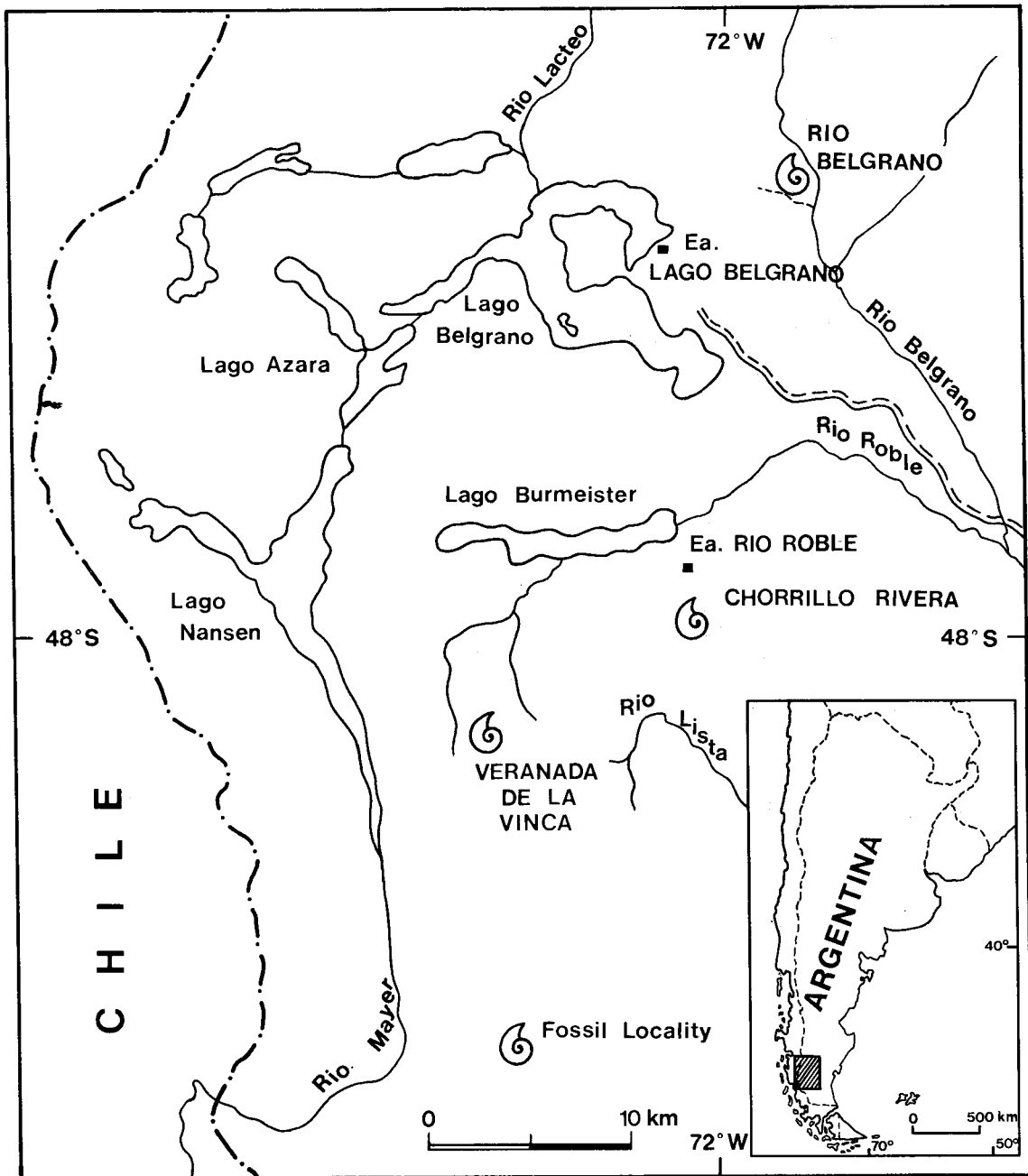
Dimensions. Dimensions of specimens are given in mm, in the following order: diameter (D), whorl height (H), whorl breadth (W), and breadth of umbilicus (U). P and S refer to number of primary and secondary ribs in half whorl. Figures in parentheses refer to dimensions as a percentage of diameter.

Suture terminology. The conventional suture terminology is followed here: I = Internal lobe, U = Umbilical lobe, L = Lateral lobe, E = External lobe.

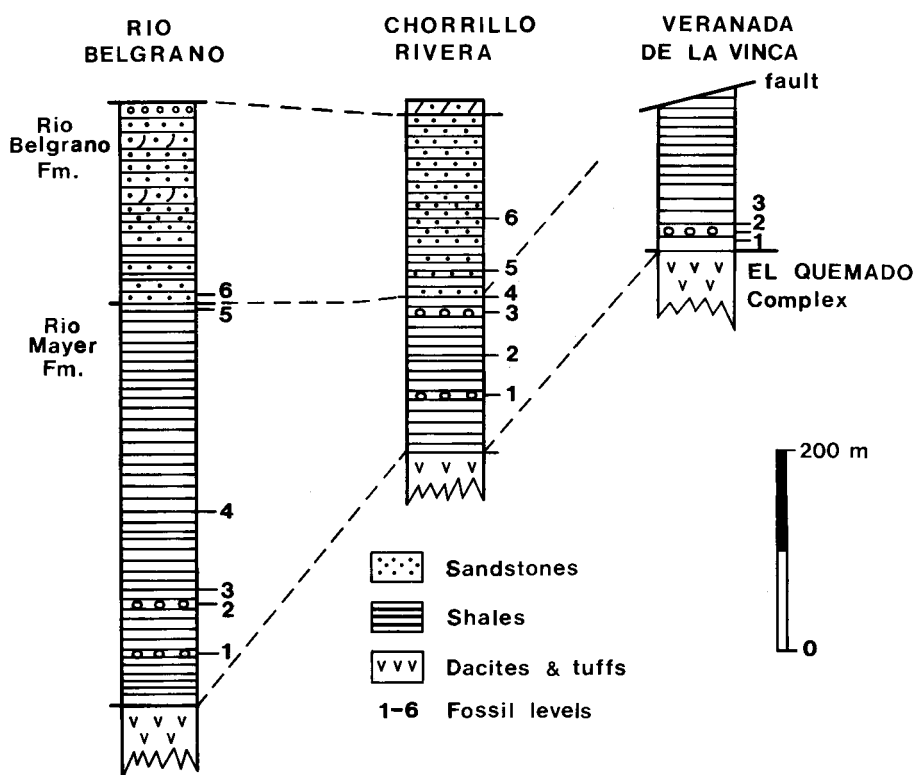
Abbreviations used for collections. CPBA, Cátedra de Paleontología, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Ciudad Universitaria, Pabellón 2, 1428 Buenos Aires, Argentina: MLP, División Paleozoología de Invertebrados, Museo de Ciencias Naturales, Universidad Nacional de La Plata, Paseo de Bosque s/n., 1900 La Plata, Argentina.

Class CEPHALOPODA Zittel, 1884
 Order AMMONOIDEA Zittel, 1884
 Suborder ANCYLOCERATINA Wiedmann, 1966
 Superfamily ANCYLOCERATACEAE Gill, 1871
 Family HEMIHOPLITIDAE Spath, 1924

Comments. Spath (1924, p. 84) introduced the Family Hemihoplitidae for *Hemihoplites*, *Pseudothurmannia*, and *Metahoplites* without further elaboration. Although the Hemihoplitidae were retained as an independent subfamily or family by Basse (1952), Wright (1957, 1981), and Luppov *et al.* (1958), the crioceratitid septal suture of *Hemihoplites* prompted Wiedmann (1962, 1966) to include this genus in the Family Ancyloceratidae,



TEXT-FIG. 1. Index map for locating the stratigraphic sections at Rio Belgrano, Chorrillo Rivera, and Veranada de La Vinca.



TEXT-FIG. 2. Stratigraphical sections at Rio Belgrano, Chorrillo Rivera, and Veranada de la Vinca (see text-fig. 1) with fossil locality numbers indicated.

Subfamily Crioceratitinae. The material included in *Hemihoplites*, however, shows no hint of other crioceratitid features such as crioceratitid coiling, presence of fine ribs intercalated with periodic stronger ribs, and bi- and trituberculation on the inner whorls with a tendency to fade on the outer. These features are also missing in *Pseudothurmannia*, as represented by its type species, *P. angulicostata* (d'Orbigny) (see Lapeyre 1974, p. 82, figs. 1-8). The presence and relative importance of crioceratitid features in *Pseudothurmannia* depends on the species included. Busnardo (1970, pp. 135-136) noted that if all species previously assigned to this genus were retained, its distinction from *Crioceratites* Leveillé would become almost impossible (see Immel 1978). A detailed assessment of the generic status of all these species is beyond the scope of this study. *Hemihoplites* and *Pseudothurmannia* seem to be distinctive enough to be included in a different family. We therefore follow Wright (1957, 1981) in retaining the Family Hemihoplitidae.

According to Wright (1957, p. 212) the Hemihoplitidae may, in addition to *Pseudothurmannia* and *Hemihoplites*, include *Pascoeites* Spath 1933. *Pascoeites* includes *P. budavensis* Spath, the type species, and *P. crassus* Spath (1933, p. 827, pl. 126, figs. 5, 7, 12), a species based on three specimens which were not described. Their stratigraphic position is unclear and no new material has been figured. As pointed out by Wright (1957, p. 212) therefore, *Pascoeites* remains a poorly known genus. *Metahoplites* has already been included (Wright 1957, p. 827) in the Holcodiscidae.

Genus HEMIOPLITES Spath, 1924 (= MATHERONITES Renngarten, 1926)

Type species. *Ammonites feraudianus* d'Orbigny, 1841, by original designation (Spath 1924, p. 84).

Diagnosis. Rather evolute, with rectangular to subquadrate whorl section, flat or slightly curved flanks and venter. Ribs simple or branching, long and short, changing from dense to well spaced;

straight or slightly flexuous, with subdued to distinct umbilical and/or lower and/or upper ventrolateral tubercles. Crioceratid suture with trifold L, and U located on inner flank.

Comments. *Hemihoplites* was introduced without diagnosis by Spath (1924, p. 84), with *A. feraudianus* d'Orbigny (1841, p. 324, pl. 96, figs. 4 and 5) as type species. Renngarten (1926, p. 27) subsequently proposed *Matheronites* as a subgenus of *Acanthohoplites* Sinzow, with *A. soulieri* Matheron (1878, pl. C-21, fig. 1a, b) as type species. In spite of the alleged (Renngarten 1926, p. 97) poor knowledge of *H. feraudianus*, the figures of *A. soulieri* show close resemblance in most features, except for the ribbing which in *H. feraudianus* is more flexuous and more often bifurcated on the umbilical margin. This similarity was made plain when Fallot and Termier (1923, p. 67, pl. 6, fig. 1; text-fig. 29) included in '*Parahoplites soulieri* Math.' a specimen that is in fact closer to the type of *H. feraudianus*.

The subgenus *Matheronites* has been subsequently raised to generic status, usually in connection with records of *M. soulieri* and related species (see below) from eastern Europe and the Caucasus. This probably explains the common usage (see Rouchadze 1933; Eristavi 1955; Luppov *et al.* 1958; Drushchits and Kudryastev 1960; Breskovski 1966; Dimitrova 1967; Bogdanova 1971) of the name *Matheronites*, whilst *Hemihoplites* has remained a poorly known genus. Nevertheless, Wright (1957) and Wiedmann (1962, 1966) considered *Matheronites* to be a junior synonym, and Kakabadze (1981, p. 92) regarded it as a subgenus, of *Hemihoplites*. Kakabadze (1981, p. 31), however, placed '*A. soulieri*' in the subgenus *Hemihoplites*, whilst considering '*A. ridzewskyi*' Karakasch as the type species of the subgenus *Matheronites*.

The species referred to *Matheronites* and *Hemihoplites* by previous authors could on morphological grounds be placed into two different groups. One of them is characterized by straight or slightly flexuous ribs, simple or bifurcated, and by umbilical, frequent ventrolateral, and rare lateral tubercles, which develop through ontogeny. Material with umbilical or with umbilical and ventrolateral tubercles has been described under '*M. soulieri*' (Matheron 1878, pl. C-21, fig. 1a, b; Fallot and Termier 1923, p. 67, pl. 6, fig. 1a-c; Rouchadze 1933, p. 201, pl. 3, fig. 5), '*M. khwamliensis*' Rouchadze (1933, p. 202, pl. 3, fig. 6; ?Kakabadze 1981, pl. 5, fig. 2a, b), '*M. turcmenicus*' Luppov (1936, p. 122, pl. 1, figs. 1-3), '*M. ridzewskyi*' (Drushchits and Kudryastev 1960, p. 287, pl. 30, fig. 3a, b; Dimitrova 1967, p. 71, pl. 32, fig. 5), and *M. brevispinus* Bogdanova (1971, p. 337, pl. 6, figs. 1 and 2). Material with three rows of tubercles has been figured under '*M. ridzewskyi*' (Karakasch 1896, p. 108, pl. 4, figs. 9 and 10; Renngarten 1926, p. 29, pl. 2, figs. 9 and 10; Luppov *et al.* 1958, pl. 46, fig. 7a, b; Drushchits and Kudryastev 1960, p. 287, pl. 30, fig. 2a, b; Kakabadze 1981, pl. 2, fig. 2a, b), '*M. astarte*' (Fallot and Termier 1923, p. 70, pl. 6, figs. 2-5; Wiedmann 1966, pl. 6, fig. 6a-c), '*M. soulieri*' (Dimitrova 1967, p. 70, pl. 32, fig. 1), '*M. coheni*' (Dimitrova 1967, p. 69, pl. 32, fig. 2), '*H. (M.) trispinosus*' (Koenen) (Kakabadze 1981, pl. 2, figs. 3a, b-5), and '*H. (M.) brevispinus*' (Koenen) (Kakabadze 1981, pl. 2, fig. 6a, b).

A different, twofold separation of most of these species has been proposed by Kakabadze (1981, p. 93) which uses the frequency of intercalatories and the density of ribbing; *Matheronites* is retained as a subgenus of *Hemihoplites*, but with a different type species *H. (M.) ridzewskyi* (Karakasch)!

Most other species referred to '*Matheronites*' are characterized by crioceratid coiling, and an ornament consisting of weak or strong ribs intercalated with prominent periodic ribs, and of umbilical, lateral, and ventrolateral tubercles which are well developed in the inner whorls and show a tendency to become ontogenetically weaker, i.e. '*M. alpinus*' (d'Orbigny, 1850, p. 100; Cottreau 1937, p. 63, pl. 78, figs. 16 and 17; Dimitrova 1967, p. 68, pl. 34, fig. 3), '*M. hammatoptychum*' (Uhlig 1883, p. 262, pl. 30, figs. 1 and 2a-c; H. Douvillé 1916, p. 111, pl. 14, figs. 1-5; Dimitrova 1967, p. 67), '*M. heberti*' (Fallot 1884, p. 296, pl. 9, fig. 2a-c; Thieuloy 1979), '*M. suessi*' (Toula 1892, p. 338, pl. 2, fig. 1; Dimitrova 1967, p. 67, pl. 32, fig. 3), '*M. barremense*' (Kilian in Kilian and Leenhardt 1895, p. 978; Uhlig 1888, p. 95, pl. 4, fig. 3a-c; Simionescu 1900, p. 14, pl. 1, figs. 4 and 5; Collignon 1948, p. 79, pl. 12, fig. 4, 4a; Sarkar 1955, p. 86, text-fig. 13; Nikolov 1964, p. 122, pl. 2, fig. 2a, b; Dimitrova 1967, p. 69, pl. 32, fig. 4), '*M. anthulai*' (Eristavi 1955; Anthula 1899, p. 125, pl. 12, fig. 2a-c; Thieuloy 1979, p. 307), '*M. parolinianus*' (Rodighiero 1919, p. 114, pl. 13, fig. 7; Dimitrova 1967, p. 70, pl. 33, fig. 3), '*M. coheni*' (Sarkar 1955, p. 86, pl. 7, fig. 2), '*M. limentinus*' Thieuloy (1979, p. 307, pl. 1, figs. 1-4; pl. 2, fig. 5; ?Haug 1889, p. 215, pl. 11, fig. 5; Drushchits and Kudryastev 1960, p. 292, pl. 34, fig. 1a, b), and the poorly known '*M. ukensis*' Dimitrova (1967, p. 68, pl. 33, fig. 5). As pointed out by Bogdanova (1971, p. 337), these species have 'crioceratid' (ancyloceratid) affinities and should not be grouped with those mentioned above under the same genus/subgenus. An assessment of their correct generic status and relationships is beyond the scope of this paper. The same holds true for the type material of '*M. brevispinus*' v. Koenen and '*M. trispinosus*' v. Koenen (1902, pp. 363, 366, pl. 35, figs. 1a-c, 2a, b, 3a, b, 4a, b, 5a, b, 6a-c, 7a-c, 8a, b; pl. 39, figs. 1a, b and 2) (see Kemper 1973, p. 51). Material from the western USA described under '*H. popenoi*' Murphy (1975, p. 38, pl. 8, figs. 1-5) does not belong in either of these groups.

The morphological differences between *H. feraudianus* (d'Orbigny 1841, p. 324, pl. 96, figs. 4 and 5; Wiedmann 1966, p. 43, pl. 6, fig. 3a, b) and '*M.* *soulieri*' (Matheron 1878, pl. C-21, fig. 1a, b) are not large enough to support a generic/subgeneric distinction, as is clearly evident from Kakabadze's (1981) inclusion of the latter species in *Hemihoplites*. The affinity between these two type species cannot be dismissed because of an artificially enlarged concept of *Matheronites* (see Dimitrova 1967; Thieuloy 1979), and the designation of another type species for *Matheronites*, as proposed by Kakabadze (1981, p. 93), is not permissible under ICZN rules. Thus, *Matheronites* is regarded as a junior synonym of *Hemihoplites*, as previously indicated by Wright (1957) and Wiedmann (1962, 1966).

The differences between *Hemihoplites* and *Pseudothurmannia* are difficult to determine because interpretations of the latter genus vary. The large number of species and material included in *Pseudothurmannia* imply a large range of variation (see d'Orbigny 1841; Simionescu 1900; Koenen 1902; Rodighiero 1919; Eristavi 1955; Sarkar 1955; Luppov *et al.* 1958; Drushchits and Kudryastev 1960; Wiedmann 1962; Dimitrova 1967; Thomel 1964; Breskovski 1966; Busnardo 1970; Immel 1978). When restricted to the type species *P. angulicostata* (d'Orbigny) (see Lapeyre 1974) and related species, it can be seen that *Pseudothurmannia* tends to become uncoiled with growth, to have tubercles on the umbilical margin (from which one or several ribs and intercalatories are born which are usually restricted to the upper part of the flank), and periodic stronger ribs on the outer whorl.

Material that could be referred to *Hemihoplites* has been described from the Barremian and/or Lower Aptian of the Balearics (Fallot and Termier 1923), Bulgaria (Dimitrova 1967), ?Canada (Jeletzky 1976), France (d'Orbigny 1841; Matheron 1878; Fallot and Termier 1923; Wiedmann 1966), Italy (Capellini 1881), ?Mexico (Imlay 1938), Spain (Wiedmann 1966), Caucasus and Turkmenia in the USSR (Karakasch 1896; Renngarten 1926; Rouchadze 1933; Luppov 1936; Eristavi 1955; Luppov *et al.* 1958; Drushchits and Kudryastev 1960; Bogdanova 1971; Kakabadze 1981), and Yugoslavia (Petkovic and Miletic 1949).

Hemihoplites varicostatus sp. nov.

Plate 51, figs. 1-9; Plate 52, figs. 1-3; text-figs. 3a-c, 4, 5a-f

?1949 *Crioceras angulicostatum* d'Orb.; Petkovic and Miletic, p. 134, pl. 2, figs. 11 and 12.

1987 *Hemihoplitidae* indet. Riccardi *et al.*, p. 109.

Holotype. The incomplete phragmocone of a macroconch (MLP 20647), figured in Plate 51, figs. 1 and 2, from level 4, Rio Belgrano, Santa Cruz, Upper Hauterivian.

Allotype. The incomplete phragmocone and body-chamber of a microconch (CPBA 14152) figured in text-fig. 5a, from the same locality as the holotype.

Derivatio nominis. Latin for the wide range of variation in rib density.

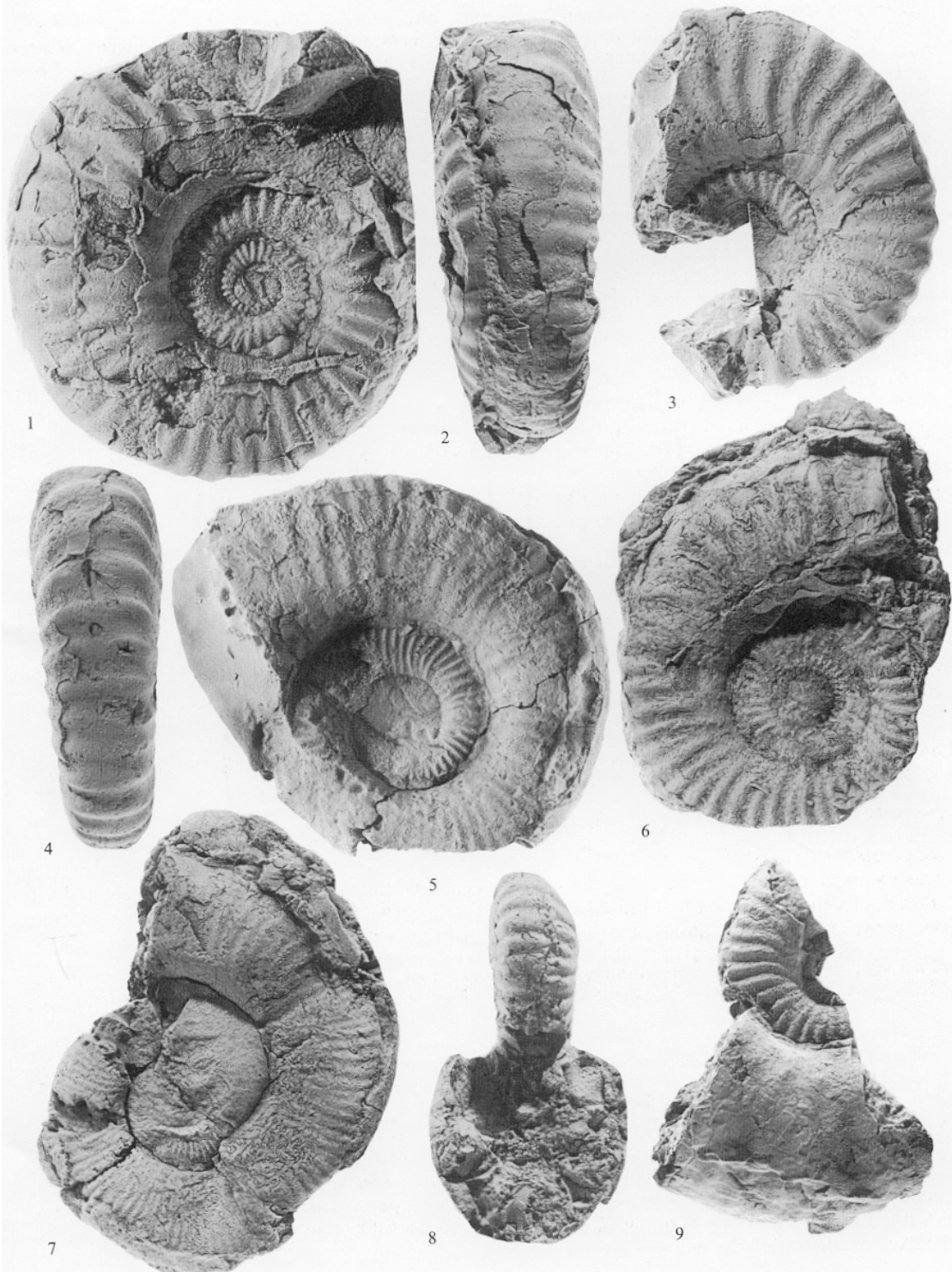
Diagnosis. A species of *Hemihoplites* with rather evolute coiling, subquadrate to subrectangular whorl section, rounded to shallow inner margin; flexuous ribbing, usually bifurcating at umbilical margin of inner whorls and simple on outer whorls, variable density, but decreasing through ontogeny; inner whorls with tubercle-like swelling present irregularly at furcation points.

Material. The holotype and seven incomplete phragmocones (MLP 20648-20650, 22044, CPBA 11096, 14150-14151) probable macroconchs. The allotype, two incomplete specimens (CPBA 14153 and 14155) probably

PLATE 51. *Hemihoplites varicostatus* sp. nov. 1 and 2, MLP 20647, holotype, incomplete phragmocone of a macroconch, lateral and ventral views. 3 and 4, CPBA 11096, incomplete phragmocone of a macroconch, lateral and ventral views. 5, MLP 20648, incomplete phragmocone of a macroconch, lateral view. 6, MLP 20649, incomplete phragmocone, lateral view. 7, CPBA 14151, incomplete phragmocone, lateral view. 8 and 9, MLP 20650, incomplete phragmocone of a macroconch, lateral and apertural views. All figures $\times 1$.

EXPLANATION OF PLATE 51

Figs. 1-9. *Hemihoplites varicostatus* sp. nov., Rio Belgrano. 1 and 2, MLP 20647, holotype, incomplete phragmocone of a macroconch, lateral and ventral views. 3 and 4, CPBA 11096, incomplete phragmocone of a macroconch, lateral and ventral views. 5, MLP 20648, incomplete phragmocone of a macroconch, lateral view. 6, MLP 20649, incomplete phragmocone, lateral view. 7, CPBA 14151, incomplete phragmocone, lateral view. 8 and 9, MLP 20650, incomplete phragmocone of a macroconch, lateral and apertural views. All figures $\times 1$.

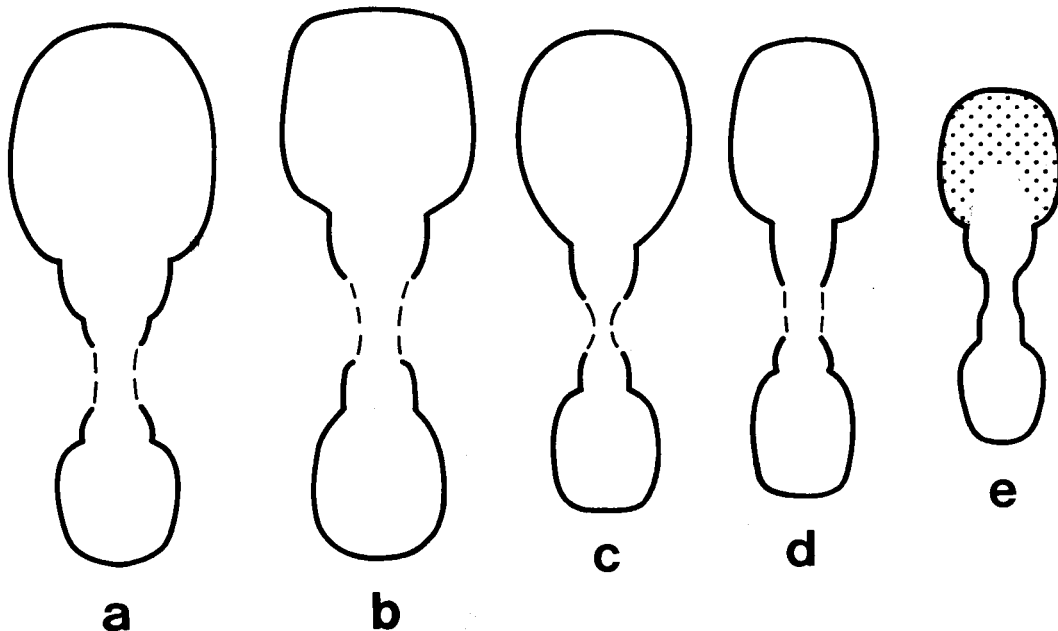


RICCARDI and AGUIRRE URRETA, *Hemihoplites*

representing microconchs, and one juvenile? incomplete phragmocone (CPBA 14154). One (CPBA 14150) from level 3, Chorrillo Rivera, and all the others from the same level and locality as the holotype. Collected by A. C. Riccardi (1972), V. A. Ramos and M. A. Palma (1979), and G. Marin and M. B. Aguirre Urreta (1981).

Description

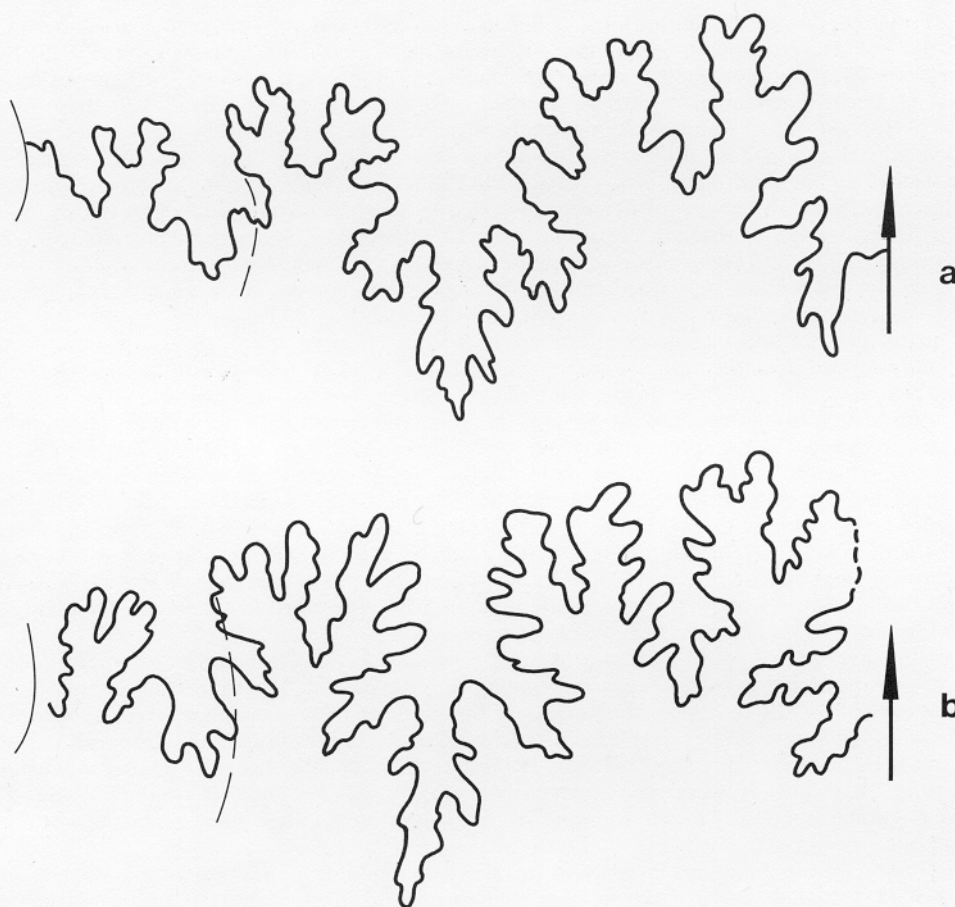
Macroconch. The incomplete phragmocones range from 45.2 mm to 77 mm in diameter and are rather evolute ($U/D = 0.35-0.44$). The whorl section varies from subquadrate to subrectangular ($H/W = 1.01-1.11$), with rounded umbilical shoulder and steep to shallow inner margin. The flanks and venter are flattish to slightly convex (text-fig. 3a-c). The ornament consists of rounded, blunt ribs which increase in strength throughout ontogeny and from the lower to the upper part of the flanks. They cross the umbilical wall with an adoral projection, and some of them, typically on the inner whorls, become thick and bifurcate on the umbilical margin; all ribs form a shallow adapical bow on the lower third of the flank, are slightly projected on the upper part of the flank, and cross straight over the venter. The number of ribs decreases throughout the last two whorls (Pl. 51, figs. 1-4).



TEXT-FIG. 3. Cross-sections through the phragmocone and body-chamber (stippled) of *Hemihoplites* spp. a-c, *H. varicostatus* sp. nov. a, MLP 20647, holotype; b, MLP 20648; c, CPBA 11096. d, e, *H. ploszkiewiczi* sp. nov. d, CPBA 14146, holotype; e, CPBA 14149, allotype.

The septal suture (text-fig. 4) is moderately complex and strongly protracted. L is slightly deeper than E, moderately wide and symmetrically trifid; U is located on the umbilical edge, is also trifid but about half as deep as L; there follow another well-developed saddle and a small lobe. The internal suture was not investigated.

Microconch. The adult body-chamber is 20 to 41 mm in diameter, rather evolute ($U/D = 0.33-0.35$), with subrectangular whorl section ($H/W = 1.26-1.35$), shallow inner margin, flat flanks, and flat to slightly concave venter. Thick and blunt flexuous ribs, simple or bifurcating on the umbilical margin, increase in thickness through ontogeny and from the lower to the upper part of the flank, and become more widely spaced on the last two whorls (text-fig. 5a). The aperture is not preserved.



TEXT-FIG. 4. External septal sutures of *Hemihoplites varicostatus* sp. nov. a, CPBA 11096 at H = 18.6 mm and W = 15.6 mm; b, MLP 22044 at H = 17.4 mm and W = c. 18.4 mm.

Dimensions.

		D	H	W	H/W	U	P	S
Holotype								
MLP 20647	phragmocone	72.3	30.7 (0.42)	28.4 (0.39)	1.08	24.5 (0.34)	17	20
	phragmocone	63.7	26.8 (0.42)	26.0 (0.41)	1.03	22.1 (0.35)	—	—
MLP 20648	phragmocone	73.0	26.3 (0.36)	25.9 (0.35)	1.02	29.0 (0.40)	22	30
	phragmocone	54.2	19.0 (0.35)	18.5 (0.34)	1.03	20.8 (0.38)	—	—
MLP 20649	phragmocone	77.0	—	—	—	27.6 (0.36)	17	23
MLP 20650	phragmocone	45.2	16.6 (0.37)	14.1 (0.31)	1.18	12.9 (0.29)	11	17
CPBA 14150	phragmocone	64.2	28.0 (0.44)	24.0 (0.37)	1.17	20.5 (0.32)	12	19
CPBA 11096	phragmocone	65.2	22.8 (0.35)	20.5 (0.31)	1.11	22.8 (0.35)	14	16
CPBA 14152	body-chamber	41.0	14.8 (0.36)	11.0 (0.27)	1.35	14.3 (0.35)	11	14
CPBA 14153	body-chamber	30.0	8.2 (0.41)	6.5 (0.33)	1.26	6.5 (0.33)	12	16
CPBA 14154	phragmocone	15.2	6.0 (0.39)	5.5 (0.36)	1.09	4.2 (0.28)	—	—

Comments. *H. varicostatus* includes some specimens (Pl. 51, figs. 3 and 4) which are similar to *H. feraudianus*, but the intraspecific variation of both species is completely different. Although d'Orbigny (1841, p. 324, pl. 96, figs. 4 and 5) figured only one specimen of *H. feraudianus* from the Emeric Collection, d'Orbigny's Collection included thirty-two specimens. A search for the type series in the Muséum National de Histoire

Naturelle (Paris) by one of the authors (A.C.R.), has revealed that the specimen figured by d'Orbigny appears to be lost. Nevertheless, the collection includes a plaster cast of a specimen (no. R.923) from the Barremian of the Maritim Alps, Emeric Collection, labelled as 'Type', and most of d'Orbigny originals. The plaster cast of Emeric's specimen is partially crushed, and agrees in most features with those figured by d'Orbigny (1841, pl. 96, figs. 4 and 5), including total absence of tubercles. Of twenty-nine specimens examined in the d'Orbigny collection, most of them (twenty-one) are characterized by the presence of tubercles, usually on the upper half of the flank and on the ventrolateral shoulder. The remaining specimens are similar to Emeric's specimen in the absence of tubercles. Even if the specimens came from different localities (S. Martin, La Loire, Angles, Barreme) there is a coexistence of both tuberculated and non-tuberculated specimens in the same locality. Thus, d'Orbigny's type series indicates that the presence of tubercles in *H. feraudianus* is quite variable. In this respect it is worth noting that both morphotypes seem to have been included in '*Parahoplites soulieri*' and '*P. astarte*' by Fallot and Termier (1923).

Part of the type series and the specimen figured by Wiedmann (1966, pl. 6, fig. 3a, b) indicate that the species is characterized by rather evolute coiling, subrectangular whorl section with flattish venter, and by blunt ribs which may bifurcate from incipient umbilical tubercles, are slightly flexuous and projected on the flanks, with obsolete tubercles on the ventrolateral shoulder, and cross the venter without interruption. The same features are present in the specimen referred to '*P. soulieri* Math.' by Fallot and Termier (1923, p. 67, pl. 6, fig. 1a-c). This specimen, also with slightly flexuous and projected ribs quite often bifurcating from umbilical tubercles, differs from *A. soulieri* Matheron (1878, pl. C-21, fig. 1a, b) and the clearly related *H. astarte* (Fallot and Termier 1923, p. 70, pl. 6, figs. 2-5). These two specimens have common, simple, and straight ribs with more clearly developed ventrolateral tubercles. Similar features appear also to be present in the specimen figured by Rouchadze (1933, pl. 3, figs. 5 and 6) under '*M. cfr. soulieri*' and '*M. khwamliensis*' Rouchadze. But all features of *H. feraudianus* are quite clearly represented in the incomplete phragmocone figured by Luppov (1935, pl. 1, figs. 1-3) under '*M. turcmenicus*'.

However, the inclusion of all these specimens in *H. feraudianus* is not enough to characterize adequately the range of variation of this species, especially considering the possible inclusion of morphotypes with up to three rows of tubercles (see above). Furthermore, the presence of sexual dimorphism, as shown by the Patagonian material, needs also to be explored. Existence of sexual dimorphism in the European Hemihoplitiidae is suggested by material figured by d'Orbigny (1841, pl. 42, fig. 3), and later referred to *Pseudothurmannia* (see Busnardo 1970, p. 135). However, the specimen examined by one of us (A.C.R.) in the Muséum National de Histoire Naturelle, is a poorly preserved impression with aperture poorly defined, and its taxonomic status is uncertain.

Thus, the material from Patagonia included in *H. varicostatus* sp. nov. appears to have a range of variation unlike that of *H. feraudianus*. Furthermore, in specimens referred in the European and Soviet literature to either *H. feraudianus* and related species or even to the genus/subgenus *Pseudothurmannia*, the subquadrate whorl section and dense ribbing shown by some of the Patagonian specimens is absent. We therefore conclude that the Patagonian species is characterized by a different range of variation, in spite of some morphological overlap with *H. feraudianus* related to specimens with more subrectangular whorl section and sparser ribbing without tubercles.

Although specimens with subrectangular whorl section and sparser and stronger ribbing included in *H. varicostatus* are very close to European material referred to *H. feraudianus*, closer similarity was found to a specimen referred to as '*Crioceras angulicostatum*' by Petkovic and Miletic (1949, pl. 2, figs. 11 and 12). This Yugoslavian species, as well as the specimen figured by these authors on Plate 2, figs. 7-9, do not belong to *Pseudothurmannia* as indicated by other authors (see references under genus discussion).

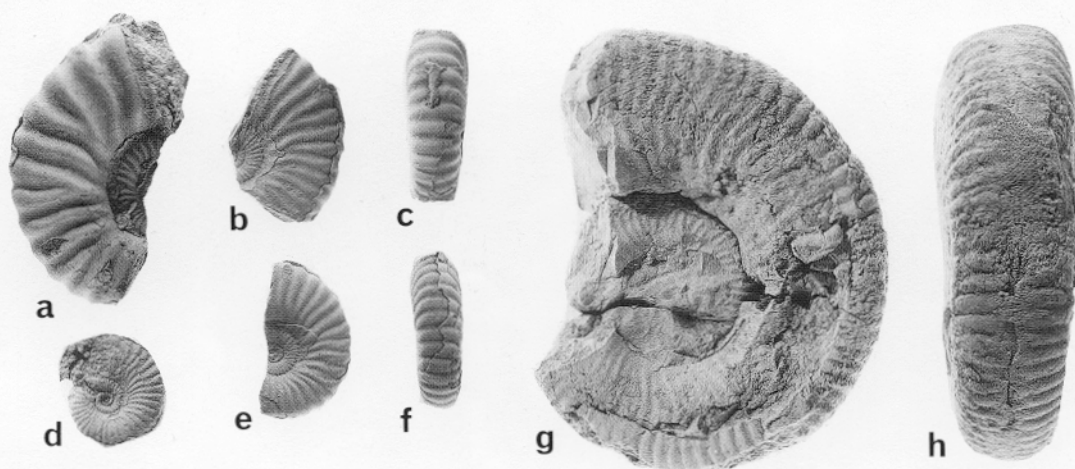
EXPLANATION OF PLATE 52

Figs. 1-3. *Hemihoplites varicostatus* sp. nov. 1, CPBA 14151, incomplete phragmocone, lateral view, Rio Belgrano. 2 and 3, CPBA 14150, incomplete phragmocone, ventral and lateral views, Chorrillo Rivera. Figs. 4-9. *H. ploszkiewicz* sp. nov., Veranada de la Vinca. 4, CPBA 14147, ?mature phragmocone with nearly complete body-chamber, lateral view. 5 and 6, CPBA 14149, allotype, complete? microconch, lateral and ventral views. 7 and 8, CPBA 14148, nearly complete microconch, ventral and lateral views. 9, CPBA 14145, incomplete phragmocone of a macroconch, lateral view.

All figures $\times 1$.



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TEXT-FIG. 5. *a-f*, *Hemihoplites varicostatus* sp. nov., Rio Belgrano. *a*, CPBA 14152, allotype, mature? incomplete phragmocone and body-chamber of a microconch, lateral view. *b*, *c*, CPBA 14155, incomplete phragmocone and body-chamber of a ?mature specimen, lateral and ventral views. *d*, CPBA 14154, phragmocone of a ?juvenile, lateral view. *e*, *f*, CPBA 14153, incomplete phragmocone of a ?juvenile, lateral and ventral views. *g*, *h*, *H. ploszkiewicz* sp. nov. CPBA 14146, holotype, incomplete phragmocone of a macroconch, lateral and ventral views, Veranada de la Vinca. All figures $\times 1$.

Hemihoplites ploszkiewicz sp. nov.

Plate 52, figs. 4-9; text-figs. 3*d*, *e*, 5*g*, *h*, 6

Holotype. The macroconchiate incomplete phragmocone (CPBA 14146), figured in text-fig. 5*g*, *h*, from the basal part (level 1) of the Rio Mayer Formation, Veranada de La Vinca, Santa Cruz, late early Hauterivian.

Allotype. The complete? microconch (CPBA 14149), figured in Plate 52, fig. 4*a*, *b*, from the same level and locality as the holotype.

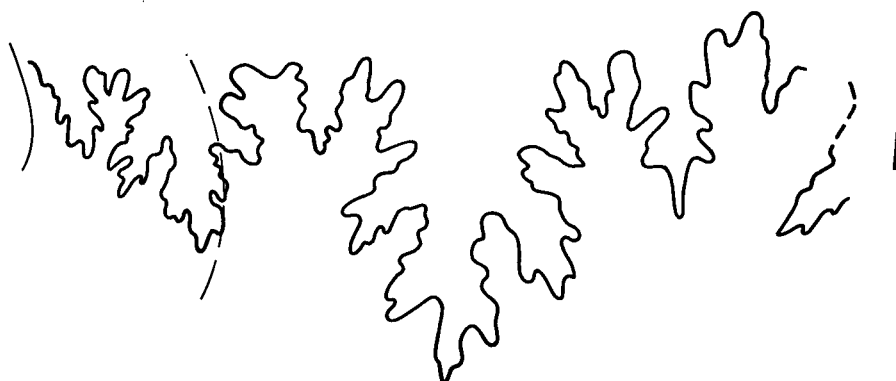
Derivatio nominis. After J. V. Ploszkiewicz, who collected the material here described.

Diagnosis. A species of *Hemihoplites*, with subrectangular and compressed whorl section, and dense, fine, flexuous ribbing on phragmocone, becoming more widely spaced on body-chamber; microconchiate body-chamber with faint ventral tubercles and more frequent intercalatory ribs.

Material. The holotype, the allotype, one macroconch with mature? phragmocone and nearly complete body-chamber (CPBA 14147), one incomplete macroconchiate phragmocone (CPBA 14145), and one nearly complete microconch (CPBA 14148); all from the same level and locality as the holotype collected by J. V. Ploszkiewicz and V. A. Ramos (1982).

Description. Coiling is relatively evolute, with impressed dorsum. On the inner whorls, the whorl section is subquadrate, slightly higher than wide, with flat flanks, rounded venter, and angular umbilical and ventrolateral margins. With increasing diameter, the whorl section becomes more compressed ($H/W = 1.05-1.14$) with flanks flat but slightly converging towards the venter and the umbilical border more rounded. The maximum width is on the lower third of the flank (text-fig. 3*d*, *e*). The umbilicus is relatively large and shallow, and becomes smaller with increasing diameter ($U/D: 0.38-0.32$).

On the phragmocone the ribs arise at the umbilical margin, curve forward, then backwards, cross the flanks with a flexuous curve, and are straight over the venter. Most of the ribs arise singly from the umbilical edge, some are in pairs, while a few are intercalated higher on the whorl flanks. The macroconchiate phragmocones have 17-19 primary ribs and 30-35 secondary ribs per half-whorl. One microconchiate phragmocone shows 17 primary and 21 secondary ribs. They are fine, dense, and evenly separated by interspaces as wide as the ribs.



TEXT-FIG. 6. External septal suture of *Hemihoplites ploszkiewiczzi* sp. nov. CPBA 14147 at H = 21.7 mm and W = c. 19 mm.

On the body-chamber of both macro- and microconchs, ribbing retains the pattern of the phragmocone, but becomes coarser and more spaced. The microconchiate body-chamber has more intercalatories, arising from the dorsal third of the flank, and faint tubercles, which border a siphonal depression. There are 14 primary and 23–24 secondary ribs per half-whorl.

The septal suture (text-fig. 6) is moderately complex and strongly protracted. L is deeper than E, moderately wide and symmetrically trifid; U is located on the umbilical margin and is also trifid; there follows another saddle and a small lobe. The internal suture was not investigated.

Dimensions.

		D	H	W	H/W	U	P	S
Holotype								
CPBA 14146	phragmocone	61.6	23.3 (0.38)	20.4 (0.33)	1.14	22.5 (0.36)	19	35
Allotype								
CPBA 14149	body-chamber	50.5	20.2 (0.40)	17.8 (0.35)	1.14	16.0 (0.32)	14	23
	phragmocone	34.7	15.3 (0.44)	14.5 (0.42)	1.05	12.0 (0.34)	18	21
CPBA 14148	body-chamber	52.5	21.8 (0.41)	19.1 (0.36)	1.14	17.1 (0.32)	14	24
	phragmocone	37.5	15.4 (0.41)	14.3 (0.38)	1.07	13.9 (0.37)	—	—
CPBA 14147	phragmocone	85.8	c. 32.6 (0.38)	—	—	c. 28.0 (0.33)	—	—
	phragmocone	74.2	29.0 (0.40)	—	—	25.8 (0.35)	—	—
	phragmocone	52.2	22.5 (0.44)	—	—	19.9 (0.38)	—	—
CPBA 14145	phragmocone	56.8	22.7 (0.40)	20.5 (0.36)	1.10	20.0 (0.37)	17	30

Comments. *H. ploszkiewiczzi* n. sp. differs from *H. feraudianus* (d'Orbigny 1841, p. 324, pl. 96, figs. 4 and 5; Wiedmann 1966, pl. 6, fig. 3a, b) in the denser ribs on the phragmocone at similar diameter, and the seemingly larger size. Comparison is hindered by the poorly known sexual dimorphism in *H. feraudianus*. However, *H. ploszkiewiczzi* is similar to some Northern Hemisphere specimens described under other specific names, but here referred to *H. feraudianus* (see under genus and below).

The new dimorphic species *H. varicostatus* (see above), differs in the range of variation of ribbing and whorl section of the macroconchs, which at similar phragmocone diameter includes specimens with sparser and stronger ribs and subrectangular whorl section. When the microconchs are compared, *H. ploszkiewiczzi* is larger and has more numerous and finer ribs.

H. ploszkiewiczzi differs from all other species of *Hemihoplites* (see under genus) in the denser ribbing. Only the microconch resembles quite closely some Northern Hemisphere representatives of *Hemihoplites* described under different species, but here referred to *H. feraudianus* (see Fallot and Termier 1923, pl. 6, fig. 1a, b; Rouchadze 1933, pl. 3, figs. 5 and 6; Luppov 1936, pl. 1, figs. 1–3; Drushchits and Kudryastev 1960, pl. 38, fig. 1a, b). These specimens, however, are more involute and no possible macroconch is known that could be compared to the Patagonian species. *H. ploszkiewiczzi* has some superficial resemblance to *Pseudothurmannia* in coiling and rib density. However, the Patagonian form lacks a distinctive row of umbilical tubercles, the

intercalatories are born near the umbilical margin, and the ribs are bent on the lower part of the flank and straight on the upper; it shows no hint of progressive uncoiling and of periodic, stronger ribs throughout ontogeny (see under generic discussion).

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REFERENCES

- AGUIRRE URRETA, M. B. and KLINGER, H. C. 1986. Upper Barremian Heteroceratinae (Cephalopoda, Ammonoidea) from Patagonia and Zululand, with comments on the systematics of the subfamily. *Ann. S. Afr. Mus.* **96**, 315-358.
- ANTHULA, D. J. 1899. Über die Kreidefossilien des Kaukasus. *Beitr. Paläont. Geol. Ost.-Ung.* **12**, 55-159.
- BASSE, E. 1952. Classe des Céphalopodes. In PIVETEAU, J. (ed.). *Traité de Paléontologie*, **2**, pp. 461-755. Masson et Cie, Paris.
- BOGDANOVA, T. N. 1971. New Barremian ammonites from western Turkmenia. *Paleont. J.* **3**, 334-344.
- BRESKOVSKI, S. T. 1966. Biostratigraphie du Barrémien au sud du village de brestak dans la region de Varna. *Trav. géol. Bulgarie, Ser. Paleont.* **8**, 71-121.
- BUSNARDO, R. 1970. Les *Pseudothurmannia* (Ammonoidea) de l'Hauterivien supérieur de la Montagne de Lure. *Docums Lab. Géol. Fac. Sci. Lyon*, **37**, 133-145.
- CAPELLINI, G. 1881. Il magigno di Porretta e le rocce a Globigerine dell'Appennino bolognese. *Memorie R. Accad. Sci. Ist. Cl. Sci. fis. Bologna*, ser. Y, **2**, 175-194.
- COLLIGNON, M. 1948. Faune Néocomienne des couches à *Crioceras* de Belohasifaka, Cercle de Sitampiky, Madagascar. *Annls. géol. Serv. Mines Madagascar*, **15**, 55-83.
- COTTREAU, J. 1937. Types du prodrome de Paléontologie stratigraphique universelle de d'Orbigny. B. Néocomien supérieur ou Urgonien. *Annls. Paléont.* **26**, 17-48.
- DIMITROVA, N. 1967. *Les fossiles de Bulgarie. 4. Crétacé inférieur. Cephalopoda (Nautiloidea et Ammonoidea)*, 424 pp. Academy of Bulgarian Science, Sofia.
- DOUVILLÉ, H. 1916. Les terrains secondaires dans la Massif du Moghara. *Mém. Acad. Sci. Inst. Fr.* (2) **54**, 1-48.
- DOUVILLÉ, R. 1909. Sur des Ammonites provenant des environs de Lima et sur une nouvelle coupure de la famille des Hoplitidés: *Favrella* n. gen. *C. r. Soc. géol. Fr.* (4) **9**, 164-166.
- DRUSHCHITS, V. V. and KUDRYASTEV, M. P. 1960. Atlas of the Lower Cretaceous fauna of northern Caucasus and Crimea. *Trudy vses. nauchno-issled. Inst. priv. Gazov.* 1-700. [In Russian.]
- ERISTAVI, M. S. 1955. Lower Cretaceous fauna of Georgia. *Monogr. Inst. Geol. Akad. Nauk Gruz. SSSR*, **6**, 1-224. [In Russian.]
- FALLOT, E. 1884. Note sur un gisement crétacé fossilifère des environs de la gare d'Eze (Alpes-Maritimes). *Bull. Soc. géol. Fr.* (3) **12**, 289-300.
- FALLOT, P. and TERMIER, H. 1923. Ammonites nouvelles des Iles Baléares. *Trab. Mus. nac. Cienc. nat. (Geol.)*, **32**, 1-83.
- HAUG, E. 1889. Beitrag zur Kenntniss der Ober-Neocom Ammoniten fauna der Puezalpe bei Corvara (Subtirol). *Beitr. Paläont. Geol. Ost.-Ung.* **7**, 193-229.
- IMLAY, R. 1938. Ammonites of the Taraises Formation of Northern Mexico. *Bull. geol. Soc. Amer.* **49**, 539-602.
- IMMEL, H. 1978. Die Crioceratiten (Ancyloceratina, Ammonoidea) des Mediterranen und Borealen Hauterive-Barreme (Unter Kreide). *Palaeontographica*, **A163**, 1-85.
- JELETZKY, J. A. 1976. Cretaceous Macrofaunas. *Geol. Surv. Canada, Economic Geology Report*, **1B**, 649-662.
- KAKABADZE, M. V. 1981. The ancyloceratids of the south of the USSR and their stratigraphical significance. *Trudy geol. Inst. Tbilisi*, **71**, 1-196. [In Russian.]

- KARAKASCH, N. 1896. Partie Paléontologique. In INOSTRANZEFF, A. (ed.). *Au travers de la Chaîne Principale du Caucase*, 205 pp. St Petersburg.
- KEMPER, E. 1973. Die Unterkreide im Untergrund der Gehrdenen Berge und in der Deister-Mulde. *Ber. Naturhist. Ges.* **117**, 29–54.
- KILIAN, W. and LEENHARDT, F. 1895. Sur le Néocomien des Environs de Moustiers Ste. Marie (Basses-Alpes). *Bull. Soc. géol. Fr.* (3) **23**, 970–981.
- KOENEN, A. VON. 1902. Die Ammonitiden des Norddeutschen Neocom (Valanginien, Hauterivien, Barremien und Aptien). *Abh. preuss. geol. Landesanst.* NF **24**, 1–451.
- LAPEYRE, J. F. 1974. Révision de l'ammonite-index *Pseudothurmannia angulicostata* d'Orbigny. *Ann. Mus. Hist. nat. Nice*, **2**, 81–86.
- LEANZA, A. F. 1963. *Patagoniceras* gen. nov. (Binneyitidae) y otros ammonites del Cretácico superior de Chile meridional con notas acerca de su posición estratigráfica. *Boln. Acad. nac. Cienc. Córdoba*, **43**, 203–225.
- LUPPOV, N. P. 1936. Ammonites from Barremian deposits of eastern Karabugag area (Northwestern Turkmenia). *Trudy Leningr. Obshch. Yestestvoispyt.* **65**, 116–124. [In Russian.]
- ERISTAVI, M. S. and DRUSHCHITS, V. V. 1958. Superfamily Berriasellacea. In ORLOV, Y. A. (ed.). *Osnovy Paleontologii*, **6**, 96–104. Nedra Press, Moscow. [In Russian.]
- MATHERON, P. 1978. *Recherches paléontologiques dans le Midi de la France*. 3 partie, pl. C-21. Marseille.
- MURPHY, M. A. 1975. Paleontology and stratigraphy of the lower Chickabally Mudstone (Barremian–Aptian) in the Ono Quadrangle, Northern California. *Univ. Calif. Publ. geol. Sci.* **113**, 1–52.
- NIKOLOV, T. 1964. Barremian ammonites from north-eastern Bulgaria. *Trav. géol. Bulgarie, Sér. Paléont.* **6**, 117–141.
- OLIVERO, E. B. 1982. Estratigrafía de la cuenca sur del lago Fontana. *Tesis de la Universidad de Buenos Aires*, 147 pp. (unpublished).
- ORBIGNY, A. D'. 1840–1842. *Paléontologie Française. Terrains Crétacés*, I (Céphalopodes), 662 pp., 151 pls. Masson, Paris.
- 1850. *Prodrome de Paléontologie stratigraphique universelle des animaux mollusques et rayonnés*. . . , **2**, 427 pp. Masson, Paris.
- PETROVIC, K. and MILETIC, O. 1949. Sur les ammonites barrémiens trouvés dans les calcaires urgoniens de Košutnjak (environs de Belgrade) et leur importance. *Ann. géol. Pénins. Balkan.* **17**, 123–139.
- RENNGARTEN, V. 1926. La Faune des dépôts crétacés de la région d'Assa-Kambilévka, Caucase du Nord. *Mém. Com. géol. Rus.* NS **147**, 1–132.
- RICCARDI, A. C. 1984a. Las Asociaciones de Amonitas del Jurásico y Cretácico de la Argentina. *9 Congreso Geol. Argentino*, **4**, 559–595.
- 1984b. Las zonas de Amonitas del Cretácico de la Patagonia (Argentina y Chile). *3 Congreso Latinoamericano Paleont.* 346–405.
- 1988. The Cretaceous System of Southern South America. *Mem. geol. Soc. America*, **168**, 1–143.
- AGUIRRE URRETA, M. B. and MEDINA, F. A. 1987. Aconeceratidae (Ammonitina) from the Hauterivian–Albian of Southern Patagonia. *Palaeontographica*, **A196**, 105–185.
- RODIGHERO, A. 1919. Il sistema Cretaceo del Veneto occidentale compreso fra l'Adige e il Piave, con speciale riguardo al Neocomiano dei Sette Comuni. *Palaeontogr. Ital.* **25**, 39–125.
- ROUCHADZE, J. 1933. Les ammonites aptiennes de la Géorgie occidentale. *Bull. Inst. géol. Georgie*, **1** (3), 165–273.
- SARKAR, S. S. 1955. Révision des ammonites déroulées du Crétacé inférieur du Sud-est de la France. *Mém. Soc. géol. Fr.* NS **72**, 1–176.
- SIMIONESCU, I. 1900. Notes sur quelques ammonites du Néocomien français. *Trab. Lab. Géol. Univ. Grenoble*, **5**, 1–17.
- SPATH, L. F. 1924. On the ammonites of the Speeton Clay and the subdivisions of the Neocomian. *Geol. Mag.* **61**, 73–89.
- 1933. Revision of the Jurassic cephalopod fauna of Kachh (Cutch). *Mem. geol. Surv. India, Palaeont. Indica*, NS **9**, **2** (6), 659–945.
- STANTON, T. W. 1901. The Marine Cretaceous Invertebrates. *Rep. Princeton Univ. Exped. to Patagonia*, **4**, 1–43.
- THIEULOY, J. P. 1979. *Matheronites limentinus* n. sp. (Ammonoidea) espèce-type d'un horizon-repère Barrémien Supérieur du Vercors méridional (Massif Subalpin Français). *Geobios, Mém. spéc.* **3**, 305–317.
- THOMEL, G. 1964. Contribution à la connaissance des Céphalopodes Crétacés du Sud-Est de la France. *Mém. Soc. géol. Fr.* NS **101**, 1–80.

- TOULA, F. 1892. Geologische Untersuchungen im östlichen Balkan und in anderen Theilen von Bulgarien und Ostrumelien. *Dunkschr. math.-naturwiss. Kl. K. Akad. Wiss. Wien*, **57**, 323–400.
- UHLIG, V. 1883. Die Cephalopodenfauna der Wernsdorfer Schichten. *Ibid.* **46**, 127–290.
- 1888. Ueber neocom Fossilien von Gardenazza in Südtirol nebst einem Anhang über das Neocom von Ischl. *Jb. K.-K. geol. Reichsanst., Wien*, **37**, 69–108.
- WIEDMANN, J. 1962. Unterkreide-Ammoniten von Mallorca. 1. Lieferung: Lytoceratina, Aptychi. *Abh. math.-naturwiss. Kl. Akad. Wiss. Mainz*, **1962**, 1, 1–148.
- 1966. Stammesgeschichte und System der postriadischen Ammonoideen. Ein Überblick. *Neues Jb. Geol. Paläont. Abh.* **127** (1), 13–81.
- WRIGHT, C. W. 1957. Mesozoic Ammonoidea. In MOORE, R. C. (ed.). *Treatise on invertebrate paleontology. Part L, Mollusca 4*, L80–L465. Geological Society of America and University of Kansas Press, Kansas.
- 1981. Cretaceous Ammonoidea. In HOUSE, M. R. and SENIOR, J. R. (eds.). *The Ammonoidea. Systematics Assoc. Spec. Vol.* **18**, 157–174.

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