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Heteroceras gracile sp. nov., a new species of Heteroceras ORBIGNY, 1849, from the upper Barremian of Morteiron (Alpes de Haute-Provence, France)

Cyril BAUDOUIN [1, 2]

Gérard DELANOY [2, 3]

Grégoire BOURNAUD [4]

Roland GONNET [2, 5]

Abstract: The species *Heteroceras gracile* sp. nov. is described; it is a small and slender species, with a small helix and hamuliniform morphology, previously considered as an atypical variant of *Heteroceras baylei* (REYNÈS, 1876). In southeast France, it is mainly known in the Morteiron section (Alpes de Haute-Provence, France), but the species is also present in Bulgaria and possibly in Japan.

Key-words:

- Ammonoidea;
- upper Barremian;
- *Heteroceras*;
- Alpes de Haute-Provence;
- France

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Résumé : Heteroceras gracile *sp. nov., une espèce nouvelle d'*Heteroceras *ORBIGNY, 1849, du Barrémien supérieur de Morteiron (Alpes de Haute-Provence, France).-* L'espèce *Heteroceras gracile* sp. nov. est créée ; elle est représentée par des formes de petite taille, à enroulement frêle et petit turricône, de morphologie hamuliniforme, précédemment considérées comme des morphes atypiques d'*Heteroceras baylei* (REYNÈS, 1876). Dans le sud-est de la France, elle est essentiellement connue dans la coupe de Morteiron (Alpes de Haute-Provence, France), mais l'espèce est aussi présente en Bulgarie et hypothétiquement au Japon.

Mots-clefs :

- Ammonoidea ;
- Barrémien supérieur ;
- *Heteroceras* ;
- Alpes de Haute-Provence ;
- France

[1] *6, rue Frédéric Mistral, 26200 Montélimar (France)*
cyril.baudouin@gmail.com
[2] *Centre d'Études Méditerranéennes, 04170 St-André-lès-Alpes (France)*
[3] *Département des Sciences de la Terre, Université de Nice-Sophia-Antipolis, Faculté des Sciences, 28 avenue Valrose, 06108 Nice Cedex 2 (France)*
delanoy@unice.fr
[4] *7, impasse du Clos, 04200 Peipin (France)*
[5] *Chemin de Dardène, La Barthelasse, 84000 Avignon (France)*

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I. Introduction

The genus *Heteroceras* ORBIGNY, 1849, includes forms of very diverse size, from a few centimeters for the species *Heteroceras baylei* (REYNÈS, 1876), *H. elegans* ROUCHADZÉ, 1933, *H. eristavii* KAKABADZE, 1975, and *H. veratiae* FRAU *et al.*, 2016, to 60 cm or more in *Heteroceras coulleti* DELANOY, 1995. The small forms of southeast France have been the subject of several recent studies (DELANOY & BULOT, 1990; DELANOY, 1997; DELANOY & BERT, 2006; FRAU *et al.*, 2016). The existence in bed no. 3 of the Morteiron section (Alpes de Haute-Provence, France) of a population of small individuals with hamuliniform morphology and bearing a long and slender *proversum*, was described by DELANOY (1997, p. 98). It was then considered as a variant of *Heteroceras baylei* (REYNÈS, 1876), and linked to particular ecological conditions. The collection and study of new specimens showed, however, very marked morphological differences with *Heteroceras baylei* (REYNÈS, 1876), including slender coiling, with a long *proversum* and a relatively short *retroversum* that is not in contact with the helix, leading us to consider this population as a distinct species.

II. Paleontological and systematic study

The biozonation scheme of the Lower Cretaceous employed here (Fig. 1) is the one developed by the IUGS Lower Cretaceous Ammonite Working Group (REBOULET *et al.*, 2011, 2014). We retain the tripartite division of the *Imerites giraudi* Zone at the top of the Barremian (BERT *et al.*, 2008, 2011; REBOULET *et al.*, 2011).

Stages		Zones	Subzones	Horizons
Barremian	Upper	*Imerites giraudi*	*Pseudocrioceras waagenoides*	
			Martelites sarasini	
				Anglesites puzosianum
			Imerites giraudi	
				Heteroceras emericianum
				Imerites giraudi
				Imerites dichotomus
		Gerhardtia sartousiana	*Hemihoplites feraudianus*	*Pseudoshasticrioceras autrani*
				Pseudoshasticrioceras bersaci
				Pseudoshasticrioceras magnini
				Hemihoplites feraudianus
			Gerhardtia provincialis	*Hemihoplites casanovai*
				Gerhardtia provincialis
			Camereiceras limentinus	*Gerhardtia sartousiana*
				Camereiceras limentinum
		Toxancyloceras vandenheckii	*Gassendiceras alpinum*	*Camereiceras marchandi*
				Ancylezeiceras breistrofferi
				Gassendiceras alpinum
			Toxancyloceras vandenheckii	
	Lower	*Toxoceras moutonianum*		*Heinzia caicedi*
				Coronites darsi
		Kotetishvilia compressissima		*Subtorcapella defayae*
				Heinzia communis
				Nicklesia didayana
				Holcodiscus fallax
		Nicklesia pulchella		
		Kotetishvilia nicklesi		
		Taveraidiscus hugii auctorum	*Psilotissotia colombiana*	
			Taveraidiscus hugii auctorum	

Figure 1: Biozonation of the Barremian (according to BERT *et al.*, 2008, 2011, and REBOULET *et al.*, 2011, 2014).

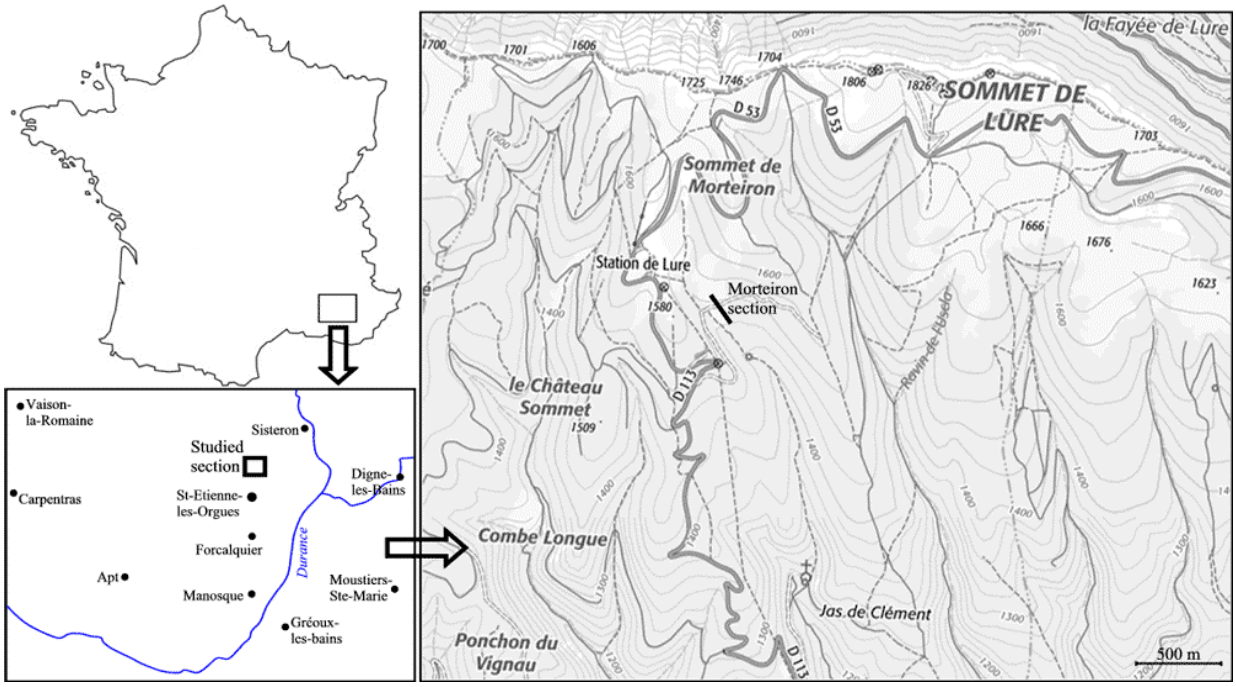

Figure 2: Geographical location of the studied section (source: www.geoportail.gouv.fr).

All the specimens studied in this work come from the Morteiron section (Fig. 2), located in the commune of Saint-Étienne-lès-Orgues (Alpes de Haute-Provence, France). The important Heteroceratidae fauna of this section was first reported by KILIAN (1889) and described in detail by DELANOY (1997), DELANOY & EBBO (2000) and DELANOY & BERT (2006). Two levels in particular are remarkable for the diversity and abundance of the representatives of this family: bed no. 3, with *Heteroceras emericianum* ORBIGNY, 1842, and its morphotypes, *H. gracile* sp. nov. (= *H. baylei* (REYNÈS, 1876) *in* DELANOY, 1997), *Rouchadzeites mascarellii* (DELANOY & EBBO, 2000), *Egoianites mikhaili* DELANOY & BERT, 2006, *Paraimerites* ? sp., *Argvethites* sp., and bed no. β, with *Heteroceras emericianum* ORBIGNY, 1842, *H. moulladei* DELANOY & BERT, 2006, *H. gracile* sp. nov., *H. gonneti* DELANOY, 1997, *H. baylei* ? (REYNÈS, 1876) and several forms of *Heteroceras* sp. which will be the subject of a future study.

The terminology of the different parts of the shell is the one used by FRAU *et al.* (2016, Fig. 4).

The measurements (Fig. 3 and Tab. 1) were carried out according to the protocol employed by DELANOY (1997, p. 18, fig. 2 and p. 26) for the measurements *N* (ribbing density), and *Cp* and *Cc* (growth rate). On incomplete specimens, measurement *H* corresponds to the height of the preserved part of the shell. The *h2* measurement was performed at the last suture if it was visible. If the last suture is not visible, *h2* was measured at the top of the *proversum*, at the level where the boundary between the phragmocone and the body chamber is usually observed. In order to allow the calculation of the growth rates *Cp* and *Cc* on the maximum number of specimens, where *h1* or *h3* are not measurable (incomplete specimens), additional measurements *h1** or *h3** (as well as the *lp** and *lc** lengths of the corresponding shell segments) were carried out, corresponding respectively to the lowest measurable whorl height on the phragmocone and to the highest measurable whorl height on the body chamber.

Table 1: Abbreviations used in the text.

H	Total length
L	Total width
Dt	Turricone diameter
h1	Whorl height at the end of the turricone
*h1**	Whorl height at the base of the preserved part of the proversum (when h1 is not measurable)
h2	Whorl height at the last suture
h3	Whorl height at the end of the body chamber
*h3**	Whorl height at the end of the preserved part of the body chamber (when h3 is not measurable)
lp	Length of the phragmocone (without the turricone)
*lp**	Length of the preserved part of the phragmocone (when lp is not measurable)
lc	Length of the body chamber
*lc**	Length of the preserved part of the body chamber (when lc is not measurable)
Cp	Relative growth in whorl height of the phragmocone: Cp = (h2 – h1)÷lp (or of the preserved part of the phragmocone when it is incomplete: Cp = (h2 – h1*)÷lp*)
Cc	Relative growth in whorl height of the body chamber: Cp = (h3 – h1)÷lc (or of the preserved part of the body chamber when it is incomplete: Cp = (h3* – h1)÷lc*)
N	Number of ventral ribs belonging to a longitudinal interval of length h, where h is the whorl height in the middle of this interval

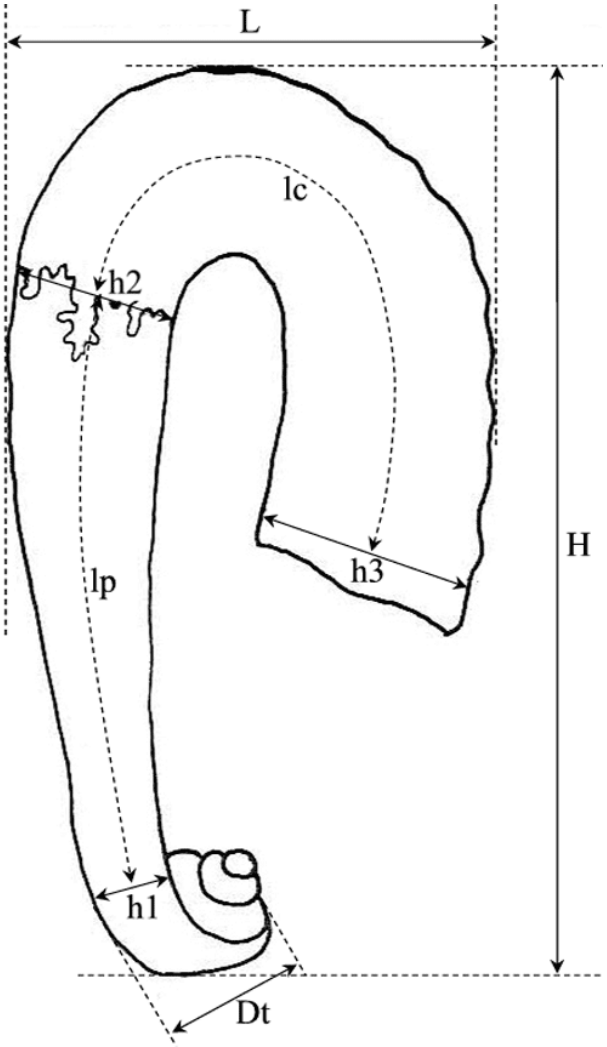

Figure 3: Explanatory diagram of the measurements made on the specimens studied.

Suborder Ancyloceratina Wiedmann, 1966

Superfamily Ancyloceratoidea Gill, 1871

Family Heteroceratidae Spath, 1922

Genus *Heteroceras* Orbigny, 1849

(= *Lindigia* Karsten, 1858; *Atopoceras* Jaubert *in* Kilian, 1889, *nomen nudum*; *Hemibaculites* Hyatt, 1900, *nomen dubium*; ? *Dirrymoceras* Hyatt, 1900, *nomen dubium*; *Colchidites* Djanélidzé, 1926; ? *Santandericeras* Royo y Gomez, 1945)

Type species: *Turrilites emericianus* Orbigny, 1842 (by subsequent designation of Meek, 1876, p. 477).

Heteroceras gracile sp. nov.

(Pl. 1, figs. 1-12)

?	1964	*Anahamulina subcylindrica* (Orbigny, 1850). - Nikolov, p. 126, Pl. 4, fig. 6; non Pl. 5, figs. 1-2 (= *Heteroceras* sp.)
?	1976	*Acrioceras* (?) aff. *julivertii* Etayo-Serna, 1968. - Obata & Ogawa, Pl. 4, fig. 6
	1989	*Heteroceras* cf. *elegans* Rouchadzé, 1933. - Conte, p. 39, fig. 9 ?, 10 ?, 11
pars	1997	*Heteroceras baylei* (Reynès, 1876). - Delanoy, p. 95, Pl. 13, fig. 4; Pl. 16, fig. 3; Pl. 20, figs. 3-4; Pl. 50, fig. 3; non Pl. 9, fig. 3; Pl. 13, fig. 5; Pl. 14, figs. 4-7; Pl. 20, fig. 2; Pl. 50, figs. 4, 8; Pl. 51, figs. 2-8 [=*Heteroceras baylei* (Reynès, 1876)]
	2013	*Heteroceras baylei* (Reynès, 1876). - Ivanov & Idakieva, fig. 6.E ?, F-G

Holotype: Specimen no. FSL13388, coll. Claude Bernard University, Lyon, France. Examination of the matrix indicates that the holotype comes from bed no. 3 of the Morteiron section (Alpes-de-Haute-Provence, France).

Derivatio nominis: In reference to the slender and hamuliniform character of this new species.

Locus-typicus: Morteiron, Saint-Étienne-lès-Orgues (Alpes-de-Haute-Provence, France).

Stratum-typicum: Upper Barremian, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon.

Geographical and stratigraphical distribution: *H. gracile* sp. nov. is mainly known in the *Heteroceras emericianum* Horizon of the Morteiron section (Alpes-de-Haute-Provence, France), more precisely in beds no. 3 and β (Delanoy, 1997, p. 255).

H. gracile sp. nov. also appears to be present in Bulgaria in the *Heteroceras astierianum* Zone of Nikolov (1964, Pl. 4, fig. 6). Its presence seems certain at the base of the *Martelites sarasini* Subzone of the Opaka section (Ivanov & Idakieva, 2013, p. 55 and Fig. 6).

Its presence in Japan is still hypothetical and is based on the morphological affinities between *Acrioceras* (?) aff. *julivertii* Etayo-Serna, 1968, figured by Obata & Ogawa (1976, Pl. 4, fig. 6) and *H. gracile* sp. nov.

Material and dimensions (N=29): Specimens no. FSL13388, coll. Claude Bernard University (Lyon, France), mot02, mot03, mot04, mot05, mot06, mot07a, mot07b, mot09, mot10, mot11, mot12, mot13, mot14, mot16, mot17, mot18, mot19, mot20, coll. Baudouin, 28824, 28838, 28839, 28840, coll. Delanoy, MOT GBD 01, MOT GBD 02, coll. Bournaud, bed no. 3, upper Barremian, *Imerites giraudi* Zone, *Imerites*

Table 2: Morphometric measurements of *Heteroceras gracile* sp. nov. (Bold italic type indicates that these values were measured on photographs).

no.	*"H"*	*L*	*h1*	*h1**	*h2*	*h3*	*h3**	*Dt*	*lp*	*lp**	*lc*	*lc**	*Cp*	*Cc*
FSL13388	65.9	24.5	3.8	-	8.2	13.7	-	4.8	58.3	-	48.4	-	7.5	11.4
mot02	50.9	-	-	3.9	8.2	-	-	-	-	39.6	-	-	10.9	-
mot03	59.6	24.3	-	4.3	8	12.3	-	-	-	47.8	30.2	-	7.7	14.2
mot04	57.3	23.2	-	2.9	7.8	13.9	-	-	-	48.3	49.7	-	10.1	12.3
mot05	51.4	20.7	-	4.6	7.2	-	11.6	-	-	39.6	-	29.5	6.6	14.9
mot06	55.5	-	-	4.7	7.7	-	-	-	-	39.6	-	-	7.6	-
mot07a	80	29.5	-	5.2	9.7	16.2	-	-	-	60.3	34.9	-	7.5	18.6
mot07b	69.3	-	-	-	-	-	-	-	-	-	-	-	-	-
mot09	83.3	28.2	3.5	-	10.7	15.5	-	-	75.2	-	51.5	-	9.6	9.3
mot10	59	-	4.1	-	c9.8	-	-	c8.1	52	-	-	-	11.0	-
mot11	56.9	25.1	-	4.1	7.8	16.2	-	-	-	42.8	44.3	-	8.6	19.0
mot12	72.6	36.4	-	6.4	10.2	18.4	-	-	-	58.3	48.2	-	6.5	17.0
mot13	45.3	27.9	-	5.2	7.4	15.4	-	-	-	38.4	50.9	-	5.7	15.7
mot14	67.9	23.4	-	5.3	9.1	-	-	-	-	45	-	-	8.4	-
mot16	55.3	24.5	-	6.6	8.5	13.8	-	-	-	37.3	63	-	5.1	8.4
mot17	56.7	28.3	-	6	9.1	13.7	-	-	-	42.3	44.9	-	7.3	10.2
mot18	34.4	26	-	-	7.9	12.8	-	-	-	-	42.1	-	-	11.6
mot19	49.6	21.6	-	4.8	7.6	12.3	-	-	-	39.6	47.5	-	7.1	9.9
mot20	50.9	27.6	-	3.9	6.7	13.4	-	-	-	42.6	49	-	6.6	13.7
RG419a	62.9	23.9	4.2	-	7.6	11.6	-	-	51.2	-	50.3	-	6.6	8.0
RG419b	55.8	20	-	-	6.7	-	-	-	-	-	-	-	-	-
MOT GDB 01	58.4	23.5	-	7	9.3	-	11.8	-	-	42.2	-	29.8	5.5	8.4
MOT GDB 02	65.6	25.3	3.4	-	8	c13	-	9.4	53.5	-	50.1	-	8.6	10.0
MOT GDB 03	46.7	25.2	-	5.5	8.4	14.9	-	-	-	34.1	57	-	8.5	11.4
MOT GDB 06	37.5	16.8	-	3.4	5.3	9.6	-	-	-	31	43.2	-	6.1	10.0
22839	55	21.9	-	5	8.6	-	10.8	-	-	37.7	-	22.8	9.5	9.6
28840	61	-	-	6.6	10.4	17.1	-	-	-	45.8	46	-	8.3	14.6
Heteroceras baylei, holotype no. MHNM 1989-44	65.7	-	-	8.6	11.7	16.7	-	-	-	34.3	62	-	9.0	8.1
Heteroceras elegans, holotype no. GIT 350/1016	53.1	28	8.1	-	9.4	14.8	-	13.6	29.8	-	39.7	-	4.4	13.6
Heteroceras veratiae, holotype no. FCC.8A	33	-	***5.7***	-	***7.4***	9	-	11	***16.2***	-	***25.1***		10.5	6.4

giraudi Subzone, *Heteroceras emericianum* Horizon, Morteiron, Saint-Étienne-lès-Orgues (Alpes-de-Haute-Provence, France); no. RG419a, RG419b, coll. BAUDOUIN leg. GONNET, bed no. β, upper Barremian, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, Morteiron, Saint-Étienne-lès-Orgues (Alpes-de-Haute-Provence, France); no. MOT GBD 03, MOT GBD 06, coll. BOURNAUD, bed no. β ?, upper Barremian, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, Morteiron, Saint-Étienne-lès-Orgues (Alpes-de-Haute-Provence, France). See Tables 2 and 3 for dimensions.

The holotype no. FSL13388 and specimens no. 28839 and no. 28840, as well as casts of specimens no. mot09 and no. mot10 (registered as UCBL-FSL 391837 and UCBL-FSL 391838) are deposited in the collections of the Claude Bernard University, Lyon 1 of Villeurbanne (France).

Diagnosis: Small *Heteroceras* ORBIGNY, 1849, of hamuliniform morphology with a relatively slow growth rate, having a small helix, a long and thin *proversum* and a *retroversum* approximately half the length of the shell. The ribbing is very regular and consists of simple ribs on most of the shell, with bifurcated ribs present only on or near the *flexus*.

Table 3: Ribbing density measurements of *Heteroceras gracile* sp. nov.

no.					
FSL13388	*h*	4.2	6.3	8.6	13.7
	N	4	5	6	8
mot02	*h*	6.4			
	N	6			
mot03	*h*	4.6	6.5	8.5	11.8
	N	4	5	6	6
mot04	*h*	3.7	8.4	11.5	
	N	5	11	9	
mot05	*h*	4	7.2	11.1	
	N	4	7	7	
mot06	*h*	5.1	7.6		
	N	5	6		
mot07a	*h*	4.9	8.2	10.7	14.9
	N	5	7	10	9
mot07b	*h*	3.2	6.6		
	N	3	6		
mot09	*h*	4	6.1	10.7	13.2
	N	5	5	9	8
mot10	*h*	4.4	5.5	8.8	
	N	5	5	6	
mot11	*h*	5.2	7.2	14.4	
	N	5	5	7	
mot12	*h*	7.5	10.9	17.3	
	N	7	9	10	
mot13	*h*	8	14.2		
	N	6	8		
mot14	*h*	5.5	9.4	11.6	
	N	5	6	6	
mot16	*h*	7.3	8.7	13.8	
	N	6	6	6	
mot17	*h*	6.5	9.3	13.5	
	N	7	8	8	
mot18	*h*	7.1	12.4		
	N	5	6		
mot19	*h*	5.1	7.2	11.7	
	N	5	6	7	
mot20	*h*	5.4	13		
	N	5	8		
RG419a	*h*	4.6	7.4	12.6	
	N	6	8	7	
RG419b	*h*	11.2	10.6		
	N	5	6		
MOT GDB 01	*h*	6.8	9.2		
	N	6	6		
MOT GDB 02	*h*	3.4	7.6	12	
	N	4	6	8	
MOT GDB 03	*h*	7.2	8.8	13.8	
	N	6	7	8	
MOT GDB 06	*h*	3.6	5.3	9.2	
	N	4	5	7	
28839	*h*	6.5	8	11	
	N	6	6	6	
28840	*h*	7	10	16	
	N	6	7	9	
Heteroceras baylei, holotype no. MHNM 1989-44	*h*	***9.3***	***16.7***		
	N	***5***	***5***		
Heteroceras elegans, holotype no. GIT 350/1016	*h*	8.5	9.3	14.9	
	N	5	6	6	
Heteroceras veratiae, holotype no. FCC.8A	*h*	***5.7***	***8.6***		
	N	***5***	***6***		

Description: Shell of small size and hamuliniform morphology. The whorl section, rarely visible in its entirety, appears to be subcircular to suboval, higher than wide. The helix, rarely preserved, is small, with whorls in contact and with both dextral (specimen no. mot10, Pl. 1, fig. 4) and sinistral coiling (specimen no. FSL13388, Pl. 1, fig. 6). The *proversum* is long, straight or slightly curved, with a relatively moderate whorl height growth (*Cp* between 5.7% and 11%). On specimens with visible sutures, the body chamber begins at the top of the *proversum*, at the junction with the *flexus*. The *retroversum* is straight, half to two thirds of the total length of the shell. Growth in whorl height is increasing, particularly on the *flexus* and the start of the *retroversum*, with a *Cc* growth rate of between 8% and 18%. The gap between the *proversum* and the *retroversum* is generally narrow, especially in specimens with straight *proversum*.

On the helix, the ribs are simple or sometimes bifurcated from the umbilical shoulder.

For most of the *proversum*, the ornamentation consists solely of straight, simple and regular, slightly prorsiradiate, more or less fine and dense ribs, *N* varying between 5 and 11 at whorl height *h* between 6 and 10 mm (Fig. 4). The ribs appear in the dorsal region where they can be relatively attenuated. During growth, the ribbing gradually strengthens, and, in the upper third of the *proversum*, bifurcated ribs appear, with the bifurcation point generally lying between the lower third and the middle of the flanks. The number of bifurcated ribs increases gradually.

On the *flexus*, the proportions of bifurcated and single ribs are highly variable; however, bifurcated ribs are most often predominant, with single ribs isolated and irregularly arranged, or even absent.

On the *retroversum*, the ribbing becomes even stronger and the ribs are then slightly rursiradiate, sometimes rectiradiate. It again consists mostly of simple ribs; bifurcated ribs, however, are present in the lower half of the *retroversum* where they may be dominant (specimen no. mot17, Pl. 1, fig. 7).

The peristome is not preserved on any of the specimens studied. At the approach of the peristome, the rib pattern seems to become slightly prorsiradiate again (specimens no. mot04, Pl. 1, fig. 1; no. mot09, Pl. 1, fig. 3; no. RG419a, Pl. 1, fig. 9).

Suture lines are difficult to observe in detail. They show, however, a relatively deep and feebly incised, trifid lateral lobe (specimen no. MOT GBD 02; Fig. 5).

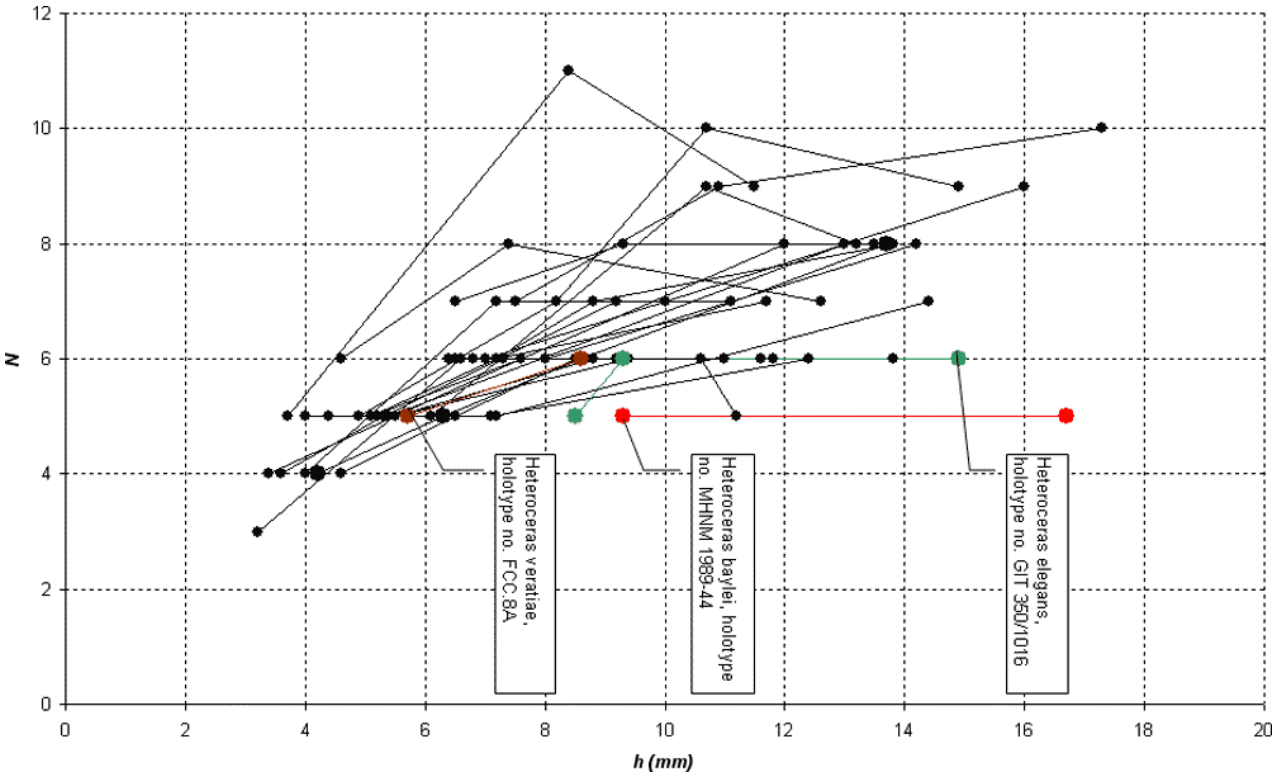

Figure 4: Ribbing density *N* in function of *h* in *Heteroceras gracile* sp. nov. (see Table 2).

Discussion and comparisons:

Heteroceras gracile sp. nov. is close to *Heteroceras baylei* (REYNÈS, 1876), of which it was considered a variant, and linked to particular ecological conditions by DELANOY (1997, p. 98). *Heteroceras gracile* sp. nov. is distinguished by its generally more hamuliniform and slender form, with a much longer *proversum* and a relatively short *retroversum* that never comes into contact with the helix, as well as by its much denser ribbing (Fig. 4).

Heteroceras gracile sp. nov. is also close to *Heteroceras elegans* ROUCHADZÉ, 1933, whose type-specimens come from the upper Barremian ("*Colchidites securiformis* Zone", KAKABADZE, 1975, p. 89) of Goresha (Georgia). *Heteroceras gracile* sp. nov. differs from it by its larger size and more slender morphology, with a significantly smaller helix and a much longer and thinner *proversum*, and by its denser ribbing (Fig. 4).

Heteroceras helicoceroides (KARSTEN, 1858) is a small form from the upper Barremian of Colombia, known only from the original picture of KARSTEN. This makes it difficult to establish the specific characteristics of this taxon, which appears to differ from *Heteroceras gracile* sp. nov. by its less slender morphology and the chevron-like ribbing on its ventral region.

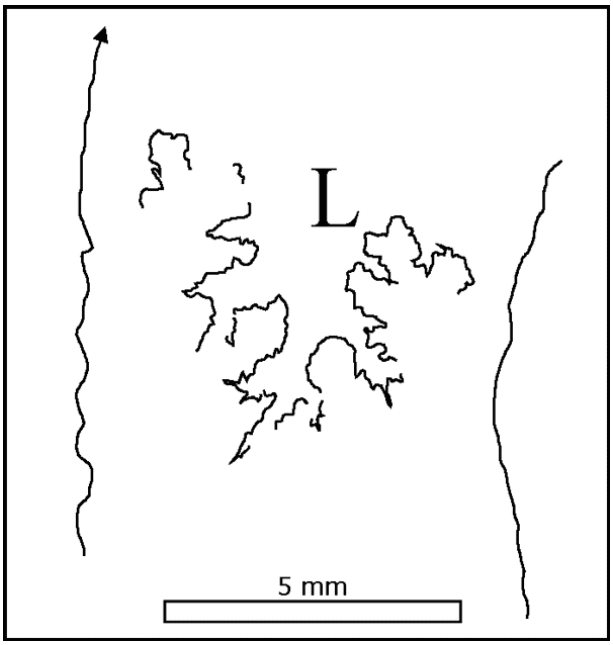

Figure 5: Detail of the suture line (lateral lobe) of *Heteroceras gracile* sp. nov. (specimen no. MOT GBD 02).

Heteroceras vermiforme ROUCHADZÉ, 1933, of the upper Barremian ("*Colchidites securiformis* Zone", KAKABADZE, 1975, p. 90) of Georgia, is known only from its holotype, which has many similarities to *Heteroceras gracile* sp. nov., in particular, a rather long *proversum* and quite similar ribbing. The very incomplete state of this holotype, figured by ROUCHADZÉ (1933, Pl. 13, fig. 5) and KAKABADZE (1975, Pl. 3, fig. 6), makes it difficult to compare the two taxa; the general morphology of the Georgian species seems less slender than that of *H. gracile* sp. nov.

Heteroceras veratiae FRAU *et al.*, 2016, a species known only in the *Martelites sarasini* Subzone of Cape Croisette (Marseille, France), differs from *Heteroceras gracile* sp. nov. primarily in its much smaller size which does not exceed 38 mm, and its less slender morphology. Its *proversum* and *retroversum* are clearly divergent instead of subparallel.

III. Conclusion

The particular morphological characteristics of the specimens studied (slender and almost hamuliniform shell, long *proversum* and relatively short *retroversum*) justify the creation of the taxon *Heteroceras gracile* sp. nov. This new species makes it possible to complete the inventory of the genus *Heteroceras* ORBIGNY, 1849, particularly for small taxa. These still poorly known species are often difficult to characterize on the basis of incomplete and/or poorly stratigraphically located specimens, which preclude us from appreciating their great morphological diversity and establishing clear specific distinctions.

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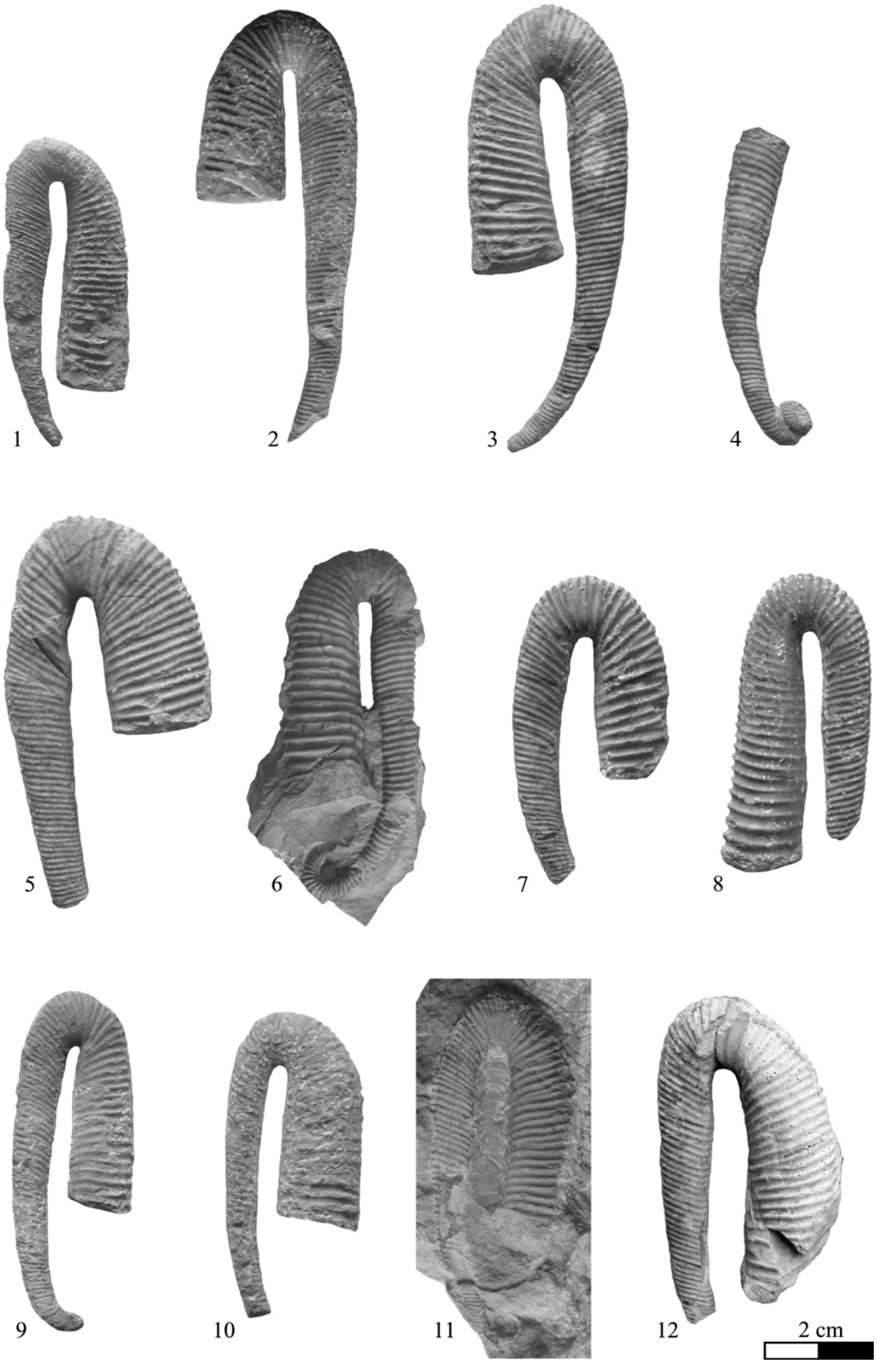
Plate

Plate 1: All specimens are from Morteiron, Saint-Étienne-lès-Orgues (Alpes de Haute-Provence, France).
Fig. 1: *Heteroceras gracile* sp. nov. Specimen no. mot04, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, bed no. 3. BAUDOUIN collection.
Fig. 2: *Heteroceras gracile* sp. nov. Specimen no. mot07a, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, bed no. 3. BAUDOUIN collection.
Fig. 3: *Heteroceras gracile* sp. nov. Specimen no. mot09, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, bed no. 3. BAUDOUIN collection.
Fig. 4: *Heteroceras gracile* sp. nov. Specimen no. mot10, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, bed no. 3. BAUDOUIN collection.
Fig. 5: *Heteroceras gracile* sp. nov. Specimen no. mot12, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, bed no. 3. BAUDOUIN collection.
Fig. 6: *Heteroceras gracile* sp. nov. Holotype no. FSL13388, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, bed no. 3. University Claude Bernard collection (Lyon, France).
Fig. 7: *Heteroceras gracile* sp. nov. Specimen no. mot17, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, bed no. 3. BAUDOUIN collection.
Fig. 8: *Heteroceras gracile* sp. nov. Specimen no. mot16, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, bed no. 3. BAUDOUIN collection.
Fig. 9: *Heteroceras gracile* sp. nov. Specimen no. RG419a, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, bed no. β. BAUDOUIN collection (donated by R. GONNET).
Fig. 10: *Heteroceras gracile* sp. nov. Specimen no. mot11, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, bed no. 3. BAUDOUIN collection.
Fig. 11: *Heteroceras gracile* sp. nov. Specimen no. MOT GBD 02, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon. BOURNAUD collection.
Fig. 12: *Heteroceras gracile* sp. nov. Specimen no. 28840, *Imerites giraudi* Zone, *Imerites giraudi* Subzone, *Heteroceras emericianum* Horizon, bed no. 3, Morteiron, Saint-Étienne-lès-Orgues (Alpes de Haute-Provence, France). DELANOY collection.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