THE LARGEST *MENUITES FRESVILLENSIS* (SEUNES, 1890) (AMMONOIDEA, PACHYDISCIDAE) FROM THE MAASTRICHTIAN QUIRIQUINA FORMATION, CHILE

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ABSTRACT

The pachydiscid ammonite *Menuites fresvillensis*, which is known from the *Abathomphalus mayaroensis* planktonic foraminifer zone, is considered an index taxon for the lower part of the Upper Maastrichtian (Upper Cretaceous), with records from Europe, Australia and South America. Two unusually large specimens are described here one of them being the largest individual ever recorded, with a diameter of 425 mm. Previously, the Quiriquina Formation has yielded specimens that reached diameters of 360 mm. Based on the new material and specimens described previously in the literature, it is now possible to reconstruct the later growth stages of *M. fresvillensis*, in particular for specimens with diameters >117 and up to 425 mm. These data demonstrate that *M. fresvillensis* maintains its characteristic morphology, albeit slight variations, throughout ontogeny, including the largest specimens described here.

Key words: Ammonites, Late Cretaceous, size, South America

RESUMEN

El más grande *Menuites fresvillensis* (Seunes, 1890) (Ammonoidea, Pachydiscidae) del Maastrichtiano de la formación Quiriquina. *Menuites fresvillensis* (Ammonoidea, Pachydiscidae) existe en la zona de foraminíferos planctónicos *Abathomphalus mayaroensis* y es considerado un taxon índice para la parte baja del Maastrichtiano Superior (Cretácico Superior), con registros en Europa, Australia y Sudamérica. Dos especímenes muy grandes son descritos aquí, procedentes de la formación Quiriquina del centro de Chile. Uno de los ejemplares alcanza un diámetro de 425 mm y de esta manera representa el individuo más grande jamás registrado. Previamente, en la Formación Quiriquina se han documentado especímenes que alcanzaron un diámetro de 360 mm. Combinando los datos del nuevo material con especímenes descritos previamente en la literatura, es posible reconstruir los estadios de crecimiento más tardíos de *M. fresvillensis*. La especie mantiene sus características morfológicas, aunque con ligeras variaciones, hasta los estadios de concha más grandes descritos aquí.

Palabras clave: Ammonites, Cretácico Superior, tamaño, Sudamérica.

1. INTRODUCTION

In the process of revising the collections of Invertebrate Palaeontology at the Museo Nacional de Historia Natural of Chile, two unregistered specimens of the late Maastrichtian pachydiscid ammonite *Menuites fresvillensis* have been noted. Based on their state of preservation, these specimens undoubtedly originate from localities of the Quiriquina Formation near Concepción Bay, possibly even from Quiriquina Island, and in particular from the type locality of the Quiriquina Formation, Las Tablas section (Figure 1).

Menuites fresvillensis is an important index taxon for the lower part of the Upper Maastrichtian in Europe, *e.g.*, the Bay of Biscay region (Spain and France), Pyrénées-Atlantique (France), the southeast Netherlands and northeast Belgium, Denmark, but also in South India, Pakistan, South Africa, Madagascar and South America (Chile). This species has been described in detail by Kennedy (1986, 1987), Stinnesbeck (1986), Ward and Kennedy (1993), Kennedy and Hancock (1993), Fatmi and Kennedy (1999), Klinger *et al*. (2001), Kennedy and Klinger (2006) and Salazar *et al*. (2010).

Up to now, juveniles of *Menuites fresvillensis* measuring 60-70 mm and adults of a maximum diameter of 360 mm were described (Salazar *et al*. 2010). Here we document two extremely large specimens, one of them considered to be the largest specimen ever recorded with a maximum diameter of 425 mm.

The importance, of the description and remarks of adult specimens, helps to clarify the determination of fragmentary or incomplete specimens previously described, and also to the new material in the future. With this new description of the largest specimen, now we have the most complete specimen described so far, that shows clearly the morphological characteristic of adult specimens and the ontogenic variation.

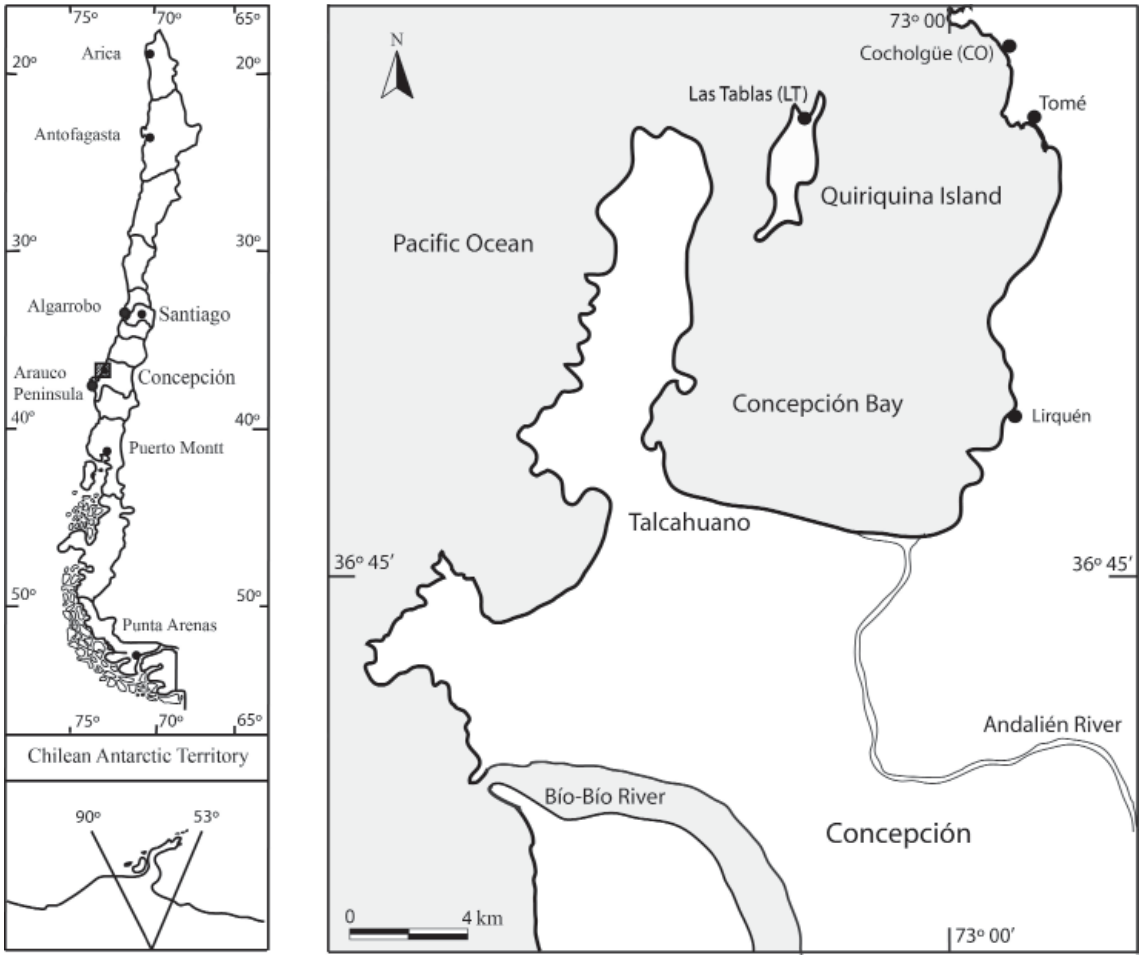

Figure 1. Localities in the Concepción area where the Quiriquina Formation is exposed (modified after Salazar *et al.* 2010).

2. SYSTEMATIC PALAEONTOLOGY

Measurements: All dimensions are given in mm.
Abbreviations: D: Diameter, Wb: Whorl width, Wh: Whorl height, U: Width of umbilicus.
Collections: Abbrevations for repositories are as follows: CPUC, Colección Paleontológica de la Universidad de Concepción; SGO.PI., Paleontología de Invertebrados, Museo Nacional de Historia Natural, Santiago, Chile; STIPB, Steinmann Institut für Paläontologie, Universität Bonn.

Systematics: Nomenclature follows Wright *et al*. (1996).
Order AMMONOIDEA von Zittel, 1884
Suborder AMMONITINA Hyatt, 1889
Superfamily DESMOCERATOIDEA von Zittel, 1895
Family PACHYDISCIDAE Spath, 1922
Genus *Menuites* Spath, 1922
Type species: *Ammonites menu* Forbes, 1846, p. 111, pl. 10, fig 1, by original designation.

Menuites fresvillensis (Seunes, 1890)
Fig. 6

1890 *Pachydiscus fresvillensis* Seunes, p. 3, pl. 2 (1), fig. 1.
1895 *Pachydiscus quiriquinae* Steinmann, p. 74, pl. 6, fig. 3a, b.
1987 *Anapachydiscus fresvillensis* Seunes; Kennedy, p. 173, pl. 6; pl. 7, figs. 1-2; pl. 8; pl. 9, figs. 1-2; pl. 10, figs. 1-5; pl. 11, figs. 5-6; pl. 12, figs. 12-14; pl. 13, figs. 6-7; pl. 14, figs. 1-3, 7, 11-12; pl. 15, figs. 4-6; pl. 23, fig. 5 (with full synonymy).
1993 *Anapachydiscus fresvillensis* (Seunes); Ward and Kennedy, p. 39, figs. 35.3, 35.5-35.6, 36.1-36.2, 37.1-37.6, 38.1-38.3, 40.8, 45.1 (with additional synonymy).
2010 *Menuites fresvillensis* (Seunes); Salazar *et al.*, p. 214, figs. 30, 32c-d, 33a-b, 34a-b, 35a-b, 36a-b (with additional synonymy).

Type
Lectotype, designated by Kennedy (1986, p. 44), is no. A1186 in the collections of the École des Mines, Paris, now in the collections of the Université Claude- Bernard, Lyon. It is the original of Seunes (1890, p. 3, pl. 2(1), fig. 1), from the Calcaire à *Baculites* of Fresville, Manche, France.

Material

Two well preserved phragmocones, SGO. PI. 6795 and SGO. PI. 6796. Additional material includes six well-preserved phragmocones from the CPUC collections, earlier described by Salazar et al. (2010).

Description

Coiling involute. In juvenile stages (D<100m), umbilicus narrow (U/D: 0.16–0.21), in adult stages (D>100 mm) becoming progressively narrower; at diameters between 100 and 200 mm, U/D 0.15-0.20; at diameters between 200 and 425 mm, U/D 0.16-0.18 (Figure 2). Juvenile stages have internal whorls slightly depressed; whorl section rounded to elliptical, higher than wide. Venter rounded to arched. Flanks slightly convex; maximum whorl width in dorsolateral area. In adult stages, whorl section rounded, higher than wide. Venter rounded. Flanks slightly convex and subparallel, with a maximum whorl width between midflank to dorsolateral area. In the largest specimen (SGO. PI. 6795) shell features are similar to juvenile individuals and other adults. Coiling involute, last whorl covering 80–90 % of previous whorl. Umbilicus narrower (U/D: 0.17), whorl section higher than wide. Venter rounded. Flanks subrounded to subparallel.

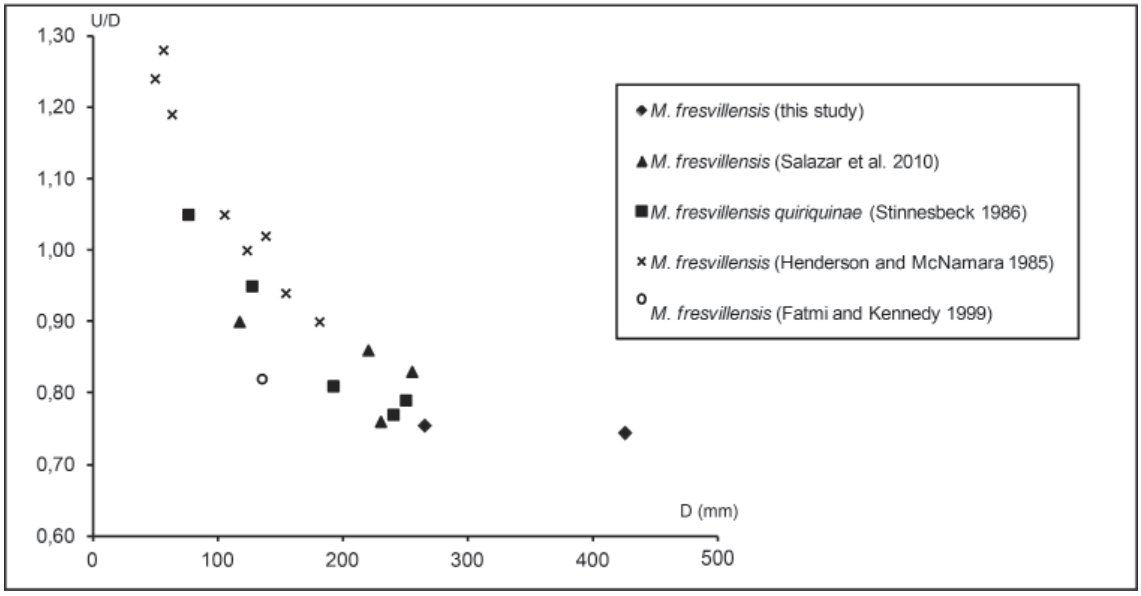

FIGURE 2. Relationship between U/D and D in Menuites fresvillensis from the Quiriquina Formation in Chile and from elsewhere (literature data).

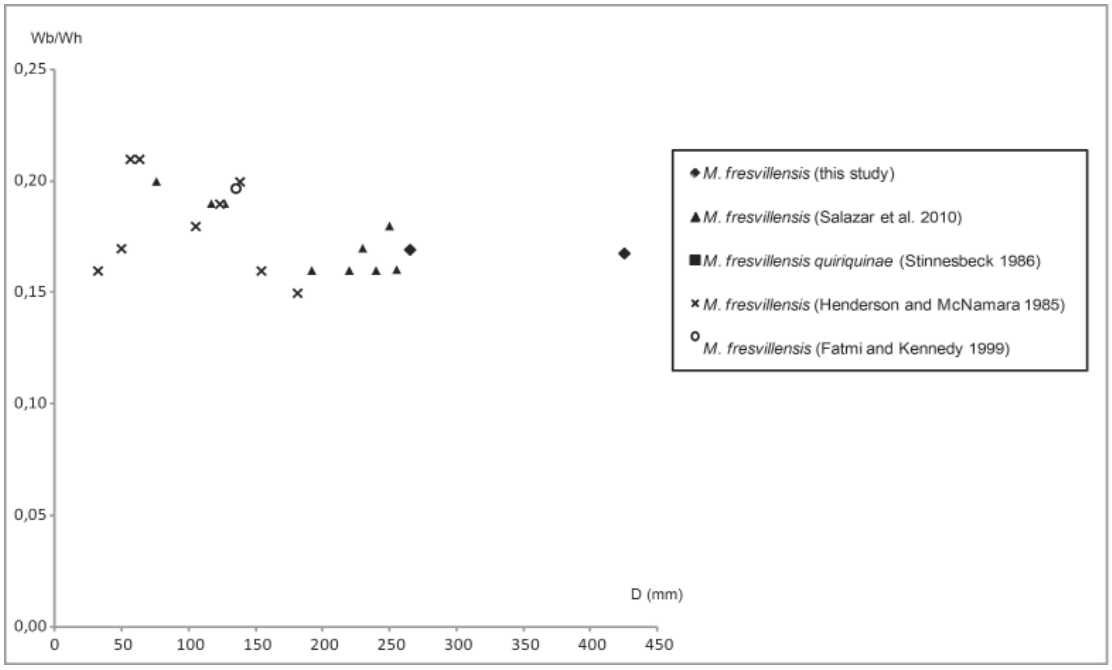

FIGURE 3. Relationship between Wb/Wh and D in Menuites fresvillensis from the Quiriquina Formation in Chile and from other formations elsewhere (literature data). Note the progressive change in growth, separating juveniles (D < 100 mm) and adults (D > 100 mm), and the stable tendency for D > 260 mm

Specimens document progressive change during growth (Figure 3). During juvenile stages (D<100 mm), whorl section is wider than high, but progressively (D: 100–260 mm), this relationship changes to higher than wide. This trend is stable in diameters in excess of 260 mm.

TABLE 1. Dimensions of *Menuites fresvillensis* from the Quiriquina Formation in Chile and from other formations elsewhere (literature data).

Menuites fresvillensis (present study)						
specimen	D	U	W	H	W/H	U/D
SGO. PI. 6795	425	71.3	175	235	0.74	0.17
SGO. PI. 6796	265	44.9	117	155	0.75	0.17
Menuites fresvillensis (from Salazar *et al.* 2010)						
specimen	D	U	W	H	W/H	U/D
CPUC/LT/Q/1452	230	39	105	138	0.76	0.17
CPUC/LT/Q/99	220	36	98	114	0.86	0.16
CPUC/SV/Q/98	255	41	109	132	0.83	0.16
CPUC/LT/Q/2439	117	22	57	63	0.90	0.19
Menuites fresvillensis (from Fatmi and Kennedy 1999)						
specimen	D	U	W	H	W/H	U/D
1052	135	26.6	53	65	0.82	0.20
Menuites fresvillensis quiriquinae (from Stinnesbeck 1986)						
specimen	D	U	W	H	W/H	U/D
STIPB/QVO/116	250	46	130	102	0.79	0.18
	127	24	63.6	60.5	0.95	0.19
	76	15	39.9	42	1.05	0.20
STIPB/Q98	240	38	130.0	100	0.77	0.16
	192	32	98.5	80	0.81	0.16
Menuites fresvillensis (from Henderson and McNamara 1985)						
specimen	D	U	W	H	W/H	U/D
60761	32	5.2	21.8	15.8	1.38	0.16
p31024	49	8.5	30.5	24.5	1.24	0.17
81,2388	56	11.8	33.5	26.2	1.28	0.21
81,252b	63	13.5	36.8	31.0	1.19	0.21
81,2707	105	19.0	55.5	53.0	1.05	0.18
81,2527	123	23.5	62.0	62.0	1.0	0.19
kz13678	138	28.0	69.0	67.0	1.02	0.2
81,2623	154	25.0	76.0	80.5	0.94	0.16
p31014	181	28.0	84.0	93.0	0.9	0.15

FIGURE 4. a-c: *Menuites fresvillensis*; SGO. PI. 6796.

Figure 6. a-b. Ventral and dorsal view of *Menuites fresvillensis*; SGO. PI. 6795.

Figure 6. a-b. Ventral and dorsal view of *Menuites fresvillensis*; SGO. PI. 6795.

On last whorls in both juveniles and adults, ornament consists of 9 or 10 weak umbilical bullae, from which primary ribs arise. Between these primary ribs, 2 or 3 secondary ribs intercalate. In total 39 to 41 wide, prorsiradiate ribs are present on the last whorl, which are straight, prominent on flank and concave and low between mid-flank and umbilical shoulder. In the large specimen SGO.PI. 6795, the ultimate whorl shows weak umbilical bullae, which nearly efface on the last half whorl. The last whorl has 25 ribs; these are progressively more distant on the last half whorl.

Remarks

Anapachydiscus fresvillensis quiriquinae was considered to be synonymous with *Menuites fresvillensis* by Kennedy (1987) and Henderson and McNamara (1985); Kennedy (1986, 1987) and Ward and Kennedy (1993) are referred to for full discussion of this species. Complementary descriptions and comparisons with other pachydiscids from the Quiriquina Formation were presented by Salazar et al. (2010).

In the largest specimen described here (SGO. PI: 6795; D 425 mm), ornament changes slightly on the last whorl, the main change being the weaker bullae, more distant and fewer ribs (approximately 25). These individuals thus document the final stages of growth of *M. fresvillensis*.

ACKNOWLEDGEMENTS

We are grateful to Romina Moncada for providing assistance with photography and acknowledge the careful and detailed reviews of Dr John Jagt (Maastricht) and Dr Sven Nielsen (Valdivia).

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Recibido: 31/julio/2013; aceptado: 27/septiembre/2013. Administrado por Herman Núñez.