Rivista Italiana di Paleontologia e Stratigrafia
(*Research in Paleontology and Stratigraphy*)
vol. 125(3): 789-804. **November 2019**

# COMMENTS ON SOME SYRINGOTHYRIDOIDEA (BRACHIOPODA) FROM THE CARBONIFEROUS OF NORTH AFRICA

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To cite this article: Mottequin B. & Cisterna G.A. (2019) - Comments on some Syringothyridoidea (Brachiopoda) from the Carboniferous of North Africa. *Riv. It. Paleont. Strat.*, 125(3): 789-804.

*Keywords*: Brachiopods; Spiriferinida; *Histosyrinx*; Mississippian; Taxonomy.

*Abstract*. The type species of the spiriferinide genus *Histosyrinx* Termier & Termier (Brachiopoda), namely *Histosyrinx vautrini* Termier & Termier, is re-investigated in detail on the basis of its type material from the Tournaisian Marar Formation (Serdeles area, Murzuq Basin, Libya), including additional specimens from the same region, and from the Tournaisian of Algeria (Reggane Basin). The internal morphology of the ventral valve of *Histosyrinx vautrini* is particularly variable, notably concerning the development of the septal pillow, the subdelthyrial plate and the median septum. *Histosyrinx* can be easily distinguished from the genus *Septosyringothyris* Vandercammen by the absence of a true delthyrial plate and the lesser development of the median septum. *Histosyrinx* is also close to *Syringopleura* Schuchert, which is generally considered as a synonym of *Syringothyris* Winchell, by its ventral internal features (e.g. development of a septal pillow), but the dorsal internal morphology of the type species of Schuchert's genus remains unknown. Thus, the relationships between both genera need to be investigated further. Specimens from the southern margin of the Tindouf Basin (Algeria), previously identified as Septosyringothyridinae? gen. indet. by Legrand-Blain in the 1970s, are fully illustrated here for the first time and referred to an unidentified genus of the subfamily Permasyrinxinae on the basis of the absence of syrinx.

## Introduction

The Syringothyridoidea is one of the most important lineages of spire-bearer brachiopods that survived the global Hangenberg Crisis and flourished in many parts of the world during the Carboniferous–Permian timespan (e.g. Carter & Gourvennec 2006; Mottequin et al. 2014). Three genera of this superfamily are only distinguished by the presence of a syrinx, namely the Syringothyridinae *Syringothyris* Winchell, 1863 and the Septosyringothyridinae *Septosyringothyris* Vandercammen, 1955 and *Histosyrinx* Termier & Termier (in Massa et al. 1974), which are both characterized by a syrinx generally supported by a median septum or a stout median ridge. *Septosyringothyris*, which was first described in the Tournaisian of southern Belgium, has been recently revised by Mottequin et al. (2018). It is defined as a syringothyridid with the syrinx suspended between the delthyrial plate and the floor of the valve by a distinct and long median septum (Carter 2006). In North Africa, *Histosyrinx* was erected on the basis of a poorly preserved material from the Tournaisian of Western Libya (Termier & Termier in Massa et al. 1974; Legrand-Blain 1974; Mergl & Massa 1992), but this genus still remains imperfectly known partly due to the absence of complete illustration of the type species both externally and internally. The syrinx would be supported by a stout median septum (Legrand-Blain 1974; Carter 2006). However, the restudy of the specimens initially described by Termier & Termier (in Massa et al. 1974) and Legrand-Blain (1974) indicates that the diag-

*Received: April 09, 2019; accepted: October 04, 2019*

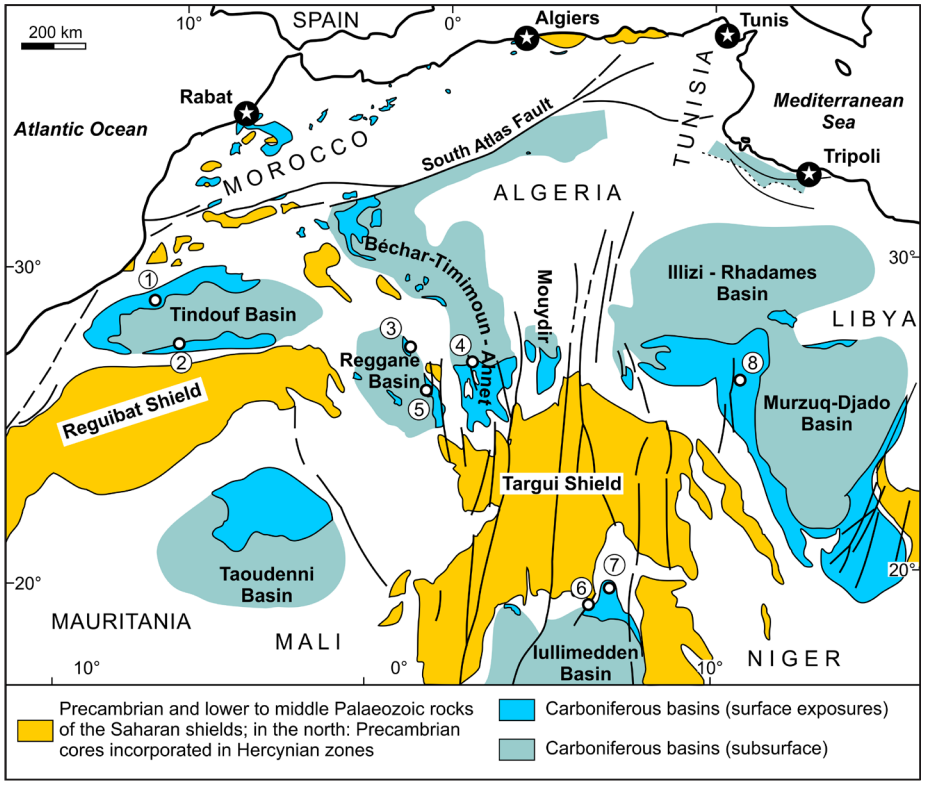



Fig. 1 - Overview of the distribution of the Carboniferous basins in North and West Africa (modified from Conrad, 1985a) with localities yielding *Histosyrinx vautrini* (except otherwise stated) (according to Legrand-Blain 1974): 1: Mou-Tagourramt (Assa area, Morocco); 2: Ouidan Tartrat (Gevin 1960; Permasyrinxinae gen. indet.); 3: Chebbi; 4: Berga; 5: Azzel Matti; 6: In Guezzam; 7: Taberia (localities 2–7 are situated in Algeria); 8: Serdeles (Libya).

nosis of the genus should be emended due to the strong variations observed within the internal morphology of the ventral valve.

This paper aims to reassess the Septosyringothyridinae previously reported from Algeria and Libya in order to discuss the diagnostic characters of the genus *Histosyrinx* and to document their differences in relation with those of *Septosyringothyris*. This study also promotes the revision of the numerous species assigned to both genera that were described in the Carboniferous–Permian of Argentina (see Cisterna 2011 and references therein).

## Stratigraphical and geographical distribution

The brachiopods discussed herein were found in eight localities of North Africa, most of them in Algeria according to Legrand-Blain (1974) (Fig. 1). The type material of *Histosyrinx vautrini* Termier & Termier (in Massa et al. 1974) is from the Serdeles area (in Tuareg; also known as Al Awainat or Al Aweinat in Arabic) on the western margin of the Murzuq Basin (Western Libya) (Fig. 1-2). It was collected within the lowermost part of the Marar (or M'rar) Formation which is assigned to the late Tournaisian on the basis of the brachiopod assemblage identified by Termier & Termier (in Massa et al. 1974), Havlíček & Röhlich (1987), and Mergl & Massa (1992, 2000). The Marar Formation consists of a thick shaly succession with alternations of sandstones and siltstones (with ferruginous levels, frequently oolitic), and its thickness reaches about 235 m in the Serdeles area (Massa et al. 1974).

*Histosyrinx vautrini* was also reported by Legrand-Blain (1974) in the upper Tournaisian and the lower Viséan of the central, southern and eastern Sahara (Algeria and Morocco, Fig. 1-2). A single Algerian specimen is illustrated herein and it comes from the upper part of the Grès de Tibaradine at Azzel Matti in the Reggane Basin (e.g. Conrad 1984; Wendt et al. 2009) (Fig. 1). This lithostratigraphic unit, which reaches 130 m in thickness in this basin (Conrad 1984), consists of coquinoid calcareous sandstones yielding abundant brachiopod faunas, notably *Keokukia*? *betainensis* (Hollard) and *Syringothyris folloti* Legrand-Blain (Mottequin & Legrand-Blain 2010).

## Material and methods

The bulk of the material studied belongs to the Lyon 1 University (Villeurbanne, France, prefixed UCBL-FSL) (Gevin and Massa's collections) whereas additional specimens are part of the

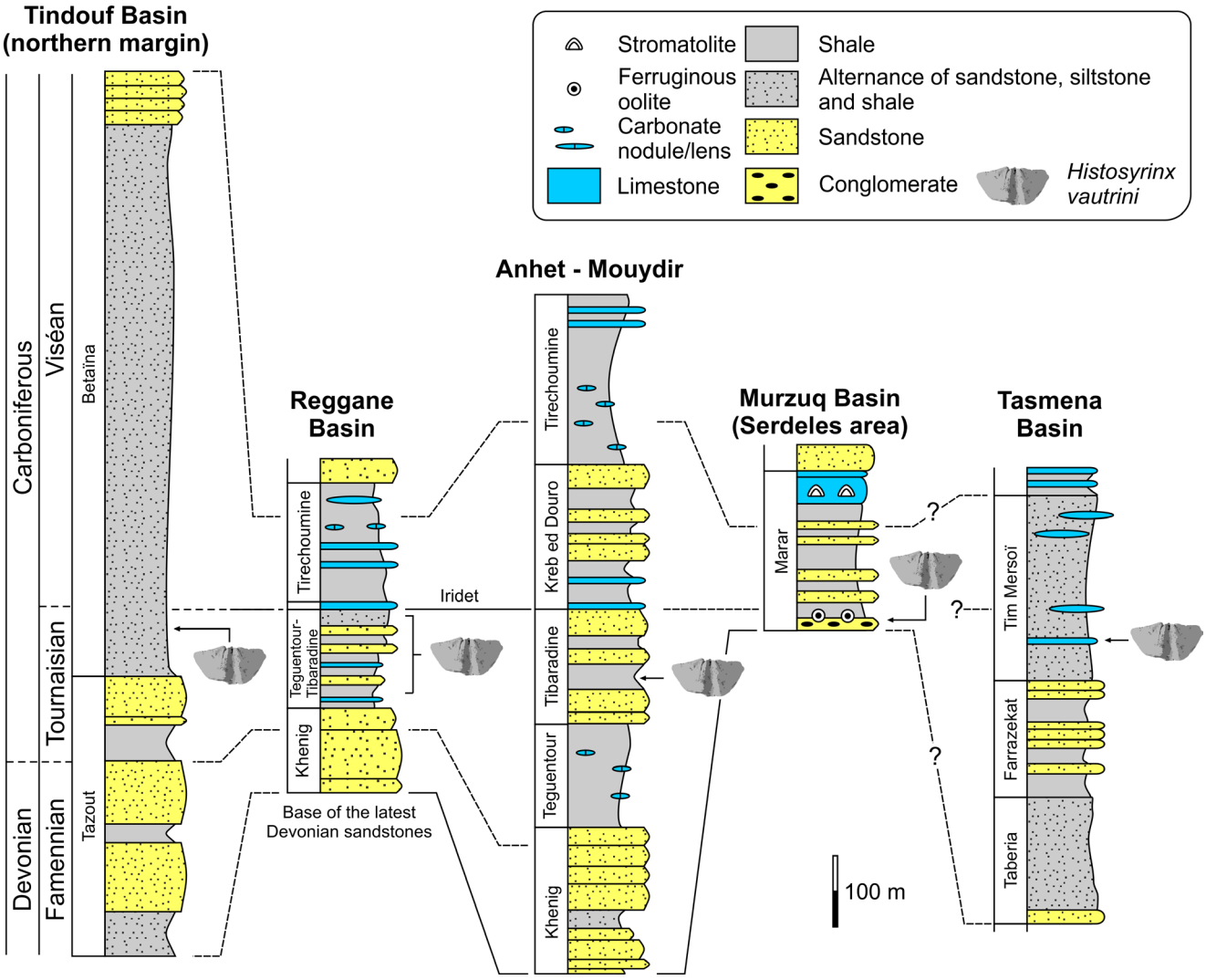



Fig. 2 - Distribution of *Histosyrinx vautrini* within the Mississippian formations recognized in Saharan basins (see Fig. 1) (modified from Legrand-Blain 1974; see also Legrand-Blain 2002 and Wendt et al. 2009). The successions are based on Hollard & Jacquemont (1956) and Hollard (1970) for the northern border of the Tindouf Basin (east of Assa), on Conrad (1973) for the Reggane Basin and the Anhet–Mouydir, on Massa in Massa et al. (1974) for the West Murzuq Basin, and on Claret & Tempère (1968) for the Tasmena Basin (east of In Ghezzam).

patrimony and collections of the faculties of the Catholic Institute of Lille (France; prefixed GFCL) (Delépine's collection) and of the Royal Belgian Institute of Natural Sciences (prefixed RBINS).

The Libyan material, which mainly includes adult specimens, is preserved as internal sandy to quartzitic or limonitic moulds, frequently articulated, but external moulds are scarcely associated to them. The specimens are generally weathered, and their state of preservation precludes to perform statistics; as is frequently the case with material from old collections, no taphonomical information is available. Size indications are only provided and the previous descriptions of *Histosyrinx vautrini* (Termier & Termier in Massa et al. 1974; Legrand-Blain 1974; Mergl & Massa 1992) are emended herein.

The specimens were coated with ammonium chloride sublimate before being photographed, and the latex casts were photographed using a low-vacuum scanning electron microscope (ESEM FEI Quanta 200), but without being coated with gold.

The syringothyridoids studied herein are mainly described according to the established terminology applied to brachiopods (Williams & Brunton 1997). However, three terms related to diagnostic characters of the ventral internal morphology have been modified by us:

*Septal pillow*. Callus deposits formed by posteriorly thickened dental plates and converging slightly below the plane of the interarea.

*Subdelthyrial plate*. Plate formed by the junction of two plates located between the dental ones.

*Syrinx*. Tube of secondary shell, split along its ventroanterior surface, medially located on the ventral side of a delthyrial plate or of a subdelthyrial one.

## Systematic palaeontology

The classification of the Suborder Spiriferinidina adopted herein follows Carter (2006).

Order **Spiriferinida** Ivanova, 1972
Suborder **Spiriferinidina** Ivanova, 1972
Superfamily Syringothyridoidea Frederiks, 1926
Family Syringothyrididae Frederiks, 1926
Subfamily Septosyringothyridinae Termier & Termier in Massa et al., 1974

Genus *Histosyrinx* Termier & Termier in Massa et al., 1974

Type species - *Histosyrinx vautrini* Termier & Termier in Massa et al., 1974, from the Tournaisian Marar Formation, Serdeles, Murzuq Basin, Libya.

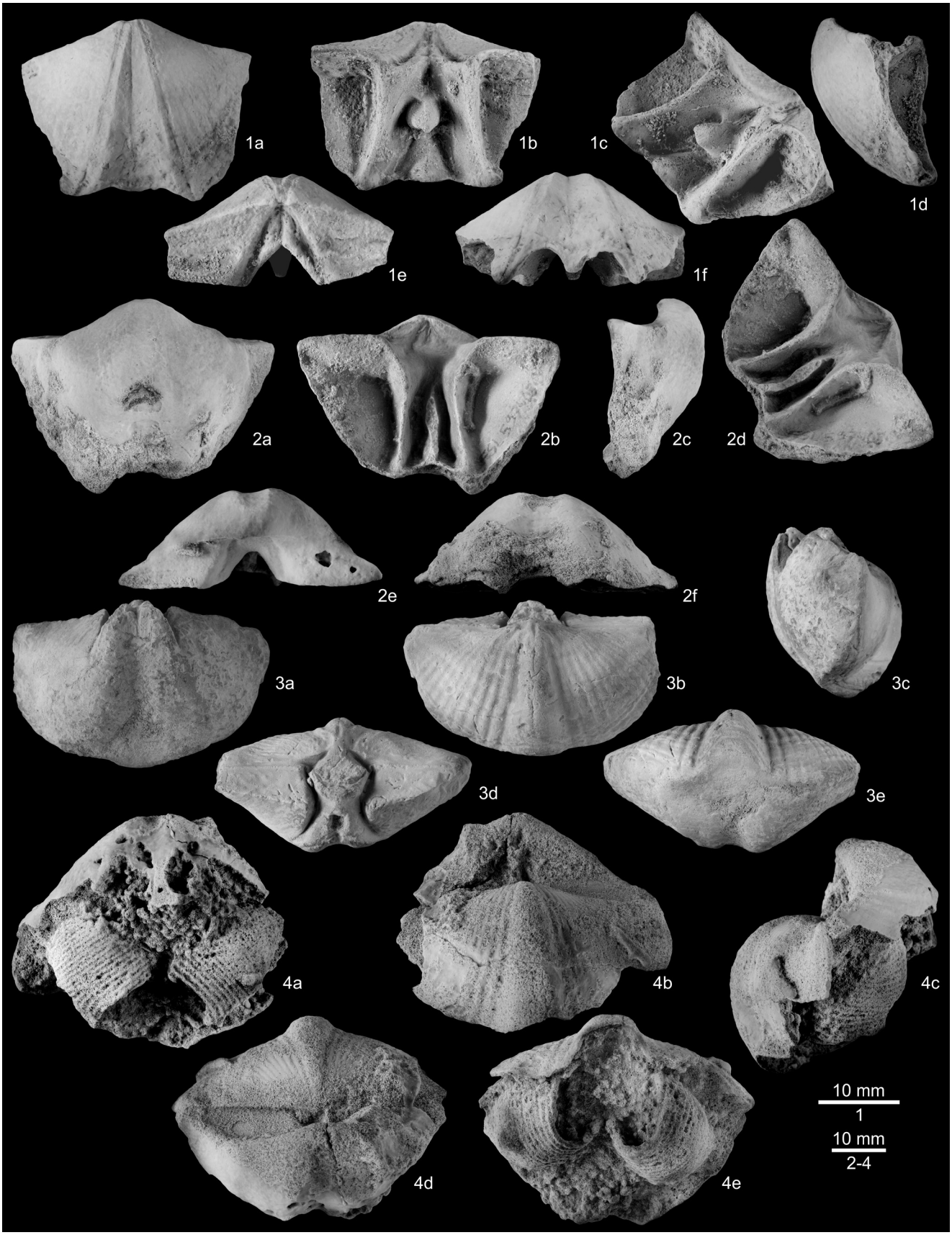
**Diagnosis (emended)**: Large-sized Septosyringothyridinae with syrinx inserted on a variably developed subdelthyrial plate; dental plates thickened by callus deposits converging to produce a septal pillow, slightly below the plane of the interarea; syrinx generally supported by a median septum that can range from an incipient umbonal one to a relatively long, narrow one; ctenophoridium supported; crural plates present.

**Remarks**. The genus *Histosyrinx* was particularly studied by Legrand-Blain (1974: fig. 10, 12-14), who examined in great detail the important polymorphism related to the variations of the ventral interior that characterizes this septosyringothyridine, especially on the basis of transverse serial sections made in Algerian specimens with preserved shell. She distinguished three different forms within the North African specimens assigned to *Histosyrinx vautrini*, notably from the locus typicus: a "forme a" (fig. 10.3-4, 12) with conspicuous syrinx supported by a "protuberance" but without a median septum (holotype), a "forme b" (fig. 10.1, 13) with an incipient median septum connecting the syrinx to the floor of the valve, and finally, a "forme c" (fig. 10.2, 14) with an extremely reduced syrinx supported by a well-developed median septum (including the specimen figured by Termier & Termier (in Massa et al. 1974: pl. 2, fig. 3)). However, the review of the type material assigned to the last form indicates that the septum supporting the syrinx is broken.

*Histosyrinx* was considered as a synonym of *Septosyringothyris* Vandercammen, 1955 by Mergl & Massa (1992, 2000). These authors emphasized that the only differences that separate *Histosyrinx vautrini* from the remaining species of *Septosyringothyris* (i.e. a rather low ventral interarea and large transverse shell of the Libyan species) would not have generic value (Mergl & Massa 1992). However, Carter et al. (1994) and Carter (2006) considered *Histosyrinx* as a distinct genus that can be distinguished from *Septosyringothyris* as the syrinx is inserted at the junction of two partly joined plates forming a subdelthyrial plate whereas in the latter the syrinx is supported by a true delthyrial plate and a thick and long septum.

*Syringopleura* Schuchert, 1910, with *Syringothyris randalli* Simpson, 1890 as type species, was proposed by Schuchert (1910) for the species previously assigned to *Syringothyris* with ribbed fold and sulcus. Although this North American genus was generally considered as a synonym of *Syringothyris* (e.g. Girty 1911; North 1920; Pitrat 1965; Carter et al. 1994; Carter 2006), Tachibana (1963, 1964, 1969), on the basis of its posteriorly supported syrinx, described it as a subgenus of *Syringothyris*. In addition, Thomas (1971) suggested using *Syringopleura* as a subgenus of *Syringothyris* to include the species with faint costae on fold and in sulcus. According to Sass (1960), the syrinx of *Syringothyris randalli* is unsupported for 90% of its length, but for Carter & Kammer (1990), *"Syringothyris"* [sic] *randalli* has a syrinx partly supported by a strong short septum. Sass (1960: 358), suggested that there are a number of structures that appear to be derived from the deposition of callist material at the upper extremities of the dental plates and these are frequently referred to the "pseudo-deltidium" that supposedly closes the delthyrium. This author also indicated that, below the callist, the dental plates are connected by a thin transverse "subdelthyrial plate" on which would be inserted the syrinx. Based on Sass' (1960) illustrations of the specimens from the Famennian Corry Sandstone of Pennsylvania (USA), the development of shelly material deposited at the upper extremities of the dental plates in Simpson's (1890) spe-

Fig. 3 - *Histosyrinx vautrini* Termier & Termier in Massa et al., 1974 from the Serdeles area (Murzuq Basin, Western Libya), Marar Formation. Material illustrated by Termier & Termier (in Massa et al. 1974: pl. 2, fig. 1-6). 1a-f) UCBL-FSL 597408c (holotype), incomplete ventral valve (limonitic mould) in external, internal, oblique internal, lateral, posterior and anterior views. 2a-f) UCBL-FSL 597408b, incomplete ventral valve (limonitic mould) in ventral, internal, lateral, oblique internal, posterior and anterior views. 3a-e) UCBL-FSL 597440, internal mould in ventral, dorsal, lateral, posterior and anterior views. 4a-e) UCBL-FSL 597408a, incomplete articulated specimen (limonitic mould) in ventral, dorsal, lateral, posterior and anterior views.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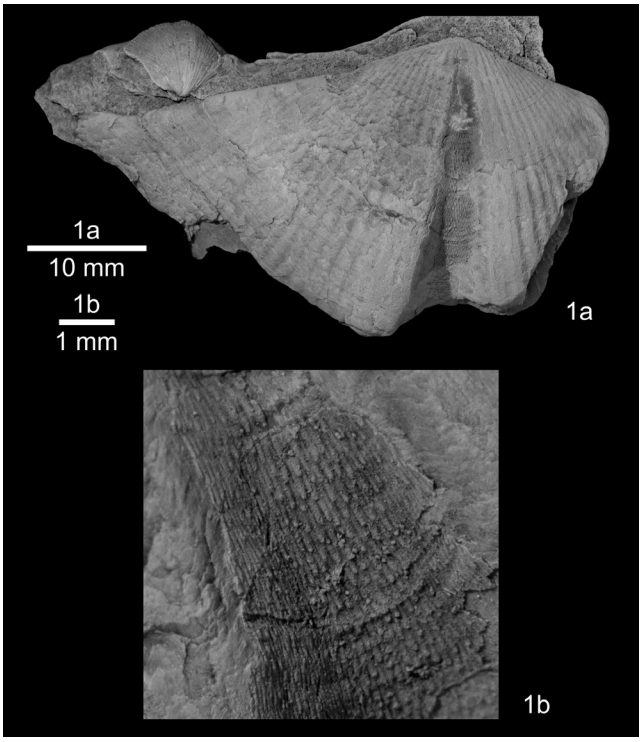



Fig. 4 - *Histosyrinx vautrini* Termier & Termier in Massa et al., 1974 fide Legrand-Blain (1974) from Azzel Matti (Algeria), upper part of the Grès de Tibaradine (Tournaisian). RBINS a13440 (JC 305a7 in Legrand-Blain 1974), incomplete ventral valve in plan view (1a) and close-up (1b) of the microornament (elongate pustules arranged in quincunx) in the central part of the sulcus.

cies and in *H. vautrini* is similar. Nevertheless, the dorsal internal morphology of the species *randalli* is unknown. The relationships between *Histosyrinx* and *Syringopleura* need to be investigated further. We note that some specimens of *Syringothyris angulata* Simpson, 1890 (Carter & Kammer 1990: fig. 10.4-5) display a septal pillow comparable to that observed in *Histosyrinx*. Their ventral interior seems to be close to that of *Histosyrinx*. These species also share the presence of the diagnostic subdelthyrial plate.

**Species included.** Besides the type species, an unidentified species of *Histosyrinx* was recently reported in upper Famennian succession of western Junggar (Xinjiang, China) by Zong & Ma (2012). Septosyringothyridine species identified in Upper Carboniferous deposits of Argentina (South America) were also assigned to *Histosyrinx* (Lech & Raverta 2005), but this generic assignment could be questionable according the last review of the Carboniferous–Permian syringothyrids from the central western Argentinian basins (Cisterna 2011). However, in light of the new information provided herein, and the recent revision of the genus *Septosyringothyris* (Mottequin et al. 2018), the syringothyrid species from Argentina should be reviewed.

## ***Histosyrinx vautrini*** Termier & Termier in Massa et al., 1974

Fig. 3-8

1934 *Spirifer carinatus* Schnur; Pagani, p. 255, pl. 6, fig. 1-4.
1934 *Spirifer carinatus* Schnur var. *latissima* Scupin; Pagani, p. 257, pl. 6, fig. 5-8.
1934 *Spirifer carinatus* Schnur var. *serdelensis* Pagani, p. 258, pl. 6, fig. 9-10.
1939 *Spirifer dowbrowiensis* Gürich; Borghi, p. 163, pl. 4, fig. 1-2, pl. 5, fig. 9-14.
1939 *Spirifer dowbrowiensis* Gürich var. *Paganii* Borghi, p. 165, pl. 4, fig. 4 (= specimen illustrated pl. 6, fig. 6 in Pagani (1934)).
1939 *Spirifer dowbrowiensis* Gürich var. *serdelensis* Pagani; Borghi, p. 166, pl. 4, fig. 3 (= specimen illustrated pl. 6, fig. 10 in Pagani (1934)).
1974 *Histosyrinx vautrini* Termier & Termier in Massa et al., 1974, pp. 163, 168, fig. 2a-c, pl. 2, fig. 1-6.
1974 *Histosyrinx vautrini* G. & H. Termier, 1974; Legrand-Blain, pp. 98, 120, fig. 10-14, pl. 2, fig. 13-16, pl. 3, fig. 5-8, (see this author for synonymy before 1974).
1979 *Histosyrinx vautrini* G. et H. Termier; Massa & Vachard, p. 9.
1985 *Histosyrinx vautrini* Termier & Termier in Massa et al., 1974; Legrand-Blain, p. 372, pl. 11, fig. 12.
v 1992 *Septosyringothyris vautrini* (Massa, Termier & Termier, 1974); Mergl & Massa, p. 92, pl. 24, fig. 1-4.
2000 *Septosyringothyris vautrini* Massa, Termier and Termier (*Histosyrinx*) [sic]; Mergl & Massa, pp. 77, 80, 81, pl. 6, fig. 15.
2001 *Histosyrinx vautrini*; Mergl et al., p. 182.
2002 *Histosyrinx vautrini* M. & T.; Legrand-Blain, p. 80, table 6.
v 2006 *Histosyrinx vautrini* Termier & Termier in Massa et al., 1974; Carter, p. 1899, fig. 1263.2a-d (copy of Termier & Termier in Massa et al., 1974), 1263.2e-g (copy of Legrand-Blain, 1974).
2010 *Histosyrinx vautrini* Termier [sic]; Mottequin & Legrand-Blain, p. 355.
2018 *H.* [*Histosyrinx*] *vautrini* Termier & Termier in Massa et al., 1974; Mottequin et al., p. 81.

**Type material**: The specimens illustrated by Termier & Termier in Massa et al. (1974, pl. 2, fig. 1-6), originally belonging to the collections of the Compagnie française des pétroles (Bordeaux), are housed now at the Lyon 1 University (Villeurbanne, France). They are the following: UCBL-FSL 597408a (pl. 2, fig. 1-2) (Fig. 3.4a-e), UCBL-FSL 597408b (pl. 2, fig. 3) (Fig. 3.2a-f), UCBL-FSL 597408c (pl. 2, fig. 4; holotype) (Fig. 3.1a-f), and UCBL-FSL 597440 (pl. 2, fig. 5-6) (Fig. 3.3a-e).

**Additional material**: Algerian specimen: RBINS a13440 (Azzel Matti, Reggane Basin, an incomplete ventral valve (JC 305a7 in Legrand-Blain 1974)) (Fig. 4). Libyan specimens: UCBL-FSL 597457d (Serdeles, Massa's locality, OC 817, five articulated, eight ventral and six dorsal internal moulds); UCBL-FSL 597451 (probably Serdeles area, Massa's localities NA95-97, 23 articulated and four dorsal internal moulds), UCBL-FSL 597468 (Serdeles, three dorsal internal moulds), UCBL-FSL 597449 (Serdeles, Massa's locality UB 206, eight incomplete ventral internal moulds); UCBL-FSL 597482 (Serdeles, Massa's locality LA 126, 12 articulated, five ventral and five dorsal internal moulds); GFCL 560-563 (Serdeles, four articulated internal moulds; Legrand-Blain 1974: fig. 10) (Fig. 5, 7.2, 8.1-4).


Fig. 5 - *Histosyrinx vautrini* Termier & Termier in Massa et al., 1974 from the Serdeles area (Murzuq Basin, Western Libya), Marar Formation. 1a-e) GFCL 560 (see Fig. 7.1), articulated internal mould in ventral, dorsal, lateral, posterior and anterior views. 2a-e) GFCL 561 (see Fig. 8.2), articulated internal mould in ventral, dorsal, lateral, posterior and anterior views. 3a-e) GFCL 562 (see Fig. 7.2, 8.3), articulated internal mould in ventral, dorsal, lateral, posterior and anterior views. 4a-e) GFCL 563 (see Fig. 8.4), articulated internal mould in ventral, dorsal, lateral, posterior and anterior views.

**Description**. Shell large-sized (up to c. 70 mm in width, up to c. 40 mm in length for the Libyan internal moulds), ventribiconvex, widest approximately at hinge, wider than long, transverse in outline with acute cardinal extremities (young specimens) to subrectangular with straight to rounded cardinal extremities (adult specimens); anterior margin flat to slightly emarginate; anterior commissure strongly uniplicate.

Ventral valve relatively convex with flanks slopping gently to moderately towards lateral commissures; umbonal region moderately inflated; interarea high, apsacline to strongly apsacline (rarely almost orthocline), flat to slightly concave; delthyrium wide, delthyrial angle between 52–62 degrees (N = 5); sulcus well-defined, narrow (sulcus width/shell width: 0.25–0.38 (N = 5)), deep, flat-bottomed at front; tongue high, more or less perpendicular to commissural plane, semi-circular in outline.

Dorsal valve highest anteriorly or posteriorly to midlength, then decreasing towards anterior margin; flanks slopping gently towards lateral commissures; fold well-defined, originating at umbo, moderately high to high, round-topped at front; interarea linear, flat, anacline.

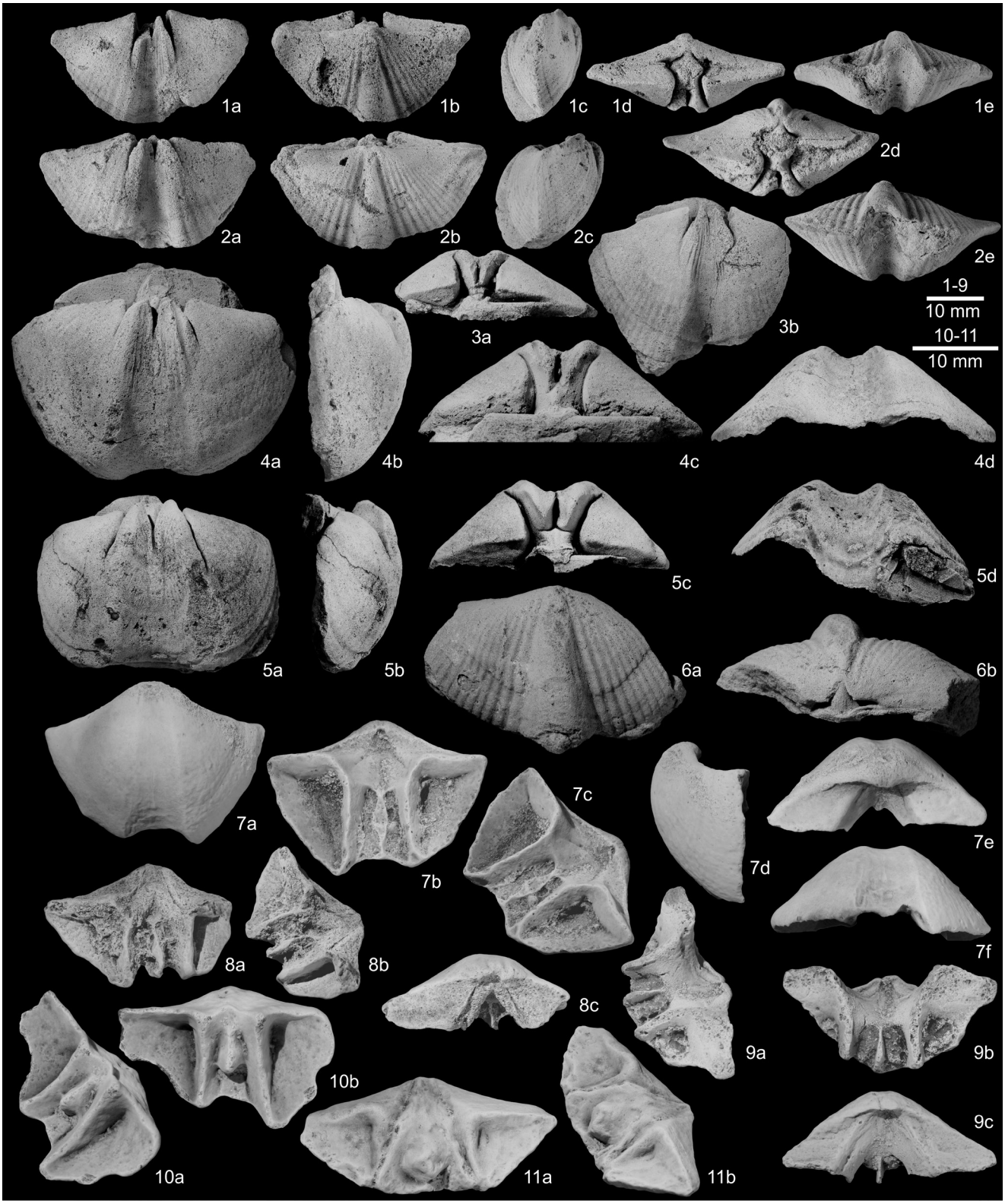
At least 16 simple, low rounded ribs per flank; grooves narrower than ribs; sulcus and fold smooth; growth varices irregularly developed; micro-ornamentation not observed in Libyan material (the coarse matrix precludes to observe such ornamental structure on the few external moulds available; the Algerian specimen RBINS a13440, cited by Legrand-Blain (1974), displays fine radial striae with fine elongate pustules (c. 8 per 1 mm) between striae producing textile-like appearance (Fig. 4.1b)); growth varices irregularly spaced, but generally well-developed anteriorly.

Ventral valve interior (see Fig. 7 for morphological terms) with dental plates well-developed, reaching up to half of valve length and divergent anteriorly at 32–61 degrees (N = 10); teeth small; subdelthyrial plate and syrinx variably developed; syrinx either enclosed apically in a septal pillow and connected to the valve floor by a protuberance (thick callus) (Fig. 3.1b, 8.3-4; "forme a" of Legrand-Blain 1974: fig. 10.3-4) or, in most of the studied specimens, connected to valve floor by a median septum varying in size (from small (Fig. 8.1; "forme b" of Legrand-Blain 1974: fig. 10.1) to well-developed (Fig. 8.2; "forme c" of Legrand-Blain 1974: fig. 10.2)); muscle field excavated in valve floor, subdiamond-shaped to subelliptic in outline (Fig. 7) with muscle scars impressed; diductor scars between and in front of the dental plates preserved as longitudinal striations; adductor scars elongate, weakly impressed into shell material.

Dorsal interior with supported ctenophoridium (precise number of longitudinal plates unknown); sockets small, deep, widely divergent; inner socket ridges stout; crural plates clearly developed leaving distinct slits on internal mould (Fig. 6.6b); myophragm long (up to half the valve length); spiral cones posterolaterally oriented; at least 19 whorls per spiral cone (Fig. 3.4a).

**Remarks**. The type species of *Histosyrinx* was poorly described and illustrated by Termier & Termier (in Massa et al. 1974). These authors did not discuss the varieties previously described by Pagani (1934) (*Spirifer carinatus* var. *serdelensis*) and Borghi (1939) (*Spirifer dombrowiensis* var. *paganii*) from Serdeles, they only placed them in the synonymy list of their new species as *Spirifer dombrowiensis*. Legrand-Blain (1974) has already stressed on the fact that the species introduced by Termier & Termier

Fig. 6 - *Histosyrinx vautrini* Termier & Termier in Massa et al., 1974 from the Serdeles area (Murzuq Basin, Western Libya), Marar Formation. 1a-e) UCBL-FSL 597457a (OC 817), incomplete internal mould of a juvenile articulated specimen (the smallest available) in ventral, dorsal, lateral, posterior and anterior views. 2a-e) UCBL-FSL 597457b (OC 817), incomplete internal mould of a juvenile articulated specimen in ventral, dorsal, lateral, posterior and anterior views. 3a-b) UCBL-FSL 597457c (OC 817), incomplete internal mould of a ventral valve in posterior and plan views. 4a-d) UCBL-FSL 597457d (OC 817) (see Fig. 7.3, 8.5), incomplete internal mould of a ventral valve in plan, lateral, posterior and anterior views. 5a-d) UCBL-FSL 597457e (OC 817) (see Fig. 7.1, 8.6), almost complete ventral internal mould in ventral, lateral, posterior and anterior views. 6a-b) UCBL-FSL 597451a (NA 95-97) (see Fig. 8.8), incomplete dorsal internal mould in plan and posterior views. 7a-f) UCBL-FSL 597449a (UB 206), incomplete limonitic mould of a ventral valve in external, internal, oblique lateral internal, lateral, posterior and anterior views. 8a-c) UCBL-FSL 597449b (UB 206), incomplete limonitic mould of a ventral valve in internal, oblique lateral internal and posterior views. 9a-c) UCBL-FSL 597449c (UB 206), incomplete limonitic mould of a ventral valve in oblique lateral internal, internal and posterior views. 10a-b) UCBL-FSL 597449d (UB 206), incomplete limonitic mould of a ventral valve in oblique lateral internal and internal views. 11a-b) UCBL-FSL 597449e (UB 206), incomplete limonitic mould of a ventral valve in internal and oblique lateral internal views.




(in Massa et al. 1974) could be a synonym of one of the varieties from the Serdeles area described by Pagani (1934) and Borghi (1939). Unfortunately, the material described by both Italian palaeontologists, that was stored at the Museo di Storia Naturale di Milano, went lost during World War II, when the museum was destroyed by a RAF bombardment on August 1943 (G. Teruzzi, pers. com., 27 June 2018). Based on the Article 45.6.4 of the ICZN (1999, 4th edition), these varieties have to be considered of subspecific rank in their original publication. Nonetheless, the subspecies *serdelensis* has nothing in

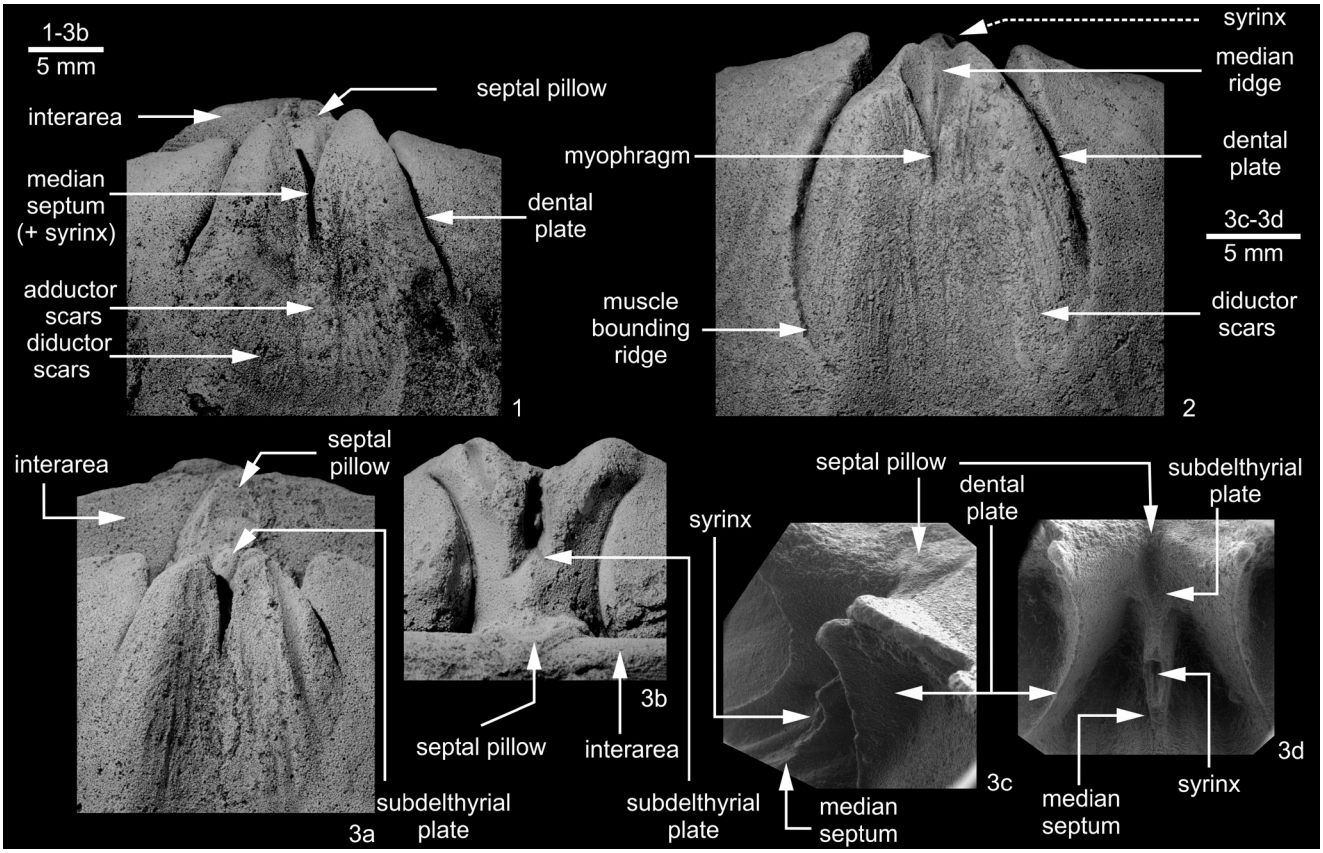
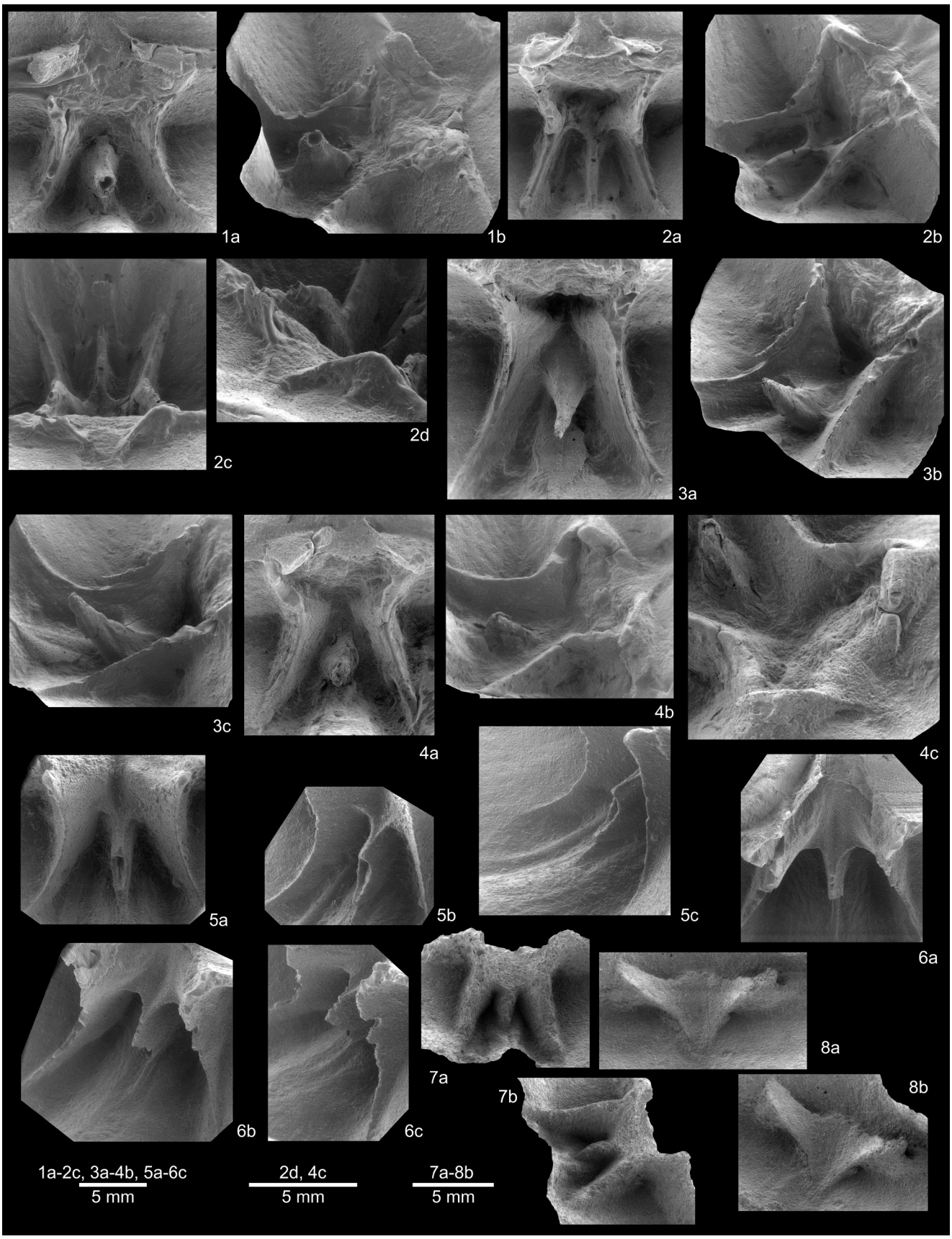



Fig. 7 - Ventral morphological terms of *Histosyrinx vautrini* Termier & Termier in Massa et al., 1974 (Serdeles, Libya, Marar Formation). 1) UCBL-FSL 597457e (OC 817) (see Fig. 6.5, 8.6), close-up of the posterocentral region (internal mould). 2) GFCL 562 (see Fig. 5.3, 8.3), close-up of the posterocentral region (internal mould). 3a-d) UCBL-FSL 597457d (OC 817) (see Fig. 6.4, 8.5), close-up and posterior view of the posterocentral region (internal mould) and latex cast in oblique lateral and anterior views.

common with *Brachyspirifer carinatus* (Schnur, 1853), the type species of *Brachyspirifer* Wedekind, 1926, as is the case of the subspecies *paganii* which is clearly distinct from *Chimaerothyris dombrowiensis* (Gürich, 1896) (see revision of Gürich's species in Studencka 1983). They are promoted to a specific rank herein for nomenclatorial purposes. In our opinion, it is obvious that the species *vautrini* encompasses those introduced by Pagani (1934) and Borghi (1939), and *Spirifer serdelensis* Pagani, 1934 should be considered as the senior synonym of the three names used to denote the same taxonomic taxon. Nevertheless, due to the impossibility to know precisely the features of the species *serdelensis* sensu Borghi (1934) because the type material is missing, and in accordance with the Principle of Priority (Art. 23.2 of the ICZN (1999, 4th edition)), we think that the reversal of precedence (Art. 23.9) should be applicated. Although the conditions of the Art. 23.9.1 are not met, we believe, however, that the use of the

Fig. 8 - Latex casts of *Histosyrinx vautrini* Termier & Termier in Massa et al., 1974 from the Serdeles area (Murzuq Basin, Western Libya), Marar Formation. 1a-b) GFCL 560 (see Fig. 5.1), close-up of the dental plates, syrinx and cardinalia in anterior and oblique lateral views. 2a-d) GFCL 561 (see Fig. 5.2), close-up of the dental plates, medium septum (in which a "syringogenous" structure should be included (compare with Legrand-Blain (1974: fig. 13)), septal pillow and cardinalia in anterior and oblique lateral views, and detail of the cardinalia. 3a-c) GFCL 562 (see Fig. 5.3, 7.2), close-up of the dental plates and syrinx in anterior, anterior oblique and oblique lateral views. 4a-c) GFCL 563 (see Fig. 5.4) close-up of the dental plates and syrinx in anterior and oblique views, and close-up of the cardinalia with well-preserved ctenophoridium. 5a-c) UCBL-FSL 597457d (OC 817) (see Fig. 6.4, 7.4), close-up of the dental plates, the subdelthyrial plate and the syrinx. 6a-c) UCBL-FSL 597457e (OC 817) (see Fig. 6.5, 7.1), close-up of the dental plates, the subdelthyrial plate and the syrinx. 7a-b) UCBL-FSL 597451b (NA 95-97), close-up of the dental plates and the septum of a young specimen in anterior and oblique lateral views. 8a-b) UCBL-FSL 597451a (NA 95-97) (see Fig. 6.6), close-up of the cardinalia in anterior and anterolateral views.


1a
1b
2a
2b
2c
2d
3a
3b
3c
4a
4b
4c
5a
5b
5c
6a
6b
6c
7a
7b
8a
8b
1a-2c, 3a-4b, 5a-6c
5 mm
2d, 4c
5 mm
7a-8b
5 mm

name *serdelensis* would threaten the stability of the nomenclature (Art. 23.9.3) and this matter must be referred to the Commission for a ruling under the plenary power.

## Further remarks on an enigmatic Algerian Syringothyrididae

Legrand-Blain (1974) identified as Septosyringothyrididae? nov. gen.? some specimens previously reported but not illustrated by Gevin (1960) in the Tournaisian succession of the southern margin of the Tindouf Basin in Algeria (Fig. 1). The material is fully illustrated here for the first time, but the data presented below should be considered as preliminary pending further collections.

Permasyrinxinae gen. indet.
Pl. 1, Fig. 1-6

1960 *Syringothyris cuspidata* Martin, variété *cyrtorhyncha*; Gevin: pp. 210, 233, fig. 54, 58.
1974 Septosyringothyrididae? nov. gen.?; Legrand-Blain: pp. 129-130, fig. 15, pl. 2, fig. 11-12.

**Material**: Ten articulated, but poorly preserved specimens.

**Description**. Shell medium-sized (up to c. 38 mm in width), ventribiconvex, wider than long, rounded trapezoidal in outline, with rounded cardinal margins; anterior commissure strongly uniplicate; anterior margin emarginate.

Ventral valve inflated, with flanks sloping moderately to steeply towards lateral commissures; beak straight to slightly curved; interarea high, moderately to strongly concave, apsacline; delthyrium narrow (no traces of delthyrial cover, deficient preservation); sulcus narrow, well-defined, shallow to moderately deep, flat- to round-bottomed at front; tongue moderately high, semicircular to subtrapezoidal in outline, perpendicular to commissural plane or bent dorsally.

Dorsal valve with flanks sloping moderately towards lateral commissures, with maximal height posteriorly to mid-length then decreasing strongly towards anterior margin; interarea linear (poorly preserved); fold originating at umbo, moderately high, round- to flat-topped at front.

Ornamentation of low, wide, simple ribs (about 15, but exact number unknown due to the poor preservation of the specimens) separated by narrower grooves; growth lines irregularly spaced; sulcus and fold smooth; microornament not observed (it could be pustulous according to Legrand-Blain (1974)).

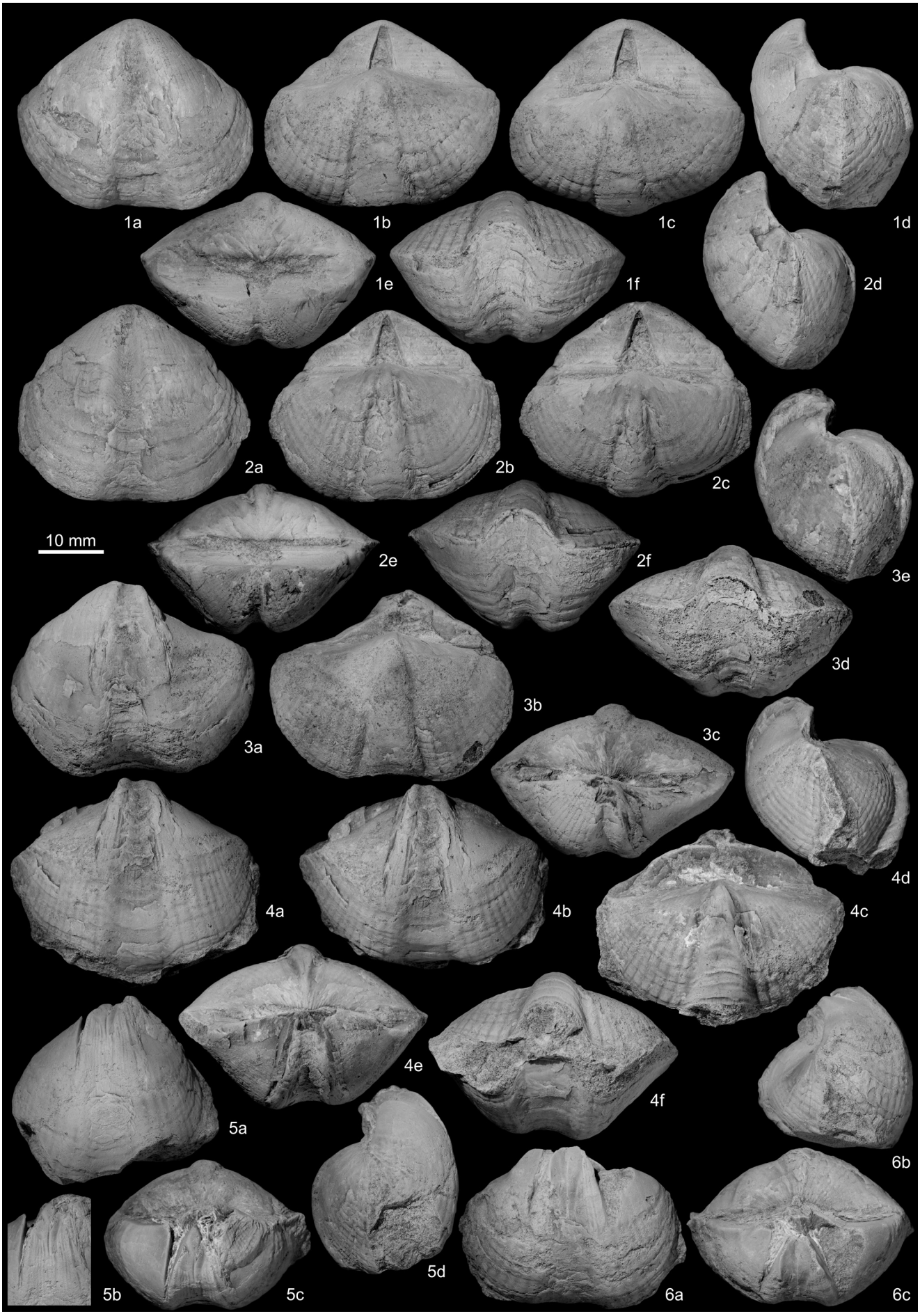
Ventral interior with dental plates long, thick, extrasinal, divergent anteriorly from 24 to 38 degrees (N = 6); muscle field excavated in valve floor, with poorly marked anterior margin; adductor scars raised on elongate ridge at posterior portion of muscle field (Pl. 1, Fig. 6a); diductor scars longitudinally striated (Pl. 1, Fig. 5b, 6a); median septum present (but no syrinx) (Legrand-Blain 1974: fig. 15, pl. 2, fig. 12) in some specimens; other are devoid of median septum but exhibit a myophragm (Pl. 1, Fig. 5b) (these specimens seem to display a plate just below the plane of the interarea).

Dorsal interior not observed.

**Remarks**. The scarce and relatively poorly preserved material previously identified as *Syringothyris cuspidata cyrtorhyncha* North, 1920, and rightly considered as enigmatic by Legrand-Blain (1974), is fully illustrated for the first time. The external morphology of the specimens described is close to that of *Syringothyris folloti* Legrand-Blain, 1974 from the Tournaisian of the Ahnet area (Algeria). From the internal viewpoint, they are particularly puzzling as the specimen sectioned by Legrand-Blain (1974: fig. 15) displays a structure resembling a septum, but

PLATE 1

Permasyrinxinae gen. indet., Ouidan Tartrat (southern margin of the Tindouf Basin, Algeria), Tournaisian.
1a-f) UCBL-FSL 699690, articulated specimen in ventral, dorsal, posterodorsal, lateral, posterior and anterior views.
2a-f) UCBL-FSL 699691, articulated specimen in ventral, dorsal, posterodorsal, lateral, posterior and anterior views.
3a-e) UCBL-FSL 699692, articulated specimen in ventral, dorsal, posterior, anterior and lateral views.
4a-f) UCBL-FSL 699693, articulated specimen in ventral, inclined ventral, dorsal, lateral, posterior and anterior views.
5a-d) UCBL-FSL 699694, incomplete articulated specimen in ventral, posterior and lateral views, and close-up of the ventral muscle field (5b).
6a-c) UCBL-FSL 699695, incomplete articulated specimen in ventral, lateral and posterior views.


1a
1b
1c
1d
1e
1f
2d
2a
2b
2c
10 mm
2e
2f
3e
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3d
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4b
4c
4d
4e
4f
5a
6b
5b
5c
5d
6a
6c

without syrinx, whereas other specimens illustrated here (Pl. 1, Fig. 5-6) are devoid of septum. The absence of syrinx strongly suggests an assignment to the subfamily Permasyrinxinae. Among the genera of this subfamily, *Verkhotomia* Sokolskaya, 1963 is externally the closest genus (e.g. shape, development of the interarea), but differs internally. At this stage, it is not excluded that the Algerian material from the Tindouf Basin includes two distinct taxa, unless accepting the great variations of the internal morphology of the ventral valve as intraspecific ones, but further material is required to reach a more confident identification.

**Occurrence**. Tournaisian of the Ouidan Tartrat section, southern margin of the Tindouf Basin, Algeria (Gevin 1960) (Fig. 1).

## Conclusions

The study of some Carboniferous Septosyringothyridinae from several localities of North Africa has allowed to document the great variability of their ventral internal morphology. Thus, the present re-assessment of the Libyan type species of the genus *Histosyrinx* Termier & Termier (in Massa et al., 1974) and the recent review of *Septosyringothyris* Vandercammen, 1955 (Mottequin et al. 2018) provide a better understanding of the content of the subfamily Septosyringothyridinae. This subfamily includes Syringothyrididae with a syrinx generally supported by a median septum or a stout median ridge.

This study promotes the revision of the Septosyringothyridinae from the Carboniferous–Permian of the Argentinian basins (see Cisterna 2011 and references therein), and also highlights the strong similarities existing between *Syringopleura* Schuchert, 1910 (generally considered as a synonym of *Syringothyris* Winchell, 1863) and *Histosyrinx,* at least, from the viewpoint of the internal morphology. Nonetheless the dorsal interior of the type species of *Syringopleura* is still inadequately known (Sass 1960), and thus further research are needed to state on the rank of Schuchert's genus.

*Acknowledgements:* The authors are grateful to Julien Cillis for the SEM photographic work, to Benoît Hubert for the loan of Gaston Delépine's material (Catholic Institute of Lille), to Emmanuel Robert for access to the collections of the Lyon 1 University and for the loan of material, to Philippe Legrand and Marie Legrand-Blain for information related to the Libyan material described by Geneviève and Henri Termier, and to Georgio Teruzzi for information on the Pagani's and Borghi's material. B. Mottequin acknowledges the Fonds national de la Recherche scientifique (FNRS) for its support to take part to the 8th International Brachiopod Congress (mission no. 2018/C 17/5/769 - JG/MS - 4939). We are also grateful to the reviewers (Marie Legrand-Blain and an anonymous one) and the Editor Renato Posenato for their helpful comments and suggestions.

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