

## Two new Emsian rhynchonellid (brachiopod) genera from the Eifel area (Germany)

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SARTENAER, P., 2009 – Two new late Emsian rhynchonellid (brachiopod) genera from the Eifel area (Germany). *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre*, 79: 27-42, 1 text-fig., 3 tables, 1 pl., Brussels, October 31, 2009 – ISSN 0374-6291.

### Abstract

Two new genera are described from the Wiltz Beds (Upper Emsian) of the Eifel area: *Astraelenia*, type species *A. losseni* (KAYSER, 1880), and *Xahetomus*, type species *X. hexadaleidensis* n. sp. *Astraelenia* is designated the type for the new family Astraeleniidae.

**Keywords:** Astraeleniidae, *Astraelenia*, *Xahetomus*, rhynchonellids, brachiopods, Upper Emsian, Eifel area.

### Résumé

L'auteur fonde deux nouveaux genres en provenance des couches de Wiltz (Emsien Supérieur) de l'Eifel. *Astraelenia* avec comme espèce-type *A. losseni* (KAYSER, 1880) et *Xahetomus* avec comme espèce – type *X. hexadaleidensis* n.sp. *Astraelenia* est designé comme type de la nouvelle famille Astraeleniidae.

**Mots-clefs:** Astraeleniidae, *Astraelenia*, *Xahetomus*, Rhynchonellides, Brachiopodes, Emsien Supérieur, Eifel.

### Introduction

Type species of the two genera proposed in the present paper have received little attention, although they were described and figured as far back as 1851 and 1853 by SCHNUR as *Terebratula Stricklandi* SOWERBY, J. de C. in MURCHISON, 1839 (1851, 1853) and *T. Daleidensis* ROEMER, C.F., 1844 var. (1853). They occur together with *T. Daleidensis* in the Upper Emsian Wiltz Beds of the “Daleiden Mulden-gruppe”, Eifel area. Their systematic status needs to be clarified and their stratigraphic significance enhanced.

### Systematic palaeontology

#### Astraeleniidae n. fam.

*Type genus:* *Astraelenia* n. gen.

#### Diagnosis

Shell of large size with strongly dorsibiconvex profile and subcircular to transversely suboval outline; top of shell posterior to front; very short ventral interarea; *lunulae*, *squamae* and *glottae* present; apical angle wide, sulcus and fold wide, not starting from the beaks; outer dorsal flanks deflected ventrally; costae numerous, well marked, start at the beaks; parietal costae present; dental plates thick, separated from wall by small umbonal cavities; hinge plate divided; septalium shallow; septum long, lens-shaped in its apical part; cardinal process well developed, crowned with numerous lamellae; ventral muscle field strongly impressed.

#### Generic composition

Outside *Astraelenia* n. gen., *Straelenia* MAILLIEUX, 1935 is also included in the new family. *Astraelenia* has been preferred to *Straelenia* as the type genus for the following reasons: there is some uncertainty regarding the equivalence, advocated in the literature, between *Rhynchonella Dannenbergi* var. *minor* DREVERMANN, 1902, elevated by MAILLIEUX (1935, p.12) to the rank of species, and designated (p.11) as the type species of the genus, and *R. Dunensis* DREVERMANN, 1902; and the poor state of preservation (isolated valves almost exclusively) of both species.

#### Remark

The diagnostic combination of characters allows separation of the new family from all known families.

*Astraelenia* n. gen.*Derivatio nominis*

*A* = privative prefix followed by *Straelenia*. The name draws attention to the removal of the type species from the genus *Straelenia* to which it has been assigned since its establishment.

*Type species: Rhynchonella Losseni* KAYSER, E. 1880. SCHNUR (1851, p.4; 1853, pp.172-173, pl.22, figs 2a-h) described as *Terebratula Stricklandi* and *T. Stricklandii* a species from the Daleiden, Waxweiler and Prüm (especially from Daleiden and Waxweiler) “Grauwacke” of the Eifel area. KAYSER (1880, p.820) agreed that the German species was close to the one from the Wenlock of Herefordshire, but saw enough reasons for accepting its “spezifische Selbstständigkeit”, and gave it the name *Rhynchonella Losseni* without bringing any change to SCHNUR’s description. He included in it specimens from Daleiden already mentioned by SCHNUR and others from the Braut mine in Walderbach (now Wald-Erbach), southeastern Hunsrück.

SCHNUR’s *Terebratula Stricklandi* has been included in the synonymy of *Rhynchonella Losseni* after 1880, but only few authors (DREVERMANN, 1902, p.108; LEIDHOLD, 1913, p.361; DIENST, 1914, p.592; WOLF, 1930, p.68; and MAILLIEUX, 1941a, p.38) excluded SCHNUR’s figures 2f-h from the synonymy, a position with which the author concurs; SCHNUR himself (1853, p.173) considered the specimen corresponding to these figures as a subspecies (“Abart”).

DREVERMANN (1902, pp.108-109) called “Gruppe der *Rhynchonella Losseni*” a group including German species + one mutation (*R. Dannenbergi* KAYSER, 1883 from the Lower Emsian of eastern Taunus, *R. Dannenbergi* mut. *minor* and *R. Dunensis* from the Lower Emsian of Oberstadtfeld near Daun in the Eifel area, and *R. Losseni*, KAYSER, 1880 from the Upper Emsian of the surroundings of Daleiden also in the Eifel area), an English species (*R. Pengelliana* DAVIDSON, 1865 from the Lower Devonian, probably Pragian, of Cornwall), a French species (*R. Le Tissieri* OEHLERT, 1877 from the Pragian of the Armorican Massif), and some species from the Oriskany Sandstone of New York State [*R. Fitchana* HALL, 1857; *R. multistriata* HALL, 1857; *R. oblata* HALL, 1857; *R. pleiopleura* (CONRAD, 1841) and possibly *R. septata* HALL, 1859].

Such a group of species, + one mutation, from widely separated regions ranging from the Pragian to the late Emsian and belonging to various genera as we know now, had little chance of surviving as a creative

concept; it was accepted by DIENST (1914, p.593), and then died out. It is only mentioned here as a reminder.

*Diagnostic features*

Shell of large size, outline subcircular to transversely subelliptical, maximum thickness posterior to front. *Squamae* and *glottae* present. Ventral interarea very short, apical angle wide. Commissure moderately to strongly serrate. Sulcus and fold wide, start in the anterior part of the umbonal regions; sulcus shallow, forming a moderately high tongue with subtrapezoidal outline, fold low to moderately high. Costae regular, start from the beaks; median costae few, lateral costae numerous. Parietal costae present. Dental plates thick, separated from the wall by small umbonal cavities. Hinge plate divided. Septalium shallow, triangular. Cardinal process crowned by numerous lamellae. Septum thin and long. Crura slender.

*Species assigned to the genus*

Outside of the type species, the Lower Emsian species *Rhynchonella Dannenbergi* from Oppershofen in the eastern Taunus, and the Upper Emsian species, described by DROT (1964, p.22, table 1, p.94, pp.155-157, 209, pl.18, figs 10, 10a,b, pl.19, figs 12a,c, 13, pl.24, fig.6 as *Straelenia* sp. e.g. *losseni*) from the upper part of the El Ansar Formation of the northeastern part of the Dra Plains (Anti-Atlas, Morocco), belong to the new genus.

*Description*

Shell of large size, profile strongly dorsibiconvex (dorsal valve considerably thicker than ventral valve); ventral valve thickest at about 1/3 shell length anterior to beak; dorsal valve thickest posterior, sometimes considerably, to front, exceptionally at front. Shell outline subcircular to transversely subelliptical; maximum width generally anterior to mid-length. Anterior, antero-lateral and lateral commissures moderately to strongly serrate, fusing into the wall. Lateral commissures passing to the cardinal commissure by a pronounced and dorsally oriented bend due to the presence of *squamae* and *glottae*. Wide apical angle (120 to 125° in the type species). Elongated *lunulae* present in both valves, defined by more or less sharp beak ridges. Ventral beak strongly incurved, coming close to the dorsal umbo; umbo low. Ventral interarea very short. Sulcus and fold well marked, start imperceptibly in the anterior part of the umbonal area. Sulcus wide, shallow, clearly delimited towards margin; bottom flat to slightly convex, extended dorsally as a low or moderately high tongue with subtrapezoidal outline, tending

sometimes to become vertical near the commissure. Fold wide, low to moderately high; top gently convex. In transverse profile, outer dorsal flanks deflected ventrally to be almost vertical or vertical near antero-lateral commissures; ventral flanks slightly convex. Median costae few, lateral costae numerous. Costae well marked, low, moderately wide, regular, start from the beaks. Parietal costae passing progressively to the median and lateral costae. Dental plates thick and convex. Umbonal cavities small. Teeth stout and short. Well developed cardinal process composed, in its upper part, of about 15 lamellae, rests on a shallow and triangular septalium and a divided and thick hinge plate. Wing-shaped crural bases passing to slender crura, strongly curving ventrally, and remaining close to each other (*Remark*: crura are better preserved in the specimen of *Straelenia* sp. e.g. *losseni* sectioned by DROT (1964, fig.65, p.156). Septum long and thin, but thick and lens-shaped in its apical part. Ventral muscle field narrow, oval, and strongly impressed; its width is around 25% shell width, and its length 40% shell length. Dorsal muscle field less impressed (around 25% shell width and shell length).

#### Comparisons

Since MAILLIEUX (1935, p.12), *Rhynchonella Losseni* has generally been assigned to the genus *Straelenia*.

*Astraelenia* and *Straelenia* have some characters in common: a subcircular to transversely oval outline; *lunulae* defined by more or less sharp beak ridges; the dorsal valve thickest posterior to front; a very short ventral interarea; a wide sulcus; the bottom of the sulcus flat to slightly convex; a tongue with subtrapezoidal outline; a wide apical angle; numerous low, regular, and angular (with rounded top) costae, very rarely divided; the presence of parietal costae; a long septum; a divided hinge plate; the presence of a cardinal process.

*Astraelenia* differs from *Straelenia* by a larger size (the type species of *Straelenia* has not a large size as its name, *minor*, indicates); a strong dorsibiconvexity (valves are subequally convex in *Straelenia*); outer dorsal flanks deflected ventrally to become almost vertical or vertical near the antero-lateral commissures; higher fold and tongue; a deeper sulcus; the commissure usually more deeply serrate; a usually lesser number of median and lateral costae; higher and better marked costae; often more parietal costae; a wider sulcus; a tongue tending sometimes to become vertical near the commissure; crura of different shape; a larger and more elaborate cardinal process.

#### *Astraelenia losseni* KAYSER, 1880

Pl.1, Figs 1-10; Text-figs 1A, B; Table 1

Four specimens (two figured and measured, one measured, and one sectioned) are deposited, respectively, in the collections of the “Paläontologisches Museum, Museum für Naturkunde, Humboldt Universität zu Berlin” with registration number prefixed MB.B. and in the collections of the Belgian Royal Institute of Natural Sciences with registration numbers prefixed IRScNBa.

#### *Types, stratum typicum, locus typicus*

KAYSER’s (1880, p.820) proposition to replace with *Rhynchonella Losseni* the name *Terebratula Stricklandii* improperly used by “SCHNUR [1851, 1853]” and “Anderen” [STEININGER, 1853, p.65; KAYSER, 1871, p.315] for characterizing a late Emsian species from the “Grauwacke” of Daleiden, Waxweiler and Prüm in the Eifel area is only acceptable on account of its compliance with Article 12b of the ICZN that considers an indication – in this case a reference to SCHNUR’s original description of the taxon – as valid for names published before 1931. In consequence of, if a lectotype is to be designated, it must be chosen in priority among the type series according to Article 74 of the Code. Therefore, WOLF’s [1930, pp.68, 69, pl.1, fig.3, *Rhynchonella (Camarotoechia?) losseni*] lectotype coming from the same beds and the same locality as the type series and housed in the “Paläontologisches Museum” of the “Museum für Naturkunde” of the “Humboldt Universität zu Berlin” must be disregarded. It is here formally replaced by the specimen figured (pl.22, fig.2d) by SCHNUR (1853) and identified as *Terebratula Stricklandii*.

SCHNUR (1853, p.173 as *Terebratula Stricklandii*) wrote that the species was “seltener” than *T. Daleidensis*, which is very abundant in the same beds. As a matter of fact, *Astraelenia losseni* is a rare species.

Thirty-three specimens, all topotypes, were available for the present study: one specimen (lectotype = pl.22, fig. 2d as *Terebratula Stricklandii* in SCHNUR, 1853) in SCHNUR’s collection of the “Naturhistorisches Verein Rheinland Westfalen” housed in the Palaeontological Institute of Bonn University; twenty-one incomplete specimens deposited in the “Paläontologisches Museum, Museum für Naturkunde, Humboldt Universität zu Berlin” [eleven specimens collected at Daleiden by KAYSER, 1880 (2 sp.), and HENN, 1914 (9 sp.), including the specimen figured by WOLF (1930, pl.1, fig.3 = topotype A, MB.B.3245, figured on Pl.1,



Figs 1-5), and erroneously designated as the lectotype of the species; two specimens from Daleiden collected by STEININGER, 1853; one specimen from Irrhausen collected by DOHM, 1913; three specimens (two dorsal valves and one ventral valve still embedded in the rock) from Daleiden and Waxweiler; three specimens from Waxweiler collected by LEMBECK, 1979 (2 sp.) and KOWALSKI, 1984 (1 sp.) identified as *Oligoptycherhynchus schansianus* n. sp. = *nomen nudum*); one specimen (dorsal valve still embedded in the rock) from Niederprüm collected by WOLLERT, 1986]; two specimens (one distorted specimen, one ventral valve still embedded in the rock) from a railroad cut in Niederprüm, collected by HAPPEL, 1929, and housed in the “Senckenberg Forschungsinstitut und Natur Museum, Frankfurt am Main”; seven distorted specimens with preserved shell, collected in the eighties from a brick-field in Niederprüm by Dr. TROST, G., were later acquired by Dr. WENNDORF, K.-W., who presented three of them to the author [serial transverse sections have been made from one specimen (Text-figs 1A,B = topotype D, IRScNBa12620) ]; and two specimens (topotypes B, IRScNBa12618 and C, IRScNBa12619) (talus) collected by the author in January 1954 near the bridge over the river Irsen, immediately N of Daleiden, both measured (Table 1), and one (topotype B) photographed (Pl.1, Figs 6-10).

#### Description

This refers only to specific characters in need of further elaboration.

Beginning of the sulcus about 30% of shell length.

Width of sulcus at front around  $\frac{2}{3}$  of shell width. Thickness

of dorsal valve between 66 and 72% of shell thickness. Maximum thickness of ventral valve about 30% of shell length anterior to the ventral beak. Maximum thickness of dorsal valve between 51 and 63% of shell length anterior to the ventral beak. Maximum shell width between 50 and 62% of shell length anterior to the ventral beak. Apical angle between 120 and 125°. Number of costae: 6 to 8 dorsal median costae, 12 to 16 lateral costae (*Remark*: slightly higher numbers cannot be rejected because the most external lateral costae are difficult, and even impossible, to count on the available material),  $\frac{1-1}{1-1}$  or  $\frac{2-2}{2-2}$  parietal costae. Width of median costae at front varies between 1.5 and 2.5 mm. Measurements of three specimens, of which two have been photographed, are given in Table 1.

in mm	Topotype C IRScNB a12619	Topotype B IRScNB a12618	Topotype A MB.B.3245
l	33.6	27.4	26.7
l <sub>vv</sub> unrolled	(32.4)	33.1	32.3
w	(32)	39	45
t	30	27.7	24.5
t <sub>vv</sub>	8.5	9.3	8
t <sub>dv</sub>	21.5	18.4	16.5
l/w	(1.05)	0.83	0.83
t/w	(0.93)	0.84	0.79
t/l	0.89	1.01	0.92
apical angle	125°	124°	120°

Table 1 – Measurements of three specimens; figures in parentheses estimates. Abbreviations: l = length; w = width; t = thickness; vv = ventral valve; dv = dorsal valve.

#### Comparisons

Although often mentioned and discussed in the literature of Germany, Belgium, and the Grand Duchy of Luxemburg, *Rhynchonella Dannenbergi*, sometimes mistaken for *R. Losseni*, is still a poorly known species.

The type series of *R. Dannenbergi* consists of “about half a dozen” of unusually large rhynchonellid specimens, which are unfortunately commonly badly crushed and distorted (“etwa ein halber Dutzend leider durchgängig stark verdrückter Exemplare” of a “durch ungewöhnliche Grösse auffällige Rhynchonelle” in “verzerrter Zustand”). These specimens, collected by the geometer DANNENBERG, come from the Lower Emsian (“Untercoblenz-Schichten”) of Cransberg (now Kransberg) near Usingen, eastern Taunus, and not from the Upper Emsian (“Obere Coblenzstufe”) as suggested by the faunal assemblage according to KAYSER (1883, p.312), the founder of the species. Three of them, figured by KAYSER (1883, pl.XIV, figs 5-7) are housed in the “Paläontologisches Museum, Museum für Naturkunde, Humboldt Universität zu Berlin”. Specimens of figure 5 (dorsal valve) and 6 (ventral valve) are crushed and still embedded in the rock, and the one of figure 7, here formally designated as the lectotype of the species, is an incomplete specimen (most of the dorsal valve plus the posterior border of the ventral valve) that is also crushed. These specimens are very large [*Remark*: the large size of *R. Dannenbergi* explains why KAYSER (1882, p.199) identified the specimens of Usingen as *R. aff. Pengelliana* DAVIDSON, 1865], have a shallow

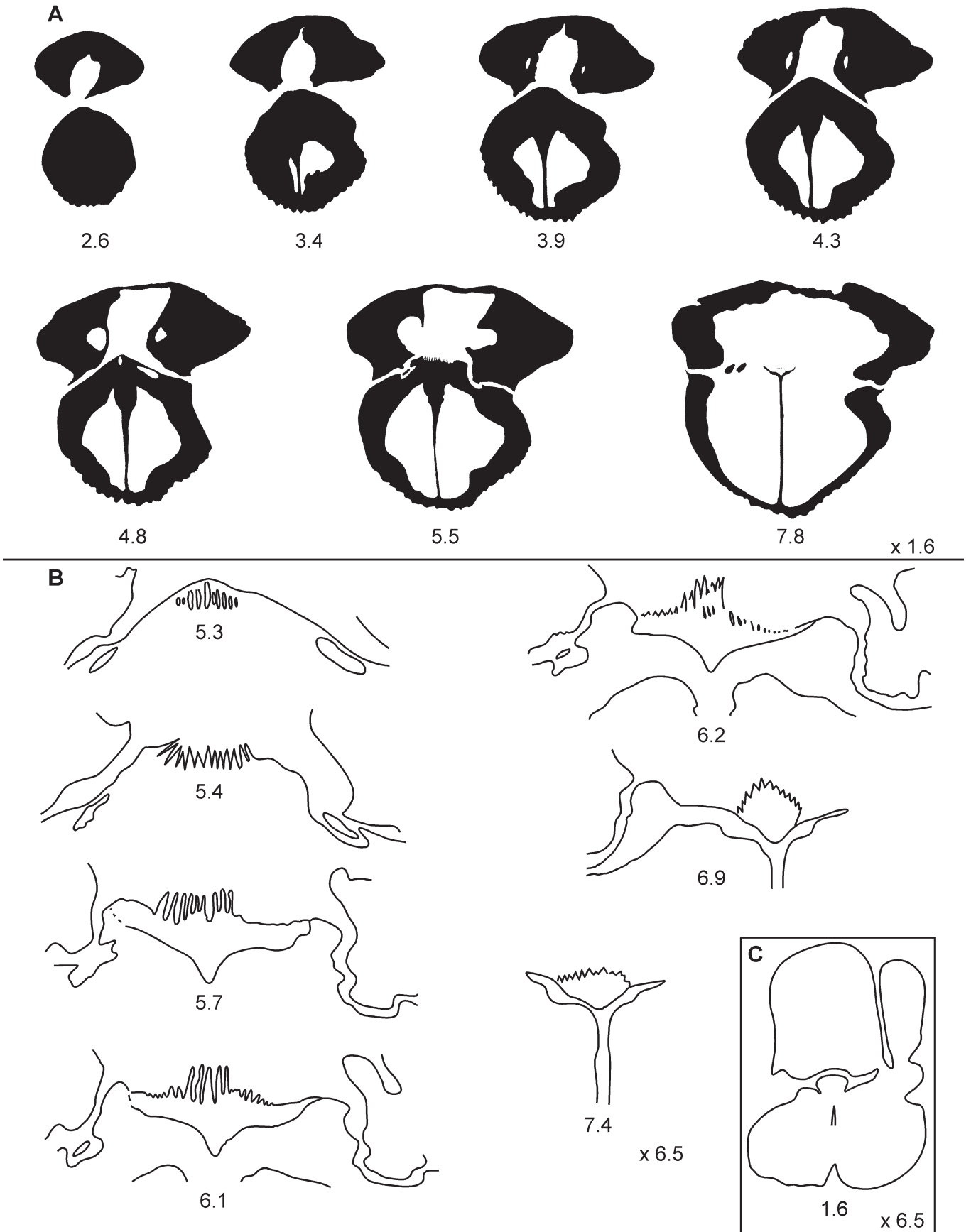


Fig. 1 — A, B, *Astraelenia losseni* (KAYSER, 1880), Topotype D, IRScNBa12620; distorted specimen. C, *Xahetomus hexadaleidensis* n. gen., n. sp., Paratype K, IRScNBa12621; measurements: length = 12.8 mm, width = 9 mm, thickness = 12.6 mm. Distances are measured in mm from dorsal umbo.

sulcus, a low fold, and many costae [about 15 in the sulcus (the state of preservation does not allow to count the parietal costae separately); as many as 20 lateral costae on the specimen of figure 5]. KAYSER (1883, p.313) mentioned 15 to 20 costae on the fold, and 15 to 18 on each flank. It is impossible to estimate the length of costae, because the two posterior thirds of the shell are worn out. KAYSER considered “characteristic” for the species the remarkable size (mean length: 40 mm; width: over 50 mm), the slight development of sulcus and fold, and the numerous costae.

The very large size of the specimens of the type series is exceptional. A large collection of 130 specimens (47 entire specimens, most of them distorted and squashed; the rest are isolated valves) from Oppershofen (15 km NE Kransberg) is deposited in the collections of the “Senckenberg Forschungsinstitut und Natur Museum, Frankfurt am Main” (registration number prefixed XVII 173); one reaches the very large size (width: 57.7 mm) of specimens of the type series, and two are somewhat smaller, 73% of the remaining specimens are large-sized, and 34% medium-sized. Three large-sized specimens have been figured by WOLF (1930, pl.1, fig.1 = XVII 173b), and by HÄUSEL & RICHTER (1936, figs 6, 7, p. 298 = XVII 173c,d). SOLLE (1942, figs 4a, b, p.261) figured also a large-sized specimen from Oberkleen (13 km N Kransberg). All these Lower Emsian specimens have well developed sulcus and fold, a moderate to large number of median costae ( $\frac{8-12}{7-11}$  = general costal formula;  $\frac{7}{6}$ ,  $\frac{13}{12}$ ,  $\frac{14}{13}$  and  $\frac{15}{14}$  have been counted on 19% of specimens), and  $\frac{1-1}{1-1}$  parietal costae starting from the beaks.

WOLF (1930, p.68) suggested that the very large size of the few isolated valves originally examined by KAYSER (1883) could be accounted for in the following way: “Die besondere Größe der Kransberger Individuen ist anscheinend durch günstige Lebensbedingungen hervorgerufen”.

At this stage it can be stated that, except for the higher number of costae in *dannenbergi*, the four other differences between *dannenbergi* and *losseni* advocated by KAYSER (1883, p.314) are only valid for the “about half a dozen” specimens he had at his disposal: *losseni* reaches only half the size of *dannenbergi*; sulcus and fold are usually stronger and better delineated in *losseni*; costae start more posteriorly than in *losseni*, and moreover they are already clearly marked more posteriorly (the state of preservation does not allow to reach any kind of conclusion as to where costae start, and if indeed they are not well marked in their posterior part).

Most of the characters of *dannenbergi* and *losseni* are similar. The major differences are a higher number of median costae and a lower tongue in *dannenbergi*. This explains why *dannenbergi* has been sometimes mistaken for *losseni*.

It is concluded that *losseni* and *dannenbergi* belong to the same genus.

Since its original description by KAYSER (1883, pp.312, 313-314, pl. XXIV, figs 5-7) from the “Grauwacke” of Cransberg (now Kransberg) near Usingen, eastern Taunus, *Rhynchonella Dannenbergi* has been sometimes mentioned, described or figured from the Lower Emsian of the type area (Kransberg, Oberkleen, Oppershofen, Usa valley, Ziegenberg) by various authors, e.g. MAURER (1886, pp.49, 50, 54 as *R. Dannenbergi*; DAHMER, 1939, table, p.122, p.125 as *R. (Straelenia) dannenbergi*; 1942, pp.265, 267, 269 as *Straelenia dannenbergi*; 1952, p.340 as *S. dannenbergi*); VON SANDBERGER (1889, pp.30-31 as *Rhynchonella Dannenbergi*); WOLF (1930, pp.14, 68, 93, pl.1, fig.1 as *R. (Camarotoechia? dannenbergi)*; HÄUSEL & RICHTER (1936, table, p.305, figs 6, 7, p.298 as *R. (Straelenia) dannenbergi*); SOLLE (1942, pp.256, 257, 261, figs 4a,b, p.261 as *R. (S.) dannenbergi*).

The presence of *dannenbergi* in the Lower Emsian from other parts of Germany (Harz, Hunsrück, Kellerwald, Middle Rhine valley, Siegerland) is doubtful; even more doubtful are mentions of the species from the Upper Emsian (e.g. by MITTMEYER & GEIB, 1967, table 3, p.35 as *Camarotoechia dannenbergi* from Hunsrück) or the Middle Siegenian (e.g. by QUIRING, 1923, p.94, table, p.111 as *Rhynchonella Dannenbergi* from the southern flank of the Siegen Anticline; DAHMER, 1932, pp.88, 89 as *R. (Camarotoechia?) dannenbergi* from the Middle Rhine valley; DAHMER, 1934, pp.17, 27-28 as *Rhynchonella dannenbergi*, and JAHNKE & MICHELS, 1982, p.183 as *Straelenia dannenbergi* from Seifen (Westerwald).

*Dannenbergi* has exceptionally and erroneously been mentioned from the Lower Emsian of the southern border of the Dinant Syncline by MAILLIEUX [1910, pp.210, 213, table, p.217 as *Rhynchonella (Plethorhynchus?) Dannenbergi*; 1912, p.59 as *Rhynchonella Dannenbergi*; 1927, p.141 as *Plethorhynchus Dannenbergi*], and by ASSELBERGHS (1940, p.20 as *P. Dannenbergi*). But MAILLIEUX (1941b, p.38) contradicted himself in writing that *Straelenia Dannenbergi* was unknown to him from the Lower Emsian of the Ardennes. No explanation was given, but labels of *S. Dannenbergi* were replaced by labels of *S. dunensis* in the collections of the Belgian Royal Institute of Natural Sciences, Brussels.

On the other hand, *dannenbergi* has been commonly and erroneously identified in Belgium and the Grand Duchy of Luxemburg in rocks of Middle and Upper Siegenian age from the southern and eastern borders of the Dinant Syncline, Ardennes, Vesdre Massif, and Oesling, so much so that ASSELBERGHS (1913, pp.108, 140) considered it as “characteristic for the Siegenian” and numbered it among the “typical Siegenian species”: MAILLIEUX [1910, pp.194, 197, table, p.200 as *R. (Plethorhynchus?) Dannenbergi*; 1912, p.62 as *Rhynchonella Dannenbergi*; 1921, pp.11-12 as *R. Dannenbergi*; 1922, pp.11-12 as *R. Dannenbergi*; in KAISIN *et al.*, 1922, p.10 as *R. Dannenbergi*; 1927, table, p.137 as *Plethorhynchus Dannenbergi*; 1933, p.51 as *Camarotoechia? Dannenbergi*; 1935, p.14 as *Straelenia Dannenbergi*]; ASSELBERGHS [1913, pp.34-35, 39, 64-65, 70-71, 108, table, p.128, p.140 as *Rhynchonella Dannenbergi*; 1921, p.165 as *R. Dannenbergi*]; in ASSELBERGHS & LEBLANC [1934, pp.17-18, 42, 66, 69-70, 71-72 as *Camarotoechia Dannenbergi*; 1934, p.345 as *C.? Dannenbergi*; 1946, table, p.150, table, p.182, table, p.329 as *Straelenia dannenbergi*]; DAHMER [1932, p.373 as *Rhynchonella dannenbergi*]; LUCIUS [1950, pp.54-55 as *R. (Straelenia) Dannenbergi*].

#### *Stratigraphic range and geographic distribution*

All specimens of *Astraelenia losseni* mentioned above come from the Wiltz Beds (sometimes called Daleiden Beds in the Eifel area) of late Emsian age on both sides (Oesling and Eifel area) of the Grand Duchy of Luxemburg – Germany boundary. The material examined by the author comes from the “Daleiden MuldenGruppe”, but the species is also present in Oesling, where it has been described by LEIDHOLD (1913, pp.335, 361-362, 364 as *Rhynchonella Losseni*), and mentioned in the list of fossils from the Wiltz Beds of this region by LUCIUS (1950, table, p.60 as *Straelenia losseni*).

Outside the type area, the species has been mentioned from only a few localities of Germany and near-by Belgium.

SOLLE (1976, p.84, table, pp.90-91) collected specimens from the Flussbach Beds of the Olkenbach Syncline (western part of the Mosel Syncline), and stated that the presence of the species was a “biostratigraphic indication” of the position of these beds in the lower Upper Emsian. KAYSER (1881, p.620) and FRECH (1889, pp.222-223) had already indicated that the species was present in the Olkenbach Syncline.

The species has been erroneously mentioned from the Lower Devonian between Ober- and Nieder-

Stadtfeld by KAYSER (1871, p.315 as *?Rhynchonella Stricklandi*), from the “Coblenz-Quarzit” near Koblenz by HOLZAPFEL (1893, p. 103, citing FOLLMANN), from the Lower Emsian of the Bernbach valley near Densberg (Kellerwald) by DIENST (1914, pp.592-593) and of the western Hunsrück by NÖRING (1939, p.56), and from the Upper Emsian from the Ardennes by MAILLIEUX (1941a, p.9; 1941b, table, p.11).

*Astraelenia losseni* has been mentioned from the Upper Emsian of the Braut mine at Walderbach (now Wald-Erbach) in the southeastern Hunsrück by KAYSER (1880, p.820 as *Rhynchonella Losseni*), FRECH (1889, pp.222-223 as *R. Losseni*) and LEIDHOLD (1913, p.362 as *R. Losseni*), and described by WOLF [1930, pp.14, 68-69, 93, pl.1, fig.2 as *R. (Camarotoechia?) losseni*] from the “Roteisenstein” of this quarry to which she assigned a lowermost Upper Emsian (“Basis der Oberkoblenz-Stufe”) age. WOLF, who considered (p.14) that *Camarotoechia losseni* was still in tune with its Lower Emsian forerunner *C. dannenbergi* (“zeigt noch deutliche Anklänge an ihrer Vorläuferin im Untercoblenz”) believed (p.69) that the Wald-Erbach form looked like (“hat den Anschein”) a transition form between *C.? dannenbergi* (Lower Emsian) from Oppershofen and *C.? losseni* (Upper Emsian) from Daleiden. The specimen figured by WOLF is better assigned to *dannenbergi*.

In short, *Astraelenia losseni* is an Upper Emsian species confined in a restricted area: Oesling-SW Eifel area-W Mosel Syncline.

A discussion on the stratigraphic distribution of *A. losseni* would be incomplete without the mention of Moroccan and Spanish forms that have been considered to be close to the Eifel species. DROT (1964, p.22, table 1, p.94, pp.155, 157, 209, pl.18, figs 10, 10a,b, pl.19, figs 12a,c, 13, pl.24, fig.6) described *Straelenia* sp. e.g. *losseni* from the Upper Emsian (upper part of the El Ansar Formation) of various localities of the Fom Zguid and Tata areas (northeastern part of the Dra Plains, Anti-Atlas, S Morocco). Although external differences from *Astraelenia losseni* are evident (higher number of median costae, shallower sulcus, etc.), specimens of the Moroccan form show some similarity to the Eifel species that have been pointed at by DROT (1964, p.157). DROT’s detailed description, including figures of three specimens from the Fom Zguid area, and good illustration of the internal characters [numerous serial transverse sections from one specimen from SE Djebel Hamsailikh (fig.65, p.156), and an excellent representation of the cardinal process of one of the figured specimens from El Ansar in the same area (pl.24, fig.6)], allow assigning the



Moroccan form with confidence to *Astraelenia*. On the other hand, GARCÍA-ALCALDE in TRUYÓLS-MASSONI & GARCÍA-ALCALDE, 1994, fig.2, p.223, p.236, pl.17, figs 9-12) described *Straelenia* cf. *losseni* (mentioned for the first time by GARCÍA-ALCALDE 1992, fig. 4, p.59) from the uppermost part (Faunal Interval 10, lower Upper Emsian) of the La Ladróna Formation (Lower Emsian + lower part of Upper Emsian) of the Asturian coast north of Oviedo. One should bear in mind that Spanish geologists subdivide the Emsian into a Lower Emsian restricted to the lower half of the La Ladróna Formation and an Upper Emsian corresponding to the upper half of that formation + the Aguión Formation + most of the Moniello Formation.

The presence of these forms was confirmed by HOLLARD (1967a, fig.7, p.220, fig.12, p.227; 1967b, pp.114-115, table, p.116; 1974, p.13; 1978, table 2, p.20) for Morocco, and by GARCÍA-ALCALDE (in GARCÍA-ALCALDE & TRUYÓLS-MASSONI, 1994, fig.2, p.87, p.88; 1994, fig.2, p.78; 1995, fig.6, p.21; 1996, fig.2, p.60; 1998, p.244; in GARCÍA-ALCALDE *et al.*, 1998, p.2), and GARCÍA-LÓPEZ & SANZ-LÓPEZ (2002, p.132) for Asturias.

These forms do not belong to the genus *Straelenia*, at present under investigation by the author.

The Moroccan form is also supposed to be present at Hassi-Remlia (SW Tafilalt, Anti-Atlas) some 300 km to the NE of the Foum Zguid area as implied by DROT (1964, p.155), who put *Rhynchonella* (*Camarotoechia*?) *mariana* DE VERNEUIL & BARRANDE, 1855 described by LE MAÎTRE (1944, pp.46, 47, pl.VI, figs 1-8) into the synonymy of *Straelenia* sp. e.g. *losseni*. The Tafilalt form, which has nothing to do with the Lower Frasnian species from the Central Iberian Zone, shares some characters with *Astraelenia losseni* according to LE MAÎTRE'S figures and DROT'S comments. Nothing else can be written on this form of unprecise (Coblencian) age until its internal morphology is investigated.

The Asturian form is closer to *Astraelenia dannenbergi* than to *A. losseni*.

### Sapphicorhynchidae SARTENAER, 2007

*Remark:* the content of the family Trigonirhynchiidae SCHMIDT, 1965 is too extensive (about 80 genera) and heterogeneous. More than half of its very few diagnostic features are alternative as exemplified by the diagnoses contained in the last two treatises (SCHMIDT in SCHMIDT & McLAREN, 1965, p.H559; SAVAGE, 1996, p.252 + 2002, p.1052). This has been explained at some length by SARTENAER (2001, p.208; 2007, pp.42-43, fig.1, p.48), who considered that a revision

was needed. The family Sapphicorhynchidae proposed by the author in 2007 is a first step in that direction. The family is defined by the combination of a large number of diagnostic features, none of them alternative. Thus, sulcus and fold are always well developed and not variable, costae extend always from beaks, the commissure is always serrate, and the septalium is always covered.

The new genus fits the definition of the family Sapphicorhynchidae, and so does *daleidensis*, which occurs in the same beds (Wiltz Beds) and is assigned to a new genus that will be described shortly.

### *Xahetomus* n. gen.

#### *Derivatio nominis*

The name is an arbitrary combination of the reversed two syllables and the last two syllables of *hexatoma*; it draws attention to the first illustration of the species by SCHNUR, J. (1853, pl.23, figs 2f, g as *Terebratula hexatoma*).

*Type species:* *Xahetomus hexadaleidensis* n. gen., n. sp.

#### *Diagnostic features*

Shell of small size, outline subcircular to subpentagonal, maximum thickness slightly posterior to front. Ventral interarea very short, apical angle moderately wide. Commissure sharp, strongly serrate. Sulcus and fold start in front of the umbones. Sulcus wide, shallow, forming a high tongue with subtrapezoidal to subquadratic outline, fold low to moderately high. Costae few, regular, simple, start from the beaks. Parietal costae sometimes present. Dental plates thin, short, separated from the wall by narrow umbonal cavities. Delthyrial cavity wide. Hinge plate undivided. Septum thin and long, septalium wide. Connectivum present.

#### *Species assigned to the genus*

Outside the type species, the Upper Emsian species described by BRICE [1981, p.197, fig.7, p.213, p.214, pl.25, figs 1a-c, 2a-d, 3a,b, 4, 5, figs 1A, B, p.196 as *Stenorhynchia nymphe* (BARRANDE, 1847)] from the la Lézaïs trench in the Ménez-Bélaire Syncline ("Département d'Ille-et-Vilaine", central Brittany, Armorican Massif), belongs to the new genus. GARCÍA-ALCALDE in TRUYÓLS-MASSONI & GARCÍA-ALCALDE (1994, pp.232-233) replaced the name with *S. briceae* GARCÍA-ALCALDE, 1994, a substitution accepted by BRICE (2000, p.15).

*Stenorhynchia briceae* is a frequent species from



the lower Upper Emsian (Faunal Intervals 9 to basal 12 of GARCÍA-ALCALDE) of the Cantabrian Cordillera (see above the definitions of the Lower and Upper Emsian according to Spanish geologists); this species could also belong to the new genus.

#### Description

*Remarks:* In his description of *Terebratula Daleidensis*, SCHNUR (1853, p.172) singled out two varieties, and suggested that one of them could be a separate species that he described as “beständig kleiner und hat immer 6 Falten auf dem an der Stirn nicht ganz so hohen Wulst”. Figures 2f, g of *T. hexatoma* SCHNUR, 1851 on plate 23 of the same publication correspond to such a description. Surprisingly, these figures were not commented up by SCHNUR (1853, p.176) in his description of *T. hexatoma*, although they represent a small specimen differing from the large one of figures 2a-e. The present author is all so much inclined to believe that such an inversion could have taken place that Schnur’s variety is mixed with specimens of *T. Daleidensis* in the large collections of the species from the Wiltz Beds (Upper Emsian) of Daleiden collected by Schnur, J. and by Jaeger, K. (Natur-Museum “Senckenberg”, Frankfurt), and by Henn, T. (“Paläontologisches Institut, Museum für Naturkunde, Humboldt Universität zu Berlin”). Finally, Schnur’s variety is not only a species of its own as he suggested, but it belongs to a new genus.

Schnur’s inversion explains why the species here described has been overlooked in the literature, in particular by SCHMIDT, H. (1941, p.8), who observed six costae on the fold of isolated (“vereinzelte”) specimens of *Camarotoechia daleidensis*, a species from the Wiltz Beds with  $\frac{4}{3}$  median costae. She contemplated the following possible explanation: “Es wäre noch festzustellen, ob diese Stücke einem besonders hohen Horizont der Wiltzer Schichten entstammen und schon eine Ankündigung der “6-Rippen-Tracht” höherer Schichten darstellen”. In reality, specimens with  $\frac{6}{5}$  median costae are not isolated as it will be indicated below and belong to *Xahetomus hexadaleidensis*; they can easily be separated by their number of median costae, and by other characters, notably the smaller size.

Shell of small size, profile strongly dorsibiconvex, valve ventral thickest at  $\frac{1}{4}$  to  $\frac{1}{3}$  shell length, dorsal valve thickest slightly posterior to front, maximum width anterior to mid-length. Shell outline subcircular

to subpentagonal (length about  $\frac{3}{4}$  to  $\frac{9}{10}$  shell width), half ellipse in frontal view. Commissure sharp, strongly serrate. Moderately wide apical angle. Ventral beak slightly incurved. Ventral interarea very short. Sulcus and fold well marked, start imperceptibly in front of the umbones. Sulcus wide, shallow; bottom flat or slightly convex, exceptionally slightly concave, extended dorsally as a high tongue with subtrapezoidal to subquadratic outline, recurving slightly posteriorly in its uppermost part. Crest of tongue slightly convex [external costae of the fold slightly lower than the median one(s)], lower than the maximum shell thickness. Fold low to moderately high; top gently convex. Median and lateral costae few, start from the beaks. Costae well marked, low to moderately high, simple, regular; the two to three external lateral costae are usually mere indentations of the commissure. Parietal costae sometimes present, reach and indent the commissure. Dental plates thin, short, and subparallel, delthyrial cavity wide, umbonal cavities narrow. Septum thin and long, may reach half shell length, septalium wide, cupula-shaped covered by a moderately robust connectivum in its anterior part. Hinge plate undivided, outer hinge plates slightly concave.

#### Comparisons

*Xahetomus* n. gen. shows great analogy to the Middle Eifelian genus *Oligoptycherhynchus* SARTENAER 1970, beginning with the number of median costae (six) as indicated by the names of their type species, *hexadaleidensis* and *hexatomus* respectively.

The two genera share many external and most internal characters: a strongly dorsibiconvex and quadrant profile; a sharp and strongly serrate commissure; a narrow ventral interarea; well marked sulcus and fold, starting at a short distance from the beaks; a wide and moderately deep sulcus; a high and clearly delineated tongue; a similar number of simple, regular, and angular with rounded top median and lateral costae, starting from the beaks; the maximum thickness of the shell located slightly posterior to front in lateral profile; thin to moderately thick dental plates and septum; wide umbonal and delthyrial cavities; an undivided hinge plate; a wide and deep septalium; and a moderately robust connectivum.

*Xahetomus* differs from *Oligoptycherhynchus* by a noticeably smaller size, the top of dorsal valve commonly located slightly posterior to front margin (it means that the valve slightly curves towards the anterior commissure), a subcircular to subpentagonal outline (the outline of *Oligoptycherhynchus* is subcordiform), the anterior half of flanks of ventral

valve slightly convex and visible in lateral profile (in *Oligoptycherhynchus* the ventral flanks are flattening anteriorly and are not visible in lateral profile); a lower tongue with variable outline (always subrectangular in *Oligoptycherhynchus*), a less constant number of median costae, the external costae of fold commonly lower than the median one(s), the absence of marginal spine-like projections of costae, the occasional presence of parietal costae indenting the commissure (in *Oligoptycherhynchus* parietal costae are common and do not indent the commissure), a thickness and a width that are not subequal, and a width that is not markedly larger than length as in *Oligoptycherhynchus* as indicated by the outline of both genera and the ratios  $\frac{l}{w}$  (0.70 to 0.95, mostly 0.84 to 0.89, for *hexadaleidensis* against 0.76 to 0.80 for *hexatomus*), and  $\frac{t}{l}$  (0.80 to 1.15, mostly 0.80 to 0.98, for *hexadaleidensis* against 1 to 1.03 for *hexatomus*), and a longer septum. (Remark: The description of the internal characters of *Oligoptycherhynchus hexatomus* is based on serial transverse sections made by the author, those of *Xahetomus hexadaleidensis* were observed chiefly on “Steinkerne” and did not allow to detect eventual minor differences between the internal characters of both genera).

***Xahetomus hexadaleidensis* n. gen., n. sp.**  
Pl.1, Figs 11- 60; Text-fig.1C; Tables 2-3

Ten specimens, all of them figured and measured, and one sectioned, are deposited, respectively, in the collections of the “Senckenberg Forschungsinstitut und Natur Museum, Frankfurt am Main” with registration numbers prefixed SMF, and in the collections of the Belgian Royal Institute of Natural Sciences with registration number IRScNBa.

*Derivatio nominis*

The name draws attention to the first mention of the species as a variety of *T. Daleidensis* by SCHNUR (1853, p.172), who inadvertently illustrated it as *T. hexatoma* SCHNUR, J. 1851 (1853, pl.23, figs 2f, g) (see above).

*Types, locus typicus and stratum typicum*

Holotype: specimen figured by SCHNUR (1853, pl.23, figs 2f, g as *Terebratula hexatoma*) in Schnur’s collection of the “Naturhistorisches Verein Rheinland Westfalen” housed in the Palaeontological Institute of Bonn University. It comes from the “Grauwacke” of Daleiden at Irrhausen, 2 km NE of Daleiden in the Daleiden “Muldenruppe”, Eifel area. Paratypes A-J, SMF66860 to 66869, figured (Pl.1, Figs 11-60) and measured (Table 3). Same locality, formation, and collector. Paratype K, IRScNBa12621 (Text-fig.1C). Same locality. Wiltz Beds. Collector: Sartenaer, P., 1954.

*Other material*

Contrary to SCHMIDT’s (1941, p.8 as *Camarotoechia daleidensis*) statement that specimens with six costae on the fold are isolated (“vereinzelt”) in the Wiltz Beds (see above), *Xahetomus hexadaleidensis* is a common species. When large collections of *daleidensis* and *hexatoma* from the Wiltz Beds are examined, about one out of five specimens is a representative of *hexadaleidensis*: 20% (120 specimens identified as *Rhynchonella hexatoma*) against 80% (480 specimens identified as *R. daleidensis*) in the HENN, T. collections (1906, 1914, and 1931) housed in the “Paläontologisches Museum, Museum für Naturkunde, Humboldt Universität zu Berlin”; 27% (13 out of 48 specimens) of the SCHNUR, J. collection (1853), and 24% (31 out of 128 specimens of the JAEGER, K. collection, 1969), all identified as *R. daleidensis*

Median costae			Parietal costae			Lateral costae		
Number of costae	Number of specimens	%	Number of costae	Number of specimens	%	Number of costae	Number of specimens	%
3/2	3	5	0	46	77	7/8	15	25
4/3	19	32	0-1/0-1	4	6.5	8/9	26	43.5
5/4	12	20	1-0/1-0	4	6.5	9/10	14	23.5
6/5	26	43	1-1/1-1	6	10	10/11	4	6.5
	60	100		60	100	11/12	1	1.5
							60	100

Table 2 – Number of median, parietal, and lateral costae.

in mm	Paratype A SMF66860	Paratype B SMF66861	Paratype C SMF66862	Paratype D SMF66863	Paratype E SMF66864	Paratype F SMF66865	Paratype G SMF66866	Paratype H SMF66867	Paratype I SMF66868	Paratype J SMF66869
l	15.9	14.8	14.4	(14.3)	14	13	13	12.8	11.9	10.8
lvv unrolled	18.9	16.6	19.5	18.2	18.5	13.7	14.7	18.4	14	12.9
w	26	24.5	25	24.5	25.5	25	23	(26.5)	19	15.59
t	14.8	14.3	13.9	11.6	13.6	14.8	10.8	14.8	11.7	8.6
tvv	4	4.7	4.5	4.7	4	5.3	3.7	4.1	2.8	3.6
tdv	10.8	9.6	9.4	6.9	9.6	9.5	7.1	10.7	8.9	5
l/w	0.84	0.89	0.74	(0.79)	0.76	0.95	0.88	0.70	0.85	0.84
t/w	0.78	0.86	0.71	0.64	0.74	1.08	0.73	0.80	0.84	0.67
t/l	0.93	0.97	0.97	(0.81)	0.97	1.14	0.83	1.15	0.98	0.80
apical angle	112°	114°	115°	120°	119°	(113°)	109°	117°	111°	115°

Table 3 – Measurements of ten specimens; figures in parentheses estimates. Abbreviations: l = length; w = width; t = thickness; vv = ventral valve; dv = dorsal valve.

in the “Senckenberg Forschungsinstitut und Natur Museum, Frankfurt am Main”. The author collected 24 specimens in January 1954.

All known specimens are preserved as moulds.

#### Description

This refers only to specific characters in need of further elaboration.

Beginning of sulcus between 15 and 37% of shell length or between 19 and 37% of the unrolled length of the ventral valve. Width of sulcus at front between 55 and 73% (mostly 65 to 73%) of shell width. Thickness of dorsal valve between 60 and 76% (mostly 64 to 73%) of shell thickness. Maximum thickness of ventral valve between 15 and 37% of shell length anterior to the ventral beak. Maximum shell width between 56 and 73% of shell length anterior to the ventral beak. Apical angle between 109 and 120° (SCHNUR's 1853, pl.23, figs 2f, g show an exceptionally small apical angle of about 90°).

The general costal formula in median, parietal, and lateral categories derived from at least 75% of the specimens is  $\frac{4-6}{3-5}$ ; 0;  $\frac{7-9}{8-10}$ ; ratios of costae are given in Table 2. Width of median costae at front varies between 1 and 1.3 mm.

Measurements of ten paratypes, all of them photographed, are given in Table 3.

#### Stratigraphic range and geographic distribution

*Xahetomus hexadaleidensis* comes from the Upper Emsian Wiltz Beds and is confined to a small area around Daleiden in the Daleiden “MuldenGruppe”, Eifel area. Its presence in the same beds in the Grand Duchy of Luxembourg (Oesling) cannot be excluded.

#### Acknowledgments

The author is grateful to Dr. U. Jansen (Frankfurt am Main) from the “Senckenberg Forschungsinstitut und Natur Museum” and Dr. D. Korn from the “Museum für Naturkunde der Humboldt Universität zu Berlin”, who allowed him to go through the collections under their care, and to borrow many specimens. Dr. U. Jansen also provided the ten specimens of *Xahetomus hexadaleidensis* from the Schnur collection (1853) that are photographed and measured in this paper. Dr. K.-W. Wendorf (Braubach) generously gave specimens of *Astraelenia losseni* with preserved shell, from which serial transverse sections could be made; and allowed these specimens to be incorporated in the collections of the Belgian Royal Institute of Natural Sciences, Brussels. The author is deeply grateful to Drs. Ulrich Jansen and Klaus-Werner Wendorf for critically reading the typescript and for their constructive remarks.

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Typescript received: November 18, 2008  
Revised typescript received: July 27, 2009

### Explanation of Plate 1

All figures are natural size

#### *Astraelenia losseni* (KAYSER, 1880)

Figs 1-5 — Topotype A, MB.B.3245. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; \frac{2-2}{2-2}; \frac{13}{14}$ .  
A ventral view has been given by WOLF [1930, pl.1, fig.3 as *Rhynchonella* (*Camarotechia*?) *losseni*], who unduly designated the specimen as the lectotype of the species (see text).

Figs 6-10 — Topotype B, IRScNBa12618. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; \frac{1-1}{1-1}; \frac{12}{13}$ .

#### *Xahetomus hexadaleidensis* n. gen., n. sp.

Figs 11-15 — Paratype A, SMF66860. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; 0; \frac{10}{11}$ .

Figs 16-20 — Paratype E, SMF66864. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; 0; \frac{9}{10}$ .

Figs 21-25 — Paratype C, SMF66862. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; 0; \frac{9}{10}$ .

Figs 26-30 — Paratype H, SMF66867. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; 0; \frac{8}{9}$ .

Figs 31-35 — Paratype D, SMF66863. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; 0; \frac{7}{8}$ .

Figs 36-40 — Paratype G, SMF66866. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; 0; \frac{8}{9}$ .

Figs 41-45 — Paratype B, SMF66861. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; 0; \frac{7}{8}$ .

Figs 46-50 — Paratype F, SMF66865. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; 0; \frac{10}{11}$ .

Figs 51-55 — Paratype I, SMF66868. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; 0; \frac{8}{9}$ .

Figs 56-60 — Paratype J, SMF66869. Dorsal, ventral, anterior, posterior, and lateral views. Costal formula:  $\frac{6}{5}; 0; \frac{8}{9}$ .

*Remark:* Dorsal and ventral views of the holotype of *Xahetomus hexadaleidensis* n. gen., n. sp. have been figured by SCHNUR (1853, pl.23, figs 2f, g as *Terebatula hexatoma*).



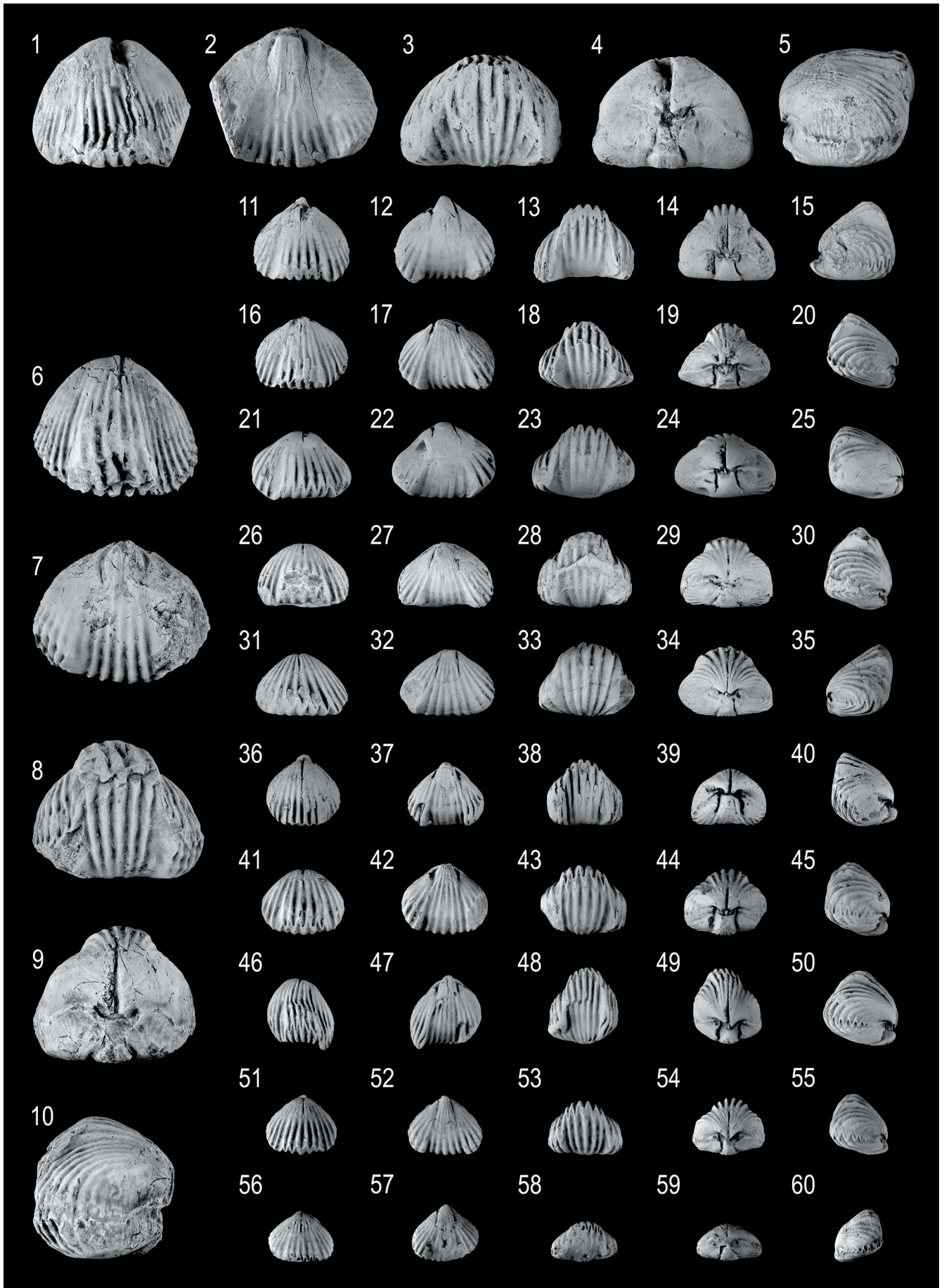


PLATE 1