
Article

Coniacian-Santonian (Upper Cretaceous) gastropods from the Coastal Basin of Gabon: palaeontological and palaeobiogeographical study

Gasterópodos del Coniaciense-Santoniense (Cretácico Superior) de la cuenca costera de Gabón: estudio paleontológico y paleobiogeográfico

Urlain Gaël Yakouya-Moubamba

Université des Sciences et Techniques de Masuku, Département de géologie et URESTE, Franceville, Gabon
yurlaingaël@yahoo.fr, <https://orcid.org/0000-0002-4578-2208>

Wilma Linda-Belle Mougola

Université des Sciences et Techniques de Masuku, Département de géologie et URESTE, Franceville, Gabon
<https://orcid.org/0009-0003-9711-2040>

Mohamed Benzaggagh

Université Moulay Ismail, Faculté des Sciences, Département de Géologie, Meknès, Maroc
<https://orcid.org/0000-0002-6106-9074>

Benjamin Musavu Moussavou

Université des Sciences et Techniques de Masuku, Département de géologie et URESTE, Franceville, Gabon
<https://orcid.org/0009-0006-6781-8829>

Abstract: A study of Coniacian-Santonian (Upper Cretaceous) gastropod fauna was carried out on two sections of the Cap-Estérias region, which belongs to the Gabonese Coastal Basin. This study led to the identification of eight gastropod genera, including four species, that were previously unknown in this region. The genera *Akera* Müller, 1776, *Latirus* Montfort, 1810, and *Fasciolaria* Lamarck, 1799, as well as the species *Turritella* aff. *rigida* Sowerby, 1835, and ?*Voluta* (*Aulica*) *stromboides* Munier-Chalmas, 1881 are reported for the first time from the Gabonese Coastal Basin. Similarly, the stratigraphic range of the genera *Voluta* and ?*Nerita* in the Gabonese Coastal Basin is extended to the Santonian.

Keywords: Gastropods; Gabonese Coastal Basin; Upper Cretaceous; paleobiogeography.

Resumen: Se ha realizado un estudio de la fauna de gasterópodos del Coniaciense-Santoniense (Cretácico Superior) en dos secciones de la región de Cap-Estérias pertenecientes a la Cuenca costera gabonesa. Este estudio nos permitió identificar ocho géneros de gasterópodos, incluyendo cuatro especies, que eran previamente desconocidas en esta región. Los géneros *Akera* Müller, 1776, *Latirus* Montfort, 1810 y *Fasciolaria* Lamarck, 1799 y las especies *Turritella* aff. *rigida* Sowerby, 1835 y ? *Voluta* (*Aulica*) *stromboides* Munier-Chalmas, 1881 se reportan por primera vez para la Cuenca costera gabonesa. Esto nos lleva a extender la distribución geográfica de estos taxones a Gabón. De igual manera, la extensión estratigráfica de los géneros *Voluta* y ?*Nerita*, en la Cuenca costera gabonesa, se extiende hasta el Santoniense.

Palabras clave: gasterópodos; Cuenca costera gabonesa; Cretácico Superior; paleobiogeografía.

Received: 20-01-2025 / Accepted: 01-09-2025 / Published: 24-07-2026

Citation: Yakouya-Moubamba, U.G., Mougola, W.L., Benzaggagh, M. & Musavu Moussavou, B. (2026). Coniacian-Santonian (Upper Cretaceous) gastropods from the Coastal Basin of Gabon: palaeontological and palaeobiogeographical study. *Estudios Geológicos*, 82(1), 1122. <https://doi.org/10.3989/egeol.45677.1122>

Copyright: © 2026 CSIC. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International (CC BY 4.0) License.

Supplementary information ↓

1. INTRODUCTION

The Gabonese Coastal Basin has been the subject of numerous geological studies that have significantly enriched our understanding of its geological evolution. This research has covered various aspects, including sedimentology (Klasz, 1965; Mbina Mounguengui, 1998), tectonics (Ndong Ondo, 2002), lithostratigraphy, biostratigraphy (Klasz, 1965; Hudeley & Belmonte, 1970; Klasz, 1965; Chevalier and al., 2002), and palaeontology (Lombard, 1930; Meister and al., 2003; Yakouya-Moubamba, 2020).

The tectonic analysis of the Gabonese margin reveals a complex structure, characterized by several transverse tectonic structures. Among them, the NE-SW N'komi Fault stands out, which plays a fundamental structural role by dividing the Gabonese Coastal Basin into two distinct sub-basins: northern and southern. Stratigraphic studies documented the succession of various geological units that compose the stratigraphic sequence of the coastal basin. Within this setting, the Anguille Formation constitutes several remarkable outcrops in the Cap-Estérias region, located in the northern sub-basin.

This marine unit is characterized by a rich gastropod fauna, which paradoxically remains poorly studied. This fauna has generally been either briefly mentioned (Mbina Mounguengui and al., 2008), or inventoried in the form of check-lists (Hudeley & Belmonte 1970; Chevalier and al., 2002), but it was rarely illustrated or described in detail. The study by Darteville & Brébion (1956) is the only one to provide a comprehensive taxonomic and paleobiogeographic analysis of the gastropod fauna from the Anguille Formation. Reported gastropod fauna by Darteville & Brébion (1956) is composed of: *Ampullina* (*Pseudamaura*) *bulbiformis* Sowerby, 1831; *Nerinea* cf. *incavata* Bronn, 1858; *Otostoma* *parvula* (Binkhorst, 1861); *Piestochilus* (*Cryptorhytis*) cf. *bleicheri* (Thomas & Peron, 1889); *Trichotropis* *konincki* (Müller, 1851); *Tylostoma* aff. *peroni* Pervinquière, 1912; *Volutoderma* *elongate* (d'Orbigny, 1842); *Volutomorpha* ? *mungoensis* Reymont, 1954; *Volutomorpha* cf. *aspera* Dall, 1908; *Volutocorbis* *indica* Douvillé, 1904.

In order to better characterize the composition of the gastropod fauna from the Anguille Formation, a new investigation was conducted on two sections (Cap-Estérias 1 and 2) of the Cap-Estérias region, leading the collection of numerous gastropod specimens.

The present study has three main objectives: (1) to provide a detailed systematic description of the collected gastropod species; (2) to increase our knowledge of the specific and generic assemblage and diversity of this fossil group in the studied area, and; (3) to analyse the stratigraphic and geographical distribution of the Coniacian-Santonian gastropod species in the Gabonese Coastal Basin, belonging to the western Atlantic margin, and to compare with the other basins, mainly those of the northern and southern Tethyan margins.

2. GEOGRAPHICAL AND GEOLOGICAL SETTING

The Anguille Formation, dated of Coniacian-Santonian age (Klasz, 1965; Teisserenc & Villemin, 1990; Volat and al., 1995), is a part of the post-rift deposits of the Gabonese Coastal Basin (Fig. 1A, B). This basin extends for 800 km along the West African margin, between the latitudes 1° N and 4° S, from Equatorial Guinea to the Congolese border (Hudeley & Belmonte, 1970; Teisserenc & Villemin, 1990). Its

geological evolution is closely linked to the opening of the South Atlantic Ocean (Mbina Mounguengui and al., 2002; Mbina Mounguengui & Lang, 2003). With a thickness ranging between 650 and 800 m (Teisserenc & Villemin, 1990), the Anguille Formation is stratigraphically bounded by the Azilé Formation (Turonian) at its base and the Pointe Clairette Formation (Campanian) at its top (Fig. 1 B).

Borehole data (Mbina Mounguengui and al., 2008) record a sedimentary sequence composed of laminated black mudstones, dolomitic and silty clay, alternating with quartzo-dolomitic, siltstones, and argillaceous carbonate siltstones layers, and calcareous siltstones and fine-grained carbonate sandstones. The sequence also includes coarse shelly limestones with abundant gravel and pebbles. In the studied outcrop, the Anguille Formation is represented by mudstone, silt, siltstone and sandstone facies (Mougola, 2021).

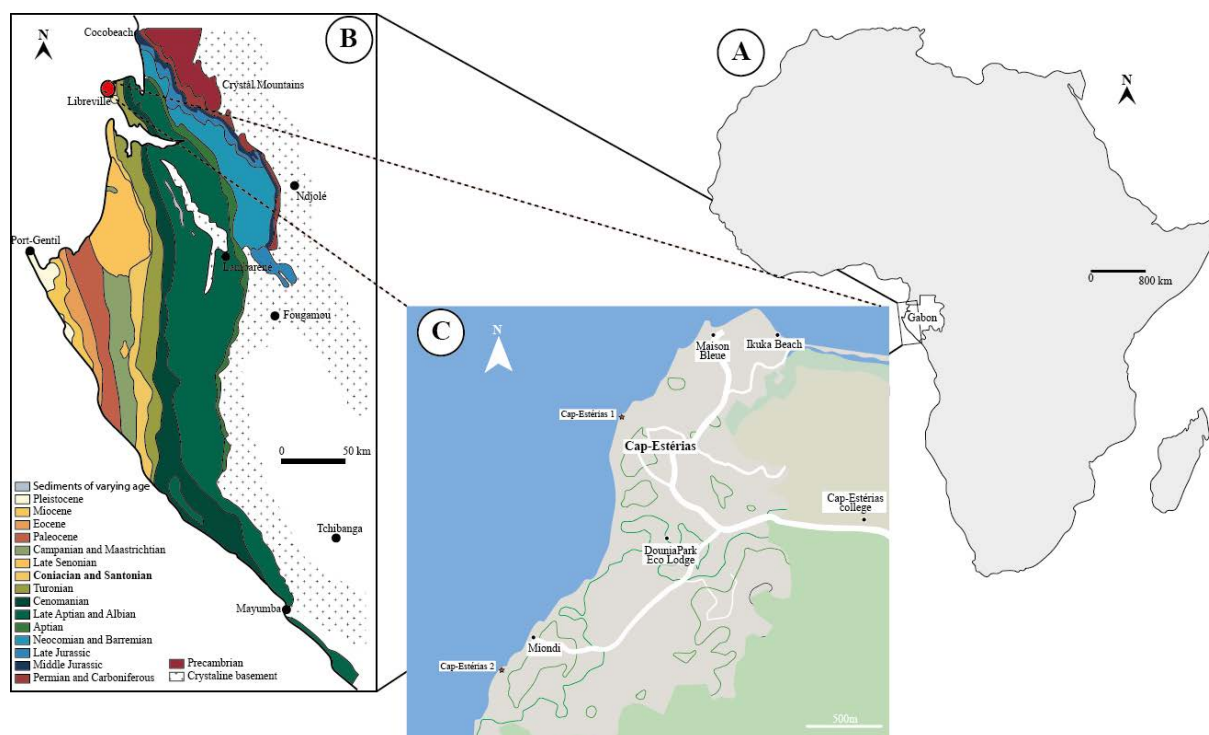


Figure 1. A. Location map of Gabon; B. Geological map of the Gabonese Coastal Basin (after Ndong Ondo, 2002, modified); C. Location map of the studied sections.

3. DESCRIPTIONS OF THE STRATIGRAPHIC SECTIONS

3.1. Cap-Estérias section 1

This stratigraphic section (Fig 1C; Fig. 2C-D) is located on the beach at Cap-Estérias, with coordinates N00°36'16.2" and E009°19'00.3. It has a total thickness of 4.3 m and consists of eight different levels: level 1, silty sandstone, 5-10 cm thick, with thin silt intervals and a rich inoceramid fauna; levels 2, 5 and 7, beige siltstones with plant remains, gastropods and abundant bivalves, with well-defined horizontal bedding (Fig. 2 F); level 3, sandstones with horizontal bedding at the base and a rich inoceramid fauna (Fig. 2C; Fig. 2 G); levels 4, 6 and 8, grey silty sandstone containing plant remains and bivalves. The transitions between these levels are gradual, making it difficult to define precise boundaries between these different levels.

3.2. Cap-Estérias section 2

This stratigraphic section (Fig 1C; Fig. 2A-B) is also located on the beach at Cap-Estérias, with coordinates N00°36'51.2" and E009°19'10.1". It has a total thickness of 3.8 m and consists of eight well-defined levels: level 1, silty sandstone; levels 2 and 4, sandstone rich in bivalves and gastropods; level 3, silty sandstone with abundant bivalves and rare gastropods; levels 5 and 7, mudstones; levels 6 and 8, sandstones showing cross-bedding, planar cross-bedding, and horizontal bedding (C Fig. 2 E), and debris-flow deposits.

4. MATERIALS AND METHODS

This study is based on the palaeontological analysis of 65 gastropod specimens collected from two outcrop sections at Cap-Estérias: Cap-Estérias 1 (Fig 1C; Fig. 2A-B) and Cap-Estérias 2 (Fig 1C; Fig. 2C-D). The specimens are housed in the collections of the Department of Geology, Faculty of Science, University of Science and Technology of Masuku (Franceville, Gabon), under the reference numbers MDG/GBN/Gas.

The systematic classification follows that of Bouchet and Rocroi (2005), while the descriptive terminology is based on the glossary of Cox (1960). Sample measurements were taken using a calliper and are expressed in millimetres (mm). The measured parameters are: SH, specimen height; AH, aperture height; SpH, spire height; SD, specimen diameter; AD, aperture diameter, and LWH, last whorl height.

Most of the studied specimens are internal moulds made of medium to coarse-grained sandstone, with little or no shell preserved.

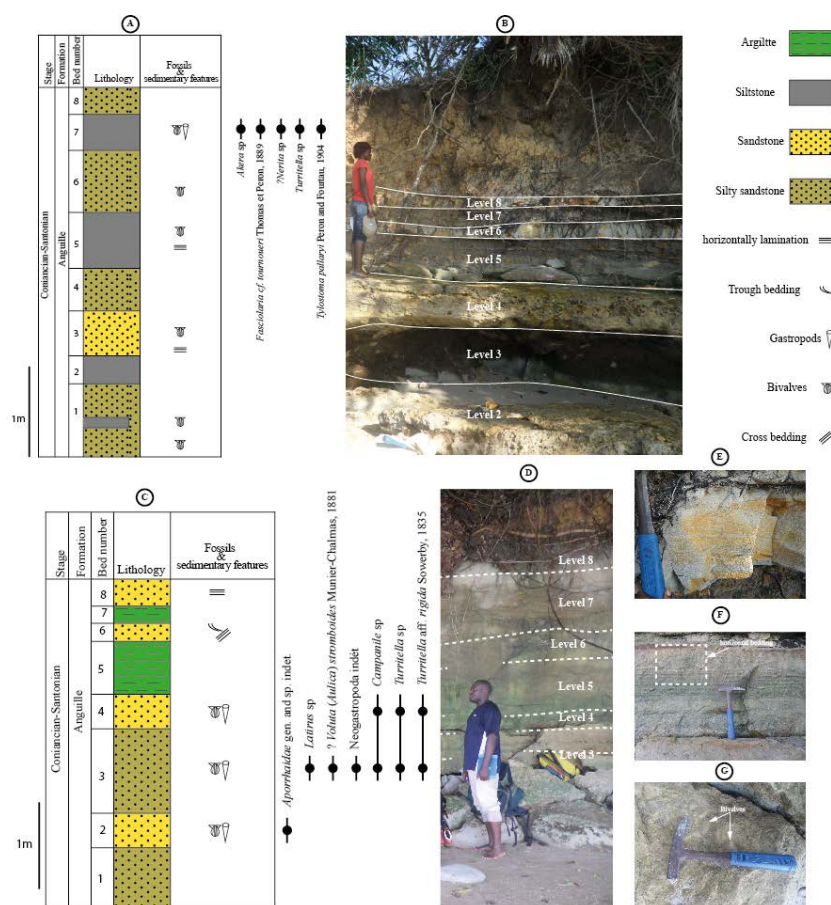


Figure 2. Lithofacies and field photographs of the Cap-Estérias sections. **A.** Cap-Estérias 2 section plotted against gastropod samples; **B.** Field photographs of the Cap-Estérias 2 section; **C.** Cap-Estérias 1 section plotted against gastropod samples; **D.** Field photographs of the Cap-Estérias 1 section; **E.** Sandstone units exhibiting trough cross-bedding, planar cross-bedding, and horizontal bedding structures (level 6, Cap-Estérias 1 section); **F.** Horizontally bedded siltstone (Level 5, Cap-Estérias 2 section); **G.** Fossil bivalves within the siltstone series (Level 7, Cap-Estérias 2 section).

5. SYSTEMATICS

Phylum Mollusca Linnaeus, 1758

Class Gastropoda Cuvier, 1797

Order Littorinimorpha Golikov & Starobogatov, 1975

Family Aporrhaidae Gray, 1850

Aporrhaidae gen. and sp. indet.

(Fig. 3 A-B)

Material: Eleven specimens from the section Cap-Estérias 2 (references: MDG/GBN/Gas - 6.1 to 6.11)

Measurements

SH	AH	SpH	SD	AD	LWH
32-52 (mean: 42)	17-22 (mean: 18.5)	8-25 (mean: 16.5)	17-29 (mean: 23)	10-15 (mean: 12.5)	16-33 (mean: 24.5)

Description: The mould is fusiform, turreted and large, bearing orthocline axial ribs; spire is elongated but partially damaged with two to three whorls decreasing in size towards the apex; whorls are slightly convex, separated by a depressed suture; last whorl represents 50% of the total preserved height; aperture is semicircular; the outer lip is incomplete, and the columellar lip is concave; the base is rounded at the columellar margin.

Remarks: The specimen studied resembles in its external contours, its elongated, turrlicated shell and its deep suture to the holotype of *Aporrhais dutruei* figured by Coquand (1862, p. 185, pl. 5, fig. 4.), and to the specimens described by El Qot (2006, p. 100, pl. 20, figs. 7- 8) and Mekawy (2007, p.160, pl. 1, fig. 15) from the Cenomanian-Turonian of Egypt and those from Tunisia figured by Pervinqui re (1912, p. 24, pl. 2, figs. 1-7). However, the absence of a widened, wing-like or digitated adapical and abapical sinuses, precludes a generic assignment.

Occurrence: Coniacian-Santonian of Gabon (this study).

Superfamily Akerioidea Mazzarelli, 1891

Family Akeridae Mazzarelli, 1891

Genus Aker  M ller, 1776

Type species (by monotypy): *Aker  bullata* M ller, 1776

Aker  sp.

(Fig. 3 C-F)

Material: Twenty specimens from the section Cap-Est rias 1 (references: MDG/GBN/Gas - 7.1 to 7.20)

Measurements

SH	AH	AH	SD	AD	LWH
9-23 (mean: 16)	9-23 (mean: 16)	9-23 (mean: 16)	8-21 (mean: 14.5)	6-13 (mean: 10.5)	9-23 (mean: 16)

Description: Medium-sized cylindrical internal mould with a truncated and flattened apex; convex whorls and strongly involute mould; aperture extends along the height of the mould, being broad near the base, and narrowing towards the apex; the inner lip is curved, thickened near the columella, and thin along the parietal margin; the outer lip is thick and rounded anteriorly; the ornamentation consists of fine orthocline growth lines, more pronounced and inflected at the junction with two spiral grooves located near the base.

Discussion: This morphotype is similar in its form and ornamentation to *Bulla dyonisea* Buvignier, 1852 from the Kimmeridgian of France (Buvignier, 1852; p. 28, pl. 21 Figs. 25, 26), but this latter differs from the studied specimen by the presence of an umbilicus and by a narrower and taller spire. *Aker * sp. also

resembles *Akera soluta*, of England (Adams, 1850, p. 573, pl. 121, fig. 4) in its general shape and truncated apex, but this latter differs by its size. *Akera* sp. has a shorted and wider shell than *Akera soluta*.

Occurrence: The genus *Akera* is reported for the first time from Gabon where it occurs in the Coniacian-Santonian (this study).

Family Campanilidae Douvillé, 1904

Genus Campanile Fischer, 1884

Type species: *Cerithium giganteum* Lamarck, p. 1804, 439-440, n° 57.

Campanile sp.

(Fig. 3 G-H)

Material: Two specimens from the section Cap-Estérias 2 (references: MDG/GBN/Gas - 8.1 to 8.2)

Measurements

SH	AH	SpH	SD	AD	LWH
70-96 (mean: 83)	32-40 (mean: 36)	45-62 (mean: 53.5)	44-55 (mean: 49.5)	16-27 (mean: 21.5)	25-34 (mean: 29.5)

Description: Large and conical internal moulds with a conical spire often damaged, and two to five whorls decreasing in height towards the apex and showing a rostrum at its base; whorls are flat to slightly convex in outline, and separated by weakly impressed sutures; each whorl slightly overlaps the base of the previous one; subquadrangular aperture and dextral coiling; rounded outer lip; ornamentation is partially preserved and consists of four raised spiral cords on each whorl, which are thicker near the suture, and are parallel to the basal part of the outer lip at the base of the mould.

Remarks: This morphotype resembles in its shape and the length of the spire to other representatives of this genus such as *Campanile giganteum* Deshayes, 1824 from the Lutetian of Ankara-Haymana (Güngör, 1974; p. 31, pl. 1 fig. 1), but it differs by its smaller dimensions and apparent absence of tubercles.

Occurrence: Coniacian-Santonian of Gabon (this study).

Family Fascioliidae Gray, 1853

Genus Fasciolaria Lamarck, 1799

Type species: *Murex tulipa* Linnaeus, 1758

Fasciolaria cf. *ournoueri* (Thomas & Peron in Peron, 1889)

(Fig. 3 I-J)

Cf. 1889 *Fusus tournoueri* sp. nov. - Thomas & Peron in Peron, p. 91; pl. 21, figs 19-20.

Cf. 1912 *Fasciolaria* (Cryptorhytis) *ournoueri* (Thomas & Peron in Peron) - Pervinquière, p. 71; pl. 5, fig. 16.

Cf. 2011 *Fasciolaria tournoueri* (Thomas & Peron in Peron) - Ayoub-Hannaa, p. 190; pl. 19, fig. 5.

Material: One specimen from the section Cap-Estérias 1 (reference: MDG/GBN/Gas - 9.1).

Measurements

SH	AH	SpH	SD	AD	LWH
24	16	6	11	5	18

Description: Smooth medium-sized internal mould of fusiform shape, with three whorls decreasing in height towards the apex; convex whorls separated by depressed sutures; last whorl is relatively large, occupying three-quarters of the total height; elongated aperture and dextral coiling; convex outer lip and concave inner lip; the base of the shell is acute; ornamentation is erased on the spire whorls and on the last whorl.

Remarks: The studied specimen resembles the holotype of *Fasciolaria tournoueri* (Thomas & Peron in Peron, 1889, p. 91; pl. 21, figs 19-20) and is tentatively assigned to this species, but it differs by the folds at the columella which are not visible. It also resembles *Fasciolaria* (Cryptorhytis) *bleicheri* Thomas & Peron, in Peron, 1889 from the Coniacian of Tunisia (Pervinqui re, 1912, p. 70, pl. 5, figs 12-15), but it differs from it by the presence of fantome of longitudinal ribs.

Occurrence: Turonian of Tunisia (Thomas & Peron, 1889; Pervinqui re, 1912), Cenomanian-Turonian of Egypt (Ayoub-Hannaa, 2011). The genus *Fasciolaria* is recorded for the first time from the Coniacian-Santonian of Gabon (this study).

Genus: *Latirus* Montfort, 1810

Type species: *Latirus aurantiacus* Montfort, 1810

Latirus sp.

(Fig. 3 K-L)

Material: Four specimens from the section Cap-Est rias 2 (reference: MDG/GBN/Gas - 10.1 to 10.4).

Measurements

SH	AH	SpH	SD	AD	LWH
26–38 (mean = 32)	16–17 (mean = 16.5)	11–23 (mean = 17)	14–26 (mean = 20)	11–12 (mean = 11.5)	14–24 (mean = 19)

Description: Wide fusiform internal mould with three large convex whorls, separated by depressed suture lines; last whorl represents three-quarters of the total height; half-crescent aperture; rounded outer lip; the base is damaged; ornamentation consists of strong longitudinal ribs extending across the height of the whorl, and intersected by numerous spiral cords, mainly visible in the intercostal spaces; longitudinal ribs appear to alternate between successive whorls; the width of the intercostal spaces decreases towards the apex.

Remarks: This morphotype is tentatively assigned to the genus *Latirus*, based on its general shape, although the longitudinal ribs appear to alternate between whorls. The present material is similar in its shape and ornamentation to *Fusus numidicus* Coquand, 1879 from the Danian of Tunisia (Thomas & Peron, 1889; p. 88, pl. 21, figs 13-14). However, it differs from *F. numidicus* species in having a more acute extremity anterior.

Occurrence: The genus *Latirus* is recorded for the first time from the Coniacian-Santonian of Gabon (this study).

Family Turritellidae Lov n, 1847

Genus *Turritella* Lamarck, 1799

Type species: *Turritella terebra* Linnaeus, 1758

Turritella sp.

(Fig. 4 A-B)

Material: Seven specimens from sections Cap-Estérias 1 and Cap-Estérias 2 (reference: MDG/GBN/Gas - 11.1 to 11.7).

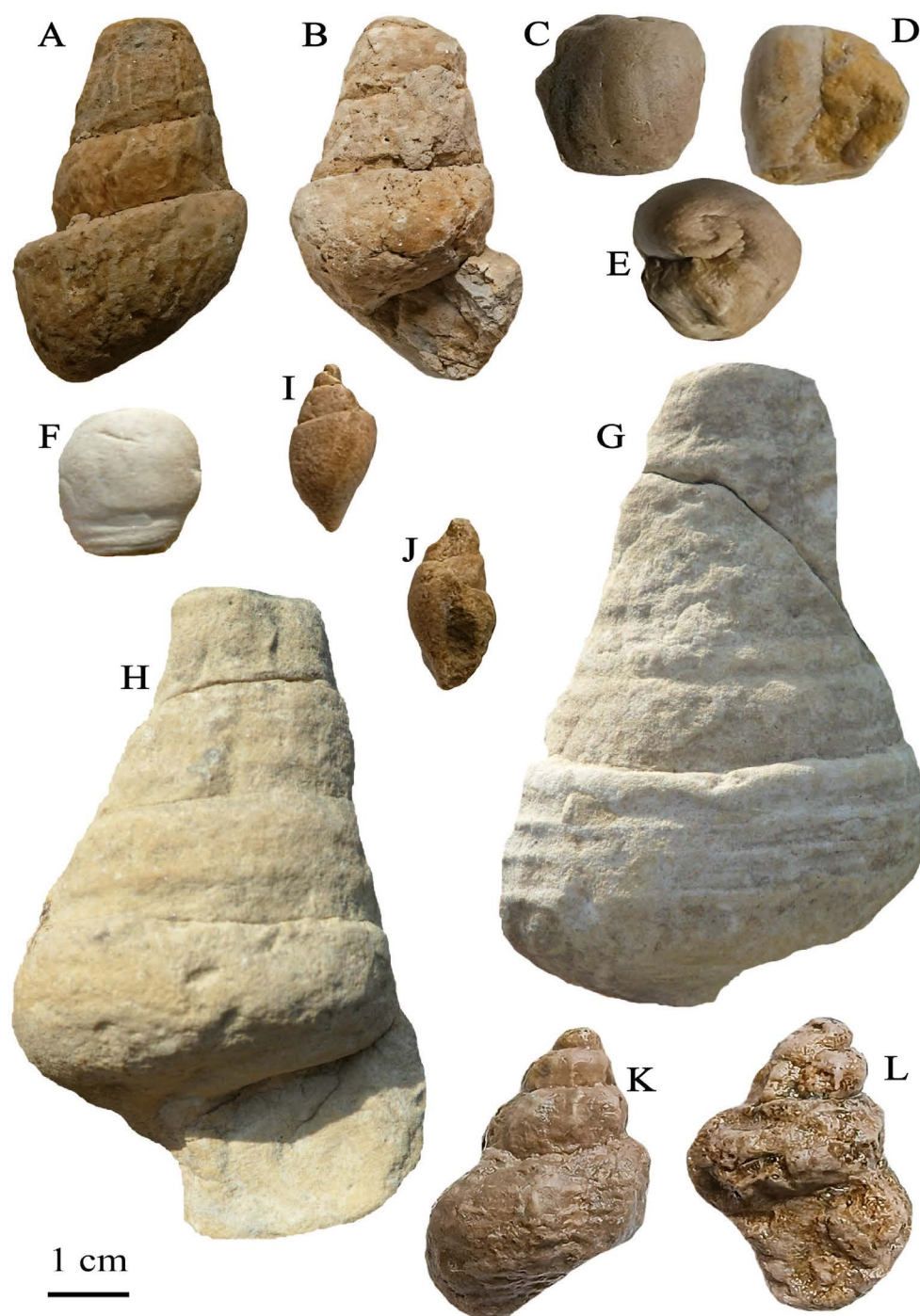


Figure 3. Coniacian-Santonian gastropods from the Cap-Estérias (Gabon). **A-B. Aporrhaidae gen. et sp. indet.**, A. abapertural view, B. apertural view (MDG/GBN/Gas-6.2); **C-F. Akera sp.**, C. abapertural view, D. apertural view, E. apical view (MDG/GBN/Gas-7.1), F. lateral view (MDG/GBN/Gas-7.8); **G-H. Campanile sp.**, G. abapertural view, H. apertural view (MDG/GBN/Gas-8.2); **I-J. Fasciolaria cf. tournoueri** (Thomas & Peron, 1889), I. abapertural view, J. apertural view (MDG/GBN/Gas-9.1); **K-L. Latirus sp.**, K. abapertural view, L. apertural view (MDG/GBN/Gas-10.3).

Measurements

SH	AH	SpH	SD	AD	LWH
15–56 (mean = 35.5)	6–10 (mean = 8)	5–29 (mean = 17)	10–24 (mean = 17)	5–10 (mean = 7.5)	10–13 (mean = 11.5)

Description: Large and elongated internal mould with damaged apex; high spire with five whorls separated by shallow depressions and decreasing in height towards the apex; outline of spire whorls becomes increasingly subflat towards the last whorl. The base showing a pseudo-rostrum; mould bearing four to five strong spiral cords at the adapical part of the spire whorls and the last whorl.

Remarks: Present material shows morphological similarities with *Mesalia jovisammonis* from Maastrichtian of Egypt (Quaas, 1902, p. 256, pl. 26, figs. 18-20; Cossmann, 1912:126; Squires and Saul, 2007, p.3) in its general shape, but it differs in the absence of granular ribs.

Occurrence: *Turritella* sp. is reported for the first time from the Coniacian-Santonian of Gabon (this study).

Turritella aff. *rigida* Sowerby, in Sedgwick & Murchison, 1835

(Fig. 4 C-D)

aff. 1835 *Turritella rigida* sp. nov. - Sowerby in Sedgwick & Murchison, pl. 38; fig. 19.

aff. 1852 *Turritella rigida* Sowerby - Zekeli, p. 22; pl. 1, fig. 1.

aff. 1980 *Torquesia rigida* (Sowerby) - Kollmann, p. 200; pl. 2, figs 13-15.

Material: Eight specimens from the section Cap-Estérias 2 (reference: MDG/GBN/Gas - 46.1 to 46.8).

Measurements

SH	SpH	SD	LWH
14–30 (mean = 22)	9–20 (mean = 14.5)	5–13 (mean = 9)	5–12 (mean = 8.5)

Description: Medium-sized turreted internal mould with a conical spire, consisting of four to six whorls decreasing in height towards the apex; whorls are rounded in outline, and separated by a deep suture; damaged aperture; ribbing consists of four spiral cords on each whorl.

Remarks: *Turritella* aff. *rigida* Sowerby, 1835 shows affinities with the holotype of *Turritella rigida* by its ornamentation and shell shape. It also resembles *Mesalia foucheri* Pervinquier, 1912 in its general shape, but it differs from it in having consistently rounded and well-individualized whorls, and the ribbing of the last whorl consisting of four spiral cords.

Occurrence: *Turritella* aff. *rigida* is reported for the first time from the Coniacian-Santonian of Gabon (this study).

Family Tylostomatidae Stoliczka, 1868

Genus Tylostoma Sharpe, 1849

Tylostoma pallaryi (Peron & Fourtau, 1904)

(Fig. 4 E-F)

1904. *PSEUDOMELANIA PALLARYI* SP. NOV. PERON & FOURTAU, P. 270; PL. 1, FIG. 22

1974. : *TYLOSTOMA (TYLOSTOMA) PALLARYI* (PERON & FOURTAU); ALBANESI & BUSSON, P. 310, PL. 24, FIG. 6

2007. *TYLOSTOMA (TYLOSTOMA) PALLARYI* (PERON & FOURTAU) - MEKAWY, P. 167; PL. 3, FIG. 5

2011. *TYLOSTOMA (TYLOSTOMA) PALLARYI* (PERON & FOURTAU) - AYOUB-HANNAA & FÜRSICH, P. 138; FIG. 14D, E

2015. *TYLOSTOMA (TYLOSTOMA) PALLARYI* (PERON & FOURTAU) - GAMEIL & EL-SOROgy, P. 135; FIG. 5E-F
2015. *TYLOSTOMA PALLARYI* (PERON & FOURTAU) - MUSAVU MOUSSAVOU & MABICKA OBAME, P. 37; PL. 2, FIGS 1, 2, 11

Material: One specimen from the section Cap-Estérias 1 (reference: MDG/GBN/Gas - 13.1).

Measurements

SH	AH	SpH	SD	AD	LWH
44	29	9	31	13	35

Description: Smooth oval and wide internal mould with a rounded base and dextral coiling and a conical damaged spire; mould consists of two whorls decreasing in size towards the apex; slightly rounded whorls separated by a shallow depression; wide last whorl representing three-quarters of the total height; oval elongated aperture; A narrow umbilicus is present on the columellar edge.

Remarks: The studied specimen resembles the holotype of *Tylostoma pallaryi* (Peron & Fourtau, 1904, p. 270; pl. 1, fig. 22) by its internal mould wide smooth and oval, and shows morphological similarities with *T. syriacum* Conrad, 1852 from the Cenomanian of Syria (Blanckenhorn, 1927, p. 137, pl. 2, fig. 2) and *T. torrubiae* Sharpe, 1849 from the Cenomanian-Turonian of Spain (Berrocal-Casero and al., 2013), but it differs from the first species by its smaller size and from the second one by its shallow depression separating the whorls.

Occurrence: Albian-Turonian of North Africa (Mekawy, 2007; Ayoub-Hannaa & Fürsich, 2011), Maastrichtian of Saudi Arabia (Gameil & El-Sorogy, 2015), and Cenomanian of Algeria (Albanesi & Busson, 1974; Aouissi and al., 2018, 2024), and Albian-Santonian of Gabon (Musavu Moussavou & Mabicka Obame, 2015; and this study).

Family Neritidae Rafinesque, 1815

Genus Nerita Linnaeus, 1758

Type species: *Nerita senegalensis* Linnaeus, 1758

?*Nerita* sp.

(Fig. 4 G-H)

Material: Seven specimens from the section Cap-Estérias 1 (reference: MDG/GBN/Gas - 14.1 to 14.7).

Measurements

SH	SpH	SD	LWH
10-26 (mean = 18)	1-5 (mean = 3)	12-27 (mean = 19.5);	15-21 (mean = 18)

Description: Medium-sized auriform and smooth internal mould with very short apex and broad and rounded last whorl, covering partially the previous whorls and occupying almost the entire height of the mould.

Remarks: The genus *Nerita* Linnaeus, 1758 is characterized by a robust auriform shell with spiral ribs. It has morphological similarities with the genus *Otostoma* Archiac, 1859, which differs in having transverse ribs intersected by spiral striations. Our specimens show robust auriform and smooth internal mould. The poor preservation of the specimens prevents its identification at the species level.

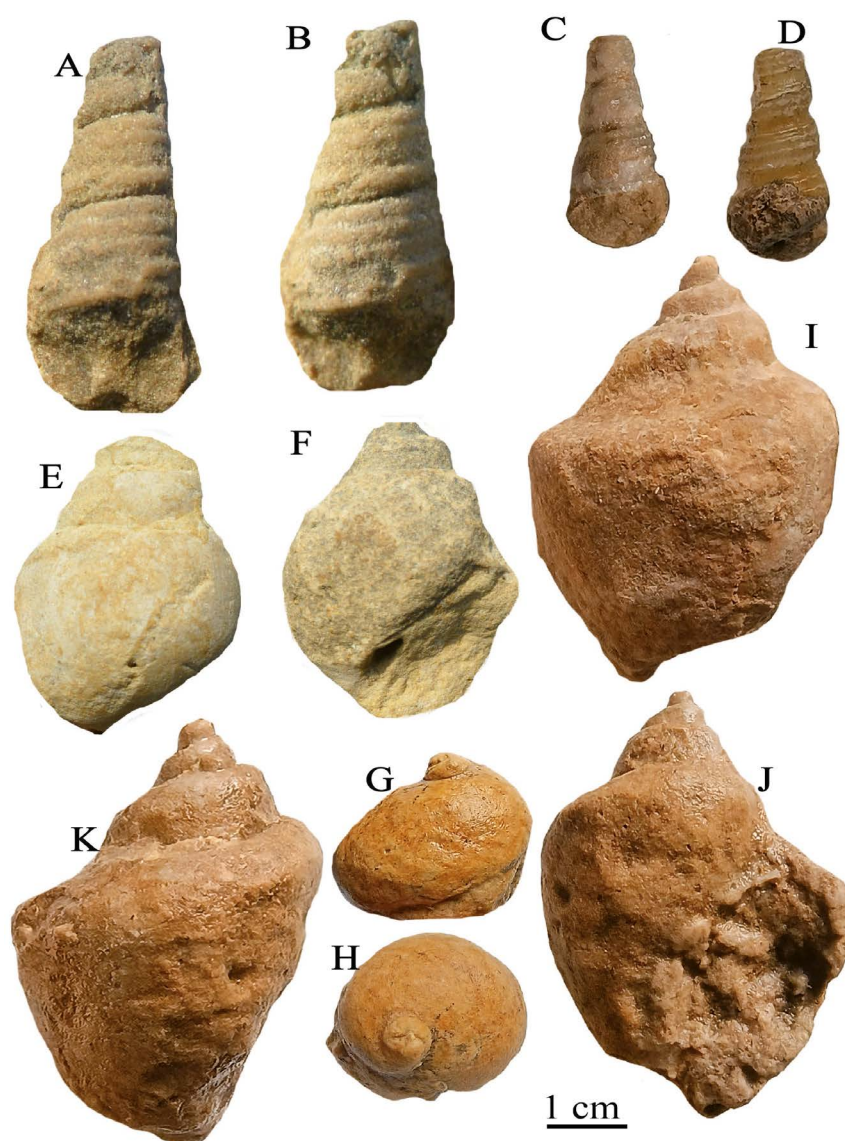


Figure 4. Coniacian-Santonian gastropods from the Cap-Estérias (Gabon). **A-B.** *Turritella* sp., A, B. apertural view (MDG/GBN/Gas-11.5); **C-D.** *Turritella* aff. *rigida* Sowerby, 1835, C, D. apertural view (MDG/GBN/Gas-12.1); **E-F.** *Tylostoma pallaryi* (Peron & Fourtau, 1904), E. abapertural view, F. apertural view (MDG/GBN/Gas-13.1); **G-H.** ?*Nerita* sp., G. abapertural view, H. apical view (MDG/GBN/Gas-14.1); **I-J.** ?*Voluta* (*Aulica*) *stromboides* Munier-Chalmas, 1881, I. abapertural view, J. apertural view (MDG/GBN/Gas-15.4).

Occurrence: Coniacian-Santonian of Gabon (this study).

Family: Volutidae Rafinesque, 1815

Genus : *Voluta* Linnaeus, 1758

Type species: *Voluta musica* Linnaeus, 1758

?*Voluta* (*Aulica*) *stromboides* Munier-Chalmas, 1881

(Fig.4 I-J)

1881. *VOLUTA* (*AULICA*) *STROMBOIDES* SP. NV. - MUNIER-CHALMAS, P. 78; PL. 5, FIGS 10-11

1912. *VOLUTA* (*AULICA*) *STROMBOIDES* MUNIER-CHALMAS - PERVINQUIÈRE, P. 77; PL. 6, FIGS 14-19

Material: Four specimens from the section Cap-Estérias 2 (references: MDG/GBN/Gas - 15.1 to 15.4).

Measurements

SH	AH	SpH	SD	AD	LWH
25-60 (mean = 42.5)	19-42 (mean = 30.5)	4-18 (mean = 11)	18-39 (mean = 28.5)	10-22 (mean = 16)	21-42 (mean = 31.5)

Description: Large-sized ovate and slightly biconical internal mould with damaged base; conical spire consisting of two to three whorls with convex profile; whorls decrease in height towards the apex, last whorl corresponds to two-thirds of the total height, and bears a row of tubercles in the angular margin of the sutural ramp; sutures are slightly depressed; ramp is stepped; the outer lip is rounded and the columellar is slightly concave.

Remarks: The studied specimens are poorly preserved as internal moulds, preventing the observation of columellar folds. Their spires are much higher than that of the Tunisian specimens described by Pervinquière (1912). The attribution of our specimens to the species *Voluta (Aulica) stromboides* is tentatively based on the general shape and the presence of tubercles on the last whorl and the straight columella.

Occurrence: Upper Cretaceous of Tunisia (Pervinquière, 1912). The species is reported for the first time as probably occurring in the Coniacian-Santonian of Gabon (this study).

6. DISCUSSION

6.1. Faunal diversity

This study reveals a gastropod fauna distinct from previously described assemblages in the Anguille Formation of the Gabonese Coastal Basin (Dartevelle & Brébion, 1956; Hudeley & Belmonte, 1970; Chevalier et al., 2002). The main results are: (1) The first occurrence in the Gabonese Coastal Basin of the genera *Fasciolaria* Lamarck, 1799, *Latirus* Montfort, 1810 and *Akera* Müller, 1776, together with the species *Turritella* aff. *rigida* Sowerby, 1835 and ?*Voluta (Aulica) stromboides* Munier-Chalmas, 1881; (2) The identification of eight genera and nine species new to Gabon adding to the nine genera and ten species previously known in the studied area.

Except for the genus *Turritella*, is represented by two species, all other genera are monospecific in the studied localities.

6.2. Geographic and stratigraphic distribution

The assemblage studied includes genera with a cosmopolitan distribution. In the Gabonese Coastal Basin, the genera *Voluta* and ?*Nerita*, previously known from the Albian to the Turonian in the regions of Libreville, N'toum and Owendo (Dartevelle et Brébion, 1956; Musavu Moussavou et Ngnibome Angoue, 2014; Musavu Moussavou et Mougola, 2016), now have their stratigraphic range extended to the Santonian and their geographical distribution extended to Cap-Estérias. Similarly, the species *Tylostoma pallaryi* (Peron & Fourtau, 1904), previously known only from the Albian of N'Toum, is now documented in the Coniacian-Santonian.

The genera *Latirus* and *Akera* are reported for the first time from the studied basin. The species *Fasciolaria* cf. *tournoueri* Thomas & Peron, 1889, which is known from the Cenomanian-Turonian of North Africa, has its stratigraphic range extended to the Santonian and its geographical distribution to Gabon. Likewise, *Turritella* aff. *rigida* Sowerby, 1835, previously known from the Upper Cretaceous of Austria, is documented for the first time in Gabon.

7. CONCLUSION

The study of Coniacian-Santonian gastropods from the Gabonese Coastal Basin, based on two sections from the Cap-Estérias region, makes a significant contribution to the palaeontological knowledge of the area. This research has allowed: (1) The first identification of the genera *Akera*, *Latirus* and *Fasciolaria*

in the Gabonese Coastal Basin; (2) The recognition of a taxonomic assemblage different from previous studies; (3) The extension of the stratigraphic range of the genera *Voluta* and *Nerita* to the Santonian and their geographical distribution to Cap-Estérias, and (4) A substantial increase in the known taxonomic diversity within the Anguille Formation, from nine to 17 genera and from 10 to 14 species.

Supplementary information ↑

Funding sources

Not applicable.

Supplementary material

Not applicable.

Data availability

Not applicable.

Acknowledgements

The authors are very grateful to the reviewers, Dr. Pedro Callapez (University of Coimbra, Portugal), Dr. Riadh Aouissi (Université de Larbi Ben M'hidi, Algérie), and an anonymous reviewer for their numerous valuable comments and constructive remarks on the first version of the manuscript, which highly increased the quality scientific of the manuscript. They also thanks the Editor for his valuable comments.

Authorship contribution statement

Urlain Gaël Yakouya-Moubamba: Data Collection, Methodology, Writing - Original Draft.

Wilma Linda-Belle Mougola: Data Collection, Methodology, Writing - Original Draft.

Mohamed Benzaggagh: Writing review, and editing.

Benjamin Musavu Moussavou: data collection, supervision, validation, visualization.

Competing interests

The authors declare that they have no financial, professional, or personal conflicts of interest that could have inappropriately influenced this work.

Statement on the use of Artificial Intelligence

Not applicable.

REFERENCES

- Adams, A. (1850). Monograph of the Family Bullidae. In G. B. Sowerby II (Ed.), *Thesaurus conchyliorum or monographs of genera of shells* (pp. 553-608). G.B. Sowerby, London.
- Albanesi, C. & Busson, G. (1974). Gastéropodes du Crétacé Supérieur de l'extrême-sud tunisien et de la région du Tinrhert (Sahara Algérien). *Rivista Italiana di Paleontologia e Stratigrafia*, 80 (2), 251- 342,
- Aouissi, R., Salmi-Laouar, S. & Ferré, B. (2018). Macro-invertébrés du Cénomanien du Djebel Metrassi (Batna, NE Algérie): Systématique et biostratigraphie. *Estudios Geológicos*, 74 (2), e082. <https://doi.org/10.3989/egeol.43158.492>
- Aouissi, R., Salmi-Laouar, S., El Qot, G. M., Gomez, C. & Buitron, B. (2024). Taxonomy and significance of Cenomanian echinoids distribution in the Batna Mounts (NE, Algeria). *Journal of African Earth Sciences*, 105302. <https://doi.org/10.1016/j.jafrearsci.2024.105302>
- Archiac, A. D.' (1859). Note sur le genre *Otostoma*. *Bulletin de la Société Géologique de France*, 2(16), 871-879.

- Ayoub-Hannaa, W. S. (2011). Taxonomy and palaeoecology of the Cenomanian-Turonian macro-invertebrates from eastern Sinai, Egypt [Unpublished doctoral dissertation] Bayerischen Julius-Maximilians-Universität.
- Ayoub-Hannaa, W.S. & Fürsich, F. T. (2011). Revision of Cenomanian-Turonian (Upper Cretaceous) gastropods from Egypt. *Zitteliana*, 51, 115-152.
- Berrocal-Casero, M., Barroso-Barcenilla, F., Callapez, P., Joral, F. G. & Segura, M. (2013). Bioestratigrafía de macrofósiles del Cenomaniense superior-Turonense inferior en el área de Santamera y Riofrío del Llano (Guadalajara, España). *Revista de la Sociedad Geológica de España*, 26 (2), 85-106.
- Blanckenhorn, M. (1927). Die fossilen Gastropoden und Scaphopoden der Kreide von Syrien-Palästina. *Palaeontographica*, 69, 111-186.
- Bouchet, P. & Rocroi, J. P. (2005). Classification nomenclator of gastropod families. *Malacologia*, 47, 1-397.
- Buvignier, A. (1852). *Statistique géologique, minéralogique et paléontologique du département de la Meuse*. Baillière J.B. et fils, Paris.
- Chevalier, L., Makanga, J. F. & Thomas, R. J. (2002). *Carte géologique de la République gabonaise au 1/1 000 000. Notice explicative*. Council for Geoscience, Pretoria.
- Conrad, T. A. (1852). Description of the fossils of Syria collected in the Palestine expedition. In: Lynch W.F. (Ed.). *Official report of the United States expedition to explore the Dead Sea and the River Jordan* (pp. 211-229), Murphy and Co, Baltimore.
- Coquand, M. H. (1862). Géologie et paléontologie de la région Sud de la province de Constantine. *Mémoires de la Société d'Émulation de la Provence*, 2, 5-342.
- Coquand, M.H. (1880). Études supplémentaires sur la paléontologie algérienne faisant suite à la description géologique et paléontologique de la région Sud de la province de Constantine. *Bulletin de l'Académie d'Hippone*, 15, 1-449.
- Cossmann, M. (1912). *Essais de paléoconchologie comparée*. Volume 9. Privately published, Paris.
- Cox, L. R. L. (1960). General characteristics of gastropods. In: RC. Moore (Ed.). *Treatise on Invertebrate Paleontology, Part L (Mollusca)* (pp. 249-251). Boulder, Geological Society of America, and Lawrence, K. S, University of Kansas Press.
- Darteville, E. & Brébion, P. (1956). Mollusques fossiles du Crétacé de la côte occidentale d'Afrique du Cameroun à l'Angola. I. Gastéropodes. *Annales du Musée Royal du Congo Belge, Science géologique*, 5, 1-127.
- El Qot, G. M. (2006). Late Cretaceous macrofossils from Sinai, Egypt. *Beringeria*, 36, 3-163.
- Güngör, A. (1974). Etude des espèces du genre *Campanile* Bayle (in Fischer), 1884, de l'Eocène de la région d'Ankara-Haymana. *Bulletin of the Mineral Research and Exploration Institute of Turkey*, 84, 31-35.
- Hudeley, H. & Belmonte, Y. (1970). *Carte géologique de la République gabonaise au 1/1 000 000. Notice explicative*. Bureau de Recherches Géologiques et Minières, 72.
- Klasz, I. (1965). Biostratigraphie du bassin gabonais. 3^{ème} Colloque international (Dakar 1963). *Mémoire du Bureau de Recherches Géologiques et Minières*, 277-303.
- Kollmann, H. A. (1980). Gastropoden aus der Sandkalkbank (Hochmoossschichten, Obersanton) des Beckens von Gosau (ÖÖ.). *Annalen des Naturhistorischen Museums in Wien*, 83, 197-213.
- Lombard, J. (1930). Céphalopodes et lamellibranches Crétacés du Congo Français. *Bulletin de la Société Géologique de France*, 4(30), 277-322.
- Mbina Mounquengui, M. (1998). *Dynamique sédimentaire et fluctuations eustatiques au cours du Cénomaniens et du Turonien basal dans le Nord du bassin côtier gabonais* [Unpublished doctoral dissertation]. Université de Bourgogne.
- Mbina Mounquengui, M., Lang, J., Guiraud, M. & Jocktane, O. (2002). Sedimentary dynamics and structural geology of pre-rift deposits of interior basin of Gabon. *Journal of African Earth Sciences*, 35(2), 315-329. [https://doi.org/10.1016/S0899-5362\(02\)00035-0](https://doi.org/10.1016/S0899-5362(02)00035-0)

- Mbina MOUNGUENGUI, M., BAUDIN, F. & GUIRAUD, M. (2008). Caractérisation et paléoenvironnements des dépôts riches en matière organique de la série de l'Anguille d'âge coniacien-santonien dans le bassin sédimentaire côtier gabonais. *Africa Geoscience Review Special Publication*, 1, 89-97.
- Meister, C., Mbina MOUNGUENGUI, M. & LANG, J. (2003). Les ammonites du Cénomano-Turonien du bassin côtier nord gabonais: systématique et intérêt paléogéographique pour la liaison Téthys-Atlantique Sud. *Revue de Paléobiologie*, 22(1), 341-345.
- Mekawy, M. S. (2007). Gastropods of the Cenomanian-Santonian sequence from north Eastern Desert, Egypt. *Egyptian Journal of Geology*, 51, 149-176.
- Mougola, W. L. B. (2021). *Les bivalves et les gastéropodes des Formations de l'Azilé (Turonien) et de l'Anguille (Coniacien-Santonien) du bassin côtier nord gabonais: systématique, paléoenvironnement et paléobiogéographie* [Unpublished doctoral dissertation]. Université des Sciences et Techniques de Masuku.
- Musavu MOUSSAVOU, B. & MABICKA OBAHE, R. (2015). Taxonomy and paleoecology of Albian Madiela Formation gastropods, Gabonese coastal basin: N'Toum quarry section. *Bulletin de la Société Géologique de France*, 186(1), 35-42. <https://doi.org/10.2113/gssgfbull.186.1.35>
- Ndong ONDO, S. M. (2002). *Interaction entre la tectonique gravitaire extensive et la sédimentation sur la marge passive sud-gabonaise au cours de l'Albo-Turonien: application sur les structures gravitaires kilométriques*. [Unpublished doctoral dissertation]. Université de Bourgogne.
- Peron, A & Fourtau, L. (1904). Etude de la faune Crétacique d'Égypte. *Bulletin de l'institut Egyptien*, 4, 231-350. <https://doi.org/10.3406/bie.1903.4399>
- Pervinquière, L. (1912). Étude de la paléontologie tunisienne. II, gastéropodes et lamellibranches des terrains crétacés. In Lamarre J. et Cie (Eds), *Carte géologique de la Tunisie*, Paris.
- Quaas, A. (1902). Beitrag zur Kenntniss der Fauna der obersten Kreidebildungen in der libyschen Wüste (Überwiegend Schichten und Blätterthon). *Palaeontographica*, 30, 153-336.
- Sowerby, J. (1835). In: Sedgwick, A., Murchison, R. A sketch of the structure of the Eastern Alps; with sections through the newer formations on the northern flanks of the chain, and through the Tertiary deposits of Styria. *Transactions of the Geological Society*, 2, 301-420.
- Squires, R.L., Saul, L.R. (2007). Paleocene pareorine turritellid gastropods from the Pacific Slope of North America. *The Nautilus*, 121, 1-16.
- Teisserenc, P. & Villemin, J. (1990). Sedimentary basin of Gabon. Geology and oils systems, in Edward J.D., Santogrossi P.A. (Eds), Divergent/Passive margin basin. *Bulletin American Association Petroleum Geologists*, 48, 117-199. <https://doi.org/10.1306/M48508C3>
- Thomas, P. & Peron, A. (1889). *Description des mollusques fossiles des Terrains Crétacés de la région sud des Haut-Plateaux de la Tunisie recueillis en 1885 et 1886 par Philippe M. Thomas*. Masson, Paris.
- Volat, J. L., Hugo, B. & BIGNOUMBA ILOGUE, J. (1995). Foraminifères arénacés du Crétacé supérieur du Gabon. *Bulletin des Centres de Recherches Exploration-Production Elf-Aquitaine*, 20(1), 229-275.
- Yakouya-Moubamba, U. G. (2020). *Les échinides de la Formation de l'Azilé (Turonien) du bassin côtier gabonais: systématique, morphométrie, paléoenvironnement et paléobiogéographie*. [Unpublished doctoral dissertation], Université des Sciences et Techniques de Masuku.
- Zekeli, F. (1852). Die Gasteropoden der Gosaugebilde in den nordöstlichen Alpen. *Abhandlungen der Kaiserlich-königlichen Geologischen Reichsanstalt*, 1, 1-124. <https://doi.org/10.5962/bhl.title.49120>