Cretaceous amniotes from Angola: dinosaurs, pterosaurs, mosasaurs, plesiosaurs, and turtles

Amniotas cretácicos de Angola: dinosaurios, pterosaurios, mosasaurios, plesiosaurios y tortugas

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Abstract

Although rich in Cretaceous vertebrate fossils, prior to 2005 the amniote fossil record of Angola was poorly known. Two horizons and localities have yielded the majority of the vertebrate fossils collected thus far; the Turonian Itombe Formation of Iembe in Bengo Province and the Maastrichtian Mocuio Formation of Bentiaba in Namibe Province. Amniotes of the Mesozoic of Angola are currently restricted to the Cretaceous and include eucryptodire turtles, plesiosaurs, mosasaurs, pterosaurs, and dinosaurs. Recent collecting efforts have greatly expanded our knowledge of the amniote fauna of Angola and most of the taxa reported here were unknown prior to 2005.

Key words: Angola, Africa, mosasaurs, plesiosaurs, turtles, dinosaurs, pterosaurs, Cretaceous

Resumen

Aunque rica en fósiles de vertebrados del Cretácico, el registro fósil amniotas de Angola es poco conocido con anterioridad al 2005. La mayoría de los vertebrados fósiles recogidos hasta el momento provienen de la Formación Itombe, Turoniense de Iembe en la provincia de Bengo y del Maastrichtiense, Formación Mocuio de Bentiaba en la provincia de Namibe. El registro fósil de amniotas del Mesozoico de Angola está actualmente restringido al Cretácico e incluye las tortugas eucriptodiras, plesiosaurios, pterosaurios y dinosaurios. Los recientes esfuerzos del trabajo de campo han ampliado en gran medida nuestro conocimiento de la fauna de los amniotas de Angola y la mayoría de los taxones que se presentan no se conocían antes de 2005.

Palabras clave: Angola, África, mosasaurios, plesiosaurios, tortugas, dinosaurios, pterosaurios, Cretácico.

INTRODUCTION

Angola has the best Southern Hemisphere record of Late Cretaceous marine amniotes, including mosasaurs, plesiosaurs and chelonians (all refs). It has also produced pterosaurs and dinosaurs (refs) preserved in marine sediments. This faunal richness is particularly relevant in the context of the mid-Cretaceous opening of the South Atlantic (Jacobs *et al.*, 2006a, 2006b, 2009a, 2009b) and the general paucity of records for that region of the Earth (Jacobs *et al.*, 2011).

The main sedimentary packages of the Angolan Mesozoic can be broadly grouped into three divisions: (1) Karoo-like continental basin deposits (with Triassic fishes), at Baixa de Cassange; (2) Cretaceous marine sediments related to the opening and expansion of the South Atlantic (and rich in marine vertebrates); and (3) continental Cretaceous, with no vertebrate record so far, filling rift valley remnants along the coast and broadly distributed in the interior of the country. The latter are poorly known, in part because of the inaccessibility and rareness of outcrops.

The goal of this article is to provide an overview of the fossil amniotes from the Cretaceous of Angola. Additionally, we provide a list of non-amniote taxa reported from Angola (Appendix).

History of Mesozoic amniote paleontology in Angola

According to Nunes (1991: 317), the first reports of fossils in Angola are attributed to Lang, who in 1839 (cit. in Nunes, 1991, without bibliographic reference) wrote "… petrifications of Ammon horns, that show the existence of Mesozoic terrains in the country." The German explorer Eduard Peschuel-Loesche (German, 1849-1913) prospected that part of Africa between 1873 and 1876, including what are now the provinces of Cabinda and Namibe. O. Lenz (1877) wrote notes on fossils from the Cenozoic of Cabinda, including a crocodile tooth collected by Pechuel-Loesche. To our knowledge this is the first report of a fossil amniote from Angola.

Edmond Dartevelle and Edgard Casier worked on the rich fish fauna from Bentiaba, and also reported a "partial tooth of dinosaur, and vertebrae and bone fragments of reptiles" (Dartevelle and Casier, 1941: p.106; and 1943: p.16). The Dartevelle collection is housed in the Royal Museum of Central Africa in Tervuren, Belgium. Their purported dinosaur tooth (RG 2084; Fig. 1) was found to be the proximal portion of a plesiosaur dorsal rib (Mateus *et al.,* 2011).

Soares Gaspar de Carvalho published a major work on the geology of Namibe desert in which mosasaur teeth attributed to *Mosasaurus beaugei* are first reported and figured from Bentiaba and other localities in Namibe (Carvalho, 1961: p.85, 89, 92, fig. 128).

Mascarenhas Neto of the Angola Mines and Geology Survey (Neto, 1960) reported reptiles from the locality of Iembe later published by Antunes (1961). Miguel Telles Antunes published the first comprehensive work on the Mesozoic-Cenozoic vertebrates of Angola (Antunes, 1964). He has continued to work on the fossil fishes, publishing a report on the Cretaceous selachians of Angola (Antunes and Cappetta, 2002). Antunes (1964) named the mosasaurs *Angolasaurus bocagei* (see also Jacobs *et al.,* 2006b) and *Mosasaurus iembensis*, later transferred to *Tylosaurus iembensis*. He also reported other mosasaurs in Cabinda, Ambrizete, Barra do Dande, Benguela-Cuio, and eight localities in the Namibe basin.

In addition to mosasaurs, Antunes (1964, 1970) also reported vertebrae and girdle elements of two plesiosaur specimens from the Turonian of Iembe, isolated plesiosaur teeth and vertebrae from the Maastrichtian of Cambota, Cabinda, Barra do Dande, Ambrizete, and Bentiaba, and teeth from Fazenda dos Cavaleiros (Bero River) Neto (1964: 221) reports the occurrence of reptile teeth from the Maastrichtian of Bentiaba (former São Nicolau) and later, Cooper (1972) reported *Mosasaurus beaugei* from that locality.

South of Sumbe (formerly Novo Redondo), Lapão (1972) reported the presence of one tooth and vertebrae from Maastrichtian sediments, attributing them to *Mosasaurus* and *Plesiosaurus* respectively. Referral of Maastrichtian material to *Plesiosaurus* is doubtful since that is restricted to the Lower Jurassic (Groβmann 2007). Lapão (1972) also reported the occurrence of a mosasaur skull but it is now lost or was never collected.

Contributions on other aspects of the history of the geology and paleontology are provided by Andrade and Andrade (1957), Antunes (1964, 1970), Antunes *et al.* (1990), Nunes (1991) and Brandão (2010).

Angola's war of independence in the early 1970s, and subsequent civil war persisting until 2002, halted field research during that period. After reaching a peace agreement between the warring factions in 2002, fieldwork became feasible once more, and thus the initiation of the current research cycle. All current paleontological work is conducted under the auspices of the PaleoAngola Project, a scientific collaboraton between researchers from Universidade Agostinho Neto (Angola), Southern Methodist Universty (USA) Universidade Nova de Lisboa (Portugal), and the Natuurhistorisch Museum Maastricht (Netherlands). The current research cycle commenced in May of 2005, and has continued with expeditions in May and July 2006, July of 2007, August of 2009, February of 2010, July of 2010 and is planned for july 2011. All coastal provinces have been visited with the exception of Zaire province in the extreme northwest (Fig. 2).

Field work in Angola has been extremely productive. The first visit resulted in the discovery of a new genus and species of sea turtle, *Angolachelys mbaxi* (Mateus *et al.,* 2009), the dinosaur *Angolatitan adamastor* (Mateus *et al.,* 2011), the mosasaur *Prognathodon kianda* (Schulp *et al.*, 2008), and new specimens of the mosasaurs

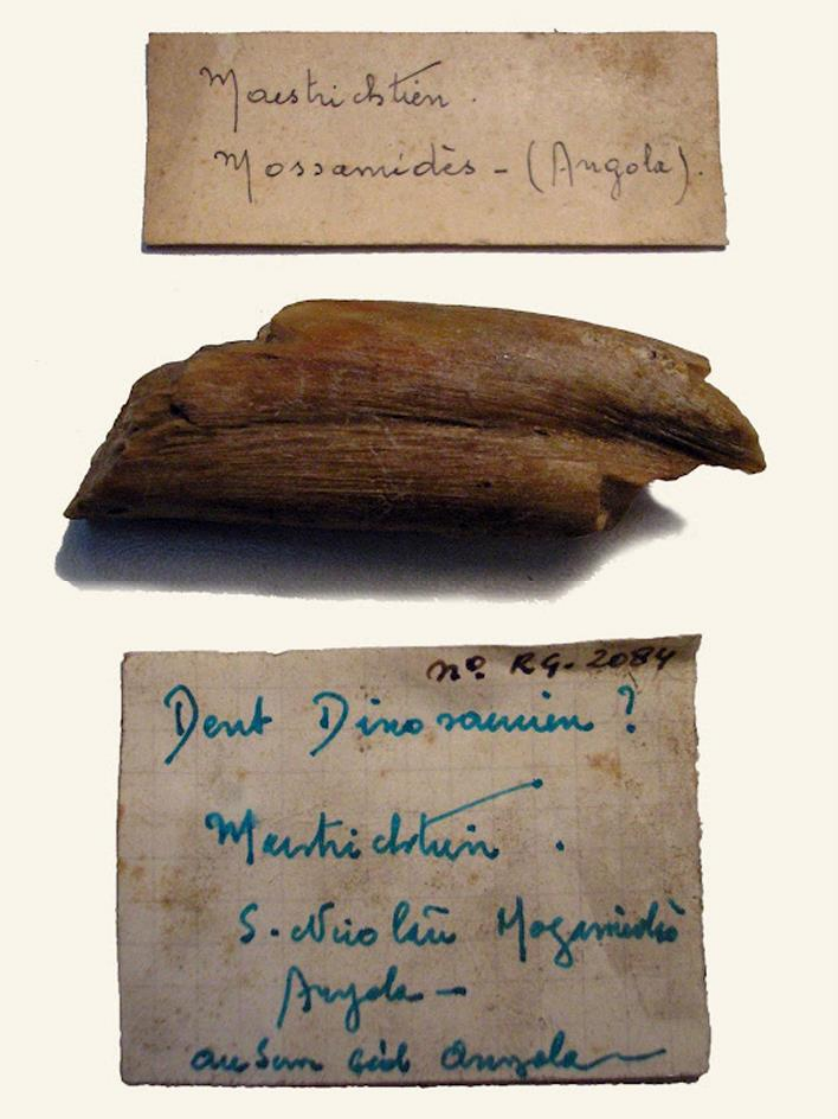

FIGURE 1.Plesiosaur rib (MRAC 2084), formely identified as dinosaur tooth by Dartevelle and Casier (1943-59).

A*ngolasaurus bocagei*, and *Tylosaurus iembensis* (Antunes 1964). Later expeditions allowed excavation of new specimens including additional forms never reported from Angola.Publication by Jacobs *et al.* (2006a, 2006b, 2009a, 2009b, 2010a, 2010b), (Polcyn *et al.*, 2007a, 2007b, 2007c, 2009, 2010), Schulp et al. (2006a, 2006b, 2008), Mateus *et al.* (2006, 2008, 2009, 2011), and Araújo *et al.* (2010) are beginning to document the richness of the Late Cretaceous amniote fauna of Angola. The Projecto PaleoAngola set of contributions represents an increase up to five high-rank clades of Mesozoic tetrapods. Prior to 2005 only the genera *Angolasaurus*, *Mosasaurus*, *Tylosaurus*, *Globidens*, and an indeterminate plesiosaur material were known. Here we report 21 different taxa. The fossils are being prepared in the laboratories of the participating institutions: ML, SMU, and NHMM (see in acronyms), where also replicas of the most important specimens will be made prior to the return of the material to University Agostinho Neto, in Luanda.

ACRONYMS

ML - Museu da Lourinhã, Portugal.
SMU - Southern Methodist University, Dallas, USA.
NHMM - Natuurhistorisch Museum Maastricht, Maastricht, The Nethertlands.
MGUAN-PA: Museu de Geologia da Universidade Agostinho Neto, Luanda, Angola (PaleoAngola Collection).
MRAC: Musée Royal d'Afrique Central, Tervuren, Belgium.

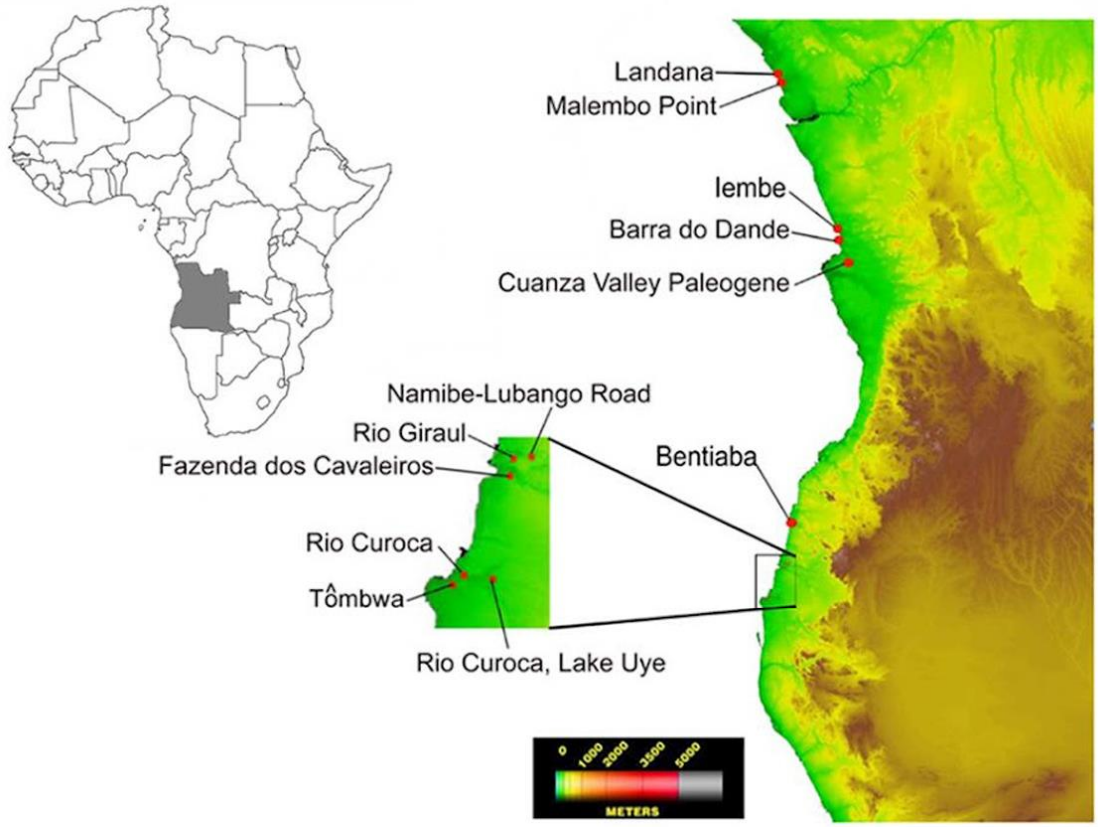

FIGURE 2. Some of the localities visited by the Project PaleoAngola team between 2005 and 2010.

MAIN CRETACEOUS AMNIOTE LOCALITIES

Projecto PaleoAngola has worked mostly in coastal marine Cretaceous rocks, obtaining abundant fishes (both Chondrichthyes and Osteichthyes, see Antunes and Cappetta, 2002), mosasaurs, plesiosaurs, and marine turtles as well as terrestrial animals including isolated bones of pterosaurs and dinosaurs and the articulated forelimb of a sauropod dinosaur (Mateus *et al.*, 2011). No mammals, amphibians, or birds have been dicovered thus far. Of the localities explored by the PaleoAngola Project (Fig. 2), two deserve special mention due to their richness: Iembe, in the province of Bengo and Bentiaba, in the province of Namibe. Being situated in the Southern Hemisphere, which has a relatively poor Late Cretacous marine vertebrate record when compared to Northern Europe, North America, and Morocco (Bardet *et al.*, 2010), add to the importance of these localities.

Iembe (Turonian)

The locality of Iembe (Fig. 2) is late Turonian in age and yielded fishes, mosasaurs, plesiosaurs and remains of a dinosaur (Fig. 3). The most productive formation in the Iembe area is the Itombe Formation (see Mateus *et al.*, 2011: Fig. 1 for the Mesozoic formations in the Cuanza Basin). This is the type locality of the mosasaurs *Angolasaurus bocagei* Antunes, 1964, *Tylosaurus iembeenses* Antunes 1964, and the turtle *Angolachelys mbaxi* Mateus *et al.*, 2009. It also yielded a forelimb of a sauropod dinosaur that represents the first non-avian dinosaur discovered in Angola, *Angolatitan adamastor* (Mateus *et al.*, 2011).

Bentiaba (Campanian-Maastrichtian)

The main vertebrate bearing layers at the locality of Bentiaba (Fig. 4) are Late Campanian and Maastrichtian in age, although older rocks are present. Most of the specimens have been collected from the mid Maastrichtian. Bentiaba is one of the most important localities for marine vertebrate fossils by virtue of the: (i) high concentration and abundance, (ii) excellent preservation, (iii) completeness and (iv) taxonomic diversity (see faunal list below). Numerous fish species (Dartevelle, 1942), at least twelve taxa of mosasaurs, three taxa of plesiosaurs, marine turtles, dinosaurs and pterosaurs are present. Hundreds of specimens have been located or collected including partial or complete skeletons and skulls, in an exposure covering less than two square kilometers. Thus far, more than 200 marine reptile specimens were and are being unearthed from a two-meter thick bonebed. Bentiaba is the type locality of

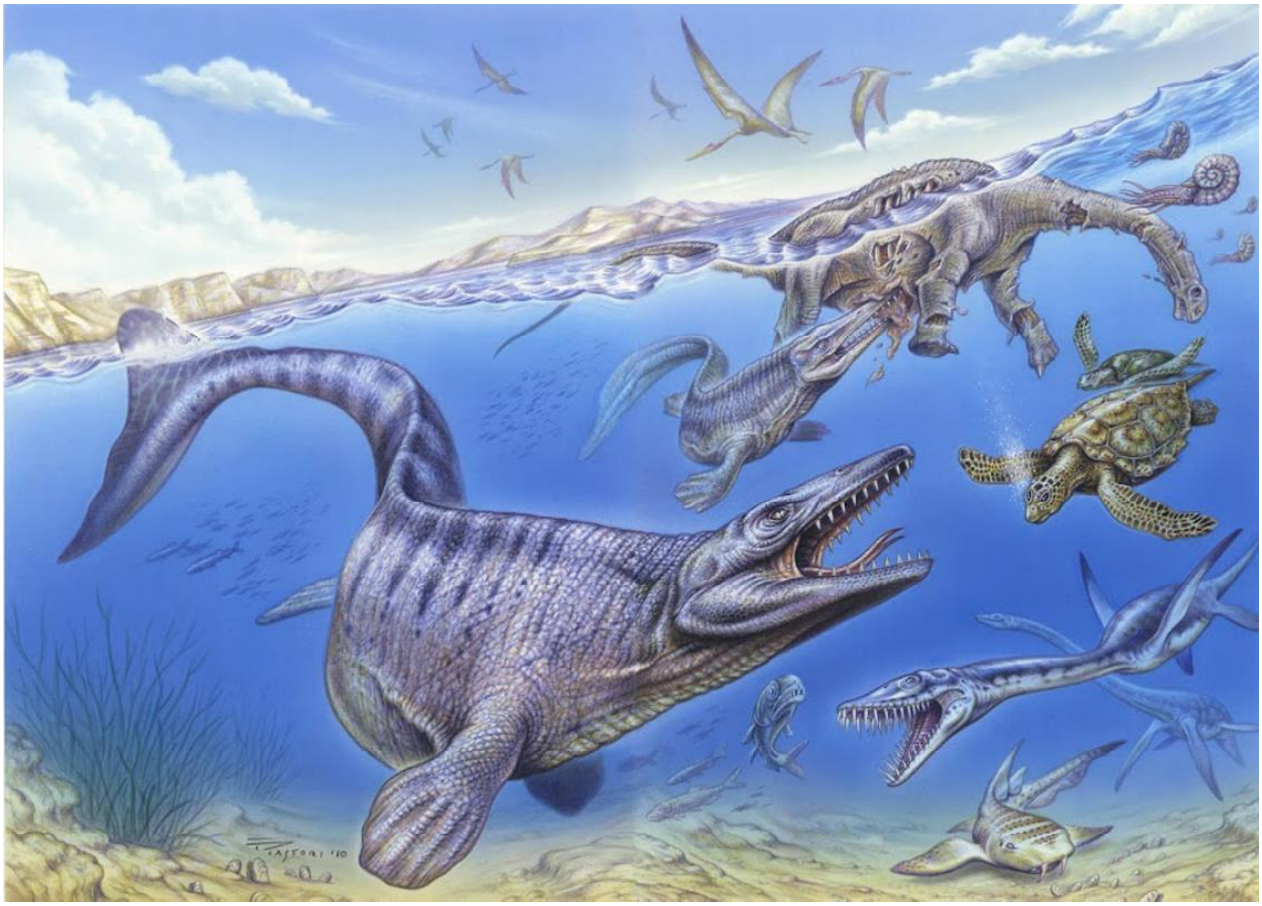

FIGURE 3. Artistic representation of the Turonian Itombe Formation fauna: the mosasaurs *Tylosaurus* and *Angolasaurus*, the dinosaur *Angolatitan*, the turtle *Angolachelys*, elasmosaur plesiosaur, the selacian *Ptychodo*n, and the bony fish *Enchodus* (artwork by Fabio Pastori).

the mosasaur *Prognathodon kianda* Schulp *et al.*, 2008 and has provided the most complete G*lobidens phosphaticus* skeletons to date (Polcyn *et al.,* 2010). Work in progress shows the occurrence of new taxa of plesiosaurs, turtles, and mosasaurs. Also several isolated bones attributed to dinosaurs were found at this locality.

The presence of such a large number of top predators in the Late Cretaceous fossil beds of Angola suggest the high primary productivity of the Benguela upwelling system (Shannon 1985) extends back to the Cretaceous (Jacobs *et al.,* 2009a,b).

SYSTEMATIC PALEONTOLOGY

CHELONIANS

Although the picture is changing quickly, chelonians are poorly known in the Cretaceous of Angola. The first taxon identified to species level was the recently described and named *Angolachelys mbaxi* (Mateus *et al.,* 2009) from the Turonian of Bengo Province. To date, all turtle remains collected in the Mesozoic of Angola are Cretaceous eucryptodirans, including angolachelonians (Mateus *et al.*, 2009), chelonioids, and a possible dermochelyid, which would be the oldest record for that clade.

Eucryptodira Gaffney, 1975
Angolachelonia Mateus *et al.*, 2009
Angolachelys mbaxi Mateus *et al.,* 2009

Material: MGUAN-PA2, nearly complete skull (Fig. 5), dentary, fragments of vertebrae, carapace, one ungual phalanx.

Locality and horizon: North of Iembe (Bengo Province), Turonian.

Comments: Angolachelonians have mandibular articulation aligned with or posterior to the occiput, and basisphenoid not visible or visibility greatly reduced in ventral view.

Basal eucryptodires and angolachelonians originated in the northern hemisphere (Mateus *et al.*, 2009), thus *Angolachelys* represents one of the first marine amniote

FIGURE 4. Panorama of the fossil locality of Bentiaba, in Namibe, Angola. Type locality of *Prognathodon kianda* and one of the richest localities for marine vertebrates in the world.

lineages to have invaded the South Atlantic after separation of Africa and South America, as shown by the phylogenetic affinities of angolachelonians (Mateus *et al.,* 2009) with marine eucryptodires from Europe and from Glen Rose in Texas (Mateus *et al.*, 2009; Vineyard, 2009; Vineyard *et al.*, 2009).

Chelonidae Bonaparte 1832
Euclastes Cope 1867
Euclastes sp.

Material: MGUAN-PA14, an incomplete anterior portion of a skull (Fig. 6) and MGUAN-PA157, a new complete skull and mandible, cervical vertebrae, peripheral plates, forelimb (collected in 2010, still mostly unprepared, Fig. 7).
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian, Mucuio Formation.
Comments: Vineyard *et al.* (2009) reported the presence of an *Euclastes*-like turtle from Bentiaba based on specimen MGUAN-PA14. Additional material collected at Bentiaba since the work of Vineyard *et al.* (2009) improves the quality of the sample of Maastrichtian angolachelonians and will allow evaluation of diversity and relationships among marine eucryptodires.
With respect to MGUAN-PA14, the ventral surface of the palate is flat, smooth and vascularized with a low marginal rim (Fig. 6). In ventral view, the premaxillae are well developed paired bones that form a large contact with the vomer and the maxilla laterally. Sutures are present that form a contact with the palatines, although part of the left palatine is missing. Orbits are anterodorsally positioned on the skull. The vomer is large and roughly rectangular in shape. The dorsal surface floors the fossa nasalis, and foramina praepalatina are present. In anterior view, the premaxillae are large, and form the ventral margin of the external narial opening. The maxilla forms the broad and posteriorly inclined margin of the nares. In lateral view the maxilla is large and forms the anteroventral margin of the fossa orbitalis. In posterior view, the vomer pillar is strong, forming the septum between the nasal passages. The posterior extent of the pillar is in line with the posterior margin of the horizontal portion of the vomer. Also in posterior view, a foramen presumed to be the foramen supramaxillare, is present on the maxilla.
Parham (2005) placed *Euclastes* among the Pancheloniidae (however, see also Jalil *et al.*, 2009 for alternate interpretation). Parham's (2005) diagnosis of the genus, based on *Euclastes wielandi* is: (1) V-shaped basisphenoid; (2) secondary palate; (3) closely positioned foramina for the exits of the anterior carotids; and (4) rod-shaped rostrum basisphenoidale, but noted a high variability within the group. *Euclastes meridionalis* has a more extensive secondary palate, *Euclastes planimenta* has a wider robust head, *Euclastes platyops* has a shallow tomial ridge, dorsally directed orbits, and non-concave triturating surface; and *Euclastes roundsi* has a less developed secondary palate. The complete skull and jaw, incomplete postcrania and carapace collected during the 2010 expedition will test and refine the attribution of these specimens to *Euclastes*.

Chelonioidea Baur, 1893
Protostegidae Cope, 1873
Protostega sp.

Material: MGUAN-PA158, two humeri, three costal plates, one xiphiplastron (Fig 8), and one peripheral plate (identified as the first or second peripheral) of a single animal.
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.
Comments: The PaleoAngola expedition of July 2010 to the Maastrichtian of Namibe Province collected bones of a very large turtle. More bones are still in the field for future excavation. The turtle is identified as a protostegid cryptodire based on its very large size (humerus length is 63 cm), fenestrated carapace, finger-like terminations and curvature of the xiphiplastron, and long and thin costal plates (e.g. Zangerl, 1953, but see Hooks, 1998, for the systematics of Protostegidae).
The long costal plate (98cm long) found in Bentiaba is virtually identical to the holotype of *Protostega dixie* (CNHM P27314) figured by Zangerl (1953: fig. 39). The xiphiplastron is long, with an acute curve of the

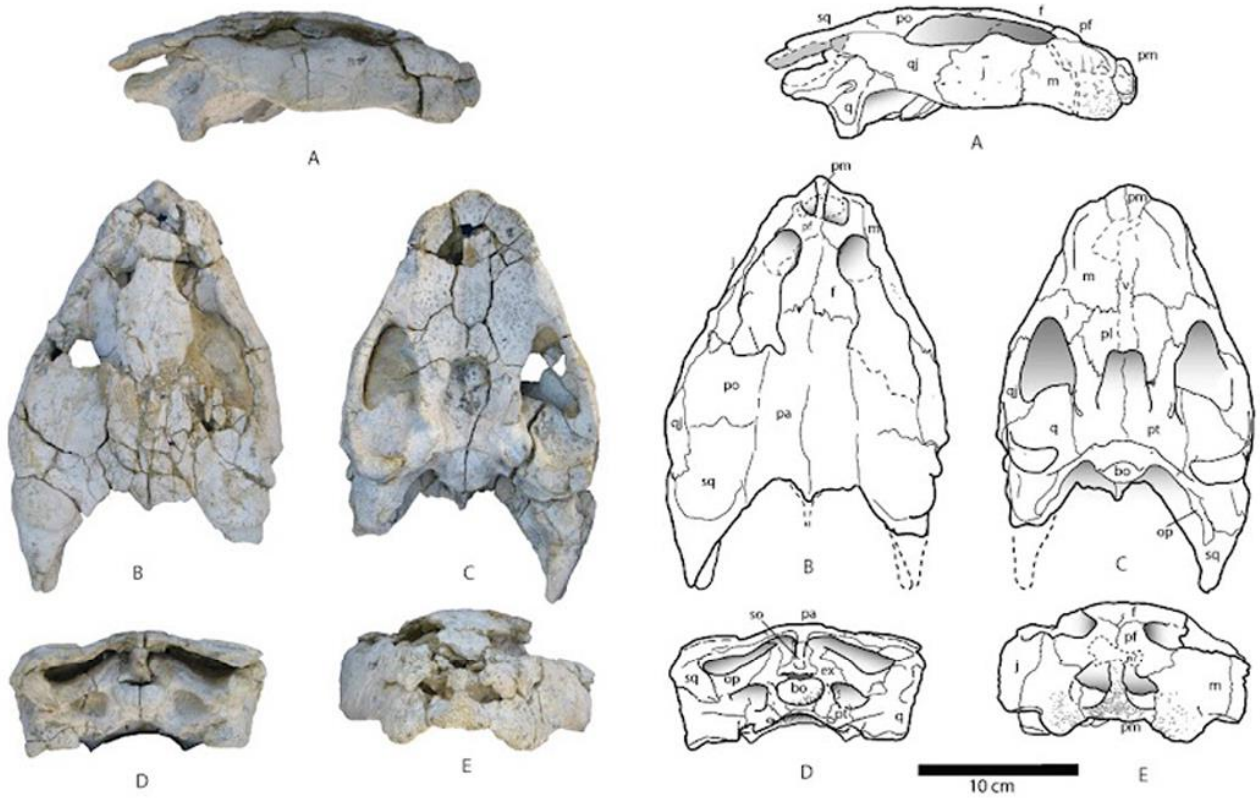

FIGURE 5. Skull (MGUAN-PA 002) of the cryptodiran turtle *Angolachelys mbaxi* Mateus et al., 2009, from the Turonian of Angola.

xiphiplastron body, forming a distinct L-shape of the lateral rim, rather than the smooth posterolateral curve for most chelonioids. The anterior end is pointed, while the posterior end is digitiform. These features are also similar to those observed in the xiphiplastron of *Protostega dixie* (see Zangler, 1953: fig. 45 and 46). The humeri show abundant bite marks, probably caused by sharks. The articular ends of the humerus are broad. The lateral process is moderately projected, not beyond the shaft edge in ventral view.

Protostegidae Cope, 1873
?*Calcarichelys*

Material: MGUAN-PA 167, neural scute (Fig. 9).
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.

Comments: An isolated bone (Fig. 9) found in Bentiaba is here identified as a neural scute, possibly from a Calcarichelys-like protostegid, which would indicate the presence of a second protostegid taxon at Bentiaba.
The base has a saddle-like shape, with the conical dorsal face culminating in an acute thorn-like structure. The bone resembles the ankylosaur osteoderms but does not have the typical keel forming a sharp point, and the edges are thin. The surface texture is smooth, contrary to the typically rugose osteoderms of thyreophorans.
Calcarichelys gemma Zangler 1953 is known from the Upper Cretaceous of Alabama (Hooks, 1998). Hooks (1998) diagnosed *Calcarichelys* by the mid-dorsal keel composed of alternating, laterally compressed conical and saddle-shaped elements. The Angolan specimen is known from the above described scute, which is not enough for a detailed attribution. It differs from *Calcarichelys* because the Angolan scute is totally conical without an elongate

FIGURE 6. Anterior portion of the skull (MGUAN-PA 014) of the cryptodiran Euclastes sp. from the Maastrichtian of Bentiaba (Namibe Province), in anterior, dorsal, lateral right, ventral, lateral left, and posterior views.

midline keel. The protostegid *Chelosphargis advena* (Hay, 1908) also has sharp scutes (see Hay, 1908: Fig. 257), but they are more keel-like and not as prominent as *Calcarichelys*.

Toxochelyidae Baur, 1896
Toxochelys sp.

Material: MGUAN-PA168, hyoplastron, peripherals and costals plates (Fig. 10).
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.
Comments: Contrary to most cheloinoids, the toxochelyids have rectangular peripheral plates without digitiform terminations, with a socket-like cavity for the rib, and often fenestrated carapace. Nicholls (1988) lists two characters as diagnostic of the genus *Toxochelys* that are visible in the Angolan material: the presence of costoperipheral fontanelles in carapace and the peripheral border smooth, without notches or serrations. The hyoplastron outline is virtually identical to that of *Toxochelys moorevellensis* (see Zangler, 1980: fig.3c). We tentatively assign this Angolan form to *Toxochelys* sp.

PLESIOSAURS

The expeditions of 2007 and 2010 yielded significant plesiosaur material. Several partial skeletons, including cranial material were collected in 2010. Although some plesiosaur vertebrae have been recovered from the Turonian of Iembe, the most productive locality for plesiosaurs is Bentiaba (Fig. 11)

Sauropterygia Owen, 1861
Plesiosauria de Blainville, 1835
Plesiosauroidea Welles, 1943
Elasmosauridae Cope, 1869
cf. *Tuarangisaurus* Wiffen and Moisley, 1986

Material: MGUAN-PA85, MGUAN-PA106, MGUAN-PA120, propodials, cervical and pectoral vertebrae and pectoral and pelvic girdle elements.
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.
Comments: Referral to this taxon is based on possession of unfaceted distal ends of the propodials, short, straight and robust propodials, presence of low longitudinal ridges

FIGURE 7. Field photograph of skull and mandible of ?Euclastes (MGUAN-PA 157) from the Maastrichtian of Bentiaba (Namibe Province).

along the distal borders of the propodials, and short and narrow ischia. The *Tuarangisaurus*-like specimens are important to better understand the phylogenetic status and the ontogeny of this genus, previously reported from Argentina and New Zealand (Gasparini *et al.,* 2003, Wiffen and Moisley, 1986).

Elasmosauridae indet.

Material: MGUAN-PA113, basicranium, MGUAN-PA126, symphyseal region of mandible, various unnumbered specimens, teeth.
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.
Comments: The recovered Elasmosauridae mandible portion is ascribed on the basis of straight dentary rami, short symphysis and presence of four symphyseal teeth. Several isolated teeth have been found ascribable to Elasmosauridae on the basis of the recurvature of the tooth crown, thin enamel, fine striae that do not anastomose, and some teeth slightly labiolingually flattened.
Antunes (1964) describes fragmentary plesiosaur material coming from coastal basins except Benguela Basin. The most complete plesiosaur remains, referred to "Cimoliasauridae", comprise twelve vertebrae and a tooth from Cambota in the Cabinda Enclave. As the "Cimoliasauridae" family is not supported in recent phylogenetic hypotheses (O'Keefe and Street 2009, Ketchum and Benson 2009) the above mentioned material should be referred to Elasmosauridae indet., following Vincent *et al.,* 2010).

MOSASAURS

With the exception of two Turonian taxa described by Antunes (1964), the mosasaur record of Angola was limited to isolated tooth crowns. Since 2005, a collection of relatively complete and well preserved material of several taxa from the late Turonian through the Maastrichtian deposits, now represents the largest collection of Southern Hemisphere mosasaurs. It also provides new information on poorly known taxa and is still producing numerous new species. Mosasaurs are the most common amniote found in all Late Cretaceous localities visited in Angola, with dozens of specimens collected to date and many more still in situ. They are also the most taxonomically diverse amniote in the Upper Cretaceous of Angola, with at least ten species identified to date.

Squamata Oppel, 1811

FIGURE 8. Xiphiplastron (MGUAN-PA 158) of the Protostegid turtle *Protostega* sp. from the Maastrichtian of Bentiaba (Namibe Province).

Mosasauridae Gervais, 1853
Mosasaurinae Gervais, 1853
Plotosaurini Russell 1967
Mosasaurus sp. aff. *M. hoffmanni* Mantell, 1829

Material: MGUAN-PA35, isolated shed teeth, complete and partial humeri.
Locality and horizon: Baba, Bentiaba, Fazenda Dos Cavaleiros (Namibe Province); middle to upper Maastrichtian.
Comments: The teeth we have referred to *Mosasaurus* are strongly D-shaped in cross section and medially recurved, with minor faceting of the otherwise smooth enamel surface. Previous discoveries of teeth of this genus from Angola have been referred to *Mosasaurus beaugei* Arambourg 1952 (Carvalho 1961, Antunes 1964), known from the Maastrichtian of Morocco; however, the isolated teeth reported here are indistinguishable from specimens of *Mosasaurus hoffmanni* from northern Europe and *Mosasaurus maximus* from North America. The European and North American forms likely represent the same species (Russell, 1967; Mulder, 1999). Fernandez *et al.* (2008) reported a contemporaneous *Mosasaurus* from the upper Maastrichtian of northern Patagonia, referring it to *Mosasaurus* sp. aff. *M. hoffmanni*.

Globidensini Russell, 1967
Prognathodon kianda Schulp *et al.,* 2008

Material: MGUAN-PA129 (holotype), MGUAN-PA128, MGUAN-PA149, MGUAN-PA150, MGUAN-PA151.

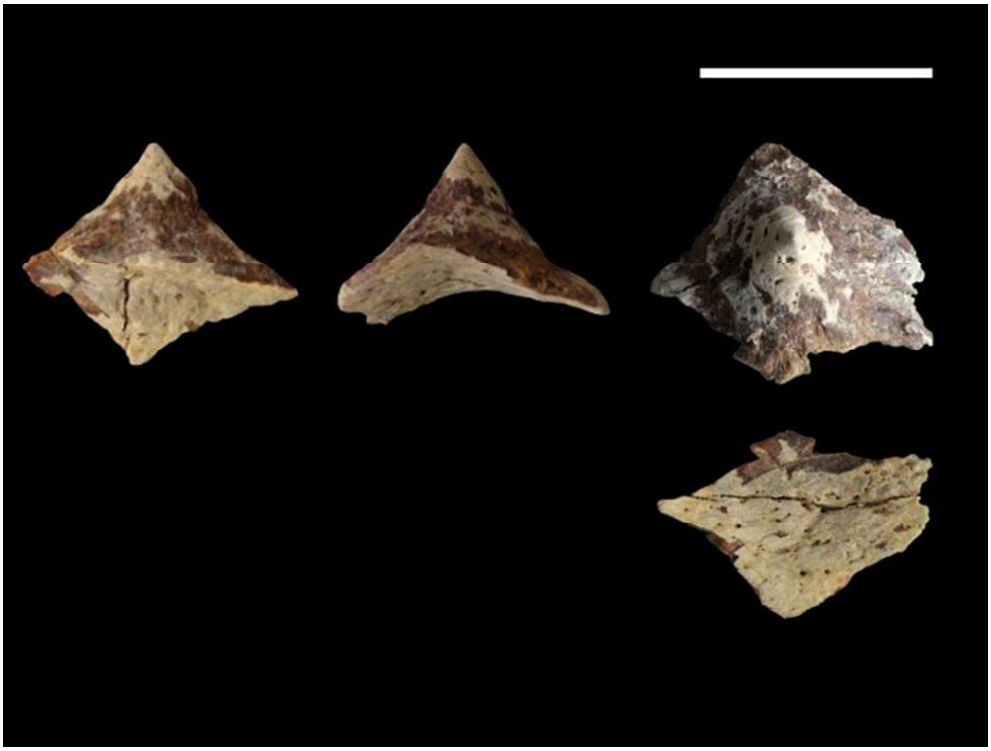

FIGURE 9. Neural plate possibly belonging to aff. Calcarichelys (MGUAN-PA 168), in lateral, axial, dorsal and ventral views. Scale bar: 10 cm.

Several specimens of different ontogenetic stages. Shed teeth, isolated bones, partial skulls and skeletons.
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.
Comments: *Prognathodon kianda* (Fig. 12 A, B, D) is the most abundant taxon at the Bentiaba locality and previous reports of *Liodon* (Antunes, 1964; Jacobs *et al.*, 2006a) from Bentiaba are referred to that taxon. A new specimen collected in 2010 consists of a largely articulated skeleton and skull, but lacks the portion of the tail posterior to the second caudal vertebra.

Prognathodon cf. *saturator* Dortangs *et al.,* 2002

Material: MGUAN-PA 169. Fragmentary dentary including tooth crown.
Locality and horizon: "Bentiaba 2" locality (Namibe Province); middle Maastrichtian.
Comments: The specimen is composed of badly weathered fragments of the right dentary (Fig. 12 C). Collectively the fragments preserve three relatively complete alveoli and a single tooth crown. The broad tooth base is elevated above the dorsal margin of the dentary. The tooth crown is extremely robust and ~60 mm in basiapical length. Albeit fragmentary and despite that the only tooth crown lacks the enamel, the specimen preserves some diagnostic characters. The bicarinate tooth is slightly recurved posteriorly, and possesses no medial curvature. It is swollen above the constricted region at its base. This combination of characters allows referral to the genus *Prognathodon* (Bell, 1997; Schulp, 2006). The only Late Maastrichtian species of *Prognathodon* possessing the robustness and proportions seen in the new specimen is *P. saturator* Dortangs *et al.*, 2002, allowing tentative referral to that taxon. This is the first report of this taxon from the South Atlantic region. Antunes (1964, plate 26, fig 4) reported a tooth from the Maastrichtian of Cabinda that he referred to Mosasauridae indet. That tooth may represent an early ontogentic stage of *P. saturator.*

Globidens phosphaticus Bardet and Pereda Suberbiola, 2005b

Material: MGUAN-PA23, MGUAN-PA24, partial skulls, vertebrae and limb material.
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian, Mocuio Formation.
Comments: *Globidens phosphaticus* was originally described and named on the basis of isolated tooth crowns from Morocco by Bardet *et al.* (2005b). Bardet (2005b) also indicated the presence of that taxon in Angola, based on illustration of an isolated tooth crown in Antunes (1964). Polcyn *et al.* (2010) reported the first skeletal material of this taxon, providing a preliminary description and

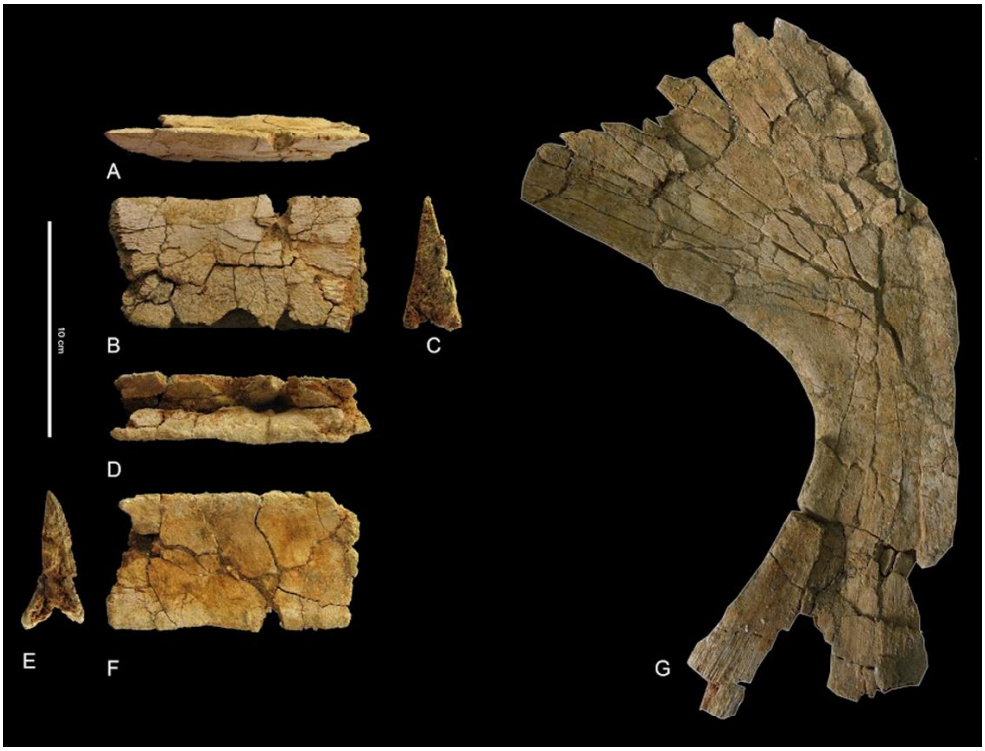

FIGURE 10. *Toxochelys* sp. from the Maastrichtian of Bentiaba: A-F, peripheral plaque; G, hyoplastron (MGUAN_PA 016).

confirming the taxonomic validity of the species. Referral of the Angolan materal to *G. phosphaticus* was on the basis of the tooth characters given by Bardet *et al.* (2005b) That study also presented character data establishing *Globidens phosphaticus* as the sister-taxon to the late Campanian *G. schurmanni* from North America.

Plioplatecarpinae Russell, 1967
Angolasaurus bocagei Antunes, 1964

Material: MGUAN-PA 001, Partial skull, MGUAN-PA 063, MGUAN-PA 065, articulated skull, partial postcrania, and nearly complete forelimbs.
Locality and horizon: Iembe (Bengo Province); upper Turonian.
Comments: The Turonian section at Iembe has yielded new material of *Angolasaurus bocagei* (Fig. 13) allowing an updated phylogenetic analysis and confirming its taxonomic validity. The phylogenetic analysis supports *Angolasaurus* as the sister-taxon of *Selmasaurus*, and along with *Ectenosaurus*, form a clade that apparently diverged from the *Platecarpus-Plioplatecarpus* lineage in the Turonian (Polcyn and Everhart, 2008; Polcyn *et al.,* 2009).

"Platecarpus" ptychodon Arambourg, 1952

Material: MGUAN-PA 160 Two partial skulls and skeletons including limb material, isolated tooth crowns.
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.
Comments: This species was erected by Arambourg (1952) on the basis of isolated tooth crowns from the Maastrichtain phosphates of Morocco. Antunes (1964) reported isolated tooth crowns (Antunes, 1964; plate XXVI figures 11 and 11a) that he referred to the same taxon. The new specimens collected in 2010 represent most of the skull elements, the presacral vertebral column, and the pectoral girdle and forelimb. The new material does not support referral to the genus *Platecarpus,* or any named genus of mosasaur.

Tylosaurinae Williston, 1895
Tylosaurus iembeensis Antunes 1964

Material: MGUAN-PA64, fragmentary skull elements.
Locality and horizon: Iembe (Bengo Province); upper Turonian.
Comments: *Tylosaurus iembeensis* remains poorly known and the holotype was lost in a fire in Lisbon (Jacobs *et al.,* 2006); however, a fragmentary new specimen has been recovered. The preserved quadrate has a poorly developed infrastapedial process, similar to that seen in *T. kansasensis,* suggesting a relatively basal divergence within Tylosaurinae. However, *T. iembeensis* is significantly larger than *T. kansasensis*, approaching the size of *T. nepaeolicus* and *T. proriger*.

FIGURE 11. Field photograph of an Elasmosauridae plesiosaur left pelvic girdle and hindlimb in ventral view from the Maastrichtian of Bentiaba, Angola

Halisaurinae Bardet *et al.*, 2005a
Halisaurus sp.

Material: MGUAN-PA18, Two partial skeletons including many elements of the skulls, vertebrae, ribs, and limb.

Material, MGUAN-PA 83, fragmentary skull found with a single vertebrae.
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.
Comments: These specimens (Fig. 14 A and B) will be described and named elsewhere; however, preliminary phylogenetic analysis supports its referral as a new species, closely related to *Halisaurus arambourgi* and *H. platyspondylus* (Polcyn *et al.,* 2007a).

Phosphorosaurus sp.

Material: MGUAN-PA52, isolated partial frontal.
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.
Comments. This isolated partial frontal (Fig. 14 C and D) allows description and comparison with the type material of *Phosphorosaurus ortliebi* from the Maastrichtian of Belgium (IRSNB R34). The frontal is damaged, missing a small portion of the posterior border, the posterolateral edges, and a significant portion anteriorly. The lateral margins, dorsal and ventral surfaces are largely intact. MGUAN-PA52 belongs to a relatively small animal, the frontal measuring 35 mm wide at its widest point anterior to the orbits, and 61 mm long as preserved, thus it belongs to an individual that was approximately 1.5 to 2 meters long.
The dorsal surface bears a strong, tall median ridge along the entire length of the frontal, terminating posteriorly in a prominent triangular boss. There is a significant supraorbital constriction, the preserved lateral margins are strongly convex antorbitally. The dorsal surface is striated, with strong longitudinal ridges near the midline, and more laterally, weaker ridges occur, radiating anterolaterally to meet the lateral margins. Ventrally, the frontal has a broadly open olfactory canal, the descending processes are prominent, forming blunt parallel ridges anteriorly and grading to finer narrow ridges interorbitally, where they trend toward but do not meet the midline, then diverge as low blunt ridges posteriorly. Two sulci are present on this posterior portion, corresponding to the structures labeled by Russell (1967, his text-figure

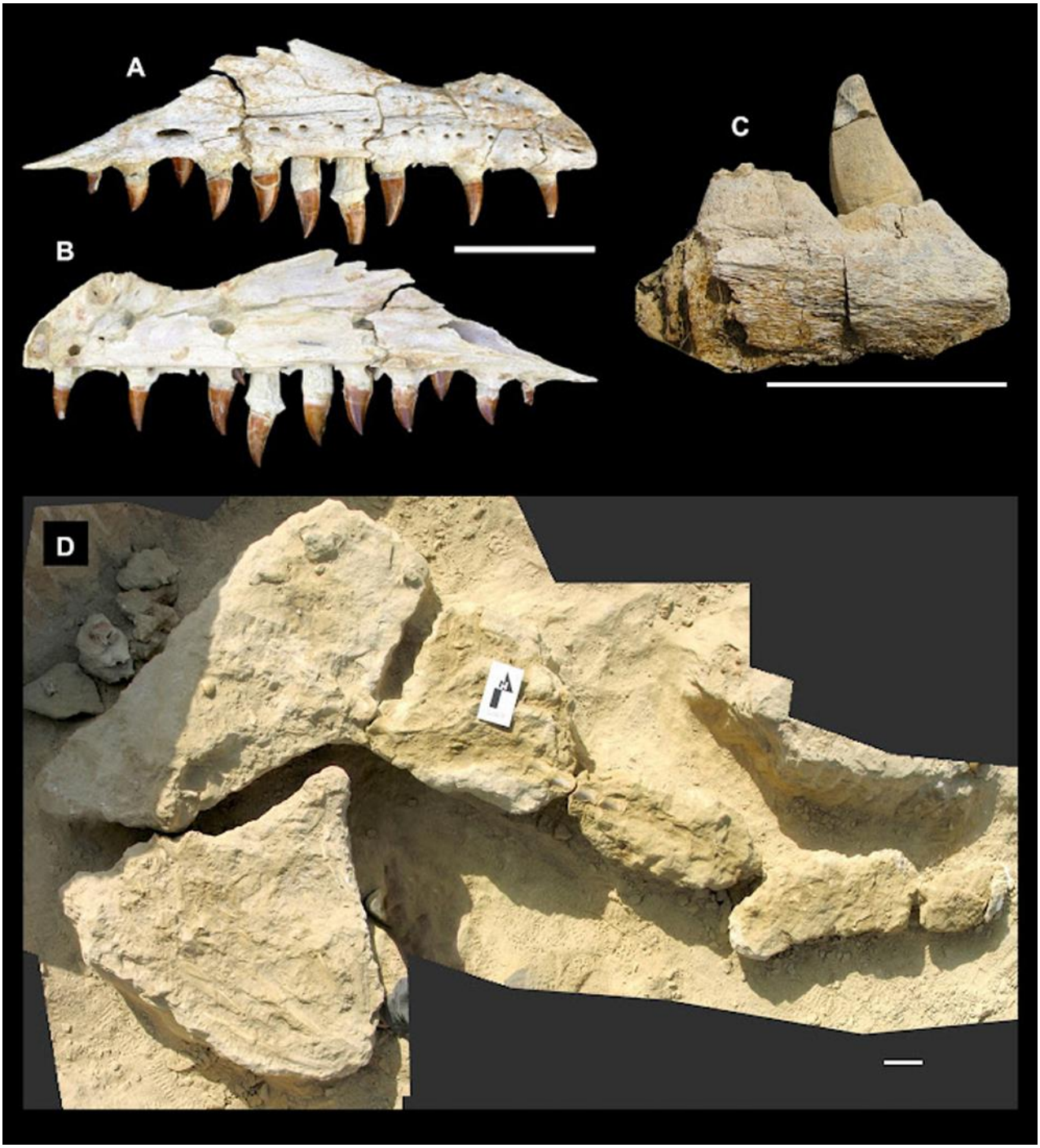

FIGURE 12. Select examples of *Prognathodon* specimens. Right maxilla of the holotype of *P. kianda* MGUAN-PA 129 in (A) lateral, and (B) medial views; Fragment of (C) specimen of *P.* cf. *saturator* MGUAN-PA 159 in right lateral view; photomosaic of an articulated specimen of *P. kianda* excavated during the 2010 field season. All from the Maastrichtian of Bentiaba, Namibe Province. Scale bars = 10 cm.

FIGURE 13. Skull of the mosasaur *Angolasaurus bocagei* from the Turonian of Iembe, Angola.

FIGURE 14. Right quadrate of *Halisaurus novum* sp. from the Maastrichtian of Bentiaba in (A) lateral and (B) medial views; *Phosphorosaurus* sp. from the Maastrichtian of Bentiaba in (C) dorsal and (D) ventral view; *Halisaurinae* n. gen. novum sp. from ?Santonian of Iembe, (E-G) Caudals, (H) dorsal, and (I) cervical vertebrae in right lateral, dorsal, ventral and posterior views. Scale bars = 5 cm.

FIGURE 15. Left femur (MGUN-PA163) of pterosaur (possible ornithocheiroid) from the Maastrichtian of Angola.

4) as accommodating the cerebral hemispheres. The articulation for the postorbitofrontal is missing due to breakage. The prefrontal articulation is only weakly developed antorbitally, slightly incising the lateral surface of the descending processes and forming a simple, fibrous lap-joint with ventral surface of the frontal but with no corresponding excavation.

Phosphorosaurus ortliebi was described and named by Dollo (1889) and subsequently redescribed and referred to the genus *Halisaurus* by Lingham-Soliar (1996). Some characters do unite *Phosphorosaurus* with *Halisaurus*, including the configuration of the quadrate but significant differences also exist, warranting retention of Dollo's (1889) genus (Polcyn *et al.*, in press). These include the strong median ridge along the entire length of the dorsal surface, terminated posteriorly by a triangular boss and the pineal foramen location on the frontoparietal suture. A weak posteriorly placed triangular boss is visible in *H. platyspondylus* and *H. arambourgi*, but in those taxa, the median ridge is restricted to the anterior part of the frontal and the pineal foramen rests within the parietal table (Holmes and Sues, 2000; Bardet *et al.*, 2005a).

Halisaurinae sp.

Material: MGUAN-PA 070 Cervical vertebra, two dorsal vertebrae and four caudal vertebrae (Fig. 14 E - I).

Locality and horizon: Iembe (Bengo Province); ?Santonian.

Comments: The four caudal vertebrae were found together and two are still articulated. The remaining vertebrae were found as isolated specimens. The single cervical vertebra (Fig. 14 I), is an axis and has an oblique intervertebral articulation, a broadly oval condyle, and relatively large hypapophysis. The dorsal vertebra (Fig. 14 H) bears an oblique intervertebral articulation, has a weak constriction anterior to condyle, its condyle is wider than high, and the synapophyses originate anteriorly. The caudals (Fig. 14 E, F and G) have a roughly symmetrical hexagonal condyle, relatively large haemal arches, a ventral sulcus between haemal arch bases, and large prezygopophyses. Although

FIGURE 16. Artistic reconstruction of *Angolatitan* sauropod dinosaur, in the Cretaceous coast of Angola (artwork by Karen Carr).

no cranial material has been collected, the combination of characters present in the vertebral elements supports the referral to the Halisaurinae (Polcyn *et al.*, 2009). This specimen is diminutive and judging from the size of individual centra, would have been no more than about 1.5 meters in length. It represents the oldest halisaurine outside North America and presuming the Santonian date as reliable, is approximately as old as the holotype of *Eonatator sternbergi* (See Bardet *et al.,* 2005a) from the Santonian of Kansas.

PTEROSAURS

So far, pterosaur remains have only been recorded from the Maastrichtian of Bentiaba. Several bones were collected, mainly incomplete and isolated. Here we present the preliminary data on the first report for pterosaurs in Angola.

Pterosauria Kaup 1834
Pterodactyloidea Plieninger 1901
Ornithocheiroidea Seeley 1876

Material: Left femur (MGUN-PA163; Fig. 15).
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.
Comments: Attribution of this specimen to the Ornithocheiroidea is due the femoral head with distinct stout neck and steeply directed caput (see Unwin, 2003: character 38). However, this referral is tentative.

DINOSAURS

Dinosaurs were unknown in Angola until the publication of *Angolatitan adamastor* Mateus *et al.*, 2011. Here we report two additional bones from Bentiaba (Mocuio Formation, middle part of the Maastrichtian) belonging to distinct individuals. Material includes the distal end of a propodial element and a phalanx.

Dinosauria Owen, 1842
Saurischia Seeley, 1888
Sauropoda Marsh, 1878
Eusauropoda Upchurch, 1995
Neosauropoda Wilson and Sereno, 1994
Somphospondyli Wilson and Sereno, 1998
Angolatitan adamastor Mateus *et al.,* 2011

Material: MGUAN-PA3. The only material known is the forelimb and scapular girdle, including the scapula, humerus, ulna, radius, and metacarpals I, III, and IV.
Locality and horizon: North of Iembe (Bengo Province); Turonian.
Comments: A forelimb of the sauropod dinosaur *Angolatitan adamastor* Mateus *et al.,* 2011 (Fig. 16) from the late Turonian of Iembe, represents the first dinosaur

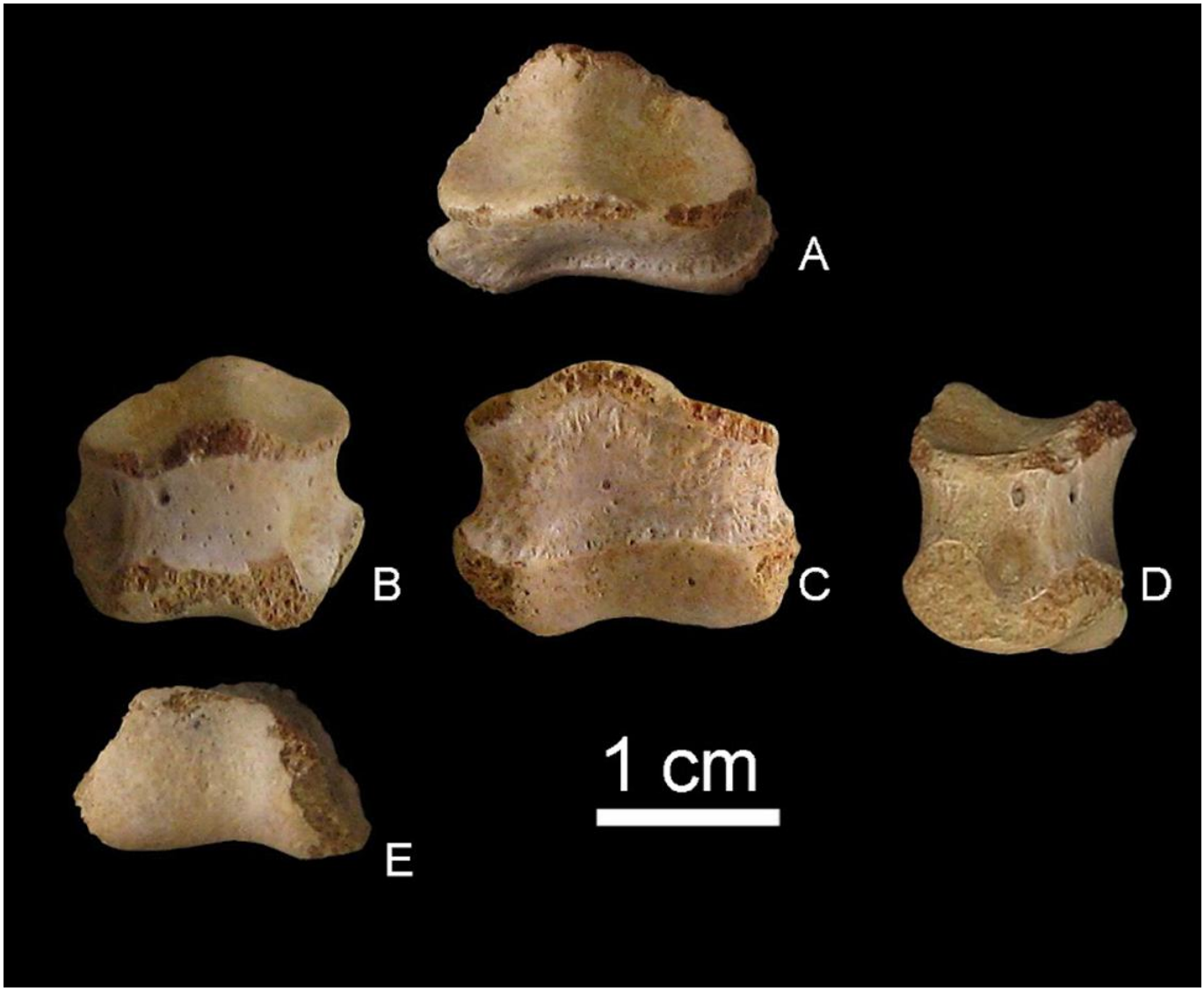

FIGURE 17. Left pedal phalanx II-2 (MGUAN-PA 176) of Hadrosauroidea dinosaur from the Maastrichtian of Angola, in proximal (A), dorsal (B), ventral (C), medial (D), and distal (E) views.

discovery in Angola, and is one of the few occurrences of sauropod dinosaurs in sub-Saharian Africa with a reliable geochronological dating. The marginal marine sediments yielding the specimen are reported to be late Turonian in age (see more on the geology of Iembe in Antunes, 1964, Jacobs *et al.*, 2006), thus it is a non-titanosaurian sauropod in sub-Saharian Africa at a time supposed to be dominated by titanosaurians. Moreover, *Angolatitan adamastor* is the only basal somphospondyl known in the late Cretaceous, which implies the existence of relict forms in Africa.

Angolatitan is more derived than *Giraffatitan* but less derived than *Euhelopus*, which is notable given its relatively late appearance in the sauropod fossil record. Its habitat is thought to have been an arid setting.

Ornithopoda Marsh, 1881
Iguanodontia Baur, 1891
Hadrosauroidea Sereno, 1986

Material: MGUAN-PA 176, a single phalanx (Fig. 17).

Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.

Comments: A single isolated phalanx from Bentiaba is here interpreted as the left pedal phalanx II-2 of an ornithopod, due to the proximodistal short proportion, presence of two assymetrical distal condyles and proximal pits, and trapezoidal outline in distal view. Is not considered a theropod due to the lack of pneumatic cavity, shallow colateral pits and being wider than it is

long. The ventro-lateral and ventro-medial margins have a expanded lip, which is seen in the pedal phalanx II-2 of hadrosaurs but unsual in other dinosaurs. Prieto-Márquez and Wagner (2009: character 295) consider that length/width proportions of pedal phalanx II2 (http://www.morphbank.net/Show/?id=461032) subsquared, only slightly shorter proximodistally than it is wide mediolaterally is seen in *Ouranosaurus nigeriensis* and Hadrosauroidea, as *Probactrosaurus* spp., *Bactrosaurus johnsoni*, *Gilmoreosaurus mongoliensis*, *Lophorhoton atopus*, and Saurolophinae, but not in Lambeosaurinae (except for *L. lambei*). Therefore, although this is not an unambigous synapomorphy, it is more distributed in non-lambeosaurine hadrosauroids.
The Hadrosauroidea clade is not known in the fossil record of Africa, so if this interpretation is correct, this phalanx represents the possible first Hadrosauroidea in that continent.

Dinosauria indet.

Material: MGUAN-PA 175, distal part of ?humerus.
Locality and horizon: Bentiaba (Namibe Province); middle Maastrichtian.
Comments: The specimen is the distal end of a large propodial, likely a humerus. Collected in 2010, the specimen is unprepared and identification is preliminary. Assignment to Dinosauria is based on its large size, well formed distal condyles, and long shaft. The very thick medullary region excludes the possibility it belongs to a theropod dinosaur.

Associated fauna (Chondrichthyes, Osteichthyes, and invertebrates)
Although the associated fauna (Chondrichthyes, Osteichthyes and invertebrates) is outside the focus of this article, the Mesozoic of Angola has proven to be very productive of some clades, namely on the Chondrichthyes and marine molluscs.
In Appendix 1, we provide the compilation of Mesozoic fossil animal species (excluding amniotes), with the systematic, chronostratigraphic and geographic data, and bibliographic source, compiled using the available scientific publications, including geological maps explanations and recent PhD theses (for example, Tavares, 2006). We recognize that much of the taxonomy might require revision, so we have excluded reports that seem doubtful and pre-1960 citations of genera not existing in the Paleobiology Database (www.paleodb.org). That decision reduces the list of taxa, but guarantees that most taxonomy is updated. This should be seen as a historical list of species reported to Angola.
To date, over 700 animal species have been reported from the Cretaceous of Angola. Over 80% of those taxa is represented by molluscs, mainly ammonites, which represent around 70% of the total mollusca species. Ammonites alone provide more than half of the taxa found and were as such an important component of the Angolan Late Cretaceous marine ecosystem.
More than fifty species of Chondrichthyes have been reported in the literature (Antunes and Cappetta, 2002) and represent the most diverse vertebrates in the study area. Other important groups include the Osteichthyes, with 18 species, and the Echinodermata with 60 taxa.

Summary taxa checklist.

Checklist of the Mesozoic amniotes of Angola (see Appendix 1 for invertebrates and non-amniote vertebrates list):

Chelonia
- Eucryptodira
  - Angolachelonia
    - *Angolachelys mbaxi* Mateus *et al.,* 2009 (Turonian)
    - ?*Euclastes* sp. (middle part of the Maas trichtian)
  - Protostegidae
    - *Protostega* sp. (middle Maastrichtian)
    - Protostegidae indet aff. *Calcarichelys* (middle part of the Maastrichtian)
  - Toxochelyidae
    - *Toxochelys* sp. (middle Maastrichtian)

Plesiosauria
- Plesiosauroidea
  - cf. *Tourangisaurus* (middle part of the Maastrichtian)
  - Elasmosauridae indet. (middle part of the Maastrichtian)

Squamata
- Mosasauridae
- Mosasaurinae
- Plotosaurini
  - *Mosasaurus* sp. aff. *hoffmanni* Mantell 1829 (middle part of the Maastrichtian-late Maastrichtian)
- Globidensini
  - *Globidens phosphaticus* Bardet and Pereda Suberbiola, 2005b (middle part of the Maastrichtian)
  - *Prognathodon kianda* Schulp *et al.,* 2008 (Maastrichtian)
  - *Prognathodon* cf. *saturator* Dortangs *et al.* 2002 (Maastrichtian)
- Plioplatecarpinae
  - *Angolasaurus bocagei* Antunes, 1964 (Turonian)
  - "*Platecarpus*" *ptychodon* Arambourg, 1952 (Maastrichtian)
- Halisaurinae
  - *Halisaurus* sp. (Maastrichtian)

Phosphorosaurus sp. (Maastrichtian)
Halisaurinae indet. (Santonian)
Tylosaurinae
Tylosaurus iembeensis Antunes 1964 (Turonian)
Pterosauria
Ornithocheiroidea
Ornithocheiroidea indet. (middle part of the Maastrichtian)
Dinosauria
Sauropoda
Angolatitan adamastor Mateus *et al.,* 2011 (Turonian)
Dinosauria indet. (middle part of the Maastrichtian)

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APPENDIX 1. List of non-amniotes (anthozoans, brachiopods, molluscs, echinoderms, arthropods and fishes) from the Mesozoic of Angola.

This list represents the historical reports of the Mesozoic Angolan fauna (see criteria in the text). There was an attempt for taxonomical updates but revision may be required in most groups, which was out of the scope of this article. Therefore, this list should be regarded critically.

B: Benguela Basin; Cb: Cabinda Basin; Cs: Cassange Basin K: Kwanza Basin; N: Namibe Basin; C: Congo Basin.

Anthozoa

The only Anthozoa species in this list was reported in Galvão (1972).

Scleractinia: Astrocoeniidae

Astrocoenia koninckí (upper Albian; B)

Brachiopoda

The only Brachiopoda species is mentioned both in Galvão (1972) and Lapão (1971).

Rhynchonellata: Terebratulidae

Terebratula depressa Lamarck, 1819 (upper Albian; B)

Mollusca

Acera thevestensis (Coquand 1862) (upper Albian; B)
*Acera choffat*i Rennie 1945 (Senonian; B)

Mollusca- Bivalvia

For the Bivalvia references are Antunes (1964), Araújo & Guimarães (1992), Borges (1946), Carvalho (1961), Cooper (1972, 1974, 1978), Galvão (1972), Howarth 1965, Lapão (1971, 1972), Neto (1964), Rennie (1929), Soares (1965). Some species were taken from the Paleobiology Database.

Arcoida: Arcidae

Arca (Senilia) senilis (Linnaeus, 1758) (upper Albian; B)
Arca sp. 1758 (lower to upper Albian; B and N)

Arcoida: Cucullaeidae

Pseudocucullaea lens Solger, 1903 (Albian to Campanian; N)

Arcoida: Glycymerididae

Trigonarca aff. *galdrina* d'Orbigny 1871 (Cretaceous; N)
Trigonarca angolensis Rennie, 1929 (Coniacian to Maastrichtian; N)
Trigonarca camerunensis Riedel, 1932 (Cretaceous; N)
Trigonarca cf. *diceras* (Seguenza, 1882) (upper Albian; B and K)
Trigonarca cf. *ligeriensis* d'Orbigny, 1844 (Albian; B)
Trigonarca cf. *trichinopolitensis* (Forbes, 1846) (Coniacian to Campanian- Maastrichtian; N)

Arcoida: Parallelodontidae

Nemodon natalensis (Baily, 1855) (Campanian; N)
Grammatodon aff. *carinatus* (Sowerby, 1813) (Cretaceous; N)

Carditoida: Astartidae

Astarte sp. Sowerby, 1816 (Albian; K)
Nicaniella (Nicaniella) aff. *trigonoides* (Stoliczka, 1871) (Cretaceous; N)

Carditoida: Carditidae

Cardita beaumonti d'Archiac & Haime, 1854 (Maastrichtian; N)
Cardita cf. *beaumonti* d'Archiac & Haime, 1854 (Senonian; B)
Cardita barroneti Munier-Chalmas, 1881 (Senonian; N)
Glyptoactis (Baluchicardia) *ameliae* Peron 1936 (Maastrichtian; B)
Venericardia nauliensis Cox, 1952 (Senonian; N)

Carditoida: Crassatellidae

Crassatellites sp. Krueger, 1823 (Cretaceous; B)
Crassatella numidica Munier-Chalmas, 1881 (Maastrichtian; N)

Heterodonta: Poromyidae

Liopistha (Psilomya) corrugata Woods, 1828 (Campanian; N)

Limoida: Limidae

Lima (Mantellum) sp. (Campanian-Maastrichtian; N)
Lima (Plagiostoma) grenieri (Coquand, 1862) (Turonian to Campanian; N)

Myoida: Corbulidae

Corbula elegans Sowerby, 1827 (Coniacian; N)
Corbula truncata Sowerby, 1836 (upper Cretaceous; N)

Mytiloida: Mytilidae

Lithodomus sp. Cuvier, 1817 (Cretaceous; N)
Modiolus typicus concentrica Dartevelle, 1957 (Cenomanian to upper Senonian; N)
Perna sp. Retzius, 1788 (upper Aptian; K and N)
Volsella sp. Scopoli, 1777 (Albian; B)

Nuculoida: Nuculidae

Acila (Truncacila) bivirgata (Sowerby, 1836) (upper Albian; B)
Nucula aff. *antiquata* Sowerby 1825 (upper Albian; B)

Pectinoida: Pectinidae

Camptonectes virgatus Nilsson, 1827 (Coniacian; N)

Pecten curvatus Geinitz, 1843 (Cretaceous; N)
Neithea quadricostata Sowerby, 1814 (Albian; B)
Neithea quinquecostata Sowerby, 1814 (Albian; B)
Pecten sp. Müller (1776) (upper Albian; B)
Neithea aequicostata (Lamarck, 1819) (upper Albian to Turonian?; B)
Neithea tricostata Coquand (Albian to Cenomanian; B and K)
Neithea angoliensi Newton, 1916 (Albian; B)
Neithea shawi Pervinquière (middle part of the Albian to upper Albian; B)
Neithea salinasensis Rennie, 1930 (Senonian; N)
Eopecten studeri (Pictet and Roux) (upper Albian; B)
Pectinoida: Plicatulidae
Plicatula cf. *jerryi* Coquand (Turonian to Maastrichtian; N)
Plicatula ferryi Coquand, 1862 (Cretaceous; N)
Plicatula instabilis Stoliczka, 1871 (Cretaceous; N)
Plicatula sp. Lamarck (1801) (upper Albian to Turonian?; B and K)
Pectinoida: Spondylidae
Spondylus angolensis Rennie, 1929 (Cretaceous; B)
Pholadomyoida: Laternulidae
Cercomya gurgitis Pictet & Campiche, 1865 (upper Albian; B)
Pholadomyoida: Pholadomyidae
Pholadomya aff. *tigris* Noetling (Senonian; K)
Pholadomya pleuromyaeformis Choffat (lower Aptian to Albian; B and N)
Pholadomya vignesi Latet, 1877 (upper Albian; B)
Pterioida: Gryphaeidae
Exogyra (Costagyra) olisiponensis Sharpe, 1850 (Cenomanian- Turonian; B, K and N)
Exogyra aff. *olisiponensis* Sharpe,1850 (upper Albian?; B)
Exogyra cf. *conica* Sowerby, 1813 (Albian; K)
Exogyra cf. *flabellata* (Goldfuss, 1833) (Albian; B)
Exogyra ostracina Lamarck, 1801 (Aptian- Albian;B and N)
Exogyra overweigide Buch (upper Albian; B)
Pycnodonta cf. *vesicularis* Lamarck, 1806 (upper Albian; B)
Pycnodonta flicky Pervinquiére (Senonian; B)
Pycnodonta vesicularis Lamarck, 1806 (Cenomanian-Turonian; B)
Rhynchostreaon cf. *suborbiculutum* (Lamarck, 1801) (Cenomanian; N)
Rhynchostreon cf. suborbiculatum Cooper, 1972 (upper Cenomanian; N)
Rhynchostreon suborbiculatum Cooper, 1972 (upper Cenomanian- lower Turonian; N)

Pterioida: Inoceramidae
Inoceramus expansus Baily, 1855 (Maastrichtian, Senonian; B)
Inoceramus regularis d'Orbigny, 1842 (Campanian/ Maastrichtian; K)
Inoceramus sp. (Cenomanian to Senonian; B, N and K)
Tethyoceramus madagascariensis Heinz, 1933 (Maastrichtian; B)
Pterioida: Isognomonidae
Isognomon neivai Soares, 1965 (Senonian (Campanian?); N)
Pterioida: Ostreidae
Lopha cf. *diluviana* Linnaeus, 1767 (upper Albian; B)
Lopha cf. *lombardi* Freneix (Santonian to Campanian; N)
Lopha syphax Coquand, 1854 (upper Albian; B)
Ostrea baylei, Guer (Cenomanian- Turonian?; B)
Ostrea szajnochai Choffat (Cenomanian- Turonian?; B and N)
Pycnodonte (Pycnodonte) biauriculatum (Lamarck, 1819) (Albian; K)
Pterioida: Pinnidae
Pinna cf. *robinaldina* d'Orbigny, 1844 (Cenomanian ?; B)
Pinna petrina White, 1874 (Cretaceous; N)
Pterioida: Pteriidae
Avicula sp. Bruguière (1791) (Cretaceous; N)
Trigonioida: Trigoniidae
Pterotrigonia (Acanthotrigonia) shepstonei (Griesbach, 1871) (Senonian (Campanian?); N)
Pterotrigonia (Scabrotrigonia) cf. *scabra* (Lamarck, 1819) (Cretaceous; N)
Pterotrigonia (Scabrotrigonia) scabra (Lamarck, 1819) (Campanian; N)
Trigonia (Scabrotrigonia) borgesi Rennie (Senonian; B)
Trigonia (Scabrotrigonia) shepstonei Griesbach, 1871 (Campanian-Maastrichtian; N)
Trigonia af. *spinosa* Parkinson, 1811 (Cretaceous; N)
Trigonia aliformis (Parkinson) Roemer, 1849 (Cretaceous; N)
Trigonia scabra Lamarck, 1819 (Coniacian; N)
Trigonia sp. Bruguière, 1789 (Aptian to Albian; B)
Veneroida
Agelasina plenodonta Riedel, 1932 (Conacian to Maastrichtian; N)
Veneroida: Arcticidae
Cyprina (Venilicardia) cf. *barrosi* Coquand (Coniacian; N)
Cyprina sp. Schumacher (1817) (Cretaceous; K)
Veniella drui Munier-Chalmas, 1881 (Turonian to Maastrichtian; B and N)
Veniella forbesiana Stoliczka, 1871 (Cenomanian to Maastrichtian; B and N)
Venilicardia odonnelli Rennie 1945 (Maastrichtian; B)
Veneroida: Cardiidae
Cardium sp. Linnaeus, 1758 (Cretaceous; B)
Cardium (Trachycardium) reynoldsi Rennie, 1929 (Senonian; B and N)
Cardium cf. *gentianum* Sowerby, 1796 (upper Albian; B)
Cardium hillanum Sowerby, 1813 (Cretaceous; N)
Granocardium (Granocardium) productum Sowerby, 1832 (Albian to Campanian; N)
Granocardium (Granocardium) reynoldsi (Rennie) (Cenomanian to Maastrichtian; B and N)
Integricardium aphaeroideum Forbes (upper Albian; B)

Globocardium cf. *sphaeroideum* Forbes, 1845 (upper Aptian; B)
Globocardium Integricardium sphaeroideum Forbes, 1845 (upper Albian; B)
Protocardia cf. *hillana* Sowerby, 1813 (upper Albian; B)
Protocardia hillana Sowerby, 1813 (Cenomanian; K and N)
Protocardia moutai Rennie, 1940 (Senonian; B)
Veneroida: Lucinidae
Lucina angolensis Rennie, 1929 (Cretaceous; B)
Lucina egitoensis Rennie, 1940 (Senonian; B)
Lucina reineckei Rennie, 1929 (Cretaceous; K)
Veneroida: Tellinidae
Tellina (Palaeomorea?) sp. Linnaeus, 1758 (Campanian; N)
Veneroida: Thyasiridae
Thyasira cretacea Whiteaves, 1903 (Maastrichtian, Senonian; B)
Veneroida: Veneridae
Aphrodina (Mesocallista) cf. *andersoni* Newton (lower Albian; N)
Trigonocallista umzambiensis (Woods) (Cenomanian? to Campanian- Maastrichtian; N)
Venus plana Sowerby, 1812 (Coniacian; N)

Mollusca - Cephalopoda

The Cephalopoda, including the numerous ammonite species, were taken from Antunes (1964), Antunes & Cappetta (2002), Araújo & Guimarães (1992), Borges (1946), Carvalho (1961), Cooper (1972, 1974, 1978, 1988), Dartevelle & Casier (1941), Galvão (1972), Haas (1942, 1943) Howarth (1965, 1966, 1985), Lapão (1971, 1972), Jacobs (2006a), Nunes (1991), Tavares (2005) and Tavares, Meister, Duarte-Morais, & David (2007).

Ammonoidea: Acanthoceratidae
Acanthoceras cf. *tunetana* Pervinquière, 1907 (Cenomanian; B)
Calycoceras annulatum Collington, 1964 (Cenomanian; B)
Calycoceras coleroonense percostata Collington, 1964 (Cenomanian; B)
Calycoceras naviculare (Mantell, 1822) (lower Turonian; B)
Eucalycoceras sp. Spath (1923) (upper Cenomanian; N and B)
Euomphaloceras (Kanabiceras) septem-seriatum (Cragin, 1893) (L. Cenom.- E. Turon.; B and N)
Euomphaloceras cunningtoni meridionale Stoliczka, 1864 (Cenomanian; B)
Euomphaloceras cunningtoni, Sharpe (lower Cenomanian to middle Cenomanian; B)
Euomphaloceras euomphalum (Sharpe, 1855) (Cenomanian-Turonian?; B)
Mammites mocamedensis Howarth, 1966 (middle Turonian to lower Coniacian; N)
Mantelliceras cf. *saxbii* Sharpe, 1857 (lower Cenomanian; K)
Mantelliceras sp. Hyatt, 1903 (Turonian to Santonian; B)
Metoicoceras cf. *whitei* Hyatt, 1903 (upper Cenomanian; N)
Metoicoceras gibbosum Hyatt, 1903 (upper Cenomanian-Lower Turonian; N)
Protacanthoceras sp. Spath, 1923 (upper Cenomanian; N)
Protacanthoceras angolaense Spath, 1931 (Cenomanian; N)
Pseudaspidoceras footeanum Stolickzka, 1864 (lower Turonian; B)
Pseudaspidoceras sp. Hyatt, 1903 (lower Turonian; B)
Pseudocalycoceras aff. *haugi* (Pervinquière, 1907) (upper Cenomanian- lower Turonian; N)
Pseudocalycoceras angolaense (Spath, 1931) (upper Cenomanian- lower Turonian; N)
Romaniceras sp. Spath, 1923 (Turonian; K)
Sharpeiceras florencae Spath, 1925 (lower Cenomanian; B)
Sharpeiceras goliath Haas, 1942 (Turonian to Santonian; K)
Sharpeiceras indicum Kossmat (upper Albian? to lower Cenomanian; B)
Sharpeiceras laticlavum Sharpe, 1855 (lower Cenomanian; K)
Sharpeiceras mexicanum Böse, 1928 (lower Cenomanian; B)
Sharpeiceras schlueteri Hyatt, 1903 (upper Albian? to lower Cenomanian; B)
Watinoceras coloradoense (Henderson, 1908) (upper Cenomanian- lower Turonian; N)
Ammonoidea: Anisoceratidae
Anisoceras aff. *armatum* (Sowerby, 1817) (upper Albian; B)
Anisoceras armatum (Sowerby, 1817) (lower to Upper Albian; B)
Anisoceras arrogans (Giebel, 1852) (upper Albian; B)
Anisoceras jacobi (Breistroffer) (upper Albian; B)
Anisoceras perarmatum Pictet & Campiche, 1861 (upper Albian; B)
Anisoceras picteti Spath, 1926 (upper Albian; B)
Anisoceras plicatile (Sowerby, 1819) (Cenomanian; B)
Anisoceras pseudoelegans Pictet & Campiche, 1861 (upper Albian; B)
Anisoceras renzi Kotetishvili, 1984 (upper Albian; B)
Anisoceras saussureanum spinosa Haas, 1942 (upper Albian; B)
Anisoceras subarcuatum Spath, 1938 (upper Albian; B)
Anisoceras teixeirai Collignon, 1978 (upper Albian; B)
Hysteroceras cf. *varicosum* (Sowerby, 1824) (upper Albian; B)
Idiohamites spiniger (Sowerby, 1818) (upper Albian; B)
Idiohamites subspiniger Spath, 1939 (upper Albian; B)
Protanisoceras sp. (upper Albian; B)
Ammonoidea: Baculitidae
Baculites aff. *asper* Morton, 1830 (upper Senonian; N)
Baculites anceps Lamarck, 1822 (Turonian to Santonian; K)
Baculites capensis Woods, 1906 (lower Campanian; K)
Baculites cf. *anceps* Lamarck, 1822 (Turonian to Santonian; K)
Baculites subanceps Haughton, 1925 (upper Campanian; K)
Sciponoceras gracile (Shumard, 1861) (upper Cenomanian-lower Turonian; K and N)

Ammonoidea: Brancoceratidae

Dipoloceras aff. *quadratum* Spath, 1921 (upper Albian; B)
Dipoloceras bouchardianum (d'Orbigny, 1841) (upper Albian; B)
Dipoloceras cf. *subdelaruei* Spath, 1931 (upper Albian; B)
Dipoloceras pseudaon moliniformis Spath (middle to upper Albian; B)
Dipoloceras rectangulare Spath (upper Albian; B)
Dipoloceras remotum Spath, 1931 (middle to upper Albian; B)
Dipoloceras symmetricum Sowerby (upper Albian; B)
Hysteroceras aff. *antipodeum* Etheridge, 1902 (upper Albian; B)
Hysteroceras binum (Sowerby, 1815) (upper Albian; B)
Hysteroceras binum lobitoensis Haas, 1942 (upper Albian; B)
Hysteroceras carinatum Spath, 1922 (upper Albian; B)
Hysteroceras carinatum haasi Collignon, 1978 (upper Albian; B)
Hysteroceras cf. *subbinum* Spath, 1934 (upper Albian; B)
Hysteroceras choffati Spath, 1925 (upper Albian; B)
Hysteroceras falcicostatum Haas, 1942 (upper Albian; B)
Hysteroceras intermedium Haas, 1942 (upper Albian; B)
Hysteroceras orbignyi minor Haas, 1942 (upper Albian; B)
Hysteroceras orbignyi (Spath, 1922) (upper Albian; B)
Hysteroceras propinquum Haas, 1942 (upper Albian; B)
Hysteroceras semileve Haas, 1942 (upper Albian; B)
Hysteroceras cf. *simplicostatum* (Spath, 1934) (upper Albian; B)
Hysteroceras varicosum angolanum Haas, 1942 (upper Albian; B)
Hysteroceras varicosum Sowerby, 1824 (upper Albian; B)
Mortoniceras (Angolaites) galvaoi Collignon, 1978 (upper Albian; B)
Mortoniceras (Angolaites) gregoryi Spath, 1922 (upper Albian; B)
Mortoniceras (Angolaites) simplex Choffat, 1905 (upper Albian; B)
*Mortoniceras (Angolaites) vicin*a Haas, 1942 (upper Albian; B)
Mortoniceras (Angolaites) wintoni Adkins, 1920; upper Albian; B)
Mortoniceras (Boesites) aff. *barbouri* Haas, 1942 (upper Albian; B)
Mortoniceras (Boesites) barbouri Haas, 1942 (upper Albian; B)
Mortoniceras (Boesites) haasi Collignon, 1978 (upper Albian; B)
Mortoniceras (Boesites) howelli Haas, 1942 (upper Albian; B)
Mortoniceras (Boesites) proteus (Haas, 1942) (upper Albian; B)
Mortoniceras (Boesites) romeri Haas, 1942 (upper Albian; B)
Mortoniceras (Boesites) stoliczkai Spath, 1922 (upper Albian; B)
Mortoniceras (?Boesites) vokesi (Haas, 1942) (upper Albian; B)
Mortoniceras (Deiradoceras) bassleri Haas, 1942 (upper Albian; B)
Mortoniceras (Deiradoceras) prerostratum (Spath, 1921) (upper Albian; B)
Mortoniceras (Deiradoceras) proteus (Hass, 1942) (upper Albian; B)
Mortoniceras (Deiradoceras) reali Collignon, 1978 (upper Albian; B)
Mortoniceras (Deiradoceras) rigidus Spath, 1933 (upper Albian; B)
Mortoniceras (Drepanoceras) undatum Van Hoepen (upper Albian; B)
Mortoniceras (Mortoniceras) aff. *howelli* Haas, 1942 (upper Albian; B)
Mortoniceras (Mortoniceras) aff. *pachys* Seeley, 1865 (upper Albian; B)
Mortoniceras (Mortoniceras) angolanum Collingnon, 1978 (upper Albian; B)
Mortoniceras (Mortoniceras) arietiforme (Spath, 1922) (upper Albian; B)
Mortoniceras (Mortoniceras) caheni Sornay, 1953 (upper Albian; B)
Mortoniceras (Mortoniceras) cf. *gradicostatum* van Hoepen, 1951 (upper Albian; B)
Mortoniceras (Mortoniceras) pricei intermedium Spath, 1922 (upper Albian; B)
Mortoniceras (Mortoniceras) proteus Haas, 1942 (upper Albian; B)
*Mortoniceras (Mortoniceras) stoliczka*i Spath, 1921 (upper Albian;B)
Mortoniceras (Mortoniceras) vespertinum Morton, 1834 (upper Albian; B)
Mortoniceras (Mortoniceras) whitneyi Young, 1957 (upper Albian; B)
Mortoniceras (Ophryoceras) jugosum van Hoepen (upper Albian; B)
Mortoniceras (Ophryoceras) liberta (van Hoepen) (upper Albian; B)
Mortoniceras (Pagoceras) arcuatum Collignon, 1978 (upper Albian; B)
Mortoniceras (Pagoceras) bonum (van Hoepen, 1951) (upper Albian; B)
Mortoniceras (Pervinquieria) arietiforme Spath, 1922 (upper Albian; B)
Mortoniceras (Pervinquieria) barbouri (Haas, 1942) (upper Albian; B)
Mortoniceras (Pervinquieria) bassleri (Haas, 1942) (upper Albian; B)
Mortoniceras (Pervinquieria) caheni (Sornay, 1953) (upper Albian; B)
Mortoniceras (Pervinquieria) cf. *evoluta* (Haas) (upper Albian; B)
Mortoniceras (Pervinquieria) dartevellei (Sornay, 1953) (upper Albian; B)
Mortoniceras (Pervinquieria) evoluta (Haas) (upper Albian; B)

Mortoniceras (Pervinquieria) ferecostata (Haas, 1942) (upper Albian; B)
Mortoniceras (Pervinquieria) howelli (Haas, 1942) (upper Albian; B)
Mortoniceras (Pervinquieria) inflatum Sowerby, 1818 (upper Albian; B)
Mortoniceras (Pervinquieria) margarita (Haas, 1942) (upper Albian; B)
Mortoniceras (Pervinquieria) margaritatum Haas (upper Albian; B)
Mortoniceras (Pervinquieria) montraynaudensis (Haas, 1942) (upper Albian; B)
Mortoniceras (Pervinquieria) perarmata (Haas, 1942) (upper Albian; B)
Mortoniceras (Pervinquieria) pricei intermedia Spath, 1932 (upper Albian; B)
Mortoniceras (Pervinquieria) proteus (Haas, 1942) (upper Albian; B)
Mortoniceras (Pervinquieria) rochai Collignon, 1978 (upper Albian; B)
Mortoniceras (Pervinquieria) romeri (Haas, 1942) (upper Albian; B)
Mortoniceras (Pervinquieria) stoliczkai (Spath, 1922) (upper Albian; B)
Mortoniceras (Pervinquieria) velliferum van Hoepen (upper Albian; B)
Mortoniceras (Pervinquieria) vicinia (Haas, 1942) (upper Albian; B)
Mortoniceras (subgenus ?) *rochai* (Collignon, 1978) (upper Albian; B)
Mortoniceras (Subschloenbachia) aequatoriallis Kosmat (upper Albian; B)
Mortoniceras (Subschloenbachia) angolanus Collignon, 1978 (upper Albian; B)
Mortoniceras (Subschloenbachia) antunesi Collignon, 1978 (upper Albian; B)
Mortoniceras (Subschloenbachia) cf. *subquadratum crassicostatum* Spath, 1933 (upper Albian; B)
Mortoniceras (Subschloenbachia) crassicostum Spath (upper Albian; B)
Mortoniceras (Subschloenbachia) candollianum Pictet,1847 (upper Albian (Vraconian); B)
Mortoniceras (Subschloenbachia) depressa Spath, 1922 (upper Albian; B)
Mortoniceras (Subschloenbachia) depressum Spath, 1922 (upper Albian; B)
Mortoniceras (Subschloenbachia) gracillima Kossmat, 1895 (upper Albian; B)
Mortoniceras (Subschloenbachia) inflata Sowerby, 1847 (upper Albian to Cenomanian; B and N)
Mortoniceras (Subschloenbachia) irregularis Collignon, 1978 (upper Albian; B)
Mortoniceras (Subschloenbachia) netoi Collignon, 1978 (upper Albian; B)
Mortoniceras (Subschloenbachia) af. *perinflatus* Spath 1932 (upper Albian; B)
Mortoniceras (Subschloenbachia) perinflatum (Spath, 1922) (upper Albian; B)
Mortoniceras (Subschloenbachia) perinflatus Spath, 1932 (upper Albian; B)
Mortoniceras (Subschloenbachia) cf. *quadratum* Spath, 1933 (upper Albian; B)
Mortoniceras (Subschloenbachia) rectangulatus Collignon, 1978 (upper Albian; B)
Mortoniceras (Subschloenbachia) rostratum Sowerby, 1817 (upper Albian; B)
Mortoniceras (Subschloenbachia) cf. *subquadratum crassicostatum* Spath, 1933 (upper Albian; B)
Mortoniceras (Subschloenbachia) subquadratus Spath, 1933 (upper Albian; B)
Mortoniceras dacostai (Collignon 1978) (upper Albian; B)
Mortoniceras cf. *liberta* (van Hoepen, 1946) (upper Albian; B)
Mortoniceras aff. *gradicostatum* (van Hoepen, 1951) (upper Albian; B)
Mortoniceras ordinatocostatum (Van Hoepen 1942) (upper Albian; B)
Mortoniceras planiventer van Hoepen, 1951 (upper Albian; B)
Mortoniceras rigidum Spath, 1933 (upper Albian; B)
Mortoniceras robusta Spath (upper Albian; B)
Neoharpoceras angolanum Haas, 1942 (upper Albian; B)
Neoharpoceras conditum Haas, 1942 (upper Albian; B)
Neokentroceras aff. *pseudovaricosum* Spath, 1922 (upper Albian; B)
Neokentroceras costatum Haas, 1942 (upper Albian; B)
Neokentroceras crassicostatum Howarth, 1965 (upper Albian; B)
Neokentroceras curvicornu Spath, 1922 (upper Albian; B)
Neokentroceras gr. *corvicurnu* (Spath, 1921) (upper Albian; B)
Neokentroceras magnum Haas, 1942 (upper Albian; B)
Neokentroceras pseudovaricosum Spath, 1922 (upper Albian; B)
Neokentroceras singulare Haas, 1942 (upper Albian; B)
Sphenodiscus sp. (upper Albian; B)
Neokentroceras subtuberculatum Spath, 1922; Upper Albian; B)
Neokentroceras trituberculatum Howarth, 1965 (upper Albian; B)
Oxytropidoceras (Manuaniceras) sp. (Spath, 1925) (middle Albian; B)
Oxytropidoceras (Mirapelia) aff. *mirapelium* (d'Orbigny, 1850) (middle Albian; B)
Oxytropidoceras (Mirapelia) sergipense (White, 1887) (middle Albian; B)
Oxytropidoceras (Oxytropidoceras) bösei (Knechtel, 1947) (middle Albian; B)
Oxytropidoceras (Mirapelia) buarquianum (White, 1887) (middle Albian; B)

Ammonoidea: Coilopoceratidae

Coilopoceras sp. (Lower Turonian to Coniacian; CB and K)

Ammonoidea: Collignoniceratidae
Benueites sp. (Lower Turonian; B)
Prionocyclus carvalhoi Howarth, 1966 (middle Turonian to Lower Coniacian; N)
Protexanites sp. (lower Santonian; N)
Submortinoceras mariscalense Young, 1963 (lower Campanian; K)
Subprionocyclus sp. Shimizu 1932 (upper Turonian to Lower Coniacian; N and K)
Texanites angolanus Haas, 1942 (Turonian to Santonian; K)
Texanites quiquenodosus Redtenbacher (Santonian; K)
Texanites roemeri (Yabe & Shimizu, 1923) (lower Campanian; K)
Ammonoidea: Desmoceratidae
Beudanticeras aff. *newtoni* Casey, 1961 (lower to Middle Albian; B)
Beudanticeras beudanti Brongniart, 1822 (upper Albian; B)
Beudanticeras dupianum (d'Orbigny, 1841) (lower to Middle Albian; B)
Damesites ainuanus Matsumoto, 1957 (middle Turonian to Lower Coniacian; N)
Damesites sp. Matsumoto, 1942 (lower Santonian; N and B)
Desmoceras (Desmoceras) latidorsatum lemonei, Collignon (lower Cenomanian; B)
Desmoceras (Desmoceras) latidorsatum periflatum Cooper & Kennedy, 1979 (upper Albian; B)
Desmoceras (Desmoceras) latidorsatum Michelin, 1838 (upper Albian to Lower Cenomanian, B)
Desmoceras (Pseudouhligella) aff. *ezoanum* Matsumoto, 1942 (L. Cenomanian- E. Turonian; N)
Desmoceras aff. latidorsatum Michelin, 1838 (upper Albian; B)
Desmoceras constrictum Collignon, 1978 (middle to Upper Albian; B)
Desmoceras latidorsatum (Michelin, 1838) (upper Albian; B)
Desmoceras latidorsatum perinflatum Cooper & Kennedy, 1979 (upper Albian; B)
Desmophyllites diphylloides Forbes, 1846 (Senonian; B)
Hauericeras gardeni (?) Baily (Campanian?; B)
Kitchinites angolaensis Howarth, 1965 (upper Campanian; B)
Kitchinites sp. Spath, 1922 (upper Campanian? to Maastrichtian; B)
Mesopuzosia yubarensis Jimbo, 1894 (middle Turonian; N)
Parapuzosia (*Austiniceras*) *dibleyi* Spath, 1922 (upper Cenomanian; N)
Polyptychoceras pseudogaultinum Yokoyama, 1890 (upper Campanian; B)
Polyptychoceras sp. Yabe, 1927 (upper Campanian? to Maastrichtian; B)
Puzosia (Anapuzosia) dibleyi (Spath, 1922) (L. Cenomanian- E. Turonian; N)
Puzosia (Austiniceras) intermedia orientalis Matsumoto, 1959 (L. Cenomanian- E. Turonian; N)
Puzosia aff. *defficilis* d'Orbigny (upper Albian; B)
Puzosia aff. *spathi* Venzo, 1936 (upper Albian; B)
Puzosia bistricta (White, 1887) (middle Albian; B)
Puzosia cf. *mayoriana* (d'Orbigny, 1841) (upper Albian; B)
Puzosia cf. *tenuis* Haas, 1942 (upper Albian; B)
Puzosia matheroni (d'Orbigny, 1840) (lower Cenomanian; B)
Puzosia quenstedti Parona and Bonarelli, 1897 (upper Albian; B)
Puzosia spathi Venzo, 1936 (upper Albian; B)
Ammonoidea: Diplomoceratidae
Puzosia tenuis Haas, 1942 (upper Albian; B)
Scalarites sp. Wright & Matsumoto, 1954 (lower Coniacian; N)
Solenoceras bembense Haas, 1943 (Turonian to Santonian; K)
Ammonoidea: Dipoloceratidae
Aidoceras hoepeni Collignon, 1978 (upper Albian; B)
Elobiceras aff. *intermedium* Spath, 1942 (upper Albian; B)
Elobiceras af. *irregulare* Spath, 1922 (upper Albian; B)
Elobiceras angustum Spath, 1922 (upper Albian; B)
Elobiceras browni Haas, 1942 (upper Albian; B)
Elobiceras cargustum Spath (upper Albian; B)
Elobiceras cf. *angustum* Spath, 1922 (upper Albian; B)
Elobiceras cf. *elobiense* Szajnocha (upper Albian; B)
Elobiceras cf. *flexicostatum* Spath, 1922 (upper Albian; B)
Elobiceras cf. *spathianum* Haas, 1942 (upper Albian; B)
Elobiceras conditum Haas, 1942 (upper Albian; B)
Elobiceras densicostatum Spath, 1922 (upper Albian; B)
Elobiceras elobiense Szajnocha (upper Albian; B)
Elobiceras flexicostatum Spath, 1922 (upper Albian; B)
Elobiceras haughtoni Collignon, 1978 (upper Albian; B)
Elobiceras hexagonum Haas, 1942 (upper Albian; B)
Elobiceras intermedium Spath, 1922 (upper Albian; B)
Elobiceras irregulare rigidecostatum Haas (upper Albian; B)
Elobiceras irregulare Spath, 1922 (upper Albian; B)
Elobiceras lobitoense Spath, 1922 (upper Albian; B)
Elobiceras neuparthi Choffat, 1905 (upper Albian; B)
Elobiceras orientiformis Spath (upper Albian; B)
Elobiceras oxytropidoceratoides Haas, 1942 (upper Albian; B)
Elobiceras primordiale Haas, 1942 (upper Albian; B)
Elobiceras raymondi Haas, 1942 (upper Albian; B)
Elobiceras rectangulare arietiformis Spath, 1922 (upper Albian; B)
Elobiceras spathianum Haas, 1942 (upper Albian; B)
Elobiceras subelobiense Spath (upper Albian; B)
Goodhallites tremebundum van Hoepen, 1946 (upper Albian; B)
Hysteroceras aff. *simplicicostatum* Spath, 1934 (upper Albian; B)
Hysteroceras cf. *simplicostatum* Spath, 1934 (Albian; B)
Inflaticeras orientalis Kossmat (upper Albian; B)
Inflaticeras stoliczkaia Spath (upper Albian; B)
Prohysteroceras aff. *aitchsoni* Young (upper Albian; B)

Prohysteroceras africanum Sornay, 1953 (upper Albian; B)
Prohysteroceras aitchsoni Young, 1957 (upper Albian; B)
Prohysteroceras cf. *dubium* Spath, 1922 (upper Albian; B)
Prohysteroceras decipiens Spath (upper Albian; B)
Prohysteroceras dubium Spath, 1922 (upper Albian; B)
Prohysteroceras gracile Haas, 1942 (upper Albian; B)
Prohysteroceras hanhaense Haas, 1942 (upper Albian; B)
Prohysteroceras nordici Spath (upper Albian; B)
Prohysteroceras wordiei compressa Spath (upper Albian; B)
Prohysteroceras wordiei Spath, 1922 (upper Albian; B)
Ammonoidea: Douvilleiceratidae
Douvilleiceras aequinodum Quenstedt, 1849 (middle Albian; B)
Douvilleiceras inaequinodum Quenstedt, 1849 (middle Albian; B)
Douvilleiceras mamillatum aequinodum Quenstedt, 1849 (lower to Middle Albian; B)
Douvilleiceras mamillatum Schlotheim, 1813 (lower to Upper Albian; B)
Douvilleiceras orbignyi Hyatt, 1903 (lower to Middle Albian; B)
Douvilleiceras variabile Tavani, 1949 (middle Albian; B)
Ammonoidea: Forbesiceratidae
Forbesiceras conlini Stephenson (Cenomanian- Turonian?; B)
Forbesiceras obtectum Sharpe, 1853 (middle Cenomanian; B)
Ammonoidea: Gaudryceratidae
Anagaudryceras cf. *cassisianum* d'Orbigny, 1850 (upper Cenomanian-Lower Turonian; N)
Anagaudryceras involvulum (Stoliczka, 1865) (middle Turonian; N)
Anagaudryceras mikobokense Collignon, 1956 (upper Campanian; B)
Gaudryceras (Gaudryceras) isovokyense Collignon, 1964 (upper Cenomanian-Lower Turonian; N)
Gaudryceras aenigma Haas, 1942 (upper Albian; B)
Gaudryceras varagurense Kossmat, 1895 (middle Turonian to Senonian; N and B)
Ammonoidea: Hamitidae
Hamites sp. (upper Albian; B)
Hamites angolensis Choffat (upper Albian; B)
Hamites attenuatus Sowerby, 1814 (lower Albian; B)
Hamites compressus Sowerby, 1814 (middle to Upper Albian; B)
Hamites duplicatus Pictet & Campiche, 1861 (upper Albian; B)
Hamites incurvatus Brown, 1837 (lower Albian; B)
Hamites aff. *simplex* d'Orbigny, 1942 (Cenomanian; B)
Hamites tenuicostatus Spath, 1941 (lower Albian; B)
Hamites tenuis Sowerby, 1814 (upper Albian; B)
Hamites aff. *tenuis* Sowerby, 1814 (upper Albian; B)
Hamites venetzianus Pictet, 1847 (upper Albian; B)
Hamites virgulatus Brongniart, 1822 (upper Albian; B)
Hamites aff. *virgulatus* Brongniart, 1822 (upper Albian; B)
Hamitoides angolanus Haas, 1942 (upper Albian; B)
Hemiptychoceras gaultinum (Pictet, 1847) (upper Albian; B)
Ammonoidea: Kossmaticeratidae
Kossmaticeras sp. (lower Coniacian; N)
Ammonoidea: Labeceratidae
Labeceras sp. (upper Albian; B)
Ammonoidea: Libycoceratidae
Libycoceras sp. (upper Campanian to Maastrichtian; K)
Ammonoidea: Lyelliceratidae
Stoliczkaia clavigera Neumayr, 1875 (upper Albian; B)
Stoliczkaia dispar d'Orbigny, 1841 (upper Albian; B)
Stoliczkaia dorsetensis Spath, 1932 (upper Albian; B)
Stoliczkaia dorsetensis Spath, 1932 var. compressa Spath (upper Albian; B)
Stoliczkaia notha Seeley, 1865 var. ultima (upper Albian; B)
Stoliczkaia renzi Collignon, 1978 (upper Albian; B)
Stoliczkaia reyrei Collignon, 1978 (upper Albian; B)
Stoliczkaia rhamnonota Spath, 1932 (upper Albian; B)
Stoliczkaia sp. (lower Albian to Cenomanian; N and B)
Stoliczkaia tenuis Renz, 1968 (upper Albian; B)
Tegoceras aff. *maderoense* Young, 1993 (middle Albian; B)
Ammonoidea: Nostoceratidae
Axonoceras angolanum Haas, 1943 (Turonian to Campanian; K)
Bostrychoceras sp. (upper Campanian to Maastrichtian; K)
Cirroceras sp. Conrad, 1866 (upper Campanian to Maastrichtian; K and B)
Didymoceras californicum Anderson, 1958 (upper Campanian; K)
Didymoceras cf. *angolaense* Haughton, 1924 (Campanian-Maastrichtian; K)
Didymoceras hornbyense Whiteaves, 1876 (Campanian; K)
Didymoceras subtuberculatum Howarth, 1965 (upper Campanian; B)
Nostoceras helicinus Shumard, 1861 (Turonian to Campanian; B)
Nostoceras hyatti Stephenson, 1941 (upper Campanian; B)
Nostoceras kernense Anderson, 1958 (upper Campanian; B)
Nostoceras mariatheresianum Haas, 1943 (Turonian to Santonian; B)
Nostoceras rotundum Howarth, 1965 (Turonian to Campanian; B)
Nostoceras sp. (upper Campanian; K)

Ammonoidea: Oppeliidae
Aconeceras sp. (upper Albian; B)
Ammonoidea: Pachydiscidae
Eupachydiscus pseudogrossouvrei Collignon, 1955 (Senonian; B)
Eupachydiscus sp. (Campanian? to Maastrichtian; B)
Menuites sp. (upper Campanian; K)
Ammonoidea: Phylloceratidae
Neophylloceras sp. (Maastrichtian; K)
Neophylloceras ultinatum Spath, 1953 (upper Campanian; B)
Phylloceras (Hypophylloceras) sp. (Cenomanian to Lower Coniacian; N and B)

Phylloceras (Hypophylloceras) seresitense Pervinquiére, 1907 (lower Cenomanian; B)
Phylloceras velledae (Michelin, 1834) (upper Albian; B)
Ammonoidea: Placenticeratidae
Hoplitoplacenticeras (Hoplitoplacenticeras) marroti (Coquand, 1859) (upper Campanian; B)
Hoplitoplacenticeras cf. *costulosum* Schluter, 1867 (Senonian; B)
Hoplitoplacenticeras cf. *marroti* Coquand, 1859 (Senonian; B)
Hoplitoplacenticeras costulosum Schlüter, 1867 (Senonian; B)
Placenticeras sp. (lower Senonian; CB)
Proplacenticeras ambiloense Collignon (Cenomanian-Turonian; B)
Proplacenticeras fritschi Grossouvre, 1894 (Coniacian; K)
Proplacenticeras reineckei Haughton (Coniacian; K)
Proplacenticeras sp. (lower Turonian to Lower Coniacian; N and B)
Proplacenticeras stantoni Hyatt, 1903 (upper Cenomanian; B)
Ammonoidea: Pseudotissotiidae
Hourcquia africana Kroemmelbein, 1965 (Neocomian to Aptian; CB)
Ammonoidea: Ptychoceratidae
Ptychoceras fauncei Haas, 1942 (upper Albian; B)
Ammonoidea: Pulchelliidae
Pulchellia sp. (lower Cenomanian; N)
Ammonoidea: Sphenodiscidae
Eulophoceras natalense Hyaat, 1903 (lower Campanian; K)
Manambolites dandensis Howarth, 1965 (upper Campanian; B)
Sphenodiscus sp. Meek, 1871 (upper Campanian; B and K)
Ammonoidea: Tetragonitidae
Anagaudryceras involvulum (Stoliczka, 1865) (Mid Turonian; N)
Eogaudryceras (Eugaudryceras) italicum Wiedmann & Dienie, 1968 (upper Albian; B)
Eogaudryceras cf. *italicum* Wiedmann & Dienie, 1968 (upper Albian; B)
Tetragonites (Tetragonites) aff. *jurinianus* (Pictet, 1847) (middle Albian; B)
Tetragonites (Tetragonites) jurinianus (Pictet, 1847) (upper Albian; B)
Tetragonites aff. *blaisoni* Collignon, 1964 (upper Cenomanian- Lower Turonian; N)
Ammonoidea: Tissotiidae
Hemitissotia sp. (upper Turonian to Coniacian; K)

Ammonoidea: Turrilitidae
Mariella (Mariella) oehlerti Pervinquière, 1910 (lower Cenomanian; B)
Mariella circumtaeniatus Kossmat, 1895 (upper Albian; B)
Ostlingoceras (Ostlingoceras) cf. *rorayense* Collingnon (lower Cenomanian; B)
Pseudohelicoceras sp. (upper Albian; B)
Pseudhelicoceras cf. *quadrituberculatum* Spath, 1937 (upper Albian; B)
Turrilites sp. (upper Albian to Cenomanian- Lower Turonian?; B and K)
Turrilites (Turrilites) acutus Passy, 1832 (Cenomanian-Turonian?; B)
Turrilites (Turrilites) costatus Lamarck, 1801 (Cenomanian; B)
Turrilitoides sp. (upper Albian; B)
Ammonoidea: Vascoceratidae
Gombeoceras sp. (lower Turonian; N)
Pachyvascoceras globosum Reyment, 1954 (Cenomanian-Turonian; B)
Vascoceras (Paravascoceras) harttii Hyatt, 1870 (upper Cenomanian; B)
Vascoceras (Paravascoceras) cf. *cauvini* Chudeau, 1909 (upper Cenomanian-Lower Turonian; N)
Nautilida: Eutrephoceratidae
Eutrephoceras egitoense Miller & Carpenter, 1955 (upper Cretaceous; B)
Eutrephoceras indicum Spengler (upper Senonian; N)
Eutrephoceras simile Spath, 1953 (Senonian; B)
Eutrephoceras sp. (upper Albian to Maastrichtian; B)

Mollusca- Gastropoda

Gastropoda were mentioned in Antunes (1964), Araújo & Guimarães (1992), Borges (1946), Carvalho (1961), Cooper (1972, 1974, 1978), Galvão (1972), Lapão (1971, 1972), Rennie (1929), Tavares (2005) and Tavares, Meister, Duarte- Morais, & David (2007).
Anaspidea
Akera gregoryi Newton 1917 (upper Albian- Cenomanian ?; B)
Cephalaspidea: Acteonellidae
Actaeonella aff. *fusiformis* Coquand, 1865 (upper Aptian; K)
Actaeonella anchietai Choffat (Aptian to Turonian; N and B)
Actaeonella (Trochacteon) cylindracea Stolickza (Cenomanian- Turonian; N)
Cephalaspidea: Ringiculidae
Avellana incrassata Sowerby (Cretaceous; K)
Heterobranchia: Architectonicidae
Solarium baily Yobb (upper Albian; B)
Heterobranchia: Nerineidae
Nerinea capeloi Choffat (Aptian to Turonian; B and N)
Heterostrophia
Mrhilaia cf. *nerineaformis* Coquand (upper Albian; B)
Littorinimorpha: Aporrhaidae
Aporrhais neubaueri Riedel (Campanian to Maastrichtian; N)
Chenopus sp. (Cretaceous; B)
Littorinimorpha: Naticidae
Gyrodes cf. *genti* Sowerby (Albian; B)
Natica bulbiformis Sowerby, 1870 (Senonian; B)
Natica feioi Choffat (upper Aptian; B)

Littorinimorpha: Tylostomatidae
Tylostoma aff. *rochatianum* d'Orbigny, 1850 (upper Albian; B)
Tylostoma globosum Sharpe, 1849 (Cenomanian-Turonian?; B)
Tylostoma perchueli Choffat (upper Albian; B)
Neotaenioglossa
Pterodonta aff. *elongata* d' Orbigny (Cretaceous; K)
Pterodonta cf. *inflata* d' Orbigny, 1842 (Albian; B).
Neritopsina: Neritidae
Nerita angolensis Rennie, 1929 (Senonian; K)
Prosobranchia: Pseudomelaniidae
Pseudomelania egitoensis Pictet (Senonian; B)
Pseudomelania salenasensis Rennie (Cenomanian; N)
Ptenoglossa: Epitoniidae
Acirsa egitoensis (Rennie, 1940) (Senonian; B)
Confusiscala angolensis Rennie, 1940 (Senonian; B)
Sorbeoconcha: Cerithiidae
Cerithium (Tympanotonus) fuscatus Linnaeus 1758 (upper Albian; B)
Cerithium cf. *albense* d'Orbigny (lower Aptian; K)
Cerithium monteroi Choffat (lower Albian; B)
Cerithium thoas White, 1887 (upper Albian; B)
Sorbeoconcha: Metacerithiidae
Metacerithium cf. *trimonile* Michelin (Senonian; B)
Metacerithium trimonile Michelin, 1838 (Albian; K)
Sorbeoconcha: Turritellidae
Turritella (Haustador) cf. *acanthophora* Muller (Campanian; N)
Turritella (Haustator) nodosa (Romer, 1841) (Coniacian to Campanian; N)
Turritella (Zaria) bonei (Baily) (Senonian; B and N)
Turritella sp. (upper Albian; B)
Vetigastropoda: Eucyclidae
Eucyclus sp. Eudes-Deslongchamps, 1860 (Senonian; B)
Ringicula moutai Rennie, 1940 (Senonian; B)

Arthropoda - Crustacea

The Crustacea are listed in Antunes (1964) Antunes, Maisey, Marques, Schaeffer & Thomson (1990), Araújo & Guimarães (1992), Ferreira (1957), and Nunes (1991).
Malacostraca: Decapoda
Parapirimela angolensis Van Straelen, 1937 (Albian; B)
Phyllopoda
Estheriella mautoi Lerichei (Triassic; Cs)
Estheria anchietai Teixeira (Triassic; Cs)
Estheria malanjensis Marliere (Triassic; Cs)
Estheria marimbensis Marliere, 1950 (Triassic; Cs)
Lundaestheria sp. (upper Permian - Lower Trassic; Cs)

Echinodermata - Asteroidea

The single Asteroidea species is cited in Blake, Breton & Gofas (1996).
Forcipulatida: Pedicellasteridae
Afraster scalariformis Blake et al., 1996 (upper Coniacian; K)

Echinodermata - Echinoidea

Echinoideans are reported in Choffat & Loriol (1888), Galvão (1972), Kier & Lawson (1978), Kroh (2010), Lapão (1971, 1972), Nunes (1991) and Tavares (2005) and Tavares, Meister, Duarte-Morais, & David (2007).
Acroechinoidea: Orthopsidae
*Orthopsi*s cf. *ruppeli* Desor (upper Albian; B)
Orthopsis gr. *miliaris* (d'Archiac, 1835) (lower to Upper Albian; B)
Orthopsis sp. (Albian- Turonian?; B)
Arbacioida: Arbaciidae
Cottaldia aff. *benettiae* Koening 1820 (upper Albian; B)
Cassiduloida: Archiaciidae
Acriaster aff. *sergipensis* Smith, 1991 (upper Albian; B)
Cassiduloida: Clypeidae
Pygurus africanus Loriol, 1888 (Aptian; B)
Cassiduloida: Nucleolitidae
Phyllobrissus pomeli Loriol, 1888 (Cretaceous; B)
Phyllobrisus freitasii (White, 1887) (upper Albian; B)
Cassiduloida: Pygaulidae
Plagiochasma sp. (upper Albian; B)
Pygopistes inf. *coquandi* Cotteau (Cenomanian- Turonian?; B)
Cidaroida: Cidaridae
Cidaris vafellus Loriol, 1888 (Cretaceous; B)
Leiocidaris thiebaudi Jeannet, 1955 (Albian; B)
Rhabdocidaris sp. (upper Cretaceous?; B)
Temnocidaris malheroi Loriol, 1888 (upper Albian; B)
Hemicidaroida: family uncertain
Micropedina sphaeroides Stoliczka (Cenomanian-Turonian?; B)
Holasteroida: Holasteridae
?Cardiaster sp. (upper Albian; B)
Cardiaster cf. *africanus* Woods (upper Albian; B)
Cardiaster kelleri Haughton, 1924 (upper Albian; B)
Holaster aff. *lerichei* Dartevelle, 1953 (Aptian- Albian; B)
Holaster aff. *trecensis* Leymerie, 1842 (upper Albian; B)
Holaster lerichei Dartvelle, 1952 (Aptian-Albian; B)
Holaster lerichei Dartvelle, 1953 (middle to Upper Albian; B)
Holaster sp. Agassiz, 1836 (middle to Upper Albian; B)
Medjesia meslei (Gauthier, 1892) (upper Cretaceous; B)
Pseudholaster dombeensis Loriol, 1888 (Aptian- Albian; B)
Pseudholaster suborbicularis (Brogniart, 1822) (upper Albien; B)
Tholaster carvalhoi Greyling & Cooper, 1995 (middle Campanian; B)
Holectypoida: Holectypidae
Coenholectypus neocomiensis Gras, 1848 (upper Albian; B)
Coenholectypus sp. (Cenomanian- Turonian?; B)
Holectypus sp. (upper Albian; B)
Phynosonatoida: Phymosamatidae
Phymosona binexilis White, 1887 Lower to Upper Albian; B)
Phymosona cf. *binexilis* White, 1888 (upper Albian; B)
Phymosona sp. (upper Albian; B)

Salenioida: Hyposaleniidae
Hyposalenia aff. *clathrata* (Woodward, 1856) (lower Albian; B)
Hyposalenia sp. (upper Albian; B)
Salenioida: Saleniidae
Salenia dombeensis Loriol, 1888 (middle to Upper Albian; B)
Salenia sp. (upper Albian; B)
Spatangoida: Hemiasteridae
Hemiaster cf. *forbesi* Baily 1855 (upper Albian; B)
Hemiaster proclivus Cotteau, Peron & Gauthier, 1878 (Aptian to Upper Albian; B)
Hemiaster reineckei Haughton, 1924 (upper Albian; B)
Hemiaster sp. (middle-Upper Albian; B)
Leymeriaster sp. Tavares, 2006 (Albian; B)
Mecaster aff. *africanus* Coquand, 1863 (upper Albian; B)
Mecaster aff. *ameliae* Péron & Gauthier (upper Albian; B)
Mecaster cf. *africanus* Coquand, 1862 (upper Albian; B)
Mecaster cf. *ameliae* Péron & Gauthier (upper Albian; B)
Mecaster sp. (upper Albian; B)
Spatangoida: Palaeostomatidae
Leiostomaster angolanus Greyling & Cooper, 1995 (middle Campanian; B)
Spatangoida: Toxasteridae
Douvillaster benguellensis Loriol, 1888 (upper Albian; B)
Douvillaster aff. *carvalhoi* Dartevelle (upper Albian; B)
Macraster angolensis Haughton, 1924 (upper Albian?; B)
Epiaster carvalhoi Dartevelle, 1953 (Senonian?; B)
Heteraster sp. (Aptian- Albian; B)

Echinodermata - Crinoidea

The only reference for the Crinoidea was Ferré & Granier (2001).
Roveacrinida: Roveacrinidae
Roveacrinus communis Douglas, 1908 (upper Albian; C)
Roveacrinus cf. *communis* Douglas, 1908 (upper Albian; C)
Roveacrinus aff. *geinitzi* Schneider, 1989 (upper Albian; C)
Roveacrinus pyramidalis Peck, 1943 (upper Albian; C)
Roveacrinus sp. (upper Albian; C)

Gnathostomata - Chondrichthyes

The Chondrichthyes are quoted in Antunes (1964), Antunes & Cappetta (2002), Carvalho (1961), Cooper (1972) and Lapão (1971,1972).
Carcharhiniformes: Scyliorhinidae
Pteroscyllium cf. *signeuxi* Cappetta, 1980 (upper Campanian-Maastrichtian; B)
Echinorhiniformes: Echinorhinidae
Echinorhinus lapaoi Antunes & Cappetta, 2002 (upper Campanian-Maastrichtian; B)
Elasmobranchii: Ptychodontidae
Ptychodus sp. (upper Turonian; B)
Ptychodus decurrens Agassiz, 1838 (upper Turonian; B)
Ptychodus latissimus Agassiz, 1838 (upper Turonian; K)
Ptychodus mammillaris Agassiz, 1838 (upper Turonian; K)
Ptychodus mortoni Mantell, 1836 (upper Turonian; K)
Ptychodus paucisulcatus Agassiz, 1838 (upper Turonian; K)
Ptychodus cf. *paucisulcatus* Agassiz, 1838 (upper Turonian; K)
Ptychodus whipplei Marcou, 1858 (upper Turonian; K)
Heterodontiformes: Heterodontidae
Heterodontus sp. (Maastrichtian; N)
Hexanchiformes: Chlamydoselachidae
Chlamydoselachus goliath Antunes & Capetta, 1991 (upper Campanian-Maastrichtian; B)
Chlamydoselachus gracilis Antunes & Cappetta, 2002 (upper Campanian to Lower Maastrichtian; B)
Chlamydoselachus sp. (upper Campanian to Lower Maastrichtian; B)
Hexanchiformes: Hexanchidae
Hexanchus cf. *microdon* Agassiz, 1843 (upper Turonian to Campanian-Maastrichtian; K and B)
Hexanchus microdon Agassiz, 1843 (upper Campanian-Maastrichtian; B)
Notidanodon dentatus Woodward, 1886 (upper Campanian-Maastrichtian; B)
Lamniformes: Alopiidae
Paranomotodon angustidens Reuss, 1845 (upper Turonian; K and B)
Lamniformes: Anacoracidae
Squalicorax sp. (upper Albian to Upper Turonian; B and K)
Pseudocorax affinis Agassiz, 1843 (upper Campanian-Maastrichtian; B)
Squalicorax cf. *falcatus* (Agassiz, 1843) (Cenomanian; B)
Squalicorax falcatus (Agassiz, 1843) (Turonian to Senonian; B and K)
Squalicorax cf. *kaupi* (Agassiz, 1843) (upper Campanian-Maastrichtian; B)
Squalicorax kaupi (Agassiz, 1843) (Santonian to Maastrichtian; B, CB and N)
Squalicorax pristodontus (Agassiz, 1843) (Santonian to Maastrichtian; N, CB, K and B)
Squalicorax aff. *yangaensis* Dartevelle & Casier, 1943 (Santonian to Lower Campanian; K)
Squalicorax yangaensis Dartevelle & Casier, 1943 (Santonian to Lower Campanian; B and CB)
Lamniformes: Eoptolamnidae
Leptostyrax macrorhiza Cope, 1875 (upper Albian; B)
Protolamna sp. Cappetta, 1986 (upper Albian; B)
Myliobatiformes: Myliobatidae
Brachyrhizodus cf. *wichitaensis* Romer, 1942 (upper Campanian-Maastrichtian; B)
Myliobatiformes: Rhombodontidae
Rhombodus binkhorsti Dames, 1881 (upper Campanian-Maastrichtian; CB and N)
Odontaspidida: Cretoxyrhinidae
Cretodus cassidens Dixon, 1850 (upper Turonian; K)
Cretodus semiplicatus Agassiz, 1843 (Cenomanian to Upper Turonian; B and K)
Cretolamna cf. *appendiculata* Agassiz, 1843 (Cenomanian; B)

Cretolamna biauriculata Wanner, 1902 (Santonian to Maastrichtian (CB, K, B and N)
Cretoxyrhina mantelli Agassiz, 1843 (Cenomanian to Upper Turonian; B and K)
Carcharias heathi Case & Capetta, 1997 (upper Campanian to Maastrichtian; B, CB and N)
Serratolamna caraibaea Leriche, 1938 (upper Campanian to Maastrichtian; CB and N)
Serratolamna serrata Agassiz, 1843 (upper Campanian-Maastrichtian; N)
Odontaspidida: Odontaspidae
Carcharias amonensis Cappeta & Case, 1975 (Cenomanian to Upper Turonian; B)
Odontaspidida: Scapanorhynchidae
*Scapanorhynchu*s sp. (Senonian (Santonian to Maastrichtian); CB, B and N)
Scapanorhynchus cf. *lewesii* Davis, 1887 (upper Turonian to Maastrichtian; B)
Scapanorhynchus rapax Quaas, 1902 (upper Cretaceous; B and N)
Scapanorhynchus raphiodon Agassiz, 1843 (Turonian to Senonian; K, B and CB)
Scapanorhynchus cf. *texanus* Roemer, 1949 (upper Turonian; K)
Orectolobiformes:Ginglymostomatidae
Plicatoscyllium antiquum Case & Cappetta, 1997 (upper Campanian and Maastrichtian; B)
Rajiformes
Angolabatis angolensis Antunes & Capetta, 2002 (upper Campanian-Maastrichtian; B)
Rajiformes: Hypsobatidae
Angolaia benguelaensis Antunes & Cappetta, 2002 (upper Campanian-Maastrichtian; B)
Rajiformes: Pristidae
Dalpiazia sp. (upper Campanian-Maastrichtian; N)
Sclerorhynchiformes: Sclerorhynchidae
Ganopristis sp. (upper Campanian-Maastrichtian; N)
Onchosaurus pharaoh Dames, 1887 (upper Turonian; K)
Schizorhiza stromeri Weiler, 1930 (upper Campanian-Maastrichtian; K)
Squaliformes: Somniosidae
Dalpiazia stromeri Checchia-Rispoli, 1933 (upper Campanian-Maastrichtian; N)
Cretascymnus quimbalaensis Antunes & Cappetta, 2002 (upper Campanian-Maastrichtian; B)
Squaliformes: Squalidae
Centrophoroides sp. (upper Campanian-Maastrichtian; B)
Squalus aff. *vondermarcki* Muller & Schollmann, 1989 (upper Campanian-Maastrichtian; B)
Synechodontiformes: Orthacodontidae
Sphenodus sp. (upper Campanian-Maastrichtian; B)
Synechodontiformes: Palaeospinacidae
Paraorthacodus sp. (upper Campanian-Maastrichtian; B)

Gnathostomata - Osteichthyes

Osteichthyes are reported in Antunes (1964), Antunes & Cappetta (2002), Antunes, Maisey, Marques, Schaeffer & Thomson (1990), Araújo & Guimarães (1992), Carvalho (1961), Cooper (1972), Lapão (1972) and Nunes (1991).
Dipnoi: Ceratodontidae
Ceratodus angolensis Teixeira, 1949 (Triassic; Cs)
Ceratodus formosus Wade, 1935 (Triassic; Cs)
Microceratodus angolensis (Teixeira, 1949) (Triassic; Cs)
Microceratodus sp. (Triassic; Cs)
Neopterygii: Semionotidae
Angolaichthys lerichei Teixeira, 1947 (Triassic; Cs)
Perleidiformes: Perleididae
Perleidus sp. (Triassic; Cs)
Perleidus lehmani Antunes, 1990 (Triassic; Cs)
Perleidus lutoensi Teixeira, 1947 (Triassic; Cs)
Teleostei: Paralbulinae
Eodiaphyodus lerichei (Estes, 1969) (upper Campanian-Maastrichtian; B and N)
Pseudoegertonia bebianoi Dartevelle & Casier, 1949 (upper Campanian-Maastrichtian; N)
Teleostei: Enchodontidae
Enchodus bursauxi Arambourg, 1952 (upper Campanian-Maastrichtian; CB and N)
Enchodus cf. *elegans* Dartevelle & Casier, 1949 (upper Turonian to Upper Campanian-Maastrichtian; K and N)
Enchodus crenulatus Dartevelle & Casier, 1949 (Santonian-Lower Campanian; CB)
Enchodus elegans Dartevelle & Casier, 1949 (Santonian-Maastrichtian; B, N and CB)
Enchodus faujasi Agassiz, 1835 (upper Campanian-Maastrichtian; N)
Enchodus lemonnieri Dollo, 1893 (Maastrichtian; N)
Enchodus libycus Quaas, 1902 (upper (Campanian-Maastrichtian; CB)
Enchodus sp. (upper Turonian-Maastrichtian; N and B)
Teleostei: Trigonodontoidae
Stephanodus libycus Dames, 1883 (upper Campanian-Maastrichtian;)

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