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Sharks and rays from the Mokattamian Stage (middle and late Eocene) of Egypt, including some species from the middle Eocene Midra Shale of Qatar

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TWENTY six species of "megascopic" elasmobranchs have been identified, described and figured, and a local biostratigraphic scheme has been constructed. *Ginglymostoma angolense* Dartevelle & Casier, 1943 is reported for the first time from the Egyptian Eocene. The average size of *Misrichthys stromeri* Case & Cappetta, 1990 seems to be age dependent, younger populations generally being larger in size. If this trend is confirmed by future studies, it may be used to separate specifically older populations from younger ones. Several species appear to be characteristic of specific horizons and, hence, could be used in the future for regional biostratigraphic correlation.

Ginglymostoma angolense Dartevelle & Casier, 1943, *«Carcharias» koerti* (Stromer, 1910), *Moerigaleus vitreodon* Underwood &Ward, 2011, *Rhizoprionodon* sp. and *Anoxypristis mucrodens* (White, 1926) are reported for the first time from the middle Eocene of Qatar.

Keywords: Mokattamian, Eocene, elasmobranchs, Egypt, Qatar

Introduction

Despite the long history of research on the fossil fish remains of the Eocene of Egypt, dating back to the 1850's, the amount of contributions on the subject remains limited to this day. Until quite recently, the bulk of Eocene sharks and rays of Egypt had been described from three main areas: Gebel Mokattam (east of Cairo), the area around the Pyramids of Giza (west of Cairo), and the Fayum (Dames, 1883, Priem, 1897a, b, 1899, 1909, 1914; Stromer, 1903, 1905; Leriche, 1921, Cuvillier, 1930a). It is only in recent years that the oasis of Bahariya and its northern plateau as well as the area around the northeastern rim of the Qattara depression (both located in the Western Desert) have been added to that list (Strougo et al. 2007; Adnet et al. 2011; Zalmout et al., 2012; Salame & Asan, 2019).

The ichthyological material which makes the subject of this study belongs to one of the authors (AS), and is deposited in the Department of Geology, Ain Shams University. The majority of the specimens were derived from the three classical areas– Gebel Mokattam, the Giza Pyramids plateau, and the Fayum– and from the Bahariya oasis, in the Western Desert (Fig. 1). It also contains a small number of shark and ray teeth collected from several new sites in the Nile Valley (Beni Suef, Maghagha, Minia), the Eastern Desert (Gebel Iweibid), and central western Sinai (Wadi Matulla). Besides the Egyptian specimens, this collection includes a small lot of shark teeth donated by Prof. Abdel Galil Hewaidy, of Al Azhar University. They were collected by him from the Midra Shale (middle Eocene) of Qatar, Arabian Peninsula. Their importance resides in the fact that most of the species are common to Egypt (some are first records for Qatar), and, hence, have been included in this study for comparison.

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Herein we focus on the "megascopic" elasmobranch species that are part of our assemblage. Twenty six species (twenty sharks and six rays) have been identified. The microvertebrate assemblage (composed mainly of batoids) will be described at a later date. Furthermore, a biostratigraphic chart documenting the ranges of the identified taxa within the framework of the Mokattamian classification proposed by Strougo (2008) has been constructed (Table 4). The stratigraphic ranges presented in this chart were derived exclusively from information associated with each species in the studied collection.

The Mokattamian Stage In Egypt

The term Mokattam Stufe – or Mokattamian Stage– was introduced by Zittel (1883) to characterize sediments in Egypt which he equated with the middle Eocene in other parts of the world (North Africa, Europe, Asia, and North America). The lower Eocene rocks of Egypt were also named by him the Libysche Stufe– or Libyan Stage. According to Zittel (1883), the Mokattamian first appears in outcrop in central Egypt at the latitude of Assiut and Minia where it overlies upper Libyan strata. The name Mokattamian derives from Gebel Mokattam, to the east of Cairo. The history of the Mokattamian Stage, its subdivision and its correlation with the standard Paleogene chronostratigraphic scale is discussed elsewhere (Strougo, 1985a, b,1986, 2008).

Considering the place of the Mokattamian stage in the standard Paleogene chronostratigraphic scale, Strougo (2008) has shown, by use of planktic foraminifera and calcareous nannofossils (Table 1), that the middle Eocene is represented by the levels MK1 to MK7, MK1 to MK5 corresponding to the Lutetian, and MK6 and MK7 corresponding to the Bartonian. Levels MK8 to MK12 fall into the Priabonian (late Eocene). He emphasized, however, that there are some problems that have not yet been resolved. First, there is no general agreement about some Paleogene stage boundaries (e.g., the Lutetian-Bartonian and the Bartonian-Priabonian boundaries). Second, there are several discrepancies between the biostratigraphic ranges of nummulites and their corresponding planktic foraminifera and calcareous nannofossil zones in the Shallow Benthic Foraminiferal Zones (SBZ) proposed by Serra-Kiel et al. (1998), on the one hand, and the results obtained from Egyptian sections on the other.

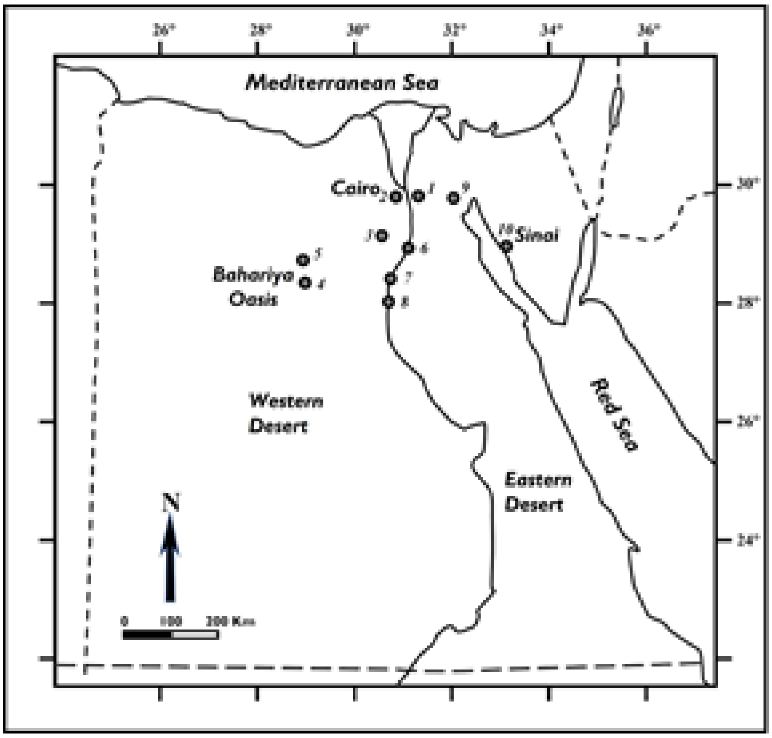

Fig. 1. Location of the most important collected areas. 1, eastern Greater Cairo; 2, western Greater Cairo; 3, Fayum area; 4, ElGedida iron mine; 5, Km 55 of the Bahariya-Cairo asphalt road; 6, Beni Suef area; 7, Maghagha area; 8, Minia area; 9, Gebel Iweibid; 10, Wadi Matulla.

TABLE 1. Place of the Mokattamian Stage and its subdivisions in the standard Paleogene time scale; (1) Boundary with respect to zones of planktic foraminifera according to Berggren & Pearson (2006); (2) Boundary with respect to zones of planktic foraminifera according to Toumarkine & Luterbacher (1985); (3) Boundary with respect to zones of planktic foraminifera according to Berggren et al. (1995) (after Strougo, 2008).

EGYPT					STANDARD STAGE
MOKATTAMIAN	UPPER	MK12	? ? ? ?	? ? ? ?	PRIABONIAN
		MK11			
		MK10			
		MK9			
	MIDDLE	MK8	*Globigerinatheka i. tropicalis* "Z." *Globigerinatheka semiinvoluta* Z.	NP19	(3)
		MK7	*Turborotalia pseudoampliapertura* Z. *Truncorotaloides rohri* Z.	NP18	(2) BARTONIAN
		MK6	*Orbulinoides beckmanni* Z.	NP17	
		MK5	*Morozovella lehneri* Z.	NP16	(1)
		MK4			LUTETIAN
	LOWER	MK3	*Globigerinatheka subconglobata subconglobata* Z.	NP15	
		MK2			
		MK1	*Hantkenina nuttalli* Z.	NP14	

Stratigraphic framework and selachian content

A multitude of formational names has been introduced by various authors in various localities sometimes to differentiate minor variations in facies and lithologic composition. Several attempts have been made since the 1980's to sort out these names and to revise their ages within the standard global stratigraphic framework (Boukhary & Abdelmalik, 1983; Strougo, 1985a, b, 1986, 2008; Strougo et al., 2007, 2013). An overview of the general stratigraphy of the most productive areas with respect to their diversity of selachian fossils is presented hereunder.

Greater Cairo

General stratigraphy

The stratigraphy of the Greater Cairo area, east and west of the Nile, has been the subject of intensive study due to its accessibility and simple structural setting. In the present work, the lithostratigraphic nomenclature and age of the various units recognized by Strougo (1985a, b, 1986, 2008) in the area are adopted.

As noted by Zittel (1883), the stratigraphic complex of Gebel Mokattam consists of two main lithologies: white and light yellow carbonates at the base and dark colored clastics at the top. The carbonate succession starts at the base with the Mokattam Formation, which includes the Lower Building Stone Member and the *Gizehensis* Member of Said & Martin (1964). The Mokattam Formation is dated to the base of the middle Mokattamian– lower MK4; it is therefore of Lutetian age. The Observatory Formation overlies the Mokattam Formation and includes two members: The Upper Building Stone Member at the base and the Giushi Member at the top. The first is dated as upper MK4 and MK5, and hence Lutetian, the second as MK6, and hence Bartonian. The carbonate section ends with the ElQurn Formation, which consists of interbedded pale yellow argillaceous limestones and tan to light brown marls. It typifies MK7 and falls in the Bartonian. The clastic beds overlying the ElQurn Formation represent the Maadi Group and are divided into a lower Wadi Garawi Formation (MK8) and an upper Wadi Hof Formation (upper Mokattamian: MK9-MK12). The Maadi Group falls entirely in the Priabonian.

All the formations recognized at Gebel Mokattam have been traced with little lithological change on the western side of the Nile, although in more reduced thicknesses; they are best displayed in the Giza pyramids plateau and its surroundings. However, older beds than those of Gebel Mokattam lie exposed at the northwestern corner of the plateau, forming the lower escarpment overlooking the Cairo-Fayum road. *Nummulites praegizehensis, N. praediscorbinus,* and *N. cuvillieri* have been identified from these beds by Boukhary & Hussein-Kamel (1993). They have been dated as upper MK2 and MK3 by Strougo (2008). The *N. praegizehensis* Beds are overlain by the Lower Building Stone Member. The stratigraphic classification of the Eocene rocks of the Greater Cairo area is given in Table 2.

There are numerous reports on fish remains of the Eocene succession of the Greater Cairo area (Meyer, 1851; Woodward, 1893, 1910; Priem, 1897a, 1914; Stromer, 1905; Leriche, 1921; Joleaud, 1934; Moustafa, 1953). Only a few contain descriptions and figures of shark teeth, and the majority of these teeth came from the lower limestone beds of Gebel Mokattam. The elasmobranch fossils of younger Mokattamian beds (e.g., the ElQurn, Wadi Garawi and Wadi Hof Formations) remained virtually unknown except for some fossil lists (without any description or illustration) given by Cuvillier (1930b: p. 214) from the Wadi Garawi Formation of Gebel Mokattam, east of Kait Bey or by Cuvillier (1934) in which he reported the discovery of a highly fossiliferous horizon, located less than 1 km south of the pyramid of Menkara, from which he identified nearly one hundred fossil species, including eight fish species (four selachians and four osteichthyans). He correlated this horizon with the base of the upper Mokattam beds of Gebel Mokattam. Also, Abbass (1972) presented a short note on the occurrence of a phosphatic bed, 30 cm thick, lying directly below the Ain Musa Bed at Gebel Giushi. He illustrated three poorly preserved teeth from this phosphatic bed which he neither described nor named; he simply referred to them as "shark teeth". In present stratigraphic terms, this phosphatic bed falls in the level MK11 of Strougo (2008) and therefore is of Priabonian age.

From the above survey, we see that the Eocene fish fauna of the Greater Cairo area remains very poorly known to this day. The few species recorded are in reports about one hundred years old, and certainly need revision.

Selachian fauna

The Eocene selachian fossils of the Greater Cairo area discussed in this study were collected from the ElQurn, Wadi Garawi and Wadi Hof Formations, spanning levels MK7 to MK12. Two sections in eastern Greater Cairo yielded a few teeth of sharks and rays: The Wadi Garawi Formation of the east ElBasatin section and the Wadi Hof Formation of the Gebel Nasuri section. From the former, the following species were identified *Carcharhinus frequens* (Dames, 1883), *Moerigaleus vitreodon* Underwood & Ward, 2011, and *Myliobatis* sp.. *Otodus (Carcharocles)* cf. *sokolowi* (Jaekel, 1895) is the only species collected from the Gebel Nasuri section.

A richer and more diversified fauna came from the sections on the west side of the Nile. At Gebel Gibli ElAhram, south of the Sphinx, the succession starts with the ElQurn Formation and ends within the Wadi Hof Formation (Strougo, 1985b). The majority of the vertebrate fossils were found at the base of the ElQurn Formation, in a thin yellow marly bed with abundant phosphatic granules (see also Bed 1 of Cuvillier, 1930b, p. 217 and 218). This horizon gave the following species: *Abdounia* aff. *minutissima* (Winkler, 1874), *Carcharhinus frequens* (Dames, 1883), *Carcharhinus* sp.1 Case & Cappetta, 1990, *Carcharhinus* sp.2 Case & Cappetta, 1990, *Misrichthys stromeri* Case & Cappetta, 1990, *Rhizoprionodon* sp., *Moerigaleus vitreodon* Underwood & Ward, 2011, and *Myliobatis* sp..

The richest horizon in fish remains was found in the Wadi Garawi Formation at Darb ElFayum, in a low butte bordering the west side of the Cairo-Fayum road. This outcrop was first reported and described by Hilmy et al. (1983) who discovered a horizon with natroalunite of early diagenetic origin in a thin succession of dark shales belonging to the Wadi Garawi Formation. The vertebrate fossils occur in «a tough phosphatic band extremely rich in shark teeth and bones» (Strougo, 2008: p. 93) lying at the base of the Wadi Garawi Formation and overlying disconformably a hard light gray limestone belonging to the level MK4. The following elasmobranch species were identified from the Darb ElFayum section: *Abdounia* aff. *minutissima* (Winkler, 1874), *Carcharhinus frequens* (Dames, 1883), *Carcharhinus* sp.2 Case & Cappetta, 1990, *Misrichthys stromeri* Case & Cappetta, 1990, *Rhizoprionodon* sp., *Moerigaleus vitreodon* Underwood & Ward, 2011, *Hemipristis*

TABLE 2. Eocene formations of the Greater Cairo area and their corresponding ages according to Strougo (2008).

<table>
<tr><td rowspan="4">UPPER MOKATTAMIAN</td><td>MK12</td><td rowspan="5">PRIABONIAN</td><td rowspan="4" colspan="2">WADI HOF FM.</td></tr>
<tr><td>MK11</td></tr>
<tr><td>MK10</td></tr>
<tr><td>MK9</td></tr>
<tr><td rowspan="5">MIDDLE MOKATTAMIAN</td><td>MK8</td><td colspan="2">WADI GARAWI FM.</td></tr>
<tr><td>MK7</td><td rowspan="2">BARTONIAN</td><td colspan="2">ELQURN FM.</td></tr>
<tr><td>MK6</td><td>GIUSHI Mb.</td><td rowspan="2">OBSERVATORY FM.</td></tr>
<tr><td>MK5</td><td rowspan="4">LUTETIAN</td><td>UP. BLDG. ST. Mb.</td></tr>
<tr><td>MK4</td><td>GIZEHENSIS Mb.</td><td rowspan="3">MOKATTAM FM.</td></tr>
<tr><td rowspan="2">LOWER MOKATTAMIAN</td><td>MK3</td><td rowspan="2">LO. BLDG. ST. Mb.</td></tr>
<tr><td>MK2</td></tr>
</table>

curvatus Dames, 1883.

The Fayum

General stratigraphy

Beadnell (1905) gave the first comprehensive stratigraphic classification of the Paleogene succession of the Fayum. He recognized the following units from youngest to oldest:

(5) Fluvio-marine Series (Jebel el Qatrani beds). Upper Eocene (Bartonian)-Lower Oligocene (Tongrian).

(4) Qasr el Sagha Series (*Carolia* beds). Middle Eocene (Parisian).

(3) Birket el Qurûn Series (*Operculina-Nummulites* beds). Middle Eocene (Parisian).

(2) Ravine Beds. Middle Eocene (Parisian).

(1) Wadi Rayan Series (*Nummulites gizehensis* beds). Middle Eocene (Parisian).

He equated units (1)-(3) with the lower Mokattam beds of Gebel Mokattam and the Qasr ElSagha Series with the upper Mokattam beds.

The above units were given formal status by Said (1962). Unit (1) became the Wadi Rayan Formation; Unit (2) was called the Gehannam Formation; unit (3) received the name Birket Qarun Formation; unit (4) was named Qasr ElSagha Formation and unit (5) was named Gebel Qatrani Formation. Said (1962) assigned the two lower formations to the middle Eocene; the Birket Qarun and Qasr ElSagha Formations were assigned to the upper Eocene while the Gebel Qatrani Formation was placed entirely in the Oligocene.

In a geological study of the southwest part of the Fayum, Iskander (1943) divided the Wadi Rayan Series into four formations. From the oldest to the youngest, these are, the Muweilih Formation, the Midawara Formation, the Sath ElHadid Formation and the ElGharaq Formation. The Wadi Rayan Series was thus raised by Iskander to a group rank to encompass the above four formations. Strougo (1986) accepted the classification of Iskander and later extended it to embrace the stratigraphic successions exposed in the Maghagha area, east of the Nile, on the one hand, and further southwest to Wadi Hitan and the Bahariya Oasis, on the other (Strougo & Elattaar, 2005; Strougo, 2008; Strougo et al., 2007, 2013). The formational names of the Fayum area and their corresponding ages according to Strougo (2008) and Strougo et al. (2013) are given in Table 3. They have been followed in the present study.

Selachian fauna

Our knowledge about the Fayum fossil fish fauna has considerably improved in relatively recent years thanks to a number of publications, two of which deserve special mention: Case & Cappetta (1990) on the selachian fauna of the Fayum in general, and Underwood et al. (2011) on the sharks and rays of Wadi Hitan. These contributions have provided a much needed taxonomic and to some extent stratigraphic updating of the fossil assemblages described by previous authors (Dames, 1883; Priem, 1897b; Stromer, 1903, 1905).

Our assemblage has been recovered from diverse sections and from all formations, except the Sath ElHadid Formation, but the most prolific horizons are the Gehannam, Birket Qarun and Qasr ElSagha Formations. The few teeth collected from the Muweilih Formation (level MK3) are attributed to two species: *«Carcharias» koerti* (Stromer, 1910) and *Myliobatis* sp., they both came from one section: Mingar ElRayan. The Midawara Formation (levels MK4 and MK5) was examined in three sections: Mingar Shinnara, Wadi Muweilih, and south of Qusûr ElArab. *Nebrius blanckenhorni* (Stromer, 1903), *«Carcharias» koerti* (Stromer, 1910), *Galeocerdo eaglesomei* White, 1955, *Anoxypristis mucrodens* (White, 1926) and some unidentified, badly preserved lamniformes are the only fossils collected from these outcrops.

Bahariya Oasis

General stratigraphy

The floor and northern escarpment of the Bahariya Oasis expose clays and sandstones known as the Bahariya Formation, of Cenomanian age. These are overlain unconformably by an Eocene sequence of limestones and clastic rocks to which Said & Issawi (1965) gave the name of Plateau Group. They divided the Plateau Group into three formations, the Naqb, Qazzun and ElHamra Formations, from base to top. They assigned the Naqb to the lower Lutetian; the Qazzun to the upper Lutetian and the ElHamra to the upper Lutetian in its lower part to upper Eocene (Bartonian) in its upper part.

The plateau just to the north and northeast of the Bahariya Depression is littered with low conical hillocks (locally known as ElNuhud) with many depressions of which Gebel Ghorabi, ElHarra and ElGedida are notable as they host iron ore deposits. According to Said & Issawi (1965) the iron ore is a lateral equivalent of the Naqb Formation.

Subsequent work revealed that the Qazzun Formation, at its type-locality, comprises (at least) two dissimilar parts (Strougo et al., 2007). The basal part contains fossils that indicate an Ypresian age and the term Qazzun Formation should only be applied to it. The topmost part should be called the Sath ElHadid Formation and belongs in the Bartonian. Between the two occurs an interval that needs further study in order to ascertain its stratigraphic position. Similarly, the ElHamra Formation comprises three formations previously defined in the Fayum: the ElGharaq, Birket Qarun and Qasr ElSagha Formations (Strougo & Hottinger, 1987; Strougo & Boukhary, 1987). For the classification scheme of the succession of the northern plateau of the Bahariya Oasis followed in this work, see Strougo et al. (2007, Table 1, p. 88).

Selachian fauna

Teeth of elasmobranchs have been found in two outcrops in the area of the Bahariya Oasis: (1) ElGedida iron mine and (2) an outcrop situated on the northern plateau of the oasis, 55 km to the north of the ElGedida-Cairo asphalt road, simply called Km 55 by Adnet et al. (2011).

One of the most prominent units revealed by mining operations at the ElGedida mine, at the northeastern corner of the Bahariya Depression, is a several meter thick glauconitic sandstone lying erosively above the iron ore. This glauconitic sandstone is intercalated in its lower part by a phosphatic layer which yielded a number of "megascopic" shark teeth which were collected

TABLE 3. Eocene formations of the Fayum area and their corresponding ages according to Strougo (2008) and Strougo et al. (2013).

UPPER MOKATTAMIAN	MK12	PRIABONIAN	QASR ELSAGHA
	MK11		
	MK10		
	MK9		
MIDDLE MOKATTAMIAN	MK8		BIRKET QARUN FM.
	MK7	BARTONIAN	ELGHARAQ FM. GEHANNAM FM.
	MK6		SATH ELHADID FM.
	MK5	LUTETIAN	MIDAWARA FM.
	MK4		
LOWER MOKATTAMIAN	MK3		MUWEILIH FM.
	MK2		

by hand by walking out the outcrop. Besides, a wide array of minute teeth of sharks and batoids were obtained by washing and screening a large amount of the phosphatic material (Strougo et al., 2007). A full list of the elasmobranch fauna obtained from this horizon has been recently presented by Salame & Asan (2019) and needs not be repeated here. The ElGedida fossil assemblage has been cautiously assigned to the Lutetian by Strougo et al. (2007) and is here tentatively placed in level MK3.

The succession of Km 55 was first documented by Strougo & Hottinger (1987). The most significant find in this section was *Nummulites fabianii*, an index fossil of the Priabonian in Europe, identified by them in the Qasr ElSagha Formation, in level MK10. The few selachian species recognized in this area come either from the ElGharaq Formation, that is MK7 (*Otodus (Carcharocles)* cf. *sokolowi, Carcharhinus frequens*), or from the Qasr ElSagha Formation, level MK11 (*Odontorhytis pappenheimi*).

Miscellaneous Egyptian localities

Numerous other sections from various parts of Egypt have yielded a small number of teeth occasionally encountered in diverse levels. These are briefly dealt with below.

Beni Suef area– Some shark teeth belonging to *Carcharhinus frequens* (Dames, 1883) have been found in the Beni Suef Formation of Gebel Tarboul (level MK7). Further south, the Wadi Garawi Formation of Gebel Homret Shaiboun (level MK8) has yielded three species: *Tethylamna twiggsensis* (Case, 1981), *Carcharhinus* sp.1 Case & Cappetta, 1990, and *Misrichthys stromeri* Case & Cappetta, 1990.

Maghagha area– The Midawara Formation (levels MK4 and MK5) of Gebel Qarara has produced several shark teeth which were identified as follows: *Nebrius blanckenhorni* (Stromer, 1903), *Carcharhinus frequens* (Dames, 1883), *Carcharhinus* sp.1 Case & Cappetta, 1990, *Carcharhinus* sp.2 Case & Cappetta, 1990, *Galeocerdo eaglesomei* White, 1955, *Rhizoprionodon* sp., and *Myliobatis* sp..

Minia area– One nice anterior tooth of *Ginglymostoma angolense* Dartevelle & Casier, 1943 has been found in the basal part of the Samalut Formation (level MK1) of the Sawada section.

Gebel Iweibid– In the north Eastern Desert, level MK11 of the Wadi Hof Formation of Gebel Iweibid has yielded a few shark teeth; these are: *Otodus (Carcharocles)* cf. *sokolowi* (Jaekel, 1895), *Carcharhinus* sp.2 Case & Cappetta, 1990, and *Myliobatis* sp.

Central western Sinai– The Darat Formation (level MK3) of Wadi Matulla has yielded three nicely preserved teeth of *«Carcharias» koerti* (Stromer, 1910).

Table 4 illustrates the stratigraphic distribution of all the identified taxa in the present study within the different intervals of the Mokattamian Stage (MK1-MK12).

Qatar

The Midra Shale of Qatar is generally considered to be of middle Eocene (Lutetian) age (Casier, 1971; Boukhary et al., 1996). Many of the Qatari species were also found in Egypt and, therefore, have been used in this study for comparison. The fossils identified in the Midra Shale and found in Egypt are the following:

Ginglymostoma angolense Dartevelle & Casier, 1943

«Carcharias» koerti (Stromer, 1910)

Tethylamna twiggsensis (Case, 1981)

Moerigaleus vitreodon Underwood & Ward, 2011

Galeocerdo eaglesomei White, 1955

Physogaleus aff. *tertius* (Winkler, 1874)

Rhizoprionodon sp.

Anoxypristis mucrodens (White, 1926)

Systematic paleontology

The synonymy listings given hereunder are not exhaustive. For many species treated in this work, a cumulative synonymy can be found in Case & Cappetta (1990) for works published prior to 1990.

Institutional abbreviations– ASUGM: Ain Shams University Geological Museum

Abbreviations used in this study–L: Length; RL: Root Length; TH: Tooth Height; W: Width.

Ginglymostoma angolense Dartevelle & Casier, 1943

Plate 1, fig. 1-4

TABLE 4. Biostratigraphic distribution of the species of sharks and rays studied in this work.

Middle Eocene							Upper Eocene					
Lutetian					Bart		Priabonian					
L. Mok.			M. Mokattamian					U. Mokattamian				
1	2	3	4	5	6	7	8	9	10	11	12	
X												*Ginglymostoma angolense* Dartevelle & Casier, 1943
		X	X	X								«*Carcharias*» *koerti* (Stromer, 1910)
		X				X	X					*Moerigaleus vitreodon* Underwood & Ward, 2011
		X	X	X								*Galeocerdo eaglesomei* White, 1955
		X										*Odontorhytis bahariensis* Salame & Asan, 2019
		X	X			X	X			X		*Rhizoprionodon* sp.
			X				X		X	X	X	*Carcharhinus* sp.2 Case & Cappetta, 1990
			X	X								*Nebrius blanckenhorni* (Stromer, 1903)
			X				X			X		*Pristis lathami* Galeotti, 1837
			X	X		X	X		X		X	*Tethylamna twiggsensis* (Case, 1981)
				X			X				X	*Anoxypristis mucrodens* (White, 1926)
						X	X					*Abdounia* aff. *minutissima* (Winkler, 1874)
						X					X	*Alopias alabamensis* White, 1956
						X	X	X		X	X	*Carcharhinus frequens* (Dames, 1883)
						X					X	*Galeocerdo latidens* (Agassiz, 1843)
						X	X					*Hemipristis curvatus* Dames, 1883
						X	X			X	X	*Macrorhizodus praecursor* (Leriche, 1905)
						X	X				X	*Misrichthys stromeri* Case & Cappetta, 1990
						X	X					*Moerigaleus vitreodon* Underwood & Ward, 2011
						X	X			X	X	*Otodus (Carcharocles)* cf. *sokolowi* (Jaekel, 1895)
						X	X					*Physogaleus* aff. *tertius* (Winkler, 1874)
						X	X				X	*Propristis schweinfurthi* Dames, 1883
							X		X		X	*Carcharhinus* sp.1 Case & Cappetta, 1990
							X					*Myliobatis* sp.1 Case & Cappetta, 1990
							X			X		*Odontorhytis pappenheimi* Böhm, 1926
											X	*Myliobatis* cf. *latidens* Woodward 1888
											X	*Myliobatis* sp.2 Case & Cappetta, 1990

1987 *Ginglymostoma angolense:* Cappetta, p. 79, fig. 71/F-I

2017 *Ginglymostoma angolense:* Sambou et al., p. 211

Material. East of Sawada village, Minia (ASUGM 14046). One anterior tooth.

Midra Shale of Umm Bab (ASUGM 16990), Qatar, Arabian Peninsula. Six teeth of various positions.

anterior teeth are symmetrical, flattened labio-lingually and slightly slanted lingually in profile view. The main cusp is narrow, triangular, with rectilinear, smooth cutting edges, separated by a narrow notch from long, oblique lateral heels that bear about 7-9 upward directed triangular cusplets with pointed tips, and increasing in size toward the central cusp. In lateral view, the lingual and labial faces are slightly convex at the level of the main cusp and become concave toward the base. The enameloid is smooth and the base of the crown lingual face is marked by a narrow furrow with no trace of lingual uvula. The labial face of the crown overhangs the root with short arched apron that does not extend beyond the basal edge of the root. The root is thin and directed lingually, with strong and high lingual protuberance. The root basal face is broad, flat and heart-shaped, with large rounded central foramen.

In the lateral teeth (Qatar specimens) the crown becomes asymmetrical and more slanted distally, with long, convex mesial heel and shorter oblique distal heel.

Remarks. Our specimens are quite similar to *G.* aff. *angolense* that has been recovered from the Lutetian (middle Eocene) of Morocco by Tabuce et al. (2005); the only difference is that the latter has a lesser number of lateral cusplets (3-4 cusplets instead of 7-9 in our specimens). *Ginglymostoma angolense* shows some degree of similarity to *G. serra* (Leidy, 1877), from the Eocene of Maryland, USA. Both exhibit rounded labial apron and the same number of lateral cusplets, but the latter differs in possessing a crown that is wider than high and a prominent lingual expansion that is absent in our specimens.

Nebrius blanckenhorni (Stromer, 1903)

Plate 1, fig. 5-12

1903 *Ginglymostoma Blanckenhorni* Stromer, p. 34, pl. 1, fig. 6/a-c

1905 *Ginglymostoma Blanckenhorni:* Stromer, p. 166, pl. 15, fig. 28-31

1987 *Nebrius blanckenhorni:* Cappetta, p. 80, fig. 71/N-Q

2011 *Nebrius blanckenhorni:* Underwood et al., p. 57, fig. 4/T

2017 *Nebrius blanckenhorni:* Sambou et al., p. 211

2019 *Nebrius blanckenhorni:* Samonds et al., p. 4, fig. 2/A-C

Material. Gebel Qarara (ASUGM 16074); south of Qusûr ElArab, Wadi Hitan (ASUGM 16033). Two teeth (one anterior and one lateral).

Description. The teeth are asymmetrical, of moderate size, reaching up to 13 mm in width. The crown is thick, compressed labio-lingually. In the anterior tooth the main cusp is reduced with broad rounded tip, not clearly separated from the strong cuspidated lateral heels. The mesial heel is long, clearly concave in labial view and bears 12 cusplets (2/mm) that are directed upward with rounded tips and increase in size toward the center. The distal heel is shorter, rectilinear and bears 9 cusplets. The enameloid is smooth with few vertical striations on the lingual face. Transversely the lingual and labial faces are concave, particularly in the center, becoming flattened upward. The crown lingual face possesses a well-developed and broad uvula that expands horizontally at the base of the crown. A broad, long labial apron is present and passes beyond the basal edge of the root with concave mesial edge and less concave distal one. The root is thin, with narrow lingual and labial faces while the basal face is broad, flat with trilobed outline and central large foramen. A prominent lingual protuberance is present with short central nutritive groove. On the lateral tooth the crown becomes low with more slanted distally main cusp, convex mesial heel and concave distal heel.

Remarks. The above described specimens are very similar in size and morphology to those described by Stromer (1903, 1905) and figured by Cappetta (1987). Underwood et al. (2011) recorded teeth of *N. blanckenhorni* that possess a more prominent main cusp from the middle Eocene of Wadi Hitan. According to Underwood et al. (2011), *N. blanckenhorni* would be confined to the Midawara Formation, of Lutetian age, at Wadi Hitan, being replaced in the younger formations by another species– *Nebrius* sp. The genus *Nebrius* was also reported from the Lutetian of ElGedida, Bahariya oasis, by Adnet et al. (2020) but they did not comment on the species.

Genus *Nebrius* lies very close to genus *Ginglymostoma*, but the former exhibits a very reduced main cusp (nearly as strong as the marginal serrae) and a long labial apron that extends beyond the basal edge of the root in profile view.

«Carcharias» koerti (Stromer, 1910)

Plate 1, fig 13-18

2007 *«Carcharias» koerti:* Strougo, Cappetta & ElNahas, p. 90, pl. 1, fig. 1-2

2010 *'Carcharias' koerti:* Adnet, Cappetta & Tabuce, p. 863, fig. 3/i1-i2

2011 *'Brachycarcharias' koerti:* Underwood et al., p. 52, fig. 4/B

2021 *'Carcharias' koerti:* Zouhri et al., p. 125, fig. 2/F-G

Material. Mingar Shinnara (ASUGM 16087; 16088); Mingar ElRayan (ASUGM 16083); Wadi Mueilih (ASUGM 16086); south of Qusûr ElArab (ASUGM 16015); Wadi Matulla (ASUGM 16085). Twenty-one teeth.

Also, from the Midra Shale of Gebel Dukhan (ASUGM 17000) and Umm Bâb (ASUGM 16993; 16987), of Qatar, in the Arabian Peninsula. Four teeth and two root fragments.

Description. The teeth are rather large-sized, reaching up to 40.5 mm in total length in our material. The lower anterior teeth possess a triangular, erect main cusp with a slight indication of a sigmoidal profile, flanked on each side by a single low cusplet. The lingual face of the main cusp is slightly convex transversely, while the labial face is nearly flat. The enameloid of the lingual face is marked by few long, vertical striations that may reach the apex; some teeth bear short vertical striations toward the base of the labial face of the crown. The cutting edges are blunt, smooth and rectilinear, and do not reach the base of the crown. A distinct lingual neck is present at the base of the crown. The labial face of the crown does not overhang the root and labial crown-root junction is straight. A single pair of short narrow triangular lateral cusplets, about 4 mm long, are divergent, separated from the base of the crown and strongly recurved labially. The root is stout, high and compact mesio-distally (RL/TH ≈ 0.60) with well-developed lingual protuberance and deep nutritive groove. The labial face of the root is marked with strongly concave surface. The root's lobes are long (as long as the crown) with rounded extremities. The basal edge is concave forming a right angle between the lobes.

In more lateral teeth the crown widens, becomes more flattened labio-lingually and slightly slanted distally. The upper teeth are similar to the lower ones except that they possess broad, triangular, blade-like main cusp that is nearly straight in profile view. The lateral cusplets are strongly recurved lingually and the root lobes are short (nearly equal to half the crown length).

Remarks. Strougo et al. (2007) remarked that the main cusp of *«Carcharias» koerti* is characterized by a rather wide base while it is much more slender in the typical forms of the genus, and, hence, it is possible that it would need to be assigned a special generic name. Underwood et al. (2011) pointed out that *«Carcharias» koerti* is restricted to the Midawara Formation in Wadi Hitan, where it is only occasionally encountered.

Tethylamna twiggsensis (Case, 1981)

Plate 2, fig. 1-14

1971 *Lamna gafsana:* Casier, p. 2, pl. 1, fig. 3-4

1981 *Lamna twiggsensis:* Case, p. 58, pl. 3, fig. 4-8, text-fig. 3

1990 *Cretolamna twiggsensis:* Case & Cappetta, p. 9, pl. 3, fig. 40-55

2007 *Cretolamna twiggsensis:* Adnet et al., p. 315, fig. 6/21-22

2010 *'Cretolamna' twiggsensis:* Adnet, Cappetta & Tabuce, p. 863, fig. 3/c-d

2011 *Brachycarcharias twiggsensis:* Underwood et al., p. 52, fig. 4/K (non fig. 4/L-M)

2011 *Cretolamna twiggsensis:* Adnet et al., p. 30, fig. 3/A

2012 *Brachycarcharias* cf. *B. twiggsensis:* Zalmout et al., p. 76, fig. 4/W-X

2016 *"Cretolamna" twiggsensis:* Malyshkina & Ward, p. 60, fig. 5/J-K

2016 *Tethylamna twiggsensis:* Cappetta & Case, p. 51-54

2019 *Brachycarcharias twiggsensis:* Ebersole, Cicimurri & Stringer, p. 43, fig. 14/A-X

2017 *Cretolamna twiggsensis:* Zalat et al., p. 207, pl. 1, fig. 11-12

2021 *Tethylamna* cf. *twiggsensis:* Zouhri et al., p. 127, fig. 3/A-F

Material. Gebel Homret Shaibun (ASUGM 16079); Mingar Shinnara (ASUGM 16089); Qasr ElSagha (ASUGM 16073); Guta (ASUGM 16071); Naqb Sobeikha (ASUGM 16064); Geziret ElQarn (ASUGM 16050); Mingar Abyad (ASUGM 16007; 16171); south of Garet Gehannam (ASUGM 16166; 16169); Wadi Hitan (ASUGM 16021; 16022; 16030). Forty-two teeth.

Also, from the Midra Shale of Gebel Dukhan (ASUGM 16999), Qatar, Arabian Peninsula. Six teeth, more or less broken, some lacking the root altogether.

Description. The lower anterior teeth are flattened labio-lingually, having long, stout and blade-like triangular cusps that are strongly recurved lingually with the apical tip pointed labially. The lingual face is slightly convex transversely, while the labial face is nearly flat. The cutting edges are smooth, and extend to the basal edge of the cusp, separated from one or two pairs of lateral cusplets by a distinct notch. The lateral cusplets are short, slender and strongly bent lingually, bear short vertical striations that are more obvious lingually. When two pairs of cusplets are present on the tooth, the distal cusplets are much more reduced than the proximal ones. Lingually the crown-root junction is marked by broad neck that is devoid of enamel. The labial face of the crown overhangs the root in a prominent bulge that is devoid of enamel and follows the root lobes. The root is high, stout and shorter than the total height of the tooth (RL/TH = 0.63-0.70); it bears a prominent lingual protuberance through which opens a rounded foramen; a very shallow nutritive groove can be observed on some teeth. The lingual and labial faces of the root are narrow while the basal face is broad and concave forming an angle approximating 90°. The root lobes are long, divergent and rounded to flattened in profile view with rounded extremities.

The lateral teeth are more compressed labio-lingually and prolonged mesio-distally with thinner cusps that are slightly slanted distally. The mesial cutting edge becomes convex apically and concave toward the base, while the distal cutting edge is concave. The lateral cusplets are divergent, low and triangular in outline with pointed tips; they are straight to slightly inclined lingually in profile view. On some teeth the distal cusplets become much reduced or even absent. The root is thin, extended mesio-distally, rather high and nearly equal to the total height of the tooth (RL/TH = 0.98-1.1). The root lobes are more flattened and divergent with rectilinear extremities. The basal face of the root is flat and broad with concave basal edge forming an angle of about 115°-125°.

The upper teeth possess broad triangular crowns that widen toward the base and become straight in profile view to slightly slanted labially. On anterior files the main cusp is short compared to the lower teeth and the lateral cusplets are more flattened and straight. The root is thinner, and the root lobes become short and more divergent forming an angle of 130°-135°. In more lateral teeth the root becomes thicker with more flattened lobes compared to those of the lower teeth.

Remarks. *Tethylamna twiggsensis* has been long known from Egypt but was designated by different names: *Otodus obliquus, Lamna (Odontaspis) verticalis* by Dames (1883), *Lamna* cf. *vincenti* (Winkler, 1878), *Otodus* cf. *aschersoni, Odontaspis* cf. *cuspidata* by Stromer (1905). In the Midra Shale of Qatar, it has been called *Lamna gafsana* by Casier (1971).

Tethylamna twiggsensis was initially described by Case (1981) from the late Eocene of south-central Georgia, USA and assigned to genus *Lamna.* This identification was later rectified by Case & Cappetta (1990) into *Cretolamna twiggsensis* based on the study of a large number of teeth (forty-eight teeth) collected from the Gehannam Formation (middle to late Eocene) and the Qasr ElSagha Formation of the Fayum (see also Zalat et al., 2017). Underwood et al. (2011) are of the opinion that the species must be placed, at least provisionally, in genus *Brachycarcharias* Cappetta & Nolf, 2005. Recently, Cappetta and Case (2016) created a new genus– *Tethylamna*– to accommodate *"Lamna" twiggsensis* along with the type-species *Tethylamna dunni* Cappetta & Case, 2016, an opinion refuted by Ebersole et al. (2019).

Otodus (Carcharocles) cf. *sokolowi* (Jaekel, 1895)

Plate 2, fig. 15-22

1895 *Carcharodon sokolowi:* Jaekel, p. 25, pl. 1, fig. 1-5

1990 *Carcharocles* cf. *sokolowi:* Case & Cappetta, p. 6, pl. 1, fig. 1-13; pl. 2, fig. 14-21

1996 *Carcharocles sokolowi:* Case et al., p. 107, pl. 6, fig. 114-117

2002 *Carcharocles sokolowi:* Mustafa & Zalmout, p. 80, pl. 1, fig. 1-6

2010 *Otodus* cf. *sokolowi:* Adnet, Cappetta & Tabuce, p. 863, fig. 3/a.1- a.2

2011 *Otodus (Carcharocles) sokolowi:* Underwood et al., p. 61, fig. 4/A

2012 *Otodus* cf. *O. sokolowi:* Zalmout et al., p. 74, fig. 3/F-BB

2012 *Carcharocles sokolovi:* Diedrich, p. 14, fig. 9-10

2016 *Carcharocles sokolovi:* Kriwet et al., p. 11, fig. 6

2021 *Otodus (Carcharocles)* cf. *sokolowi:* Zouhri et al., p. 125, fig. 2/A-C

Material. Gebel Iweibid (ASUGM 16124); Gebel Nasuri (ASUGM 18007); Guta (ASUGM 16014, 18012); Naqb Sobeikha (ASUGM 16165); Mingar Abyad (ASUGM 18015); south of Garet Gehannam (ASUGM 18013); west Table (ASUGM 18008). Eleven teeth.

Description. The teeth are large-sized, the largest measured specimen attains about 67 mm in total height, somewhat compressed labio-lingually. The main cusp of the anterior teeth is triangular, broadening rapidly toward the base, with a nearly flat to mildly convex labial face, a moderately convex lingual face, and straight, finely serrated mesial and distal cutting edges flanked by a mesial and distal cusplet which are also serrated. The serrations of the cutting edges of the main cusp are well marked but minute, crowded, regularly distributed, pointing slightly upward and extending all the way from the base to the apex. The lateral cusplets are prominent, thick and robust, slightly diverging from the main cusp and clearly separated from it by a distinct slit, rather wide mesio-distally, with slightly convex lingual and labial faces, bearing irregularly, coarsely serrated edges. The enameloid of the labial face is marked by several very faint, hardly noticeable vertical wrinkles near the base of the crown. The root is bulky, rather thick, with a prominent lingual protuberance bearing a minute central foramen. The root lobes are long and divergent with roughly rectangular outline and rounded extremities. The basal edge of the root is strongly concave forming an angle ranging from 100° to 120°.

In more lateral teeth, the main cusp becomes slightly slanted distally, with rectilinear to mildly convex mesial cutting edge and slightly concave distal cutting edge. In some fairly well-preserved specimens, the serration of the cusplet is fine along the distal edge and coarser along the mesial edge. The root is more extended mesio-distally with a less concave basal edge.

Remarks. *Otodus (Carcharocles) sokolowi* was initially placed under the genus *Carcharodon* Müller & Henle, 1838. The teeth of this genus, however, differ from *Otodus (Carcharocles)* in being flatter labio-lingually, in bearing stronger and irregular serrations on the cutting edges of the cusp, in lacking lateral cusplets, and in possessing a flatter root. However, it must be pointed out that the evolutionary history of *Carcharocles* and the number of species that can be referred to it are a matter of dispute to this day. It has been variously assigned to *Otodus* (Andrianavalona et al., 2015), *Procarcharodon* (Casier, 1960), *Carcharocles*, or *Megaselachus* (Jordan & Hanibal, 1923; Glikman, 1964) (fide Kriwet et al., 2016). *Carcharocles sokolowi* has been sometimes placed under the genus *Otodus* (Adnet et al., 2010) or treated as a subgenus of *Otodus* (Underwood et al., 2011). Zouhri et al. (2021) reported another *Otodus (Carcharocles)* species as *Otodus (Carcharocles)* sp. from the middle Eocene of Morocco that they differentiated from *Otodus (Carcharocles)* cf. *sokolowi* by its smaller size reaching up to 5 cm in total height, flatter root and more slender cusp with fine serrations and low lateral cusplets.

Macrorhizodus praecursor (Leriche, 1905)

Plate 3, fig. 1-10

1990 *Isurus praecursor:* Case & Cappetta, p. 8, pl. 2, fig. 22-39

1990 *Isurus praecursor:* Ward & Wiest, p. 84

1994 *Isurus praecursor:* Cione & Reguero, p. 7, fig. 5/a-c; fig. 7/a, c, f, g, i

1996 *Isurus praecursor:* Case et al., p. 106, pl. 6, fig. 110-113

2005 *Cosmopolotodus praecursor:* Mustafa et al., p. 408, fig. 14-20

2011 *Macrorhizodus praecursor:* Underwood et al., p. 52, fig. 4/C-D

2012 *Macrorhizodus praecursor:* Zalmout et al., p. 76, fig. 4/A-V

2012 *Isurus praecursor:* Diedrich, p. 12, fig. 11/1-10

2013 *Macrorhizodus praecursor:* Otero et al., p. 19, fig. 3/28-34

2016 *Macrorhizodus praecursor:* Malyshkina & Ward, p. 59, fig. 4/B, E

2016 *Macrorhizodus praecursor:* Cappetta & Case, p. 56, pl. 6, fig. 4

2019 *Macrorhizodus praecursor:* Ebersole, Cicimurri & Stringer, p. 56, fig. 20/A-L

2019 *Macrorhizodus praecursor:* Trif, Codrea & Arghius, p. 8, fig. 5/1-4

2021 *Macrorhizodus praecursor:* Zouhri et al., p. 125, fig. 2/H-K

Material. Naqb Sobeikha (ASUGM 16058; 16065); Wadi Hitan (ASUGM 16141); Mingar

Abyad (ASUGM 16013; 16149); south of Garet Gehannam (ASUGM 16014; 16170). Twenty-six teeth.

Description. Teeth reaching up to 35 mm in total height in our material. The anterior teeth are symmetrical, with narrow triangular central blade that broadens to the base and recurved lingually with the apical tip pointed labially. Transversely, the lingual face is convex while the labial face is flat. The cutting edges are rectilinear, smooth and reach the base of the crown with no trace of lateral heels. The enameloid is smooth except on some teeth that bear few vertical striations on the lingual and labial faces. The lingual crown-root junction is marked by a narrow neck and the crown labial face overhangs the root with shallow bulge. The root is high, stout and shorter than the total height of the tooth, bearing a prominent lingual protuberance with rounded nutritive foramen opening in the center. The root basal face is broad, while the lingual and labial faces are narrow. The root lobes are long, divergent with flattened to rounded extremities and rectilinear lateral edges. The basal edge is concave forming an angle of approximately 100°.

Lateral teeth are flattened labio-lingually with thin and broad crowns that are slightly slanted distally with sigmoidal profile. The mesial cutting edge is convex apically, becoming slightly concave toward the base, while the distal cutting edge is rectilinear to concave in more posterior teeth; both cutting edges extend with no differentiation into short, oblique to nearly horizontal lateral heels. The root becomes more flattened and broader with rectangular outline, and nearly equal to the tooth height. No true boundary separating the root basal face from the lingual one, and the root labial face becomes broader. The root lobes are symmetrical and strongly divergent with slightly concave basal edge forming an angle of about 135°-145°.

The upper teeth have quite similar morphology to the lower ones; they can be differentiated by the shape of the crown and the root height, as they exhibit broader and higher triangular crowns that are straight to slightly curved labially in profile view, and the root has shorter lobes on anterior files in comparison to the lower teeth.

Remarks. The described specimens are similar in size and morphology to those described by Case & Cappetta (1990) from the Gehannam and Qasr ElSagha Formations (middle and upper Eocene) of the Fayum. In comparison to other fossil teeth of the same genus, *M. praecursor* possesses a crown that is shorter than the root particularly in the lower anterior teeth (Case & Cappetta, 1990; Cione & Reguero, 1994), and a low short heel with no trace of lateral cusplets.

The specimens described by Otero et al. (2013) from the middle and late of Eocene of South America possess high mesial and distal heels on lateral files and a distal rounded cusplet is present on more posterior teeth. Case & Cappetta (1990) stated that the most ancient representative of this species occurs in the lower Eocene of England (Casier, 1966); these are small teeth, with vestigial low lateral denticles.

Alopias alabamensis White, 1956

Plate 3, fig 11-16

1990 *Alopias* aff. *alabamensis:* Case & Cappetta, p. 10, pl. 3, fig. 56-63

2011 *Alopias alabamensis:* Underwood et al., p. 52, fig. 5/X-Y

2012 *Alopias alabamensis:* Zalmout et al., p. 76, fig. 4/AA

2013 *Alopias alabamensis:* Malyshkina, González-Barba & Bannikov, p. 99, pl. 13, fig. 10

Material. Mingar Abyad, Wadi Hitan (ASUGM 16179); south of Garet Gehannam (ASUGM 16016). Five teeth.

Description. Teeth reaching up to 11 mm in height in our material. In the anterior teeth the labial face is flat with concave median basal part, while the lingual face is moderately convex. The enameloid is smooth, and the cutting edges are rectilinear and extend without interruption into the root shoulders. The crown labial face overhangs the root. The root is short (RL/TH = 0.7), rather thick, with moderate lingual protuberance, well developed lobes, and rounded nutritive foramen that opens through it. The root labial and lingual faces are narrow, and the basal face is rather strongly arched with concave basal edge. The root lobes are divergent with rounded extremities. On more lateral teeth, the main cusp becomes slanted distally with sigmoidal profile, rectilinear to convex mesial cutting edge and slightly concave distal edge. The root becomes prolonged mesio-distally (RL/TH ≈ 1.0) with more divergent and less strongly arched lobes.

Remarks. Underwood et al. (2011) stated that the teeth of this species display great morphological variability, possibly due to sexual dimorphism as seen in modern species of *Alopias*; if that was true, the slender teeth of *A. alabamensis* should belong to males (see Fig. 5/X in Underwood et al., 2011) while broader ones should be attributed to females (see Fig. 5/Y in Underwood et al., 2011).

An unnamed species of *Alopias* was reported by Zalmout et al. (2012) from the late Eocene of Mingar Tabaghbagh, at the southwestern corner of the Qattara Depression, associated with the more common species *A. alabamensis*. It is known by a single lateral tooth and appears to differ from *A. alabamensis* in that the distal edge of its crown is interrupted at the base by a slight notch.

According to Underwood et al. (2011), the species is extremely rare in the Lutetian of Wadi Hitan, as it is known by a single tooth from the Midawara Formation but is more common in the younger formations of this area (Bartonian to Priabonian).

Hemipristis curvatus Dames, 1883

Plate 3, fig. 17-20

1883 *Hemipristis curvatus:* Dames, p. 140, pl. 3, fig. 4

1990 *Hemipristis curvatus:* Case & Cappetta, p. 16, pl. 4, fig. 78-87

1995 *Hemipristis curvatus:* Breard & Stringer, p. 78-79

2002 *Hemipristis curvatus:* Mustafa & Zalmout, p. 89, pl. 4, fig. 13-17; pl. 5, fig. 1-2

2011 *Hemipristis curvatus:* Underwood et al., p. 57, fig. 5/C

2019 *Hemipristis curvatus:* Ebersole, Cicimurri & Stringer, p. 66, fig. 24/A-L

2020 *Hemipristis curvatus:* Adnet et al., p. 16, fig. 7/A-C

2021 *Hemipristis curvatus:* Zouhri et al., p. 127, fig. 4/D

Material. Guta (ASUGM 14034; 14035); Naqb Sobeikha (ASUGM 14028; 14029); south of Garet Gehannam (ASUGM 16025). Five teeth.

Description. The teeth are small, reaching about 7 mm in total height. The lower anterior teeth have a slender, elongated, narrowly triangular cusp, with a very strongly convex lingual face and a barely convex labial one. The cutting edge occupies only the upper part of the cusp. In profile view, the cusp is sigmoidal, the lingual face is strongly concave in its basal part, very slightly recurving toward the labial side at the apex. The labial face of the crown is strongly bulging at its base, thus overhanging the root and clearly demarcated from it by a narrow depression. The base of the cusp is flanked on each side by a rather long, pointed cusplet. The root is very thick, narrow mesio-distally, with symmetrically arranged, divergent, lobes making an angle of about 76º, and a very salient median protuberance bearing a well-marked deep groove.

The upper lateral teeth are rather flattened labio-lingually and the crown is strongly slanted distally; the lingual face of the crown is clearly more convex than the labial one. The mesial cutting edge is sigmoidal, with a slightly concave outline near the base and convex toward the apex. There is no true mesial heel, but the base of the mesial cutting edge carries two or three sharp denticles which increase rapidly in size away from the base; the longer and main portion of the mesial cutting edge is devoid of serrations. There is a real distal heel, very high and oblique, slightly concave in outline, which bears five to seven strong denticles which increase in size toward the apex. The short distal cutting edge is devoid of serrations. The root is long (RL/TH = 1.3) and narrow, rather labio-lingually flattened on the sides, strongly bulging in the middle in lingual view, bearing a very deep median groove. The labial face of the crown slightly overhangs the root. The root lobes are asymmetrical, highly divergent, with rectangular outline, and rounded extremities.

Remarks. *Hemipristis curvatus* cannot be confused with *H. serra* Agassiz, 1843 which ranges from the Oligocene to the Pleistocene (Chandler et al., 2006). Besides a marked difference in average size (*H. serra* attains much larger sizes than *H. curvatus*), *H. serra* carries distinct serrations on the mesial and distal cutting edges of the cusp (except for a more or less long unserrated tip).

The species was first described from the Eocene of Geziret ElQarn, an island in Birket Qarun, Fayum. It came very likely from the Birket Qarun Formation (late Eocene), which makes up the bulk of the sediments of this island. Our material was collected from the same formation in the scarps overlooking the western end of Birket

Qarun and also from Wadi Hitan. *H. curvatus* was also reported in the area of Quarry E, NW of Qasr ElSagha in the Qasr ElSagha Formation (late Eocene) (Case & Cappetta, 1990). Underwood et al. (2011) stated that the species is very rare in the Midawara Formation (middle Eocene: Lutetian) of the Fayum (only two teeth were found by them) but is typically more common throughout the remainder of the succession.

Moerigaleus vitreodon Underwood & Ward, 2011

Plate 4, fig. 1-8

2011 Hemigaleiid gen. et sp. nov.: Underwood et al., p. 58, fig. 6/J

2011 *Moerigaleus vitreodon:* Underwood & Ward, p. 708, fig. 2/A-T

Material. Gebel Gibli ElAhram (ASUGM 14037); Darb ElFayum (ASUGM 14060); Naqb Sobeikha (ASUGM 14030; 14032); Wadi Hitan (ASUGM 14051; 14044; 14054);. Twenty-one teeth.

Midra Shale of Umm Bâb (ASUGM 15245), Qatar, Arabian Peninsula. Five lateral teeth.

Description. The teeth are small-sized, reaching about 3 mm in total height, and biconvex labio-lingually. The antero-lateral teeth have a tall, narrow, slender main cusp that is slanted distally. The enamel is smooth. The lingual face is convex transversely while the labial face is concave at the middle of the crown's basal limit and becomes convex apically. The mesial cutting edge is long, rectilinear, sometimes slightly concave in the middle and extends all the way to the root shoulder where it bears two small and upward directed denticles that decrease in size basally. The distal cutting edge is short, smooth, slightly convex and completely separated from well-developed heel by an angle of about 45°. The distal heel is high, oblique and bears 3 to 4 triangular, sharp-edged, and pointed cusplets that decrease in size distally. The labial face of the crown slightly overhangs the root by a moderate bulge that is marked by few vertical ridges more obvious beneath the distal heel. The root is thin, extended mesio-distally, and longer than the total height of the tooth (RL/TH = 1.12). The root labial and lingual faces are narrow while the basal face is broad and flat; it bears well developed and high lingual protuberance with broad and deep median groove that cuts through the basal face and extends into the basal part of the labial face of the root. The crown-root junction is marked lingually by a deep narrow furrow. The root lobes are asymmetrical and divergent with nearly rectangular outline.

Remarks. All the anterior teeth in our possession are broken and usually lack a great part of the root. All that can be said at present about these teeth is that they seem to be higher than wide, erect and rather narrow, with nearly equally convex lingual and labial faces, complete, unserrated cutting edges, smooth crown, and one or two pairs of quite high, strong, trigonal lateral cusplets.

The described teeth come very close to the recently erected genus and species *Moerigaleus vitreodon* Underwood & Ward, 2011, from the Birket Qarun Formation of Wadi Hitan. As in that species, our teeth display a high degree of morphological variation in the shape of the crown depending on the position of the tooth on the jaw. According to Underwood et al. (2011), *Moerigaleus vitreodon* differs from other members of the Family Hemigaleidae in having strikingly different anterior and lateral teeth but quite similar upper and lower teeth.

The genus *Moerigaleus* is known only by its type-species, *M. vitreodon*, which was initially described from the Bartonian to Priabonian (middle to late Eocene) of Wadi Hitan. It is most common in the Birket Qarun Formation of this area, but is occasionally encountered in the Midawara, Gehannam and Qasr ElSagha Formations (Underwood et al., 2011). Its geographic distribution in Egyptian localities can now be widened as it has been found in this study in the Greater Cairo area, in the scarps overlooking the northern shore of Birket Qarun, and in the Bahariya Oasis. Outside of Egypt, we extend the geographic range of the species into Qatar as we were able to identify five teeth in the Midra Shale material in our possession (see Plate 4, fig. 1, 2, 7, 8).

Furthermore, two teeth reminiscent of *M. vitreodon* have been recently described and illustrated by Adnet et al. (2020) from the middle Eocene of central Tunisia. They were, however, left in open nomenclature (*Moerigaleus* sp.) awaiting further studies.

Abdounia aff. *minutissima* (Winkler, 1874)

Plate 4, fig. 9-14

1990 *Abdounia* sp.: Case & Cappetta, p. 11, pl. 4, fig. 64-77

2011 *Abdounia* aff. *minutissima:* Underwood et al., p. 57, fig. 5/D-E

2012 *Abdounia* aff. *A. minutissima:* Zalmout et al., p. 78, fig. 4/CC-DD

2013 *Abdounia minutissima:* Clayton, Ciampaglio & Cicimurri, fig. 3/E

2016 *Abdounia minutissima:* Cappetta & Case, p. 57, pl. 7, fig. 6

2019 *Abdounia minutissima:* Ebersole, Cicimurri & Stringer, p. 86, fig. 31/P-GG

Material. West of Gebel Gibli ElAhram (ASUGM 16091); Darb ElFayum (ASUGM 14055); Geziret ElQarn (ASUGM 14027); Naqb Sobeikha (ASUGM 14096; 16060; 14031); Wadi Hitan (ASUGM 16024; 16092). Seventeen teeth.

Description. Teeth consisting of one narrow main cusp and one to several pairs of lateral cusplets. The teeth in our possession are of small size, reaching about 11 mm in total height. The lower anterior teeth have long, slender and erect main cusp, with transversely convex lingual face and nearly flat labial face. The cutting edges are well developed and blunt, extending all the way to the base of the main cusp. The lateral cusplets are of moderate height (circa 2-2.5 mm height), form an acute angle with the main cusp and bent lingually. The enameloid is mostly smooth except some teeth which have vertical wrinkles on the lingual face of the main cusp; also, short vertical folds are present on the labial base of the crown particularly under the lateral cusplets. The root is short (RL/TH ≈ 0.7), stout and has prominent lingual protuberance with deep nutritive groove that cuts through the basal face. The basal face of the root is broad, flat and directed lingually. The lobes are symmetrical, parallel sided, with rectilinear outline and rounded extremities. The labial crown-root junction is straight, and the base of the crown does not overhang the root.

Antero-lateral teeth are more flattened labio-lingually, with main cusp slightly slanted distally. Many parallel and short folds are clearly obvious on the base of the crown's labial face. The lateral cusplets become low and broad. The upper teeth are morphologically similar to the lower ones except they have narrow triangular main cusp that is wider at the base.

Remarks. The teeth of this species exhibit the simplest morphology of genus *Abdounia* with smooth, narrow triangular to slender main cusp and presence of a single pair of lateral cusplets; it can be easily distinguished from other Eocene species as, for example:

– *A. beaugei* (Arambourg, 1935) has a triangular main cusp with 2 or 3 pairs of lateral cusplets on the lower antero-lateral teeth (Case & Cappetta, 1990).

– *A. recticona* (Winkler, 1874) shows many minute lateral cusplets (up to 5 cusplets) on either side of the main cusp.

– *A. enniskilleni* (White, 1956) displays higher and more slender anterior teeth with vertical folds on the lingual face of the crown.

– *A. lapierrei* (Cappetta & Nolf, 1981) is characterized by stout, slender main cusp and cusplets.

Carcharhinus frequens (Dames, 1883)

Plate 4, fig. 15-26

1971 *Aprionodon frequens:* Casier, p. 2, pl. 1, fig. 6

1990 *Carcharhinus frequens:* Case & Cappetta, p. 12, pl. 5, fig. 102-107; pl. 7, fig. 143-148, 151-159

2011 *Negaprion* sp.: Underwood et al., p. 55, fig. 5/T-U

2011 *Carcharhinus* aff. *frequens:* Adnet et al., p. 32, fig. 3/G-H

2020 *"Carcharhinus" frequens:* Adnet et al., p. 10, fig.4/C-G

Material. ElBasatin (ASUGM 16116); Gebel Gibli ElAhram (ASUGM 16098; 16148); Darb ElFayum (ASUGM 16140; 16147; 16154); Gebel Tarboul (ASUGM 16127); Garet ElFaras (ASUGM 16119); Geziret ElQarn (ASUGM 16053); Guta (ASUGM 16046; 16069; 16072; 16151; 16152); Naqb Sobeikha (ASUGM 16059; 16063; 16153); Wadi Hitan (ASUGM 16045; 16156); Mingar Abyad (ASUGM 16008; 16009); Garet Gehannam (ASUGM 16120); south of Garet Gehannam (ASUGM 16017); northern plateau of the Bahariya Oasis (ASUGM 14088; 16106; 16161). Over three hundred teeth.

Description. Teeth reaching up to 12.7 mm in total height. In the lower anterior teeth, the crown is slender, erect and slightly sigmoidal in mesial or distal view. The lingual face is strongly convex mesio-distally, especially at its base. The labial face is nearly flat near the apex, slightly convex towards the base; the enameloid of the crown is smooth except for a faint but distinct median wrinkle at the base of the labial face, sometimes flanked on the mesial and distal sides by minute parallel folds; these folds are visible only in very well-preserved specimens or appear to be lacking on some specimens. The cutting edges are sharp but do not extend to the base of the crown. The heels are long and low, nearly horizontal with more or less sharply rounded edges, barely visible on the lingual side. The root is very well developed, low, its length slightly shorter than the total height of the tooth (RL/TH = 0.83-0.95); it bears a weak lingual protuberance and a deep medio-lingual groove which cuts into the root basal edge and extends for 0.4 mm to the base of the root labial face. The lateral lobes are parallel-sided, widely divergent, symmetrical, and labio-lingually flattened; they are roughly rectangular, slightly rounded at the extremities. The angle between the lobes of the root varies between 145º and 150º. The basal face of the root is flat. The lingual crown-root junction is characterized by a shallow but distinct narrow groove. In more lateral teeth, the cutting edges of the cusp extend all the way down to the heels; the lingual face is ornamented with a few to numerous minute parallel folds in the basal part of the crown. The heels are clearly visible both lingually and labially. The root is much extended transversely, longer than the total height of the tooth (RL/TH = 1.16-1.27). The root lobes are considerably divergent; not infrequently the basal edge of the root forms a nearly straight line, that is the angle between the lobes is almost $180^{0.}$

The upper teeth have a triangular asymmetric crown which is much broader compared to the lower teeth and. The crown is somewhat compressed labio-lingually, with a moderately convex lingual face and practically flat labial face. The cutting edges are well developed and extend into the heels. The mesial cutting edge is slightly convex, and the distal cutting edge is slightly concave or straight. The heels are slightly oblique to nearly horizontal, blade-like and very long.

Remarks. This species has been generally assigned to the recent genus *Aprionodon* Gill, 1862. Garrick (1985) and Cappetta (1987) consider *Aprionodon* synonymous with *Carcharhinus* Blainville, 1816. On the other hand, Underwood et al. (2011) placed the species under *Negaprion* Whitley, 1940. According to Adnet et al. (2011) the discontinuity of the cutting edge between the cusp and the heels in lower anterior and antero-lateral teeth does not favor an attribution to *Negaprion*. In 2012, Underwood & Gunter acknowledged that the small species referred to by Underwood et al. (2011) as *Negaprion* sp. is, in fact, the true *Carcharhinus frequens* whereas the larger species identified by the latter authors as *N. frequens* is different. Adnet et al. (2007) described badly preserved specimens from the late Eocene of Pakistan as *Carcharhinus* sp.1 and stated that these teeth can hardly be differentiated from the other Eocene *Carcharhinus* species and confusion is therefore possible with *C. frequens*. However, unlike *C. frequens*, *C.* sp.1 displays a better-individualized cusp, and longer lateral heels on its upper and lower teeth.

Adnet et al. (2020) described teeth of *C. frequens* from the late middle Eocene of central Tunisia that exhibit a smaller size (reaching up to 1 cm) than those occurring in Egypt.

Carcharhinus sp.1 Case & Cappetta, 1990

Plate 5, fig. 1-8

1905 *Carcharias (Prionodon)* cfr. Egertoni: Stromer, p. 177, pl. 16, fig. 17-19

1990 *Carcharhinus* sp.1: Case & Cappetta, p. 12, pl.7, fig. 164-165

2010 *Carcharhinus* sp.: Adnet, Cappetta & Tabuce, fig. 3/g

2011 *Carcharhinus* sp.: Underwood et al., p. 62, fig. 4/N

2011 *Carcharhinus* sp.1: Adnet et al., p. 30, fig. 3/D-F

Material. Gebel Gibli ElAhram (ASUGM 16096, 16097); Gebel Homret Shaiboun (ASUGM 16080); Geziret ElQarn (ASUGM 16062); Mingar Abyad (ASUGM 16003, 16006; 16044). Thirty teeth.

Description. Teeth are large sized reaching up to 21.4 mm in total height. The lower anterior teeth are symmetrical, flattened labio-lingually with narrow pointed triangular crown. The lingual face is convex while the labial face is nearly flat. The cutting edges of the crown are strongly serrated, the serrations decrease in size apically. The mesial cutting edge is straight to very slightly concave in its lower part then slightly convex right to the apex; the distal edge is straight, nearly vertical forming an obtuse angle with a high and wide, oblique distal heel which is also serrated; the serrations on the distal heel are coarser than those on the main cusp and decrease in size toward the base. The enameloid is smooth except for some vertical wrinkles on the lingual face that appear on some teeth. The base of the labial face is straight at its junction with the root and bears a weak bulge. The root is high, short mesio-distally and its length is equal to the total height of the tooth (RL/TH = 1). The root bears a weak lingual protuberance with a shallow median nutritive groove that cuts into the basal face of the root. The root lobes are symmetrical, divergent and parallel sided with rectangular outline, and rounded at the extremities. The angle between the lobes varies from 150°-160°; the basal face of the root is flat.

In more lateral teeth the crown is bent distally with sigmoidal outline in lateral view. The mesial cutting edge is convex toward the apex, straight in the basal part, extending all the way down to the edge of the root. The distal cutting edge is straight and well separated from the distal heel. The root is thin, asymmetrical, longer than the total height of the tooth (RL/TH = 1.38) with straight basal edge (angle between the lobes is almost 180°).

The upper teeth are larger with broad triangular crowns compared to the lower teeth. The main cusp is slanted distally with the apical tip pointed labially on some teeth. The root is stout with moderate lingual protuberance. The root lobes are divergent and making an angle of about 125°-135°. In the posterior teeth, the crown becomes narrower and more tilted distally, with long sigmoidal mesial cutting edge and reduced distal heel. The root is thin and asymmetrical with more prolonged mesial lobe. The lobes angle is 180°.

Remarks. Teeth of this species are first described by Stromer (1905) from the Birket Qarun Formation (late Eocene) of the Fayum under the name *Carcharias (Prionodon)* cf. *egertoni* Agassiz. The same species has been subsequently reported by Case & Cappetta (1990) from the Gehannam Formation (late middle Eocene) of Wadi Hitan, based on one single upper lateral tooth. According to Case & Cappetta (1990), the true *C. egertoni* is a Miocene species from Maryland, USA, quite similar to the Egyptian form and probably belongs to the same species group, although the scarcity of the material does not allow a more precise identification of the species, and they chose to leave it in open nomenclature. Zalmout et al. (2012) assigned four specimens to *Carcharhinus* sp.1, but these lack serrations altogether.

Until now *Carcharhinus* sp.1 is mainly restricted to the north African coasts. In Egypt, it has been recorded from late middle Eocene and late Eocene rocks of Wadi Hitan (Case & Cappetta, 1990; Underwood et al., 2011). According to Underwood et al. (2011), *Carcharhinus* sp.1 is common in the Qasr ElSagha Formation but rare in the older rock units (Birket Qarun, Gehannam, and Midawara Formations). The species is also recorded from the late Eocene rocks of the northern plateau of the Bahariya Oasis (Adnet et al., 2011). Outside of Egypt the species has been reported from the late middle Eocene-late Eocene of southwestern Morocco (Adnet et al., 2010).

Carcharhinus sp.2 Case & Cappetta, 1990

Plate 5, fig. 9-16

1990 *Carcharhinus* sp.2: Case & Cappetta, p. 13, pl. 5 fig. 100-101; pl. 8, fig. 176-177

2010 *Carcharhinus* sp.: Murray et al., p. 668, fig. 1/D

2011 *Negaprion frequens:* Underwood et al., p. 55, fig. 5/V–W

2011 *Carcharhinus* sp. or *Negaprion* sp.: Adnet et al., p. 32, fig. 3/I–M

Material. Gebel Iweibid (ASUGM 16126); Gebel Gibli ElAhram (ASUGM 16023); Darb ElFayum (ASUGM 16138); Gebel Qarara (ASUGM 16102); Naqb Sobeikha (ASUGM 16031); Mingar Abyad (ASUGM 16026). Eighteen teeth.

Description. The maximum recorded tooth size in our material is 10.4 mm in total height. The lower anterior teeth have narrow, triangular and pointed crowns, with mildly convex labial face, more strongly convex lingual face, and elongated but low heels clearly set off from the base of the cutting edges of the cusp by a more or less distinct notch. The cutting edges are smooth and blunt. The enameloid of the crown is smooth but shows minute vertical folds on the base of the labial face. The edge of the marginal heels is nearly horizontal and shows irregular corrugations rather than true serrations. The root is stout, and its length is nearly equal to the total height of the tooth; it bears a deep median groove that cuts into the basal face of the root and extends for 1 mm up the base of the labial face. The lingual face of the root is narrow while the basal face is flat. The root lobes are symmetrical, parallel sided with roughly rectangular outline and rounded at the extremities. The root lobes angle is almost 180°. The labial crown-root junction is straight and marked by well-developed bulge. The labial face of the root is marked by many foramens and small vertical wrinkles that are orderly aligned parallel to each other. In more lateral teeth the marginal heels are longer, low and slightly oblique; the distal heel bears very faint serrations, and the mesial heel is devoid of any serrations. The root is more extended mesio-distally, and longer than the total height of the tooth (RL/TH = 1.18).

The upper teeth are flattened labio-lingually with asymmetrical triangular main cusp which is broader than that of the lower teeth. The main cusp is slanted distally with concave mesial cutting edge and straight to convex distal cutting edge. The heels are long, low and oblique, bearing serrations.

Remarks. Murray et al. (2010) described and illustrated an incomplete lateral tooth of *Carcharhinus*, which they identified as *Carcharhinus* sp., from the late Eocene of the Birket Qarun Formation of the Fayum and compared it to *Carcharhinus* sp.2 of Case & Cappetta (1990). They remarked, however, that their specimen differed slightly from this species by bearing a distinct notch separating the distal heel from the distal cutting edge of the main cusp. Underwood et al. (2011) assigned *Carcharhinus* sp.2 to *Carcharhinus frequens* (Dames, 1883).

Carcharhinus sp.2 cannot be confused with *Carcharhinus* sp.1 as the cutting edges of its cusp are unserrated and the main cusp is clearly separated from the marginal heels by a distinct notch. It also differs from *C. frequens* in having a broader main cusp and more serrated marginal heels.

Carcharhinus sp.2 till now is restricted to Egypt. It has been initially identified from the middle to late Eocene Gehannam Formation of Wadi Hitan in southwestern Fayum (Case & Cappetta, 1990). The species has also been recorded from the late Eocene Qasr ElSagha Formation of the northern plateau of the Bahariya Oasis (Adnet et al., 2011).

Galeocerdo eaglesomei White, 1955

Plate 5, fig. 17-20; Plate 6, fig. 1-2

1897 *Galeocerdo latidens:* Priem, p. 217, pl. 7, fig. 8

1905 *Galeocerdo latidens:* Stromer, p. 174, pl. 16, fig. 10, 12 (non fig. 11, 13, 14, 15)

1988 *Galeocerdo eaglesomi* (*sic!*): Cappetta & Traverse, p. 361

2006 *Galeocerdo eaglesomi* (*sic!*): Robb, p. 9, fig. 2

2007 *Galeocerdo eaglesomei:* Strougo, Cappetta & ElNahas, p. 88, pl. 1, fig. 3/a-b

2011 *Galeocerdo eaglesomei:* Underwood et al., p. 53, fig. 4/P

2012 *Galeocerdo eaglesomei:* Diedrich, p. 19, fig. 14/12

2014 *Galeocerdo eaglesomei:* Maisch, Becker & Chamberlain, p. 191, fig. 3/9-14

2019 *Galeocerdo eaglesomei:* Samonds et al., p. 6, fig. 2/ H-J (non fig. 2/M-O); fig. 3/A

2019 *Galeocerdo eaglesomei:* Ebersole, Cicimurri & Stringer, p. 99, fig. 35/A-O

2021 *Galeocerdo eaglesomei:* Zouhri et al., p. 127, fig. 3/G-I

2021 *Galeocerdo eaglesomei:* Rana et al., p. 10, fig. 11/F-H

Material. Gebel Qarara (ASUGM 16093); Mingar Shinnara (ASUGM 16090); Wadi Mueilih (ASUGM 16094); ElGedida iron mine (ASUGM 16143; 16145). Six teeth.

Also, from the Midra Shale of Umm Bâb (ASUGM 16994), Qatar, Arabian Peninsula. Two lateral teeth.

Description. The anterior teeth are high and broad, nearly erect, strongly compressed labio-lingually. Largest tooth reaches 18.8 mm in total height and 20.8 mm in root length. The labial face of the crown is nearly flat and the lingual face is slightly convex. The cutting edges are coarsely serrated, the serrations decrease in size toward the base and disappear toward the apex. The mesial cutting edge is very slightly concave at the base, nearly straight to slightly convex apically; the distal cutting edge has poorly defined notch separating the basal part of the cusp from the apical part; the latter is narrowly triangular, pointed at the extremity. The root is extensive, compressed labio-lingually, with obtusely diverging lateral lobes. The root is more exposed lingually, the height of its lingual face represents about three quarters of the total height of the tooth. The lingual face of the root has a strong protuberance with a shallow median groove. The basal face of the root is convex, and the root lobes form an angle of about 116º.

The lateral teeth are flattened labio-lingually, rather low and broad mesio-distally (RL/TH = 1.94). The crown is strongly slanted distally with convex lingual face and nearly flat labial face. The enamel of the lingual face is marked by small striations in the center of the main cusp, while the labial face is smooth. The cutting edges are well developed and bear simple serrations; the mesial cutting edge is nearly straight, being somewhat convex as it approaches the apex where the serrations become irregularly packed and decrease in size in apical and basal directions. The distal cutting edge is short and bears very small serrations; there is a well-developed, long and slightly concave distal heel that bears about 9 to 10 coarse denticles which decrease in size distally; the distal heel is separated from the cutting edge by a notch forming an acute angle ranging from 45º to 75°. The root is thin labio-lingually, much extended mesio-distally. There is a weak lingual protuberance bearing a shallow median groove that cuts through the root's basal face and extends for 0.5 mm to the base of the labial face. The root lobes are asymmetrical, divergent and parallel sided; they have rectangular outline and rounded extremities. The angle between the root lobes varies from 140º to 150º. The basal face of the root is flat. The lingual crown-root junction is marked by a clear shallow and broad furrow.

Remarks. According to Maisch et al. (2014), *Galeocerdo latidens* (Agassiz, 1843) is morphologically similar to the lateral teeth of *G. eaglesomei* although it differs in having coarse serrations on the distal margin but fine serrations on the mesial margin, a weakly defined distal notch, and a lower overall tooth height and thickness. It can be added that *G. eaglesomei* can be distinguished from *G. latidens* in that the serrations of its cutting edges reach almost to the apex of the cusp.

Teeth from the Bartonian/Priabonian deposits of Morocco have been questionably assigned to *G. eaglesomei* by Adnet et al. (2010). They are, according to these authors, similar to *G. eaglesomei* except that they are twice as large as the average size of the typical species found elsewhere. They suggested that the difference in size may be due to the younger stratigraphical position of the Moroccan specimens, indicating an increase in size of the lineage through time.

Galeocerdo latidens (Agassiz, 1843)

Plate 6, fig. 3-4

1971 *Galeocerdo latidens:* Casier, p. 3, pl. 1, fig. 9

1990 *Galeocerdo latidens:* Case & Cappetta, p. 13, pl. 5, fig. 96-99

1996 *Galeocerdo latidens:* Case et al., p. 109, pl. 8, fig. 152-159

1999 *Galeocerdo latidens:* Müller, p. 51, pl. 10, fig. 17-18

2002 *Galeocerdo latidens:* Mustafa & Zalmout, p. 86, pl. 3, fig. 5-8

2011 *Galeocerdo latidens:* Underwood et al., p. 53, fig. 4/Q

2013 *Galeocerdo latidens:* Leder, p. 20, pl. 6, fig. 1-12

Material. Mingar Abyad (ASUGM 16144); south of Garet Gehannam (ASUGM 16035). Two teeth.

Description. Teeth of this species are broad and poorly biconvex labio-lingually, the lingual face being somewhat more convex than the labial. The largest tooth is approximately 17 mm in height and 27.5 mm in length. The crown is triangular in shape, slanted distally. Mesial cutting edge with flexuous, sigmoidal course; distal cutting edge is nearly straight, notched at the base, forming an angle of about 107º with a long, broad and oblique heel. The enamel of the lingual and labial faces is smooth. The mesial cutting-edge bears about 13 small denticles that do not reach the apex; the distal cutting edge is straight and may bear very faint serrations or be completely smooth; the distal heel bears 8-11 denticles larger than those of the mesial cutting edge. The labial face overhangs the root with obvious bulge marked by faint, short and parallel vertical folds. The root is narrow, extended mesio-distally, longer than the total height of the tooth (RL/TH = 1.2) with more exposed lingual face and shallow median groove. The root lobes are divergent, nearly symmetrical, with rectilinear extremities. The root's basal face is convex forming an angle of about 150°.

Remarks. This species cannot be confused with *Galeocerdo eaglesomei* (White, 1955), previously described, as it possesses a narrower root, broad, smooth main cusp, and weak serrations of the mesial cutting edge.

In Egypt, *Galeocerdo latidens* has been reported from the lower Mokattamian (Lutetian) of Gebel Mokattam (Stromer 1903, 1905), and the late Eocene (Priabonian) of the Qasr ElSagha Formation of the Fayum (Case & Cappetta, 1990; Underwood et al., 2011).

Misrichthys stromeri Case & Cappetta, 1990

Plate 6, fig. 5-16

1905 *Carcharias* sp. indet.: Stromer, p. 176, pl. 16, fig. 20-21

1990 *Misrichthys stromeri* Case & Cappetta, p. 14, pl. 5, fig. 108-112; pl. 6, fig. 112-140; pl. 7, fig. 141-142

2002 *Misrichthys stromeri:* Mustafa & Zalmout, p. 88, pl. 3, fig. 13-14

2010 *Misrichthys stromeri:* Murray et al., p. 668, fig. 1/C

2010 *Misrichthys stromeri:* Adnet, Cappetta & Tabuce, p. 865, fig. 3/f

2011 *Misrichthys stromeri:* Underwood et al., p. 57, fig. 4/O

2011 *Misrichthys stromeri:* Adnet et al., p. 30, fig. 3/B-C

Material. Gebel Gibli ElAhram (ASUGM 16095; 16099); Darb ElFayum (ASUGM 16139); Gebel Homret Shaiboun (ASUGM 16146); Geziret ElQarn (ASUGM 16061); Guta (ASUGM 16047; 16068); Naqb Sobeikha (ASUGM 16010; 16067); Wadi Hitan (ASUGM 16155; 18016); Mingar Abyad (ASUGM 18016). Seventy-six teeth.

Description. The lower anterior teeth have a high and narrow, robust cusp which is recurved lingually in profile view with the tip pointed labially; their maximum total height reaches almost 28 mm. The lingual face is moderately convex, the labial face is nearly flat and shows slight convexity toward the base of the crown on some teeth. The enamel of the crown is smooth, but a short median fold flanked on either side by a shallow depression is discernible at the base of the labial face. The cutting edge of the crown stops at the level of the heels. The heels are poorly developed, very short, abrupt. The root is massive, narrow mesio-distally, with short, symmetrical to somewhat asymmetrical lobes and a moderately developed lingual protuberance bearing a very deep median groove which extends all the way down to the root basal edge. The root basal face is flat with convex basal edge making an angle ranging from 125º to 145º. In more lateral files, the crown widens, leans distally, the cutting edges expand into the heels, and the root broadens.

The upper teeth have a broader triangular cusp that is inclined distally in antero-lateral and lateral files, with prominent, flattened, highly elongated, blade-like heels. Both the lingual and labial faces are slightly convex. The cutting edges are sharp and extend from the apex to the lateral heels; there is a distinct notch at the junction between the distal cutting edge and the distal heel. The mesial cutting edge is convex, and the distal cutting edge is nearly straight.

Remarks. Underwood et al. (2011) have collected rare specimens of smaller size than *Misrichthys stromeri* in the Midawara Formation (middle Eocene) of the Fayum and suggested that these may be a different species of the genus. *Misrichthys stromeri* appears to reach its acme in the sandstones of the Birket Qarun Formation of the Fayum (Underwood et al., 2011). In our material the fossil teeth that have been collected from levels MK7-MK8 (middle Mokattamian) are of smaller size (up to 20 mm in total height) compared to those collected from the upper Mokattamian MK12 (28 mm in total height), and are identical to those reported by Adnet et al. (2020) from the Bartonian of Tunisia as *Misrichthys* sp.

Murray et al. (2010) have collected a single tooth of *Misrichthys stromeri*, partially damaged, from Quarry BQ-2 in the Birket Qarun Formation of the Fayum, which, they believe, is a freshwater deposit based on the associated fish remains. They thus suggested that the species must have been able to tolerate an environment of varying salinity.

Physogaleus aff. *tertius* (Winkler, 1874)

Plate 6, fig. 17-20

1905 *Alopiopsis* aff. *contortus:* Stromer, p. 176, pl. 16, fig. 5-9

1990 *Physogaleus* aff. *tertius:* Case & Cappetta, p. 15, pl. 5, fig. 88-91; pl. 7, fig. 149-150

2011 *Physogaleus* sp.: Underwood et al., p. 57, fig. 5/G-H

2012 *Physogaleus* sp.: Zalmout et al., p. 80, fig. 5/M

Material. Geziret ElQarn (ASUGM 14026); south of Garet Gehannam (ASUGM 16018;

16034). Five teeth.

Also, two teeth from the Midra Shale of Umm Bâb (ASUGM 16989), Qatar, Arabian Peninsula.

Description. The lower teeth of this species are narrow, compressed mesio-distally. The lower antero-lateral teeth are of moderate size (maximum height 9.1 mm) with narrow, slender cusp slanted distally and sigmoidal in profile view. The lingual and labial faces are convex with smooth enamel. The mesial cutting edge is slightly convex toward the apex and smooth or may show faint serrations on the basal part. The distal cutting edge is nearly straight and well separated from short oblique coarsely serrated distal heel, that can be seen from the labial view, and bears about 7 denticles decreasing in size distally. The root is massive, stretching mesio-distally and longer than the tooth height (RL/TH = 1.4) with flat basal face and rectilinear basal edge. The lingual face of the root is high, with a strong median protuberance bearing a deep median groove that cuts into the basal face of the root. The labial face of the root is narrower than the lingual face. The lingual crown-root junction has a shallow furrow marked by many small rounded foramens. The labial face of the crown overhangs the root by weak and nearly straight bulge. The root lobes are well divergent and nearly symmetrical with rounded extremities. In the lateral teeth the cusp becomes narrower and more strongly slanted distally. The enamel of the lingual face is marked by long vertical wrinkles. The distal heel is more developed, with 6-7 large pointed denticles decreasing in size distally. The mesial cutting edge is longer and bears about 6 small denticles. The root is narrow, elongated mesio-distally with flat basal face and weak lingual protuberance with shallow median groove that does not extend into the labial face. The basal edge of the root is slightly concave.

Remarks. *P. tertius* was described for the first time by Winkler (1874) under the name *Trigonodus tertius*. This species has subsequently received many different names as *Galeocerdo semilevis, Eugaleus falconeri, Sphyrna tortilis* and *Carcharhinus nigeriensis* by White (1926), *Galeorhinus formosus* and *Physodon tertius* by Arambourg (1952), and *Galeorhinus buberensis* by Case (1981) (Case & Cappetta, 1990).

Rhizoprionodon sp.

Plate 7, fig. 1-14

Material. ElBasatin (ASUGM 16027); Gebel Qarara (ASUGM 14050); Gebel Gibli ElAhram (ASUMG 14041; 14042); Darb ElFayum (ASUGM 14047; 14049); Guta (ASUGM 16048); Naqb Sobeikha (ASUGM 16057); northern plateau of the Bahariya Oasis (ASUGM 14089); ElGedida iron mine (ASUGM 14071; 16158; 18003). Over one hundred teeth.

Also, some twenty teeth from the Midra Shale of Umm Bâb (ASUGM 15246; 15249; 16988), Qatar, Arabian Peninsula.

Description. The teeth are small-sized (up to 6 mm in total height), flattened labio-lingually. The upper anterior and antero-lateral teeth present broad triangular cusps that are slightly bent distally with the apical tip pointed labially. The lingual face is slightly convex transversely and the labial face is flat. The enameloid on both faces is smooth except some teeth which have vertical wrinkles on the lingual face. The cutting edges are blunt and smooth; the mesial cutting edge is long, oblique and extends with no differentiation into short oblique mesial heel. The distal cutting edge is short, rectilinear and separated from the distal heel by an obtuse angle of about 140°. The distal heel is low and oblique to arcuate, with wavy cutting edge or sometimes weak denticles. On many teeth, the base of the crown lingually and labially is marked by a zone devoid of enameloid. The root is prolonged mesio-distally and longer than the total height of the tooth (RL/TH = 1.2-1.4). The labial and lingual faces of the root are narrow while the basal face is broad, flat and strongly oblique. The lingual protuberance of the root is weak with shallow nutritive groove that cuts deeply into the basal face. The nutritive groove is marked by a rounded foramen opening into the center of the lingual protuberance. The root basal edge is concave making an angle of about 150°. There are many vertical narrow foramens aligned parallel to each other along the lingual face of the root. The crown's labial face does not overhang the root and the junction of the two is nearly straight. The root lobes are nearly symmetrical, parallel sided with rectangular outline and rounded extremities.

On the lateral teeth the cusp becomes more slanted distally with slightly convex mesial cutting edge and rectilinear to slightly concave distal cutting edge. The root is more extended mesio-distally (RL/TH = circa 1.8). Teeth in more posterior position have more reduced and thin crowns that are very strongly bent distally; with more prolonged and concave mesial cutting edge.

The distal heel becomes short, high with more triangular outline.

The lower teeth have narrow triangular to slender main cusps that are curved lingually. The root is thicker with more developed lingual protuberance on the antero-lateral teeth as compared to the upper teeth, becoming narrower in more lateral teeth. Teeth of posterior position have much reduced main cusp that is strongly slanted distally with rectilinear to slightly convex mesial cutting edge.

Remarks. According to Case & Cappetta (1990), genus *Rhizoprionodon* is known by a very small number of species. The range of the genus is lower Eocene to Recent (Cappetta, 1987).

Odontorhytis pappenheimi Böhm, 1926

Plate 7, fig. 15-17

1905 Percoid indet: Priem, p. 638, fig. 10-11

1909 Rajid or Scyllid: Priem, p. 321, fig. 34-35

1926 *Odontorhytis pappenheimi:* Böhm, p. 84, pl. 31, fig. 17

1990 *Odontorhytis pappenheimi:* Case & Cappetta, p. 17, pl. 8, fig. 166-175

1991 *Odontorhytis pappenheimi:* Case & West, fig. 3

2011 *Odontorhytis* aff. *pappenheimi:* Adnet et al., p. 34, fig. 3/T

Material. Darb ElFayum (ASUGM 14095); Mingar Abyad, Wadi Hitan (ASUGM 14052); northern plateau of Bahariya Oasis (ASUGM 14084). Eight teeth, most of them broken.

Description. Teeth up to 10.5 mm in height in our material, with symmetrical, slender, and stout cusp that is compressed mesio-distally, concavo-convex labio-lingually, pointed at the tip and somewhat broad at the base. The cusp is narrowly rounded in lingual view, except the apical part which bears a salient, short barb. In labial view, the cusp has a sharp cutting edge that extends from the tip of the tooth to the basal end of the crown. The crown is devoid of mesial and distal cutting edges. The enamel is marked by numerous closely spaced, thin vertical striations reaching the apex lingually and scattered on the basal edge only of the labial face. The root is high (nearly equal to one half the total tooth height) and directed lingually, with prominent lingual protuberance. A deep nutritive groove is restricted to the upper part of the root height adjacent to the enamel giving the basal face of the root a heart-shape outline.

Remarks. Except their relatively larger size, the above described specimens are very similar in morphology to those described by Case & Cappetta (1990) from the middle and late Eocene of the Fayum. On the other hand, they are relatively smaller than those specimens reported by Adnet et al. (2011) from the late Eocene of the northern plateau of the Bahariya Oasis, which attain about 15 mm in total height. Cappetta (1981) recorded one species of *Odontorhytis* from the early Eocene of Morocco which he assigned to *O. pappenheimi*. Subsequently, however, Case & Cappetta (1990) mentioned that the Moroccan species clearly differs from the latter as it has well marked distal and mesial cutting edges as well as a pair of lateral denticles and should probably receive a new name.

O. pappenheimi can be easily separated from *O. bahariensis* Salame & Asan, 2019 as it is more massive and of larger size, has a complete labial cutting edge that extends to the basal edge of the cusp and a shorter median nutritive groove that does not reach the basal edge of the root; also, the relative height of the root may be a significant feature in separating the two species: in *O. pappenheimi*, the root height is nearly one half the total tooth height, while in *O. bahariensis* it is nearly equal to only one-third of the tooth height.

Odontorhytis bahariensis Salame & Asan, 2019

Plate 7, fig. 18-20

2007 *Odontorhytis* sp.: Strougo, Cappetta & ElNahas, p. 88, pl. 1, fig. 4/a-c

2010 *Odontorhytis pappenheimi:* Underwood et al., p. 55 and 57, fig. 5/Z, AA

2019 *Odontorhytis bahariensis:* Salame & Asan, p. 409, pl. 1, fig. 1-18

Material. ElGedida iron mine (ASUGM 14072; 14073; 14074; 14098). More than one hundred teeth.

Description. The teeth morphology of this species has been recently described in detail by Salame & Asan (2019).

Remarks. The characters that distinguish *Odontorhytis bahariensis* from *O. pappenheimi* have been discussed above. It is noteworthy that the two forms have not so far been found together in Egypt in the same stratigraphic level (*O.*

bahariensis probably belongs in MK3 whereas *O. pappenheimi* is much younger, MK8-MK11) which seems to negate the assumption of Adnet et al. (2020) that the two species may represent different ontogenetic stages.

Anoxypristis mucrodens (White, 1926)

Plate 8, fig. 1-6

1905 *Pristis* cf. *fajumensis:* Stromer, p. 49, pl. 6, fig. 2-3

1943 *Pristis aethiopicus:* Dartevelle & Casier, p. 172

1990 *Anoxypristis* aff. *mucrodens:* Case & Cappetta, p. 18, pl. 8, fig. 179-184

2011 *Anoxypristis mucrodens:* Underwood et al., p. 59, fig. 4/I

2012 *Anoxypristis* sp.: Zalmout et al., p. 81, fig. 5/N

2016 *Anoxypristis* aff. *mucrodens:* Cappetta & Case, p. 62, pl. 10, fig. 9-12

Material. Naqb Sobeikha (ASUGM 16160); Geziret ElQarn (ASUGM 16055); Mingar Abyad (ASUGM 16005); south of Qusûr ElArab (ASUGM 16032). Nine rostral teeth.

Also, from the Midra Shale of Umm Bâb, Qatar, Arabian Peninsula (ASUGM 16992). One rostral tooth.

Description. The rostral teeth of this species are blade-like, that is flattened dorso-ventrally, narrowly triangular, with sharp anterior and posterior cutting edges, and devoid of enameloid. The maximum length measured in our material is 41.8 mm. The anterior and posterior sides of the teeth are nearly parallel at the base narrowing gradually toward the apex, in a more abrupt manner, though, on the anterior than on the posterior side which gives to the tooth an asymmetrical outline along its longitudinal axis. There are numerous parallel striations aligned longitudinally; these are prominent in the lower half of the tooth, fading away towards the apex, intersected by transverse growth lines. The basal area exhibits a lens-shaped cross-section with many rounded foramens opening through it.

Remarks. Stromer (1905) assigned questionably two rostral teeth coming from the Qasr ElSagha Formation of the Fayum to *Pristis fajumensis*, erected by him on a rostrum. Case & Cappetta (1990), however, regard these teeth as conspecific with *"Pristis" mucrodens* White, 1926 from the middle Eocene of Nigeria while Dartevelle & Casier (1943) placed them in their new species *Pristis aethiopicus*. The latter authors stated that the rostral teeth of *Pristis aethiopicus* are perfectly symmetrical with respect to the longitudinal axis, and that their anterior and posterior cutting edges are sharp in their distal half and rounded in their proximal half.

The distinction between *Anoxypristis* and *Pristis* is essentially based on the external morphological features of the animal and, more especially, on the internal anatomy of the rostrum (Wueringer et al., 2009), which explains the difficulty of assigning several extinct species to one genus or the other, as for example, *Pristis imhoffi* Leriche, 1932 (Lutetian of Belgium and France), *P. ensidens* Leidy, 1877 (Neogene of USA), *P. ferinus* Böhm, 1926 (Eocene of southwest Africa), *P. mucrodens* White, 1926 (middle Eocene of Nigeria), *P. priemi* Leriche, 1932 (Eocene of France), *P. fajumensis* Stromer, 1905 (late Eocene of Egypt), *P. malembeensis* Dartevelle & Casier, 1943 (Miocene of Zaire). According to Cappetta (1987), it is probable that at least some of these species should be placed under the genus *Anoxypristis*. Cappetta & Case (2016) described rostral teeth as *A.* aff. *mucrodens* from the Lutetian of Alabama, USA, that are smaller with broader triangular outline and considered as proximal rostral teeth.

Pristis lathami Galeotti, 1837

Plate 8, fig. 7-12

1905 *Pristis* cfr. *Lathami:* Stromer, pl. 6, fig. 10

1990 *Pristis lathami:* Kemp, Kemp & Ward, p. 10, pl. 11, fig. 3

1990 *Pristis lathami:* Case & Cappetta, p. 18, pl. 8, fig. 186-188

1990 *Pristis lathami:* Ward & Wiest, p. 85

1995 *Pristis lathami:* Breard & Stringer, p. 78

2006 *Pristis lathami:* Robb, p. 10, fig. 2

2007 *Pristis lathami:* Adnet et al., p. 315

2007 *Pristis lathami:* Cicimurri, p. 597, fig. 1

2011 *Pristis lathami:* Underwood et al., p. 59, fig. 4/E

2012 *Pristis lathami:* Zalmout et al., p. 81, fig. 5/O-P

2012 *Pristis lathami:* Diedrich, p. 11, fig. 14/18

2016 *Pristis lathami:* Cappetta & Case, p. 63, pl. 11, fig. 1-2

2017 *Pristis lathami:* Zalat et al., p. 204, pl. 1, fig. 18

Material. Gebel ElMehasham (ASUGM 18002); Geziret ElQarn (ASUGM 16056); Wadi Hitan (ASUGM 18010; 16041); northern scarp of Birket Qarun (ASUGM 19004; 19005); northern plateau of the Bahariya Oasis (ASUGM 14085); Eleven rostral teeth.

Description. The teeth of this species are very large-sized (probably exceeding 100 mm in length when complete, 20 mm in width and nearly 16 mm thick when complete), very thick and massive, and devoid of enameloid. The posterior side is perfectly straight to the tip and nearly parallel to the anterior edge which, however, curves abruptly towards the apex. The posterior side is the thickest part of the tooth and carries in the middle a broad and shallow longitudinal groove that extends from the base to the tip. The anterior edge is not very sharp. Many strong parallel longitudinal folds cover the outer surface of the tooth, intersected by faint arched transverse growth lines.

Remarks. *Pristis lathami* is an extinct species of sawfish spanning the entire Eocene and mainly known from rostral teeth and rostrum fragments. The rostral teeth are easily distinguished by their large size and the posterior concave groove that runs from the base to the apex. According to Case & Cappetta (1990), the rostral teeth of *P. lathami* are quite similar to those of the recent *Pristis pristis* (Linnaeus, 1758), although they exhibit different oral teeth morphologies; the latter are very poorly known to this day. Cappetta (1987) stated that *P. lathami* shows a mixture of characteristics of *Pristis* and *Anoxypristis*, as it exhibits an internal rostral structure identical to that of *Anoxypristis*.

Small slender rostral teeth have been reported in the upper part of the Birket Qarun Formation and lower part of the Qasr ElSagha Formation (late Eocene) of Fayum area (Murray et al., 2010; Underwood et al., 2011) that show similar morphology to those of *Pristis* but lack the posterior groove as in *Anoxypristis*; these teeth may belong to *P. fayumensis* Stromer, 1905, or represent a new species as suspected by Adnet et al. (2011).

Propristis schweinfurthi Dames, 1883

Plate 8, fig. 13-15

1883 *Propristis Schweinfurthi* nov. gen. et nov. sp. Dames, p. 136, pl. 3, fig. 1-2.

1990 *Propristis schweinfurthi:* Case & Cappetta, p. 19, pl. 9, fig. 193-198, 201-209

2010 *Propristis schweinfurthi:* Adnet, Cappetta & Tabuce, p. 865, fig. 3/h

2011 *Propristis schweinfurthi:* Underwood et al., p. 59, fig. 4/H

2012 *Propristis schweinfurthi:* Zalmout et al., p. 81, fig. 5/Q-R

2019 *Propristis schweinfurthi:* Ebersole, Cicimurri & Stringer, p. 111, fig. 39/J-R

2021 *Propristis schweinfurthi:* Zouhri et al., p. 129, fig. 4/J

Material. Geziret ElQarn (ASUGM 16054); Mingar Abyad (ASUGM 16004; 16042); south of Garet Gehannam (ASUGM 16019). Four rostral teeth.

Description. The rostral teeth of this species are of moderate size (reaching up to 16.6 mm long), nearly as high as broad, devoid of enameloid, and totally flattened dorso-ventrally (maximum thickness, 4.4 mm), gradually increasing in thickness toward the base. Many parallel fine striations aligned vertically on the basal half of both the ventral and dorsal faces and transected by transverse growth lines. The posterior cutting edge is convex, and the anterior margin is straight to convex, ending basally by a short, slightly concave triangular shoulder that is parallel to the posterior edge. The apical tip is pointed to acutely rounded. The basal surface is lens-shaped to nearly discoidal, carrying a deep narrow groove, with narrower posterior end, and many rounded foramens opening through it.

Remarks. *Propristis schweinfurthi* is the type-species of genus *Propristis*, which was erected by Dames (1883) on a small fragment of a rostrum and isolated rostral teeth obtained from the Birket Qarun Formation of the Fayum.

Myliobatis cf. *latidens* Woodward, 1888

Plate 8, fig. 16-19

1905 *Myliobatis latidens:* Stromer, p. 42, pl. 5, fig. 2, 11, 12.

Material. Mingar Abyad, Wadi Hitan (ASUGM 16011). Part of a lower dental plate.

Description. Part of a lower dental plate that consists of five files (a central median file and two lateral files on each side). The median file possesses five interlocked median teeth that are flattened dorso-ventrally (5.5 mm in height), reaching about 32 mm in width and only 3 mm in length, with a hexagonal contour. The crown is slightly convex, reaching its greatest thickness in the center and decreasing laterally. The crown lingual face is broad and bears many vertical wrinkles. The lingual ledge is narrow, rectilinear and does not extend beyond the lingual face of the crown. A deep furrow separates the crown's lingual face from the ledge. The labial face of the crown is narrow, and the labial bulge is thin and bears many short folds. The root is low and flat, comb-like with multiple grooves. The teeth of the lateral files are much reduced. The root of the first left file possesses three grooves while the right file exhibits only two root grooves.

Remarks. The above described dental plate exhibits a particular morphology as the teeth of the median file are very short (10:1 width/length ratio), strongly recalling the *Myliobatis latidens* tooth design figured by Stromer (1905) from the Fayum. Our teeth, however, are even shorter than the typical *M. latidens* which has a 6:1 ratio of the median tooth file.

The small size of the plate suggests that it belongs to a juvenile individual. The rectilinear shape of the teeth indicates that this plate is a part of the lower tooth plate, as the upper tooth plate in the genus *Myliobatis* is more arched labially (Samonds et al., 2019).

Myliobatis latidens is known from the Eocene of Europe and U.S.A. In Egypt, the species has been identified by Stromer (1905) from the late Eocene Birket Qarun Formation of the Fayum. Our specimen came from the uppermost part of the Qasr ElSagha Formation (latest Eocene) of Mingar Abyad in Wadi Hitan.

Myliobatis sp.1 Case & Cappetta, 1990

Plate 8, fig. 20-23

1990 *Myliobatis* sp.1: Case & Cappetta, p. 20, pl. 9, fig. 216 and 220-222.

Material. Geziret ElQarn (ASUGM 16051). One isolated tooth of a median file.

Description. Out unique specimen is highly compressed dorso-ventrally, 3 mm high, 16 mm wide and 5.4 mm long. The labial and lingual faces are narrow and highly ornamented, bearing numerous crenulations that extend all over the margins of the crown. In profile view the labial face is oblique while the lingual face is vertical. The occlusal surface is flat. The lingual ledge is very narrow, rectilinear and smooth; extends beyond the lingual face of the crown. The root is flattened, and slightly extends lingually as its extremities can be seen from the occlusal view. In lingual view the lower plane of the root is slightly undulated forming a weak curve that is convex downward in the median part and concave on the sides.

Remarks. The above described specimen is quite similar to those described by Case & Cappetta (1990) as *Myliobatis* sp.1 from the Fayum area. The only noticeable difference is that our specimen is only half the size of those described by these authors.

Myliobatis sp.2 Case & Cappetta, 1990

Plate 8, fig. 24-27

1990 *Myliobatis* sp.2: Case & Cappetta, p. 21, pl. 9, fig. 199-200, 217-219.

Material. Mingar Abyad, (ASUGM 16180; 16181). Nine isolated teeth of the median file.

Description. The isolated teeth of this species are flattened dorso-ventrally, slightly arched upward, with a hexagonal contour; the maximum measured size is 38 mm in width and 9 mm in length. The crown is low, narrowing labially, and increases gradually in thickness in one direction giving the crown a slightly wedge shape. The occlusal face of the crown is pitted. Labial and lingual faces are vertical and bear many parallel vertical ridges. The labial marginal edge of the crown is rectilinear while the lingual marginal edge is concave on most of the teeth. In lingual view, the base of the crown is marked by a prominent transverse bulge overlain by a deep groove. The crown-root junction is marked by many rounded foramens aligned horizontally on both the labial and lingual faces. The root is low, flat and does not extend beyond the lingual face of the crown.

Remarks. *Myliobatis* sp.2 differs from *M.* sp.1 in that its root is flat, i.e., the height of the root is constant throughout its length, instead of showing a median angle. Also the crenulations of the root appear to be broader and more distant apart than in *M.* sp.1.

Conclusion

In this study we examined 26 species of elamobranchs (20 sharks and 6 rays) collected from many outcrops belonging to the Mokattamian Stage (middle-to-late Eocene) of Egypt. We also examined an assortment of elasmobranchs from the middle Eocene Midra Shale of Qatar of which eight species are also reported from Egypt: *Ginglymostoma angolense* Dartevelle & Casier, 1943; *«Carcharias» koerti* (Stromer, 1910); *Tethylamna twiggsensis* (Case, 1981); *Moerigaleus vitreodon* Underwood & Ward, 2011; *Galeocerdo eaglesomei* White, 1955; *Physogaleus* aff. *tertius* (Winkler, 1874); *Rhizoprionodon* sp.; *Anoxypristis mucrodens* (White, 1926); and five (*G. angolense, «C.» koerti, M. vitreodon, Rhizoprionodon* sp. and *A. mucrodens*) are reported for the first time from the Eocene of Qatar. One interesting point about the Qatari material is that it appears to lend further evidence that the ElGedida glauconitic sandstone of the Bahariya oasis likely can be assigned to the Lutetian as suspected by Strougo et al. (2007) since the Midra Shale is presently considered to be of Lutetian age (Boukhary et al. 1996) and has yielded *«Carcharias» koerti* and *Galeocerdo eaglesomei*, two species presumably indicative of that age (Strougo et al. 2007). Furthermore, it is interesting to note that, in Egypt at least, wherever *Ginglymostoma angolense, «Carcharias» koerti* and/or *Galeocerdo eaglesomei* have been found they came from well dated Lutetian deposits.

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أسماك القرش والشفنين من فترة المقطاميان (منتصف وأواخر العصر الأيوسيني) في مصر، متضمن بعض الأنواع من الأيوسين الأوسط من طفلة ميدرة في قطر

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جامعة عين شمس، كلية العلوم، قسم الجيولوجيا، ١١٥٦٦ القاهرة، جمهورية مصر العربية

تم التعرف على ستة وعشرين نوعا من الأسماك الغضروفية ووصفها وتصويرها، وتم عمل مخطط بيوستراتيجرافي على مستوى محلي. تم تسجيل وجود *Ginglymostoma angolense Dartevelle and Casier,* 1943 لأول مرة من عصر الأيوسين في مصر.

يبدو أن متوسط حجم *Misrichthys stroker Case & Catteppa,* 1990 يعتمد على العمر، حيث يكون حجم المجموعات الأحدث أكبر بشكل عام. إذا تم تأكيد هذا الاتجاه من خلال الدراسات المستقبلية، فيمكن استخدامه لفصل المجموعات الأقدم على وجه التحديد عن الأحدث. كما يبدو أن العديد من الأنواع المدروسة مميزة لنطق بيواستراتجرافية محددة، وبالتالي يمكن استخدامها في المستقبل للمضاهاة البيوستراتجرافية على المستوى الإقليمي.

تم تسجيل وجود:

Ginglymostoma angolense Dartevelle & Casier, 1943, *«Carcharias» koerti* (Stromer, 1910),

Moerigaleus vitreodon Underwood &Ward, 2011, *Rhizoprionodon* sp. and *Anoxypristis mucrodens* (White, 1926) لأول مرة من الأيوسين الأوسط لقطر.

Plate 1

***Ginglymostoma angolense* Dartevelle & Casier, 1943**

Fig. 1-2: Labial and lingual views of anterior tooth (ASUGM 14046); Sawada, Samalut Formation, lower Mokattamian (MK1), middle Eocene (Lutetian).

Fig. 3-4: Labial and lingual views of anterior tooth (ASUGM 16990); Umm Bâb, Qatar, Midra Shale Formation, middle Eocene (Lutetian).
Bar scale = 2 mm

***Nebrius blanckenhorni* (Stromer, 1903)**

Fig. 5-8: Labial, profile, lingual, and occlusal views of anterior tooth (ASUGM 16033); south of Qusûr ElArab, Wadi Hitan, Fayum, Midawara Formation, middle Mokattamian (MK5), middle Eocene (Lutetian).
Bar scale = 5 mm.

Fig. 9-12: Labial, profile, lingual, and occlusal views of lateral tooth (ASUGM 16074); Gebel Qarara, Maghagha, Midawara Formation, middle Mokattamian (MK4), middle Eocene (Lutetian).
Bar scale = 5 mm

***«Carcharias» koerti* (Stromer, 1910)**

Fig. 13-15: Lingual, labial, and profile views of upper anterior tooth (ASUGM 17000); Gebel Dukhan, Qatar, Midra Shale Formation, middle Eocene (Lutetian).

Fig. 16-18: Lingual, labial, and profile views of lower anterior tooth (ASUGM 16086); Wadi Muweilih, Fayum, Midawara Formation, middle Mokattamian (MK5), middle Eocene (Lutetian).
Bar scale = 1 cm

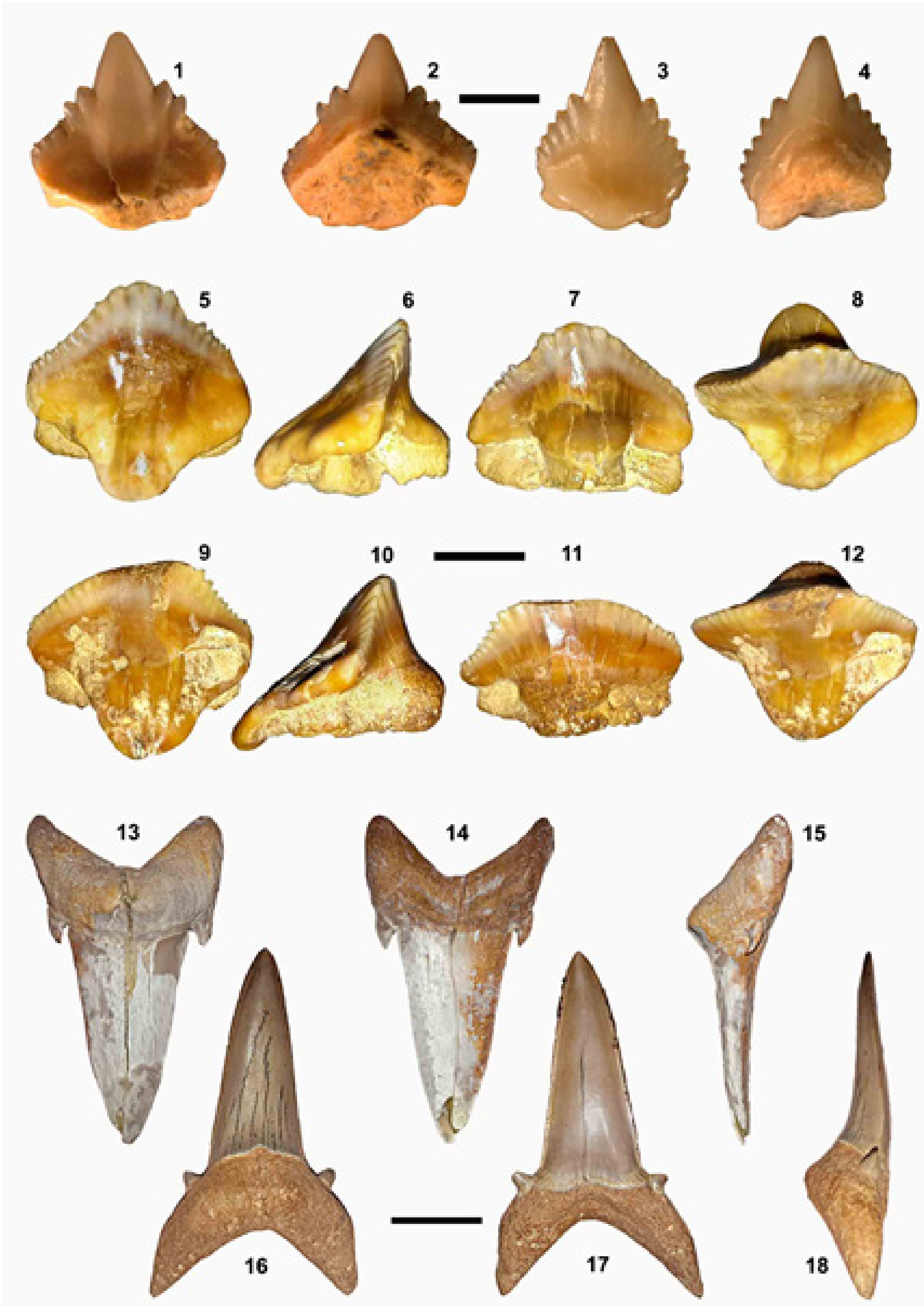
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Plate 2

***Tethylamna twiggsensis* (Case, 1981)**

Fig. 1-3, 11-12: 1-3 Lingual, labial, and profile views of upper anterior tooth; 11-12: Lingual and labial views of upper lateral tooth. (ASUGM 16166); south of Garet Gehannam, Wadi Hitan, Fayum, Gehannam Formation, middle Mokattamian (MK7), middle Eocene (Bartonian).

Fig. 4-6: Lingual, labial, and profile views of lower anterior tooth (ASUGM 16007); Mingar Abyad, Wadi Hitan Fayum, Qasr ElSagha Formation, upper Mokattamain (MK12), upper Eocene (Priabonian).

Fig. 7-8: Lingual and labial views of upper antero-lateral tooth (ASUGM 16064); Naqb Sobeikha, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).

Fig. 9-10: Lingual and labial views of lower antero-lateral tooth (ASUGM 16089); Mingar Shinnara, Fayum, Midawara Formation, middle Mokattamian (MK4), middle Eocene (Lutetian).

Fig. 13-14: Lingual and labial views of lower lateral tooth (ASUGM 16071); Guta, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).
Bar scale = 1 cm

***Otodus (Carcharocles)* cf. *sokolowi* (Jaekel, 1895)**

Fig. 15-16: Lingual and labial views of upper antero-lateral tooth (ASUGM 18007); Gebel Nasuri, Greater Cairo, Anqabiya bed, Wadi Hof Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).

Fig. 17-18: Lingual and labial views of lower antero-lateral tooth (ASUGM 18008); west Table, Bahariya Oasis, ElGharaq Formation, middle Mokattamian (MK7), middle Eocene (Bartonian).

Fig. 19-20: Lingual and labial views of upper lateral tooth (ASUGM 16014); Guta, Fayum, Gehannam Formation, middle Mokattamian (MK7), middle Eocene (Bartonian).

Fig. 21-22: Lingual and labial views of lower lateral tooth (ASUGM 18015); Mingar Abyad, Wadi Hitan, Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).
Bar scale = 2 cm

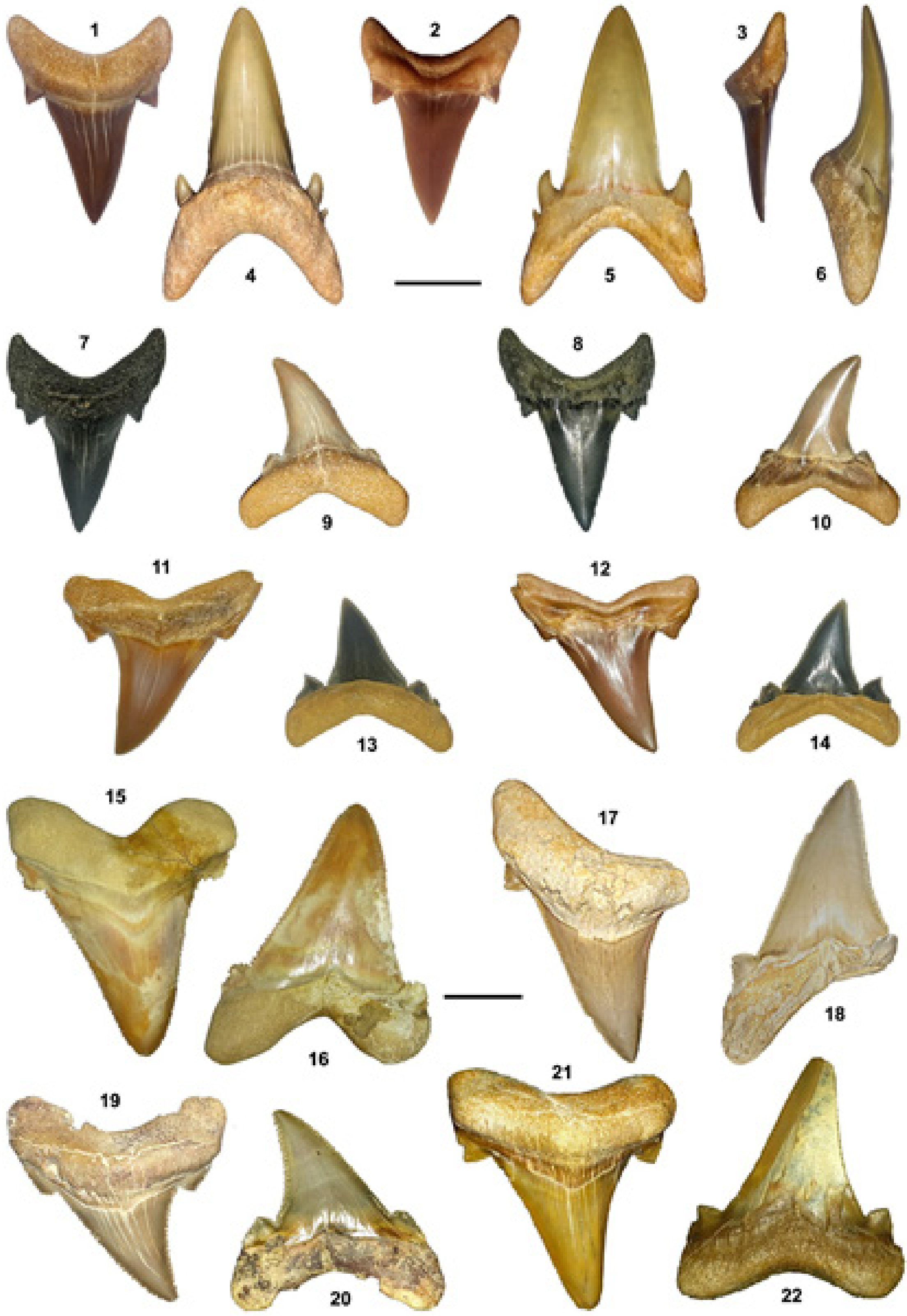
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Plate 3

***Macrorhizodus praecursor* (Leriche, 1905)**

Fig. 1-3: Lingual, profile, and labial views of upper anterior tooth (ASUGM 16149); Mingar Abyad, Wadi Hitan Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).

Fig. 4-6: Lingual, profile, and labial views of lower anterior tooth (ASUGM 16058); Naqb Sobeikha, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).

Fig. 7-8: Lingual and labial views of upper lateral tooth (ASUGM 16141); Wadi Hitan, Fayum, Qasr ElSagha Formation, upper Mokattamian (MK11), upper Eocene (Priabonian).

Fig. 9-10: Lingual and labial views of lower lateral tooth (ASUGM 16065); Naqb Sobeikha, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).
Upper bar scale = 1 cm

***Alopias alabamensis* White, 1956**

Fig. 11-12, 15-16: 11-12 Lingual and labial views of anterior tooth; 15-16: Lingual and labial views of lower lateral tooth. (ASUGM 16016); south of Garet Gehannam, Wadi Hitan, Fayum, Gehannam Formation, middle Mokattamian (MK7), middle Eocene (Bartonian).

Fig. 13-14: Lingual and labial views of upper lateral tooth (ASUGM 16179); Mingar Abyad, Wadi Hitan, Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonoan).
Middle bar scale = 1 cm

***Hemipristis curvatus* Dames, 1883**

Fig. 17-18: Lingual and labial views of upper lateral tooth (ASUGM 16025); south of Garet Gehannam, Wadi Hitan, Fayum, Gehannam Formation. middle Mokattamian (MK7), middle Eocene (Bartonian).

Fig. 19-20: Lingual and labial views of lower anterior tooth with broken crown (ASUGM 14034); Guta, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).
Lower bar scale = 1 cm

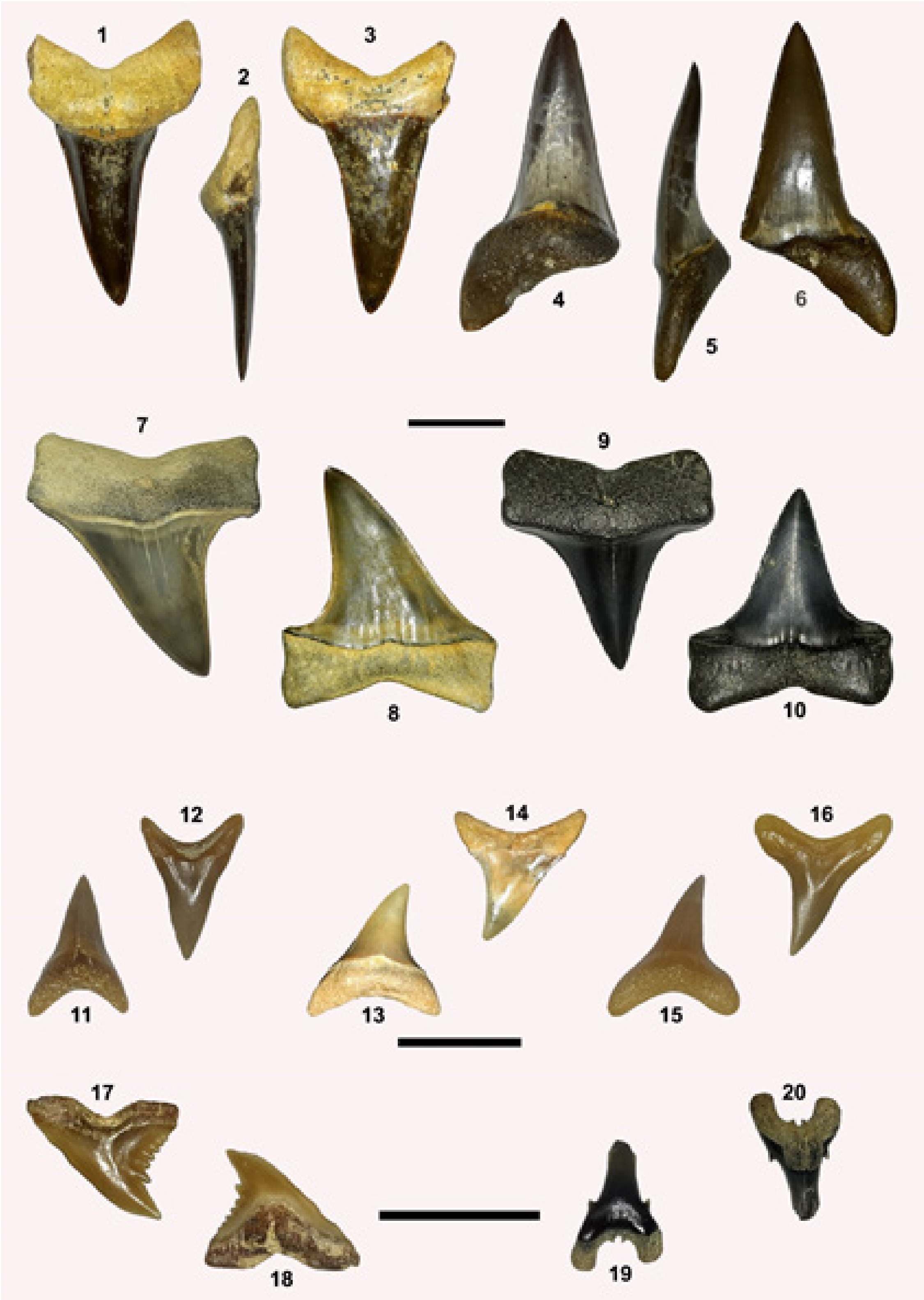
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Plate 4

***Moerigaleus vitreodon* Underwood & Ward, 2011**

Fig. 1-2, 7-8: 1-2 Lingual and labial views of upper lateral tooth; 7-8 Lingual and labial views of lower postero-lateral tooth. (ASUGM 15245); Umm Bâb, Qatar, Midra Shale Formation, middle Eocene (Lutetian).
Bars scale = 2 mm

Fig. 3-4: Lingual and labial views of upper postero-lateral tooth (ASUGM 14037); Gebel Gibli ElAhram, Greater Cairo, ElQurn Formation, middle Mokattamian (MK7), middle Eocene (Bartonian).
Bar scale = 1 mm

Fig. 5-6: Lingual and labial views of lower antero-lateral tooth (ASUGM 14030); Naqb Sobeikha, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).

***Abdounia* aff. *minutissima* (Winkler, 1874)**

Fig. 9-10: Lingual and labial views of upper anterior tooth (ASUGM 16091); west of Gebel Gibli ElAhram, Greater Cairo, ElQurn Formation, middle Mokattamian (MK7), middle Eocene (Bartonian).

Fig. 11-12: Lingual and labial views of lower anterior tooth (ASUGM 14027); Geziret ElQarn, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).

Fig. 13-14: Lingual and labial views of lower lateral tooth (ASUGM 16024); south of Garet Gehannam, Wadi Hitan, Fayum, Gehannam Formation, middle Mokattamian (MK7), middle Eocene (Bartonian).
Bar scale = 5 mm

***Carcharhinus frequens* (Dames, 1883)**

Fig. 15-22: 15-16 Lingual and labial views of lower anterior tooth; 17-18: Lingual and labial views of upper anterior tooth; 19-20: Lingual and labial views of lower antero-lateral tooth; 21-22: Lingual and labial views of upper antero-lateral tooth. (ASUGM 16008); Mingar Abyad, Wadi Hitan Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).

Fig. 23-26: 23-24 Lingual and labial views of lower lateral tooth; 25-26: Lingual and labial views of upper lateral tooth. (ASUGM 16017); south of Garet Gehannam, Fayum, Gehannam Formation, middle Mokattamian (MK7), middle Eocene (Bartonian).
Bar scale = 1 cm

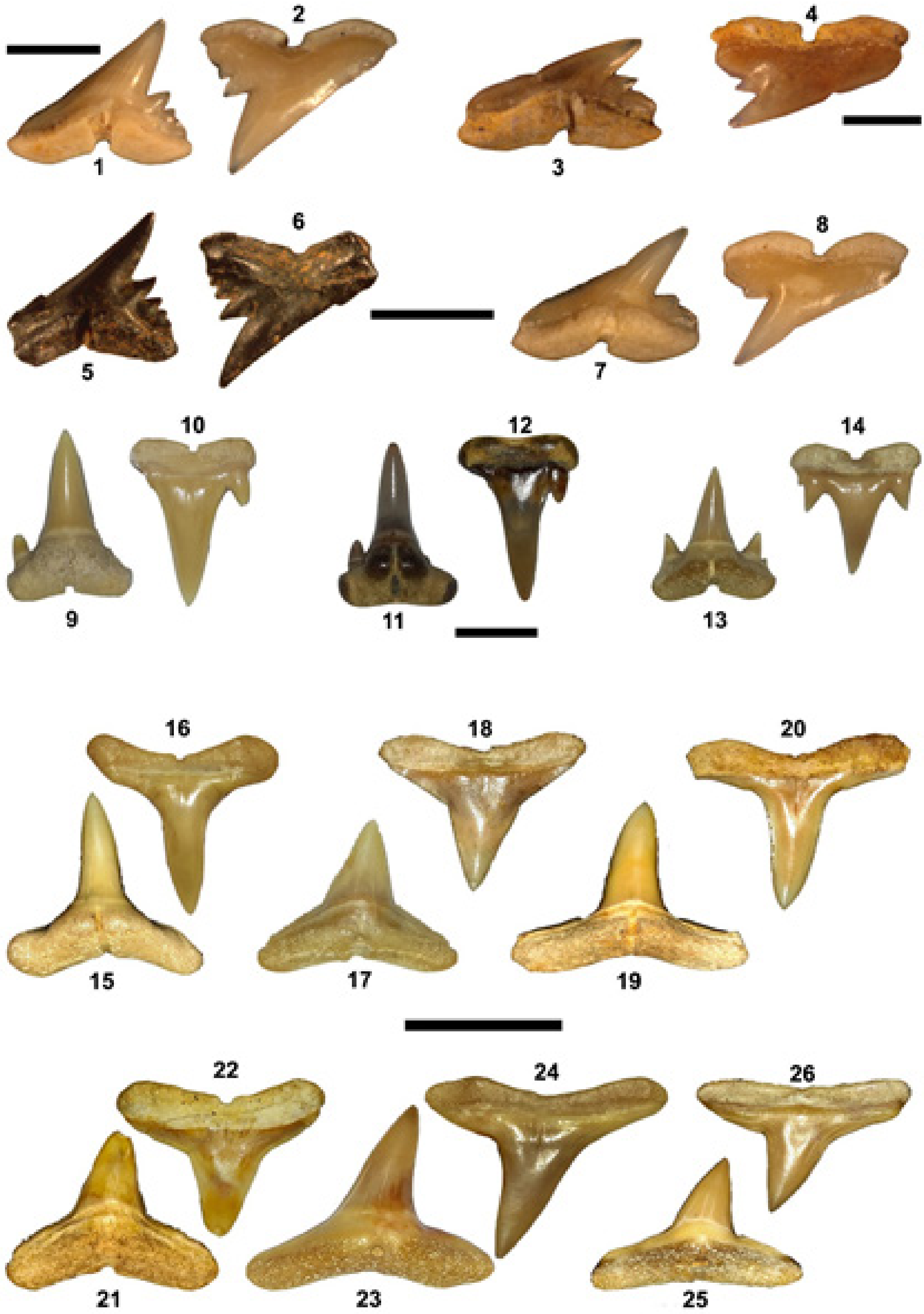
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Plate 5

***Carcharhinus* sp.1 Case & Cappetta, 1990.**

Fig. 1-2, 5-6: 1-2 Lingual and labial views of upper anterior tooth; 5-6: Lingual and labial views of upper lateral tooth. (ASUGM 16006); Mingar Abyad, Wadi Hitan Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).

Fig. 3-4, 7-8: 3-4: Lingual and labial views of lower anterior tooth; 7-8: Lingual and labial views of lower lateral tooth. (ASUGM 16003); Mingar Abyad, Wadi Hitan, Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).
Bar scale = 1 cm

***Carcharhinus* sp.2 Case & Cappetta, 1990**

Fig. 9-10, 15-16: 9-10 Lingual and labial views of upper anterior tooth; 15-16: Lingual and labial views of lower lateral tooth. (ASUGM 16026); Mingar Abyad, Wadi Hitan, Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).

Fig. 11-12: Lingual and labial views of lower anterior tooth (ASUGM 16031); Naqb Sobeikha, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).

Fig. 13-14: Lingual and labial views of upper lateral tooth (ASUGM 16126); Gebel Iweibid, north Eastern Desert, Wadi Hof Formation, upper Mokattamian (MK11), upper Eocene (Priabonian).
Bar scale = 1 cm

***Galeocerdo eaglesomei* White, 1955**

Fig. 17-18: Lingual and labial views of anterior tooth (ASUGM 16090); Mingar Shinnara, Fayum, Midawara Formation, middle Mokattamian (MK4), middle Eocene (Lutetian).

Fig. 19-20: Lingual and labial views of anterior tooth (ASUGM 16994); Umm Bâb, Qatar, Midra Shale Formation, middle Eocene (Lutetian).
Bar scale = 1 cm

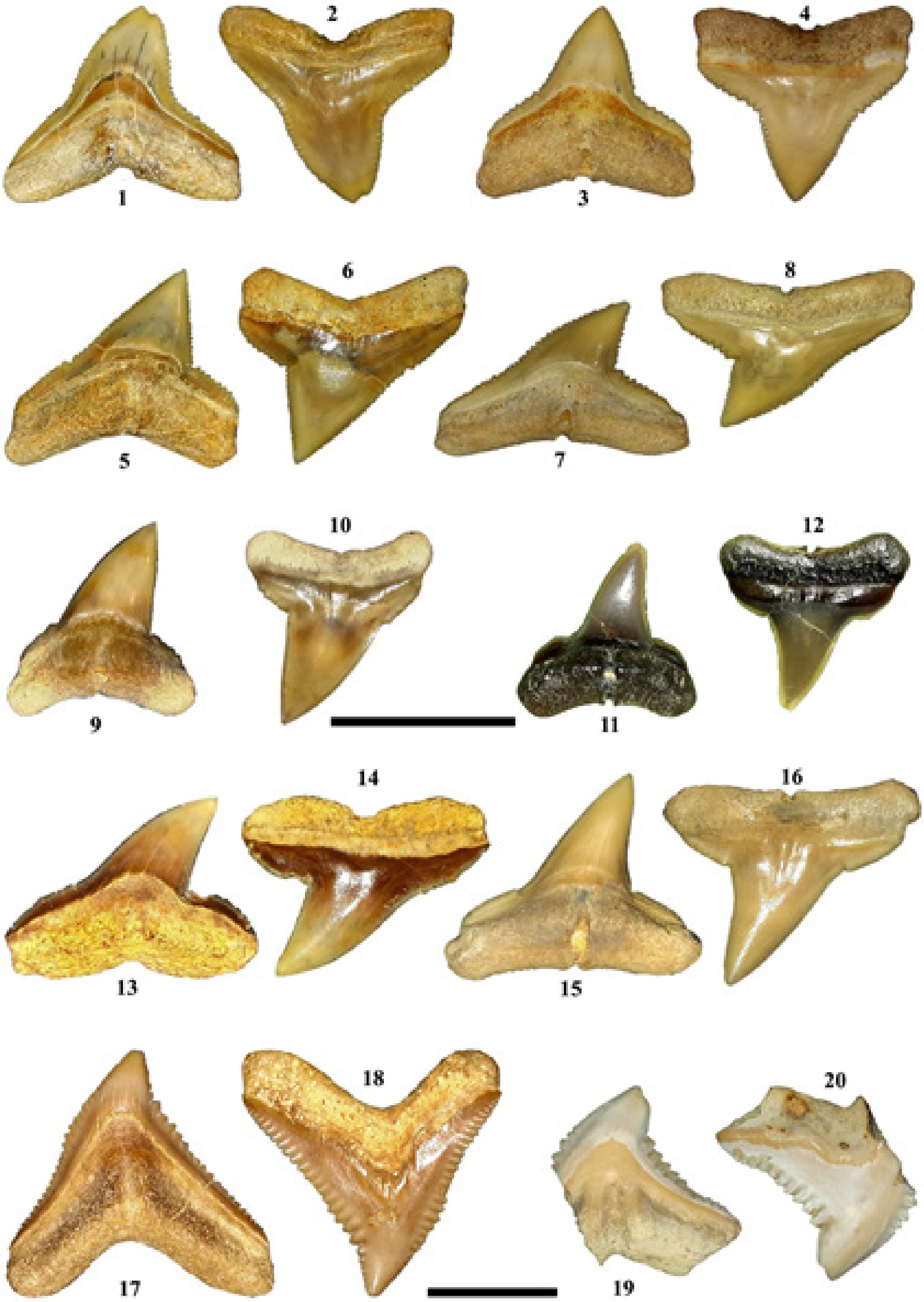
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Plate 6

***Galeocerdo eaglesomei* White, 1955**

Fig. 1-2: Lingual and labial views of lateral tooth (ASUGM 16093); Gebel Qarara, Maghagha, Midawara Formation, middle Mokattamian (MK5), middle Eocene (Lutetian).
Bar scale = 1 cm

***Galeocerdo latidens* (Agassiz, 1843)**

Fig. 3-4: Lingual and labial views of antero-lateral tooth (ASUGM 16144); Mingar Abyad, Wadi Hitan, Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).
Bar scale = 1 cm

***Misrichthys stromeri* Case & Cappetta, 1990**

Fig. 5-6: Lingual and labial views of upper anterior tooth (ASUGM 16155); Wadi Hitan, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).

Fig. 7-8: Lingual and labial views of lower anterior tooth (ASUGM 16139); Darb ElFayum, Greater Cairo, Wadi Garawi Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).

Fig. 9-10: Lingual and labial views of upper lateral tooth (ASUGM 16146); Gebel Homret Shaiboun, Beni Suef, Wadi Garawi Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).

Fig. 11-12: Lingual and labial views of lower lateral tooth (ASUGM 16068); Guta, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).

Fig. 13-16: 13-14 Lingual and labial views of lower anterior tooth; 15-16: Lingual and labial views of upper antero-lateral tooth. (ASUGM 18016); Mingar Abyad, Wadi Hitan, Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).
Bar scale = 1 cm

***Physogaleus* aff. *tertius* (Winkler, 1874)**

Fig. 17-18: Lingual and labial views of lower antero-lateral tooth (ASUGM 14026); Geziret ElQarn, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).

Fig. 19-20: Lingual and labial views of lower lateral tooth (ASUGM 16018); south of Garet Gehannam, Wadi Hitan, Fayum, Gehannam Formation, middle Mokattamian (MK7), middle Eocene (Bartonian).
Bar scale = 1 cm

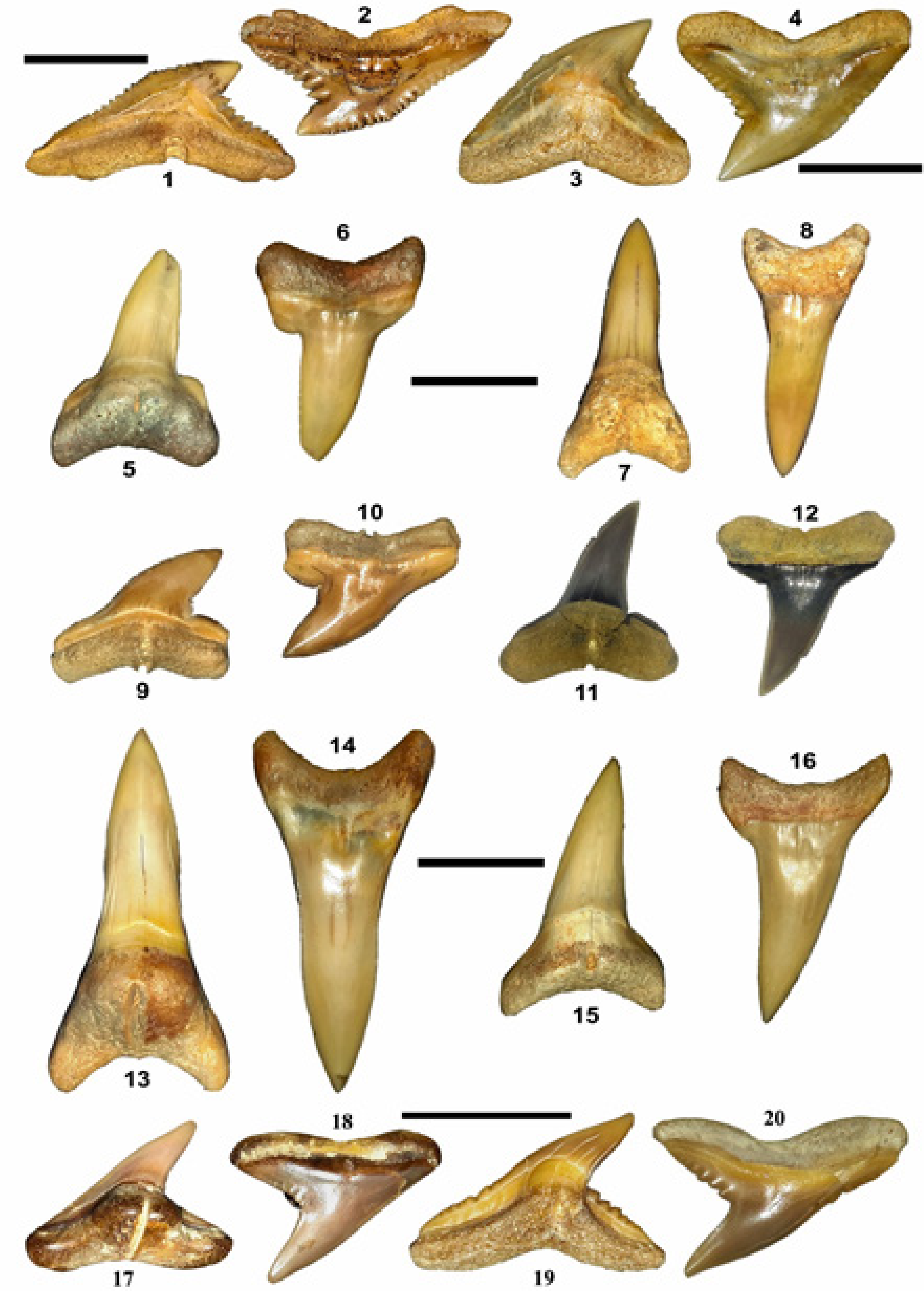
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Plate 7

***Rhizoprionodon* sp.**

Fig. 1-4: 1-2 Lingual and labial views of upper antero-lateral tooth; 3-4: Lingual and labial views of upper lateral tooth (ASUGM 14047); Darb ElFayum, Greater Cairo, Wadi Garawi Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).
Bar scale = 5 mm

Fig. 5-14: 5-6 Lingual and labial views of upper anterior tooth; 7-8: Lingual and labial views of lower antero-lateral tooth; 9-10: Lingual and labial views of lower lateral tooth; 11-12: Lingual and labial views of lower posterior tooth; 13-14: Lingual and labial views of upper posterior tooth. (ASUGM 18003); ElGedida iron mine, Bahariya Oasis, glauconitic sandstone bed, lower Mokattamian (MK3), middle Eocene (Lutetian).
Bar scales = 2 mm

***Odontorhytis pappenheimi* Böhm, 1926**

Fig. 15-17: Labial, profile and lingual views (ASUGM 14084); Km 55, northern plateau of Bahariya Oasis, Qasr ElSagha Formation, upper Mokattamian (MK11), upper Eocene (Priabonian).
Bar scale = 5 mm

***Odontorhytis bahariensis* Salame & Asan, 2019**

Fig. 18-20: Labial, profile and lingual views (ASUGM 14098); ElGedida iron mine, Bahariya Oasis, glauconitic sandstone bed, lower Mokattamian (MK3), middle Eocene (Lutetian).
Bar scale = 2 mm

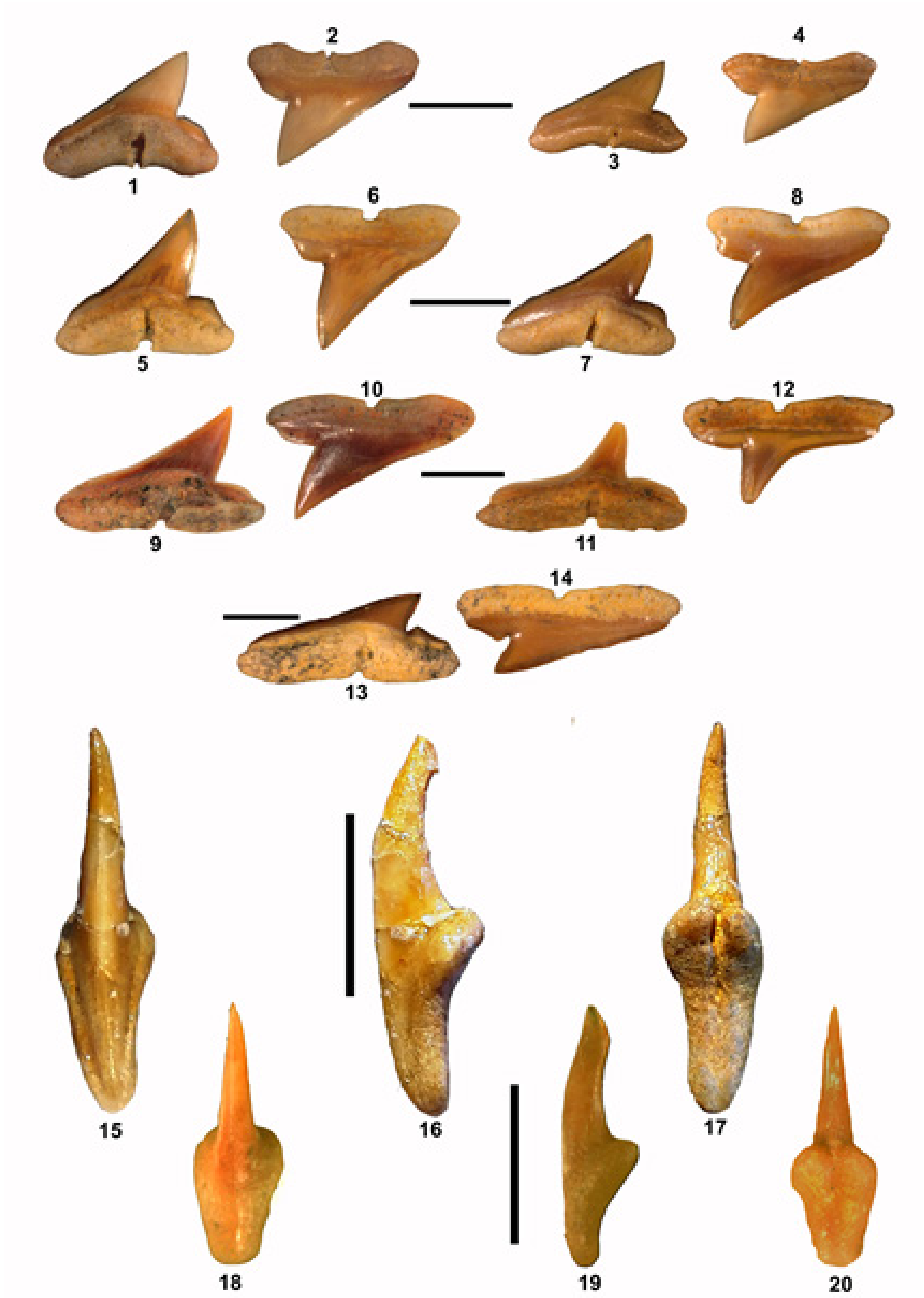
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Plate 8

***Anoxypristis mucrodens* (White, 1926)**

Fig. 1-3: Ventral, basal, and dorsal views of rostral tooth (ASUGM 16005); Mingar Abyad, Wadi Hitan, Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).

Fig. 4-6: Ventral, basal, and dorsal views of rostral tooth (ASUGM 16992); Umm Bâb, Qatar, Midra Shale Formation, middle Eocene (Lutetian).
Bar scale = 1 cm

***Pristis lathami* Galeotti, 1837**

Fig. 7-9: Ventral, basal, and dorsal views of rostral tooth (ASUGM 19005); Naqb Sobeikha, northern scarp of Birket Qarun, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).

Fig. 10-12: Ventral, caudal, and dorsal views of rostral tooth (ASUGM 19004); Naqb Sobeikha, northern scarp of Birket Qarun, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).
Bar scales = 2 cm

***Propristis schweinfurthi* Dames, 1883**

Fig. 13-15: Ventral, basal, and dorsal views of rostral tooth (ASUGM 16019); south of Garet Gehannam, Wadi Hitan, Fayum, Gehannam Formation, middle Mokattamian (MK7), middle Eocene (Bartonian).
Bar scale = 1 cm
Myliobatis cf. latidens Woodward, 1888

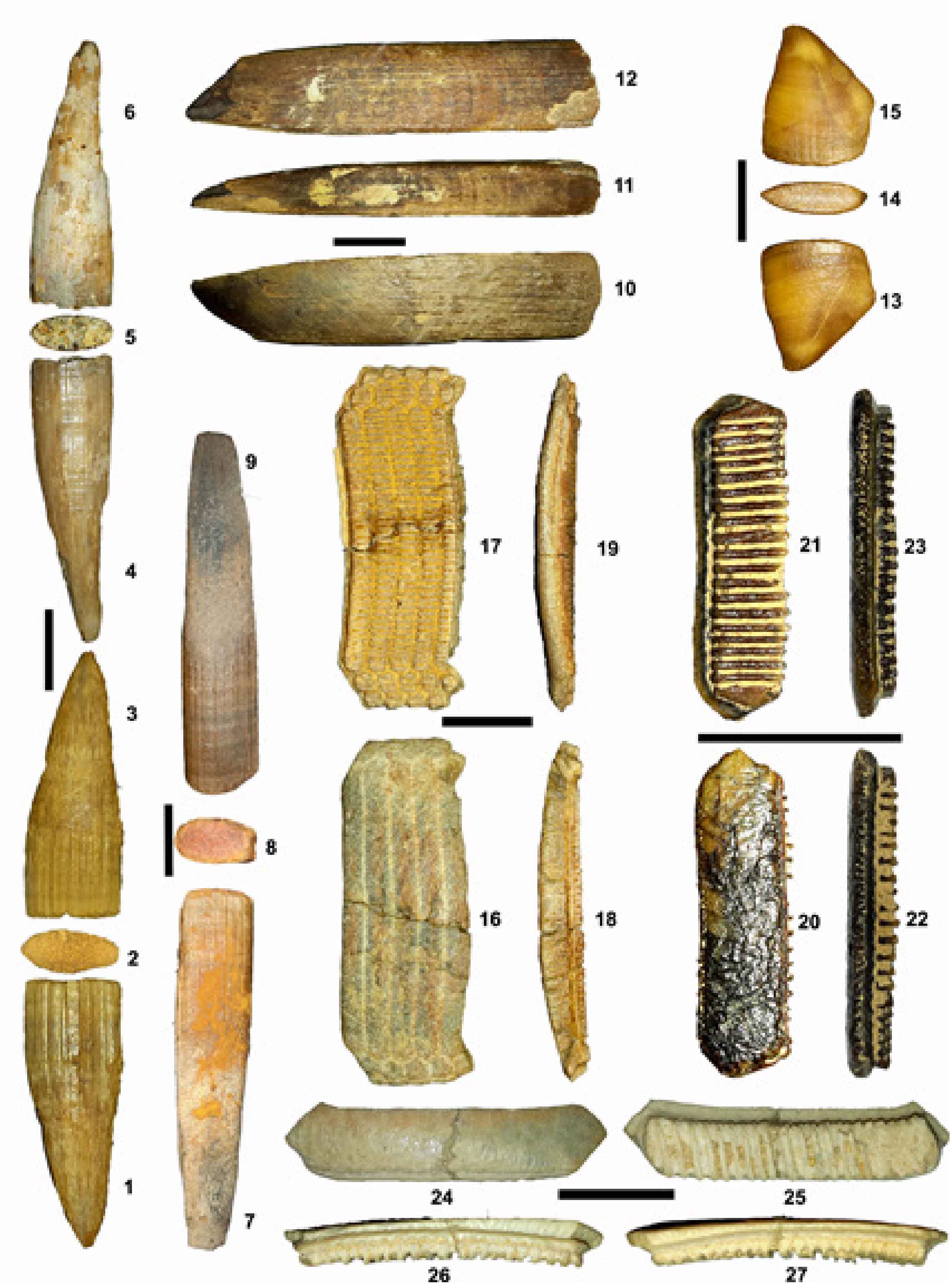
Fig. 16-19: Occlusal, basal, labial, and lingual views of part of a lower dental plate (ASUGM 16011); Mingar Abyad, Wadi Hitan, Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).
Bar scale = 1 cm

***Myliobatis* sp.1 Case & Cappetta, 1990**

Fig. 20-23: Occlusal, basal, lingual, and labial views of tooth of a median file (ASUGM 16051); Geziret ElQarn, Fayum, Birket Qarun Formation, middle Mokattamian (MK8), upper Eocene (Priabonian).
Bar scale = 1 cm

***Myliobatis* sp.2 Case & Cappetta, 1990**

Fig. 24-27: Occlusal, basal, lingual, and labial views of tooth of a median file (ASUGM 16180); Mingar Abyad, Wadi Hitan, Fayum, Qasr ElSagha Formation, upper Mokattamian (MK12), upper Eocene (Priabonian).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