

PRESIDENTIAL ADDRESS.

*(Delivered 9th February, 1912.)*ON THE LOWER TERTIARY MOLLUSCA OF THE FAYUM PROVINCE OF EGYPT.¹

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I. INTRODUCTION.

IN recent years the Fayum Province of Egypt has been the scene of some remarkable palæontological discoveries which have brought to light an entirely new vertebrate fauna, consisting of mammals, birds, reptiles, and fishes, that had their existence during the Eocene stage of Lower Tertiary times. These interesting remains were collected by Mr. H. J. L. Beadnell, F.G.S., when, as an officer of the Geological Survey of Egypt, he was investigating the structure of the region, as well as by Dr. C. W. Andrews, F.R.S.,² of the British Museum, the latter having also fully described them in an elaborate memoir published by the Trustees of the British Museum. For the stratigraphical knowledge of this subject, however, we are mainly indebted to Mr. Beadnell,³ who has written a complete history of the beds in which these animals were found, with a review of all previous opinions upon the subject.

But besides these relics of a vertebrate fauna, the same rocks of the Fayum have yielded a large number of invertebrate remains which are of immense interest and claim an equal scientific importance, since they constitute a material part of the faunistic characters of that area of Egypt. Such fossils, belonging to all groups of the invertebrata, have been known to palæontologists for many years; but by far the most numerously represented are the Mollusca, particularly the Pelecypoda and Gastropoda, the Scaphopoda and Cephalopoda being comparatively seldom found. The chief authorities on the Lower Tertiary Mollusca of the Fayum include the names of the late Professor Mayer-Eymar, M. Cossmann, Dr. Blanckenhorn, and Dr. Paul Oppenheim.

¹ Published by permission of the Trustees of the British Museum.

² *A Descriptive Catalogue of the Tertiary Vertebrata of the Fayum, Egypt*, 1906.

³ *The Topography and Geology of the Fayum Province of Egypt*. Survey Dept., Egypt (Cairo), 1905.

Before proceeding further, however, it will be necessary to refer briefly to the stratigraphical features of the district under consideration, which have been so ably described by Mr. Beadnell. From his memoir we gather that the Fayum is one of the great depressions of the Libyan Desert, being of circular contour and comprising about 12,000 square kilometres; it lies some fifty miles south-west of Cairo and immediately west of that part of the Nile Valley which is between Kafr el Ayat and Feshn. The more southern and western portions include Wadi Muela, Wadi Rayan, and Gar el Gehannem; the northern boundary being a range of hills known as Jebel el Qatrani. Mr. Beadnell divides the region into cultivated land, lake, and desert. The main part of the 'cultivated land' is in the eastern half of the depression, where the villages mostly abound. Like the Nile Valley itself, the soil here is of alluvial character, being nourished by a complete system of irrigation which emanates from the Nile through the natural canal of Bahr Yusef and its many offshoots, and so furnishing the area with an abundant water supply, many of the streams ultimately draining into Birket el Qurun. This latter, situated to the north-west of the cultivated land, forms the 'lake' area of the province, being a large sheet of brackish water, with a nearly east and west axis of 40 kilometres and a maximum breadth of 10 kilometres; it forms the lowest part of the depression. This lake, in Post-Tertiary and early historical times, must have been far more extensive than now obtains, as lacustrine deposits can be traced over wide areas of what is now desert country. It is supposed to represent all that remains of the ancient Lake Moeris when its waters, according to Mr. Beadnell, must have covered an area ten times the size of that occupied by Birket el Qurun at the present day.

The 'desert' country of the Fayum may be said to surround the lake and cultivated lands. This is the region of greatest antiquity, being formed of Lower Tertiary rocks belonging to the Middle and Upper Eocene Series, which have yielded the vertebrate and invertebrate fossils as well as large masses of silicified tree remains. It is in the escarpment area between the northern shores of Birket el Qurun and Jebel el Qatrani that the chief fossiliferous tract occurs. Speaking, generally, the strata of the Fayum are of a purely sedimentary character, consisting of limestones, marls, clays, sandstones, etc., which vary greatly in hardness and durability, the beds being nearly horizontal or with only a slight northerly dip. Igneous rocks are sometimes present, but they are regarded as having originated, more or less, from local lava-flows. The stratigraphical sequence is given as Middle Eocene, Upper Eocene, Oligocene, Pliocene, Post-Pliocene, and Recent. Certain igneous rocks referred to as intercalated basalts occur between the topmost Eocene and the Oligocene, which are considered to represent an arbitrary demarcation separating those two formations. Further divisions have been recognized in these strata. The Middle Eocene or Lutetian of European nomenclature is divided by Mr. Beadnell into four groups. The first or oldest, at the base, are termed the *Wadi Rayan Series*, containing marine shells and *Nummulites Gizehensis*, and which occur at Wadi Muela, Wadi Rayan,

and Gar el Gehannem. These are succeeded by the *Ravine Series*, also of marine character, with mollusca, fish, and cetacean remains, forming the valleys of El Bats and El Wadi, which stretch eastwards towards the Nile Valley, then northwards to Tamia, constituting as well the basal rocks of the island (Geziret el Qorn) on Birket el Qurun, then extending westwards to Gar el Gehannem. The third group is the *Birket el Qurun Series*, with marine shells and cetacea, which are developed in the south-eastern regions of the Fayum (Qalamsha) and along its eastern sides to the northern confines of the cultivated area (Tamia, etc.); they also form part of the rock structure of the island on Birket el Qurun, as well as the Gar el Gehannem in the west. These beds are followed by the *Qasr el Sagha Series*, containing land and marine vertebrates as well as numerous shells (*Carolia*, etc.), mostly marine, but with occasional fluviatile forms (*Lanistes*), the whole fauna giving evidence of estuarine conditions prevailing during the deposition of the beds. This series is mostly found in the northern areas of the Fayum as well as at Gar el Gehannem, the best development forming the cliff escarpments overlooking the Birket el Qurun.

The different 'series' of beds here enumerated belong to the Mokattam or Parisian rocks, the lower of which, comprising the Rayan, the Ravine, and the Birket el Qurun, being bracketed as Lower Mokattam, while the Qasr el Sagha Series is referred to as the Upper Mokattam. Above these occur the Upper Eocene or Bartonian rocks, which are developed among the escarpments of the northern part of the depression to Jebel el Qatrani. The lower part of this series contains quantities of silicified woods, remains of land animals, crocodiles, tortoises, etc., while the upper part shows an assemblage of mollusca of marine and freshwater habits, such as *Unio*, *Lanistes*, *Pleurotoma*, *Turritella*, etc., a repetition of the estuarine or fluviomarine features noticeable in the older series of the Qasr el Sagha. The whole of the Bartonian is capped by the basalt, beyond the boundary of which the Oligocene rocks are thought to occur, although strata of that age have not been palæontologically determined as being present within the actual confines of the Fayum. The Miocene formation is entirely absent, although known at Mogara, some 100 kilometres in a north-westerly direction from the Fayum, as well as at localities eastward of Cairo. Certain gravel terraces on the north-east of the region have been referred to the Pliocene epoch, as well as some sandy beds at Sidmant el Jebel and Qalamsha on the south-east boundary of the depression, where the well-known Pliocene ostreiform shell occurs, *Alectryonia cucullata*. The Post-Pliocene and Recent deposits are found covering the cultivated lands and the north and west of Birket el Qurun. They contain freshwater mollusca comparable to forms found in the Nile and other African waters, which include *Lanistes carinatus*, Olivier, sp., *Viviparus unicolor*, Olivier, sp., etc.

The whole of the divisions may be epitomized as follows in the succeeding table:—

average depth of strata in metres.						
	RECENT AND POST-PLIOCENE.					Alluvial soils, clays, sands, etc., containing <i>Ampullaria ovata</i>, <i>Lanistes carinatus</i>, <i>Viviparus unicolor</i>, <i>Unio teretiuseulus</i>, <i>Corbicula fluminalis</i>, etc. Blown Sand. Lacustrine clays extending 23 metres above sea-level.
50	PLIOCENE.					Gravel Terraces (? Post-Pliocene). Shell boring on rock surfaces. Sidmant deposits, with <i>Alectryonia cucullata</i>.
30	OLIGOCENE.	TONGRIAN				<i>Jebel el Qatrani Series</i> : Fluvio-marine beds : sandstones and sandstone grits, with silicified trees, otherwise unfossiliferous. Basalt sheets, interbedded and contemporaneous.
250	UPPER EOCENE.	BARTONIAN.				Fluvio-marine beds : variegated sands, sandstones, clays, and marls, with limestone grits and thin bands of limestone. The uppermost beds contain : <i>Unio</i> sp., <i>Lanistes Bartonianus</i>, <i>Potamides scalaroides</i>, <i>P. tristriatus</i>, <i>Pleurotoma ingens</i>, etc. The lower part of the section exhibits vertebrate remains, such as <i>Palæomastodon</i>, <i>Arsinoitherium</i>, <i>Ancodon</i>, <i>Mærittherium</i>, <i>Pterodon</i>, etc.
155					Upper Mokattam.	<i>Qasr el Sagha Series</i> (<i>Carolia</i> beds) : alternating limestones, marls, clays, and sandstones. The upper beds have yielded such shells as <i>Nautilus</i>, <i>Lanistes antiquus</i>, <i>Turritella Pharaonica</i>, <i>Mesalia fasciata</i>, <i>Alectryonia Clot-beyi</i>, <i>Carolia placunoides</i>, <i>Macrosolen Hollowaysi</i>, etc. The highest and lower beds of this series contain vertebrate remains, such as <i>Mærittherium</i>, <i>Zeuglodon</i>, <i>Tomistoma</i>, etc.
50	MIDDLE EOCENE.	LUTETIAN OR PARISIAN.			Lower Mokattam.	<i>Birket el Qurun Series</i> (<i>Operculina</i>-Nummulite beds) : sandstones and clays, with sandy limestones and one or more well-marked concretionary sandstones. The mollusca represented are : <i>Lucina Pharaonis</i>, <i>Plicatula polymorpha</i>, <i>Voluta Beadnelli</i> (= <i>Arabica</i>), <i>Turritella transitoria</i> = <i>Pharaonica</i>, species of <i>Clavathes</i>, etc., <i>Nautilus</i>. In the lower beds of this section are found <i>Zeuglodon</i> remains.
70						<i>Ravine Series</i> : white marls and marly limestones, with <i>Corbula</i> cf. <i>piridicula</i>, <i>Tellina tenuistriata</i>, etc. Fish-remains and <i>Zeuglodon</i>s also occur.
130						<i>Wadi Rayan Series</i> (<i>Nummulites Gizehensis</i> beds) : limestones, marls, clays, etc. <i>Carolia placunoides</i>, <i>Lucina</i>, <i>Mitra</i>, etc., occur in these beds, but no vertebrates.

II. ON THE GEOLOGICAL AGE OF THE JEBEL EL QATRANI DEPOSITS.

Since the publication of Mr. Beadnell's principal memoir on the Fayum, some criticisms have arisen as to the horizons determined of certain of the beds forming the Lower Tertiary rocks. No objection has been raised to accepting as Middle Eocene or Lutetian the three lowest groups of the Fayum succession, viz. the Wadi Rayan, Ravine, and Birket el Qurun Series. The Qasr el Sagha Beds, which follow next in ascending order and which undoubtedly belong also to the Lutetian (Upper Mokattam) stage of the Eocene period, as hitherto advocated by all geologists who have studied them, have quite recently been regarded as of Upper Eocene age by Dr. Dacqué¹ in a memoir on some fossil tortoises from Egypt, in connexion with which it should be mentioned that the Upper Mokattam rocks of Egypt had a short time previously been considered by Dr. Emile Haug² as representing the Auversian stage of the Eocene of Europe, which is the lowest part of the Bartonian.

Some conflicting views have been, likewise, published as to the proper place in stratigraphy of the Jebel el Qatrani or Fluvio-marine Series, which Mr. Beadnell, Dr. Blanckenhorn, and others assume to be Bartonian or Upper Eocene. To properly understand the discussion it is necessary to glance briefly at the literature dealing with this question, but previously it may be well to explain that the geological explorations of the Fayum were commenced by Mr. Beadnell in 1898, although he published no views thereon until 1901. During that period, however, Mr. Beadnell was making valuable collections of fossils, chiefly invertebrates, the majority of which were ultimately forwarded to the British Museum for determination, although prior to this they had been subjected to examination by Dr. Blanckenhorn, especially some molluscan remains of estuarine character which had been obtained from the Jebel el Qatrani Series, high up above the vertebrate remains occurring near the base of the section. Dr. Blanckenhorn, with the assistance of Dr. Oppenheim, was able to recognize among these specimens certain forms of Gastropods, which were characteristic of the 'Beauchamp Sands' of the Paris Basin and therefore of Bartonian or Upper Eocene age, hence they were regarded as belonging to that horizon and duly published as such in the year 1900.³

Almost simultaneously with the appearance of this first account of the Jebel el Qatrani Beds and their mollusca, Mr. Beadnell placed a paper before the Geological Congress at Paris, which was published in 1901, on the geology of the Nile and the Libyan Desert,⁴ in which reference was made to the geological structure of the Fayum.

¹ Geol. Pal. Abhandl. [Koken], N.S., vol. x, pt. iv, pp. 61, 1912.

² *Traité de Géologie*, 1911, pt. ii, p. 1503.

³ "Neues zur Geologie und Palaeontologie Aegyptens.—Das Palaeogen; Das Eocän": *Zeitsch. Deutsch. Geol. Ges.*, vol. lii, p. 456, 1900.

⁴ "Découvertes Géologiques Récentes dans la vallée du Nil et le Désert Libyen": *Congrès Geol. Intern. [Paris]*, 1901, fasc. ii, pp. 858-61. An English translation of this account was privately published in London in the same year.

He pointed out that the Upper Mokattam rocks of that region were succeeded in its northern part by a series of beds over 200 metres in thickness, which resembled a fluvio-marine area similar to the Oligocene of Hampshire in England. He also referred to the Upper Eocene age of the deposits as determined by Dr. Blanckenhorn from a study of the shells collected by himself. This was rapidly followed by Mr. Beadnell's¹ English abstract of the French memoir in which the beds in question were provisionally assigned to the Oligocene. At the end of the same year (1901) Mr. Beadnell² definitely recognized these rocks as the 'Fluvio-marine Series (Jebel el Qatrani Beds)', their age being given as Upper Eocene for the deposits below the basalts, and for those above the basalts, where only silicified woods occurred, a Lower Oligocene horizon was suggested.

In a later work by Dr. Blanckenhorn³ on the stratigraphy of Egypt, reference is again made to the estuarine shells of the Jebel el Qatrani Series, found below the basalts, which he still regarded as indicative of an Upper Eocene age. Allusion was also made to the occurrence of Lower Oligocene mollusca, outside the Fayum area, between Birket el Qurun and Wadi Natrun, quoting such forms as *Cerithium conjunctum*, Deshayes, and *Melania Nysti*, Nyst, belonging to the "Sables de Fontainebleau" of France, and therefore of Stampian age. When we come to Mr. Beadnell's chief memoir⁴ these particular beds beneath the basalts are similarly regarded as Upper Eocene, although in addition determined as Bartonian, the same geological views being also adopted by Dr. C. W. Andrews⁵ in his monograph on the fossil vertebrates from the Fayum. Succeeding this Dr. Oppenheim's important monograph⁶ on the older Tertiary mollusca of Egypt was published, in which the fluvio-marine Gastropods previously referred to by Dr. Blanckenhorn as from the Jebel el Qatrani Series were noticed as belonging to the Upper Eocene or Lower Oligocene.

Soon after the publication of this last work Professor Ch. Depéret⁷ questioned the Bartonian horizon of the vertebrates occurring near the base of the Jebel el Qatrani Series. He claimed that the relationship existing between *Ancodon Gorringeri* of Andrews and Beadnell, and his *Brachyodus Cluai* from the Sannoisian-Stampian division of

¹ "On some recent Geological Discoveries in the Nile Valley and Libyan Desert": Geol. Mag., 1901, p. 27.

² "The Fayum Depression: a preliminary notice of the geology of a district in Egypt containing a new Paleogene vertebrate Fauna": Geol. Mag., 1901, pp. 544-5.

³ "Neue geologisch-stratigraphische Beobachtungen in Aegypten": Sitz. Akad. Wiss. München, vol. xxxii, p. 400, 1903.

⁴ *The Topography and Geology of the Fayum Province of Egypt*, Survey Dept., Egypt, 1905, p. 53.

⁵ *A Descriptive Catalogue of the Tertiary Vertebrata of the Fayum, Egypt*, 1906, pp. viii, ix of Introduction.

⁶ "Zur Kenntniss alttertiärer Faunen in Aegypten": Palæontographica, vol. xxx, pt. iii, fasc. 2, pp. 278, 282, 284, 1906.

⁷ "Sur l'âge des couches à *Palæomastodon* du Fayoum": Bull. Soc. géol. France, sér. IV, vol. vii, pp. 193, 194, 1907.

the Oligocene of Spain, would be in favour of a similar age for the *Palæomastodon* and associated vertebrates of the Fayum.

Such views, however, have been objected to by Dr. Oppenheim,¹ who regarded the *Palæomastodon* beds as of Ludian age and on the same horizon as the 'Gypse de Paris', in his own language stating very explicitly: "De cette manière on pourrait à la rigueur l'âge des couches à *Palæomastodon* et *Arsinoitherium* comme Ludien."

Dr. Oppenheim further mentioned the occurrence of the mollusca in the upper part of the series, which he unreservedly regarded as of Eocene age. A reference was likewise made to Mayer-Eymar's discovery of a molluscan fauna at 'Walther Hill', one of the so-called 'Sandberger Hills', which are situated some 20 kilometres west of the Great Pyramids and to the north-east of the Fayum escarpment, and consequently outside the limits of the Fayum depression, where *Natica crassatina* and other shells had been found, and considered to belong to the Lower Tongrian stage of the Oligocene. This was followed by a second statement from Professor Depéret² involving further vertebrate evidence in support of the Oligocene age, he being of opinion that the *Palæomastodon* of the Fayum is more recent than the *Palæotherium* fauna of the 'Gypse de Paris'. Referring to the shells found high up above the vertebrates, he mentioned their bad preservation, although one of the forms, *Turritella angulata* of Sowerby, related to *T. Pharaonica*, Cossmann, which is usually in a good condition, was quoted as ranging from Middle Eocene to the Priabonian of Eastern countries such as Tunisia, Syria, and India. Professor Depéret also called attention to the Oligocene facies (already acknowledged) of the shells determined by Dr. Blanckenhorn and Mayer-Eymar, including *Natica crassatina*, etc., which were really from the 'Sandberger Hills', and therefore not within the region of the Fayum.

With the exception of Dr. A. von Reinach, who adopts the geological horizons for the vertebrate beds of the Fayum, as recognized by Dr. Blanckenhorn, Mr. Beadnell, and Dr. Andrews, we find that later investigators on the subject, such as Professor H. F. Osborn, Dr. E. Stromer, Professor Fraas, and Dr. M. Schlosser, accept Professor Depéret's views as to the Sannoisian-Stampian stage of the Oligocene formation being the correct geological horizon for the so-called *Palæomastodon* beds of the Fayum. Quite recently Dr. Dacqué, in his memoir on the fossil tortoises of Egypt, has expressed similar stratigraphical views.

A summary of these opinions may be interesting:—

1900. Dr. Blanckenhorn, assisted by Dr. Oppenheim, regarded the mollusca of the Jebel el Qatrani deposits as of Upper Eocene or Bartonian age and on the horizon of the Beauchamp Sands of the Paris Basin.

¹ P. Oppenheim, "Observations sur l'âge des couches à *Palæomastodon* du Fayoum": Bull. Soc. géol. France, sér. IV, vol. vii, pp. 358-60, 1907.

² Ch. Depéret, "Sur l'âge des couches à *Palæomastodon* du Fayoum": Bull. Soc. géol. France, sér. IV, vol. vii, pp. 455, 456, 1907.

1901. Mr. Beadnell alluded to the above views of Dr. Blanckenhorn, but regarded the whole of the Jebel el Qatrani Series as resembling a fluvio-marine area similar to the Oligocene of Hampshire in England.

1901. The beds were again referred to by Mr. Beadnell and assigned provisionally to the Oligocene period.

1901. Mr. Beadnell next definitely recognized these rocks as Upper Eocene for the beds below the basalts, and for those above a Lower Oligocene age was suggested.

1903. After further studies, Dr. Blanckenhorn still regarded the beds as Upper Eocene.

1905. In Mr. Beadnell's principal and final work the beds were referred to as Upper Eocene or Bartonian.

1906. Similar stratigraphical views to those finally published by Mr. Beadnell were expressed by Dr. C. W. Andrews in his monograph on the fossil vertebrates of the Fayum.

1906. Dr. Oppenheim regarded the Jebel el Qatrani mollusca as Upper Eocene or Lower Oligocene in his monograph on the older Tertiary shells of Egypt.

1907. Professor Depéret noticed the nearly basal deposits of the Jebel el Qatrani Series containing the vertebrates as of the Sannoisian-Stampian stage of the Oligocene.

1907. Dr. Oppenheim, contrary to Professor Depéret's views, recognized the same beds as of Ludian age (Ludian Beds being above the Bartonian and necessarily younger), but the upper beds of the Jebel el Qatrani Series containing the mollusca were unreservedly regarded as Eocene.

1907. Professor Depéret again called attention to the subject by supporting the Oligocene age for the vertebrates, an opinion followed by nearly all the later writers on the vertebrate palæontology of the Fayum.

1912. The Jebel el Qatrani or Fluvio-marine Series was regarded by Dr. Dacqué as of Lower Oligocene age.

In the chief elements of this discussion it is obvious that we are indebted to Dr. Blanckenhorn (who was assisted by Dr. Oppenheim) as to the stratigraphical value of the mollusca occurring in the upper or younger deposits of the Jebel el Qatrani Series.

Later, however, Dr. Oppenheim monographed the shells as of Upper Eocene or Lower Oligocene age, and subsequently the same author somewhat changed his views, stating that the vertebrates were of Ludian age, and that the mollusca were Eocene, without definition as to the particular stage of that formation. It should be understood that the Ludian strata follow the Bartonian, and that they are variously regarded as topmost Eocene or the lowest Oligocene, such rocks being also known as Priabonian. We can only assume, therefore, although not definitely stated, that Dr. Oppenheim no longer regarded these deposits as Bartonian but Ludian.

The Jebel el Qatrani rocks, which succeed, without unconformity, the Qasr el Sagha Series, show a total thickness of some 270 metres, the beds extending from the base near the north-west of Qasr el Sagha

to the summit of the escarpment, not far from the north-western area of Widan el Faras. Mr. Beadnell has numbered the beds from 1 to 54, the latter being near the base of the series and therefore the oldest. The more important of the fossiliferous bands are No. 49, where *Palæomastodon* and other associated vertebrates occur; No. 15, containing the estuarine mollusca *Unio*, *Lanistes*, *Turritella*, etc.; and No. 7, bed with similar estuarine shells as in No. 15, with, however, the addition of the marine shell *Pleurotoma ingens*. Some further mollusca of the same habit were obtained from about 14 kilometres north of Qasr el Sagha, these being regarded by Mr. Beadnell as on the same horizon of bed No. 15. As previously stated, the more estuarine shells from these deposits were determined by Dr. Blanckenhorn as Bartonian and on the same horizon as the 'Beauchamp Sands' of the Paris Basin.

According to Mr. Beadnell the Jebel el Qatrani Series consist of variegated sands and sandstones, with alternating beds of clay and clayey marls, in contradistinction to the older Qasr el Sagha Beds below, which are characterized by ever-recurring bands of limestone. The Jebel el Qatrani vertebrates are found very low down in the series, whereas the estuarine shells are located a hundred or more metres higher up, in the same section; it follows, therefore, that the vertebrates were first deposited and must of necessity be the most ancient. These vertebrates consist more exclusively of the remains of terrestrial mammals, while those of the Qasr el Sagha Series are mostly marine and estuarine, with only a few land mammals. Such difference in facies, together with the lithological variations noticeable in the beds themselves, have suggested the succeeding age of Bartonian for the Jebel el Qatrani vertebrates.

Turning for a moment to the Qasr el Sagha vertebrates, we find that they occupy a very high position in the section made by Mr. Beadnell of these beds, which are composed of thirty divisions, the fossils being restricted to beds 16, 17, 9, 7, and 2, in ascending order. The numerous mollusca occurring both above and below and throughout this series of deposits are referred to the Upper Mokattam horizon of Egypt, which is included in the Lutetian or Middle Eocene formation of Europe, some of the species occurring in Anglo-Parisian rocks of that age. Among the more characteristic shells are *Alectryonia Clot-beyi*, *Exogyra Fraasi*, *Carolia placunoides*, *Macrosolen Hollowaysi*, *Spondylus Egyptiacus*, *Turritella transitoria*, *Mesalia fasciata*, *Cerithium lamellosum*, *Naticina debilis*, *Lanistes antiquus*, etc. There has been no hesitation hitherto as to these Upper Mokattam Beds of Qasr el Sagha belonging to the Lutetian or Middle Eocene Series, and yet quite recently Dr. Daqué, before referred to, considered that they belong to the Upper Eocene. There seems to be little difficulty, therefore, in accepting the Lutetian age for these beds, more especially when it is known that shells like *Alectryonia Clot-beyi* and *Carolia placunoides*, which are found above and below the strata containing the vertebrates, are also of frequent occurrence throughout the section, besides being met with in rocks of the same age in the Mokattam district and in the neighbouring country of Tunisia.

Returning to the consideration of the age of the Jebel el Qatrani Series of vertebrates, it is almost possible that, instead of regarding them as younger than Bartonian, as has been suggested, the field evidence might even favour an older period for their deposition. This suggestion would arise out of the fact that there is only a distance of a few metres between the base of the Jebel el Qatrani Series and Bed No. 2 of the Qasr el Sagha section, containing the youngest of the vertebrate remains of that series, and only some 70 metres below to Beds Nos. 16 and 17 where the chief of the vertebrates are found. In any case, a generic resemblance has been observed in the two sets of beds, and it is interesting to note that *Mærittherium* and *Stereogenys* occur alike in the Qasr el Sagha and the Jebel el Qatrani Series.

The Jebel el Qatrani mollusca now in the Egyptian Geological Survey Museum at Cairo consist of the following species, the 'Beds' referred to being those described by Mr. Beadnell, while the asterisks mark Dr. Blanckenhorn's published determinations.

GASTROPODA.

- **Lanistes Bartonianus*, Blanckenhorn (Bed No. 15).
- **Potamides scalaroides*, Deshayes (Bed No. 7).
- **Potamides tristriatus*, Lamarck (Bed No. 7).
- **Melania*, n.sp., Blanckenhorn [related to *M. Nysti*] (Bed No. 7).
- **Cerithium tiarella*, Deshayes (Bed No. 7).
- Pleurotoma ingens*, Mayer-Eymar (Bed No. 7).
- Turritella transitoria*, Mayer-Eymar [related to *T. angulata*, J. de C. Sowerby] (Bed No. 7).

PELECYPODA.

- Lithophagus* allied to *cordatus*, Lamarck.
- Arca*, *Lucina*, *Tellina*, **Unio*, **Mutela*, **Spatha* (all these forms are probably from Bed No. 15).

The specimens mostly comprised hard calcareous sandstone casts, the smaller Gastropods being represented by hollow cavities, impressions of which were taken in wax so as to obtain a reproduction of the shell and its sculpture. In this way there is still preserved among the Egyptian fossils at the British Museum (Natural History) reproductions in wax of the two more important freshwater species, *Potamides scalaroides* and *tristriatus*. These I have quite recently re-examined; and I am still convinced that the original determinations are correct, and that in those species we have a fragment of a fauna which can only be synchronized with the 'Beauchamp Sands' of Paris, as demonstrated in Dr. Blanckenhorn's published paper of 1900.

According to the latest work on the geology of the Paris Basin, M. Lemoine¹ regards the 'Beauchamp Sands' as belonging to the Ermenouvillien stage of the Bartonian, which is quite the lower or older portion of that group of rocks, and consequently far removed from either the Ludian or Sannoisian-Stampian horizon, which some authorities have acknowledged as the more accurate age for the shells

¹ *Géologie du Bassin de Paris*, 1911, pp. 239-47.

in question. In the same treatise *Potamides tristriatus* is placed in the younger Lutetian beds of France (eastern region of the Paris Basin), known as the 'Calcaire Grossier Supérieur'.

The *Melania*, n.sp., has been briefly described by Dr. Blanckenhorn (Zeitsch. Deutsch. geol. Ges., vol. lii, footnote on p. 456, 1900), and reproduced in English by Mr. Beadnell (Fayum Memoir, 1905, footnote p. 60) as follows:—"It has 4-5 flat spiral rows, the uppermost of which on the last whorls is often more strongly developed, but not keel-shaped as in *M. muricata*. There are longitudinal ribs to the number of 8-12 over the whorls; the largest example was 9 millimetres long, and had 8 whorls." Dr. Blanckenhorn was further of opinion that this new form of *Melania* had its nearest relation in *M. Nysti* (Duchastel), Nyst, of the Lower Oligocene deposits of Europe.

With regard to the marine shells, *Cerithium tiarella* ranges from the Lutetian to the Bartonian, and never occurs in the Oligocene Series. On my determination a fragmentary sandstone cast was referred to *Pleurotoma ingens* of Mayer-Eymar. The original type of this shell had a length of 170 millimetres, and was described from the Upper Mokattam Beds of the Qasr el Sagha Series of the Fayum. In a similar way *Turritella Pharaonica* of Cossmann, or more accurately *T. transitoria* of Mayer-Eymar, a close ally of *T. angulata* of J. de C. Sowerby from the Indian Eocene and Oligocene rocks, which is well known in the Upper Mokattam Beds of the Fayum and the area of Mokattam near Cairo, is also a striking fossil of these deposits and usually well preserved.

On such evidence, therefore, we may conclude that the fluvio-marine mollusca of the Jebel el Qatrani Series present, if anything, a Lutetian-Bartonian facies rather than Sannoisian-Stampian or even Ludian. I am quite aware of the presence of Priabonian or Ligurian rocks, which are regarded as lowest Oligocene, outside the area of the Fayum depression, containing among other shells *Natica crassatina*, a species never found in Eocene strata, which was discovered and referred to in literature by Mayer-Eymar as coming from the 'Sandberger Hill', west of the great Pyramids and from beneath the basalts, although Dr. Andrews has given me to understand that the lava sheets are of considerable irregularity and probably of more than one age.

In dismissing this part of my subject, it certainly appears that if any permanent alteration were to take place in the stratigraphical views enunciated by Dr. Blanckenhorn and Mr. Beadnell with regard to the Fayum succession, it would be necessary to completely revise our previous conceptions as to the sequence of the Tertiary rocks of Egypt and adjacent countries.

III. THE LUTETIAN MOLLUSCA OF THE FAYUM, WITH LIST OF SPECIES, AS MONOGRAPHED BY DR. OPPENHEIM.

A brief survey of the Mokattam or Lutetian shells of the Fayum, as described by Dr. Oppenheim in the *Palæontographica* for 1903 and 1906, will now be proceeded with.

Among the Pelecypoda, Ostreiform shells are largely represented, belonging to the genera *Gryphæa*, *Ostrea*, and *Alectryonia*, the last genus having both its valves plicated; *Alectryonia Clot-beyi* is frequently met with in the Fayum, occurring in the Ravine Series up to nearly the top of the Qasr el Sagha Series. The species is also represented in the Mokattam rocks near Cairo, and in the Lutetian deposits of Tunis, where it is associated with *Carolia placunoides*.

The Anomiidæ are represented by *Carolia placunoides*, a form related to the recent *Placuna* of the Pacific and the genus *Anomia*. In the young state this shell exhibits a large byssal foramen in the cardinal region which is gradually closed up with age, and forms interiorly a prominent transversely oval cartilage process. The species is found throughout the Fayum Lower Tertiary deposits, but more particularly in the Qasr el Sagha Series. It also occurs in other areas of Egypt, and in Tunisia, where it is recognized as of Lutetian age.

Pectens are rare, only one form having been found belonging to *Pseudamusium*; the genus *Plicatula* is well represented, one species, *P. polymorpha*, being characteristic of the Qasr el Sagha Beds; there are three species of *Spondylus* which occur in the Lower Mokattam beds, that of *S. Ægyptiacus* being probably the most frequently found; the interesting genus *Vulsella* is restricted to the Lower Mokattam Series, although one of the species, *V. crispata*, ranges from that horizon to the Priabonian of the Siwah Oasis of Egypt; species of the Nuculidæ are apparently rare, only one being referred to, while some forms of *Arca* and a species of *Cucullæa*, etc., are regarded as of Upper Mokattam age; *Glycymeris* (= *Pectunculus*), several species of *Cardita*, and *Crassatellites* also occur; species of *Lucina* are fairly common, as well as the allied genus, *Diplodonta*, *Divaricella* being also present; among the Cardiidæ, *Loxocardium* is represented; the presence of *Corbicula* in the Upper Mokattam Beds (Qasr el Sagha) is of interest in proving the estuarine character of those deposits; under the family Veneridæ are included several species of *Meretrix*, *M. sulcataria* of Lamarek being of importance as occurring besides in the Eocene deposits of the Paris Basin; Telliniform shells include the genera *Macaliopsis* and *Arcopagia*, while the genus *Macrosolen* of the Solenidæ occurs throughout the Mokattam Beds of Egypt, and is also found in the well-known Bracklesham deposits of England; a fine form of *Pholadomya* occurs in the rocks of the island on Birket el Qurun, as well as *Mactra compressa*, a species characteristic of the Bartonian of France and England; two species of *Corbula* are noted from the Upper Mokattam Beds, which is again evidence in favour of the estuarine origin of the deposits.

The Scaphopoda group is represented by one form, *Fustiaria Stromeri*.

The Gastropoda contain genera of the families Fissurellidæ, Patellidæ, Trochidæ, and Neritidæ, the last represented by the familiar *Velates Schmidelianus*, which is restricted to the Lower Mokattam deposits of Egypt, being known also to range from the lowest to the Middle Eocene horizons in India and Europe; *Turritellæ* are numerous represented in the Fayum throughout the Mokattam Series; the Capulidæ contain *Calyptræa aperta*, a species well known

throughout the Eocene beds of France and England; various forms of Naticidæ are of frequent occurrence; among the Ampullariidæ are the two interesting freshwater shells *Lanistes antiquus* from the Lutetian Beds and *Lanistes Bartonianus* from the Bartonian, the former species being also found in the Mokattam Beds of the neighbourhood of Cairo; various specimens of the Melaniidæ occur, including *Bayania stygis*, found also in the Eocene of Italy, and *Diastoma costellatum*, which is known from the Mokattam Beds near Cairo, as also from the Lutetian and Bartonian horizons of Europe; *Terebellum sopitum* is found in the Lower Mokattam Beds of Muela and other areas of Egypt, occurring also in the Lutetian of the Paris Basin, besides ranging in England from Lutetian to Lower Oligocene times; there are shells belonging to the Cassididæ, Pyrulidæ, and Lampusidæ (Tritonidæ), as well as the Fusidæ, which contain some striking forms of the genus *Clavalithes*; the family Turbinellidæ is represented by the genus *Vasum*; the Melongenidæ contain *Heligmotoma*, *Pugilina*, and *Tudicla*; among the Volutidæ is *Voluta Arabica* of Mayer-Eymar, a preoccupied name, and for which that of *Voluta Beadnelli*¹ is now proposed; a giant form of a Pleurotomoid shell, *Surcula ingens*, has been found in the Qasr el Sagha and Jebel el Qatrani Series; shells belonging to the Bullidæ also occur in the Fayum, *Acera striatella* being characteristic of Parisian and English Eocene beds.

No forms of Cephalopods are referred to by Dr. Oppenheim as occurring in the Fayum, but Dr. Schweinfurth collected *Nautilus* in the 'Zeuglodon Valley', 12 kil. W.S.W. of Gar el Gehannem in the Birket el Qurun Series (Zeitsch. Ges. Erdkunde, Berlin, vol. xxi, p. 240, 1886); while Mr. Beadnell recorded specimens of the same genus from the Qasr el Sagha Series at the western end of Birket el Qurun accompanied by *Alectryonia Clot-beyi*, *Plicatula polymorpha*, etc. Mr. Beadnell also noted that the fossils from the 'Zeuglodon Valley' are found as pseudomorphs in sulphate of strontian (celestine).

Dr. Oppenheim's monograph on the older Tertiary mollusca of Egypt (*Palæontographica*, vol. xxx, pt. iii, pl. xxvii, p. 348, 1903 and 1906) recognized 141 species of shells as occurring in the Middle Eocene or Lutetian formation of the Fayum, composed of 83 Pelecypoda Scaphopoda, and 57 Gastropoda; 45 of these species are known only in the Fayum, whereas the remainder are distributed over the other Lutetian areas of Egypt and further countries of Northern Africa, besides the Lutetian districts of Europe. In the following list the species follow the order and arrangement as adopted in that work, with some slight changes in nomenclature, an asterisk being placed against those forms which are restricted to the Fayum:—

PELECYPODA.

Family OSTREIDÆ.

*GRYPHÆA PHARAONUM, Oppenheim (= *Ostrea dorsata*, Fraas, non Deshayes; *Gryphæa Escheri*, Mayer-Eymar MS., *G. Gumbeli*, M.-E. MS., *G. Kaufmanni*, M.-E. MS.).

¹ *Voluta Beadnelli*, nom. mut.

- *G. WHITEHOUSEI, Oppenheim.
- *G. EDMONDSTONEI, Oppenheim.
- *G. (?) HISTRIO, Oppenheim.
- *G. (?) ARABICA, Mayer-Eymar.
- OSTREA ELEGANS, Deshayes, var. CORNIGERA, Mayer-Eymar.
- O. FRAASI, Mayer-Eymar.
- O. STANLEYI, Mayer-Eymar.
- O. CAILLIAUDI, Mayer-Eymar.
- O. RAMOSA, Mayer-Eymar.
- O. PLICATA, Solander.
- O. CUBITUS, Lamarck, var. PAUCICOSTATA, Oppenheim.
- O. REILI, Fraas.
- *O. SCHWEINFURTHI, Mayer-Eymar.
- *O. SICKENBERGI, Mayer-Eymar.
- O. HESSI, Oppenheim.
- O. QERUNIANA, Mayer-Eymar (= *Ostrea Ægyptiaca*, Mayer-Eymar).
- O. GIGANTICA, Solander (= *Ostrea latissima*, Deshayes; *O. longirostris*, Lamarck).
- ALECTRYONIA CLOT-BEYI, Bellardi (= *Ostrea subarmata*, Bellardi).
- A. SEMIPECTINATA, Schafhæutl (= *Ostrea suborbicularis*, Schafhæutl; *O. abscissa*, Schafhæutl; *O. Martinsi*, Archiac; *O. alticostata*, Mayer-Eymar).
- *A. MEHEMETI, Oppenheim.
- A. BELLARDII, Oppenheim (= *Ostrea (Alectryonia) Heberti*, Mayer-Eymar, non Coquand).

Family ANOMIIDÆ.

- CAROLIA PLACUNOIDES, Cantraine (= *Placuna placenta*, Cailliaud, non Lamarck).

Family PECTINIDÆ.

- PSEUDAMUSIUM MOELHENSIS, Mayer-Eymar.

Family SPONDYLIDÆ.

- PLICATULA POLYMORPHA, Bellardi (= *Terebratella pyramidarum*, Fraas; *Plicatula abundans*, Mayer-Eymar; *P. Bovensis*, Oppenheim, pars).
- P. BELLARDII, Mayer-Eymar (= *Plicatula Bovensis*, De Gregorio; *P. polymorpha*, Bellardi, pars).
- P. INDIGENA, Mayer-Eymar (= *Plicatula Cairensis*, Mayer-Eymar; *P. Bovensis*, Oppenheim, pars).
- *P. SCHWEINFURTHI, Oppenheim.
- SPONDYLUS ÆGYPTIACUS, R. B. Newton.
- S. ROUAULTI, Archiac.
- S. PERHORRIDUS, Oppenheim.

Family PTERIIDÆ (= *Aviculidæ*).

- VULSELLA CRISPATA, P. Fischer (= *Vulsella lingulata*, Lamarck; *V. Cailliaudi*, Zittel; *V. deperdita*, Mayer-Eymar).
- *V. LIGNARIA, Oppenheim.
- *V. MOELHENSIS, Oppenheim.
- V. CHAMIFORMIS, Mayer-Eymar.

Family NUCULIDÆ.

*NUCULA MÆRIDIS, Oppenheim.

Family ARCIDÆ.

*CUCULLÆA DIMEHENSIS, Oppenheim.

ARCA SUBPLANICOSTA, Oppenheim (= *Arca planicosta*, Fraas, non Deshayes).

A. UNIFORMIS, Oppenheim.

*A. sp., Oppenheim (= *Arca Edwardsi*, Mayer-Eymar, non Deshayes).

BARBATIA TETHYIS, Oppenheim (= *Arca planicosta*, Fraas, pars).

FOSSULARCA TENUIFILOSA, Cossmann, sp.

*PARALLELIPIPEDUM FAJUMENSIS, Oppenheim.

GLYCYMERIS JUXTADENTATA, Cossmann (= *Axinæa* and *Pectunculus*).

*G. ÆGYPTIACA, Oppenheim (= *Axinæa* and *Pectunculus*).

Family ASTARTIDÆ.

CARDITA ACUTICOSTATA, Lamarek (= *Cardita complanata*, Fraas ; *C. multicostata*, Fraas ; *Cardium obliquum*, Fraas).

C. FAJUMENSIS, Oppenheim (= *Cardita* (*Cossmannella*) *Ægyptiaca*, Mayer-Eymar, non Fraas).

C. MOKATTAMENSIS, Oppenheim.

C. FIDELIS, Oppenheim.

C. MOSIS, Oppenheim.

Family CRASSATELLITIDÆ.

*CRASSATELLITES (= *Crassatella*) FAJUMENSIS, Oppenheim.

*C. (= *Crassatella*) JUNKERI, Mayer-Eymar.

*C. (= *Crassatella*) PUELLULA, Mayer-Eymar.

*C. (= *Crassatella*) TRIGONATA, Lamarek.

Family LUCINIDÆ.

LUCINA PHARAONIS, Bellardi (= *L. bialata*, Bellardi ; *L. Ægyptiaca*, Bellardi ; *L. Mævusi*, Coquand ; *L. subcircularis*, Fraas, non Deshayes ; *L. evanida*, Fraas, non Deshayes ; *L. pomum*, Mayer-Eymar, non Dujardin ; *L. Libyca*, Cossmann).

LUCINA RAI, Oppenheim (= *L. concinna*, Fraas, non Deshayes).

L. POLYTHELE, Oppenheim (= *L. Fortisiana*, Fraas, non Defrance).

L. CALLISTE, Oppenheim.

L. GIBBOSULA, Lamarek.

*L. FAJUMENSIS, Oppenheim.

*DIVARICELLA SINUOSA, Bellardi, sp.

DIPLODONTA CYCLOIDEA, Bellardi, sp. (= *Lucina detrita*, Fraas, non Deshayes ; *L. pomum*, Mayer-Eymar, non Dujardin).

D. INFLATA, Bellardi, sp.

D. CORPUSCULUM, Oppenheim.

Family CARDIIDÆ.

*LOXOCARDIUM SCHWEINFURTHI, Mayer-Eymar, sp.

Family CORBICULIDÆ.

*CORBICULA BLANCKENHORNII, Oppenheim.

Family CYPRINIDÆ.

*CYPRINA ÆGYPTIACA, Oppenheim.

Family VENERIDÆ.

MERETRIX (= *Cytherea*) TRANSVERSA, J. de C. Sowerby.

M. (= *Cytherea*) SULCATARIA, Lamarck, sp.

M. (= *Cytherea*) NEWBOLDI, Mayer-Eymar.

M. (= *Cytherea*) INCRASSATA, J. Sowerby, sp. (= *Cyprina brevis*, Fuchs).

Family TELLINIDÆ.

MACALIOPSIS RETICULATA, Bellardi, sp.

M. Plicatella, Mayer-Eymar, sp. (= *Tellina Bellardii*, Mayer-Eymar).

Mæra (?) FAJUMENSIS, Oppenheim.

ARCOPAGIA ZITTELI, Mayer-Eymar, sp. (= *Tellina pellucida*, Mayer-Eymar, *non* Deshayes; *T. grandis*, Mayer-Eymar; *T. latissima*, Mayer-Eymar).

Family SOLENIDÆ.

MACROSOLEN HOLLOWAYSI, J. Sowerby, sp. (= *Solen uniradiatus*, Bellardi; *S. obliquus*, Fraas; *Sanguinolaria (Macrosolen) Hollowaysi*, Mayer-Eymar; *Macrosolen Hollowaysi*, R. B. Newton).

Family PHOLADOMYIDÆ.

*PHOLADOMYA ÆGYPTIACA, Oppenheim.

*THRACIA ÆGYPTIACA, Oppenheim.

Family MACTRIDÆ.

MACTRA COMPRESSA, Deshayes (= *M. depressa*, Deshayes & J. de C. Sowerby, *non* Lamarck).

*M. FOURTAUI, Cossmann.

*RAETA SCHWEINFURTHI, Mayer-Eymar, sp. (= *Lovellia Schweinfurthi*, Mayer-Eymar).

Family MYIDÆ.

BICORBULA GALLICA, Lamarck, sp.

*CORBULA LYONSI, Oppenheim.

TUGONIA ZITTELI, Oppenheim.

Family GASTROCHÆNIDÆ.

FISTULANA ÆGYPTIACA, Oppenheim.

SCAPHOPODA.

Family DENTALIIDÆ.

*FUSTIARIA STROMERI, Oppenheim.

GASTROPODA.

Family FISSURELLIDÆ.

*FISSURELLA ACUTICOSTA, Mayer-Eymar.

Family PATELLIDÆ.

*PATELLA FACILIS, Mayer-Eymar.

Family TROCHIDÆ.

SOLARIELLA HUMILIS, Oppenheim (= *Turbo Parkinsoni*, Mayer-Eymar, non Basterot).

Family NERITIDÆ.

*PELORONTA FAJUMENSIS, Oppenheim.

VELATES SCHMIDELIANUS, Chemnitz (= *Neritina grandis*, J. de C. Sowerby; *Patella Cairensis*, Fraas).

Family ARCHITECTONICIDÆ.

ARCHITECTONICA SUBPATULUM, Oppenheim.

Family TURRITELLIDÆ.

TURRITELLA TRANSITORIA, Mayer-Eymar (= *T. angulata*, Bellardi, non J. de C. Sowerby; *T. Pharaonica*, Cossmann).

T. VINCULATA, Zittel (= *T. Parisiana*, Mayer-Eymar).

T. LESSEPSI, Mayer-Eymar (= *Mesalia oxycrepis*, Cossmann, non Mayer-Eymar).

T. PSEUDIMBRICATARIA, Oppenheim (= *T. Desmaresti*, Mayer-Eymar, non Basterot).

*T. CROCODILI, Oppenheim.

*T. FRAUDATRIX, Oppenheim.

T. CARINIFERA, Deshayes.

MESALIA HOFANA, Mayer-Eymar (= *Mesalia electa*, Locard).

M. LOCARDI, Cossmann (= *M. obruta*, Locard).

M. FASCIATA, Lamarck, sp. (= *T. fasciculata*, Fraas; *T. bilirata*, Mayer-Eymar).

*M. ANALOGA, Oppenheim.

Family VERMETIDÆ.

SERPULORBIS CLATHRATUS, Deshayes, sp.

Family XENOPHORIDÆ.

TUGURIUM AGGLUTINANS, Lamarck, sp. (= *Trochus umbilicaris*, Solander; *Xenophora splendida*, Vinassa de Regny).

Family CAPULIDÆ.

CALYPTRÆA APERTA, Solander, sp. (= *Calyptræa trochiformis*, Lamarck; *C. pectinata*, Mayer-Eymar).

HIPPONYX MOKATTAMENSIS, Oppenheim (= ? *Crepidula indigena*, Mayer-Eymar).

Family NATICIDÆ.

AMPULLINA LONGA, Bellardi, sp. (= *Natica spirata*, Fraas; *N. ammonis*, Blanckenhorn).

A. SIGARETINA, Lamarck, sp.

*NEVERITA CLEOPATRÆ, Oppenheim.

NATICINA ÆGYPTIACA, Oppenheim.

N. DEBILIS, Bayan, sp.

Family AMPULLARIIDÆ.

LANISTES ANTIQUUS, Blanckenhorn (= *L. Bolteni*, Mayer-Eymar, non Chemnitz; *Ampullaria subcarinata*, Bellardi, non G. B. & J. Sowerby).

Family MELANIIDÆ.

*BAYANIA STYGIS, Brongniart, sp. (= *Melania melaniæformis*, Bayan).

DIASTOMA COSTELLATUM, Lamarck, sp. (= *M. costellata*, var. *Roncana*, Brongniart; *M. elongata*, De Gregorio).

Family CERITHIIDÆ.

CERITHIUM LAMELLOSUM, Bruguière.

POTAMIDES FAJUMENSIS, Oppenheim.

P. ORENGÆ (Vidal), Cossmann.

Family APORRHAIIDÆ.

APORRHAIIS ARTINI, Mayer-Eymar, sp.

Family STROMBIDÆ.

RIMELLA (?) ÆGYPTIACA, Oppenheim.

PEREIRÆA BEYRICHI, Mayer-Eymar.

TEREBELLUM SOPITUM, Solander, sp. (= *T. convolutum*, Lamarck).

Family CASSIDIDÆ.

CASSIS NILOTICA, Bellardi (= *Cassis tricarinata*, Fraas).

C. ÆGYPTIACA, Oppenheim.

Family PYRULIDÆ.

*PYRULA RAI, Oppenheim (= ? *Pyrula nexilis*, Bellardi; *Ficula tricarinata*, Mayer-Eymar).

Family LAMPUSIDÆ (= Tritonidæ).

LAMPUSIA (= TRITONIUM) cf. VIPERINA, Lamarck.

Family BUCCINIDÆ.

*LATRUNCULUS STROMERI, Oppenheim.

Family FUSIDÆ.

CLAVALITHES LONGÆVUS, Solander, sp. (= *Fusus scalaris*, Lamarck).

C. GONIOPHORUS, Bellardi, sp.

*C. SPINOSUS, Mayer-Eymar.

C. NOÆ, Chemnitz, sp.

Family TURBINELLIDÆ.

VASUM FREQUENS, Mayer-Eymar, sp. (= *Voluta labiella*, Fraas, non Lamarck).

Family MELONGENIDÆ.

HELIGMOTOMA NILOTICUM, Mayer-Eymar.

*PUGILINA KOENENI, Mayer-Eymar.

*TUDICLA UMBILICARIS, Mayer-Eymar.

Family VOLUTIDÆ.

VOLUTA BEADNELLI,¹ R. B. Newton, nom. mut. (= *Turbinella prisca*, Locard, non Conrad; *Voluta Arabica*, Mayer-Eymar, non Gmelin).

Family HARPIDÆ.

HARPA MUTICA, Lamarck.

Family PLEUROTOMIDÆ.

*SURCULA INGENS, Mayer-Eymar.

PLEUROTOMA FAJUMENSIS, Oppenheim.

Family BULLIDÆ.

*BULLA OASIDIS, Oppenheim.

*B. DESERTORUM, Oppenheim.

ACERA STRIATELLA, Lamarck.

*A. STROMERI, Oppenheim.

IV. OBSERVATIONS ON SOME NEW, OR OTHERWISE INTERESTING, GASTROPODA FROM THE EOCENE DEPOSITS OF THE FAYUM.

The following account deals with certain forms of Gastropods which are of interest, either on account of good preservation or because of some suggested alteration in their nomenclature; it also includes some new or unrecorded species from this area of Egypt.

LANISTES ANTIQUS, Blanckenhorn. Pl. III, Figs. 1, 2.

Cirrus, Orlebar, Journ. Bombay Branch Roy. As. Soc., 1846, p. 243, pl. iii, fig. 18 (Geology Egyptian Desert).

Ampullaria subcarinata, Bellardi, Mem. R. Accad. Sci. Torino, ser. II, vol. xv, p. 176, pl. i, fig. 10, 1854 (Foss. Nummulit. Egitto), non G. B. & J. Sowerby, 1822.

A. (*Lanistes*) *Bolteni*, Mayer-Eymar, Viertelj. Naturf. Ges. Zurich, vol. xlvi, p. 23, pl. i, figs. 1-2, 1901 (Gastropoden Untertertiär Egyptens), non Chemnitz.

Lanistes antiquus, Blanckenhorn, Centralblatt Mineral., 1901, No. 9, p. 271, woodcut figures 1, 2 (Palaeogens in Aegypten).

L. subcarinatus, Oppenheim, Palæontographica, vol. xxx, pt. iii, p. 277, pl. xxvi, fig. 1, 1906 (Alttertiärer Faunen Ägypten).

Remarks.—During some palæontological explorations in the Fayum in 1902, Dr. C. W. Andrews was fortunate in collecting some

¹ *Voluta Beadnelli*, nom. mut.

interesting molluscan remains from the Qasr el Sagha Beds, among them being a giant form of the freshwater shell *Lanistes antiquus*, which is worthy of placing on record. Its measurements are diam. 85, height 50 mm. The largest example previously known appears to be that mentioned by Dr. Blanckenhorn, exhibiting a diameter of 53 and a height of 28 mm. The specimen under consideration is a natural cast formed of a yellowish-red sandy matrix, with no vestige of shell-structure remaining; small fragmentary ostreiform shells are seen in the rock material filling up the aperture. It belongs to the depressed forms of *Lanistes*, of which Olivier's *Ampullaria carinata* may be regarded as the type. The volutions, numbering about five, are fairly deep and laterally compressed, while the base shows considerable inflation, being besides furnished with a wide and deeply excavated umbilical region, in which the inner whorls are well exposed. According to Mr. Beadnell's section of the Qasr el Sagha Beds (p. 51 of his memoir), this mollusc occurs in Bed 18, associated with marine shells, hence we may assume that the deposits were laid down under estuarine or brackish-water conditions. The Qasr el Sagha Series belongs to the Upper Mokattam or Parisian division of the Eocene, and are consequently of Lutetian age. This species was originally figured by Orlebar from the 'Yellow Limestone' of the Mokattam Hills as *Cirrus*, and subsequently by Bellardi as *Ampullaria subcarinata* from the Nummulitic beds in the neighbourhood of Cairo. Without any reference to these two writers, Mayer-Eymar, nearly fifty years later, claimed the shell as belonging to the recent form of Chemnitz's *Helix terrestris Bolteniana contraria*, and so figured and described it as *Ampullaria (Lanistes) Bolteni*, from the Upper Parisian of Egypt (near Dimé, and the north of Mokattam), being found in the *Alectryonia Clot-beyi* beds of that formation. Dr. Blanckenhorn next discussed the shell, pointing out its wrong determination as a recent species, and established for it the new name of *Lanistes antiquus*. In the latest account of this fossil Dr. Oppenheim restored Bellardi's name, recognizing it as *Lanistes subcarinatus*. From the synonymy now offered it is apparent that *Ampullaria subcarinata*, as determined by Bellardi, is no longer tenable, because much earlier in the last century G. B. and James Sowerby (Genera of Shells, 1822) had used the same name for a recent shell from the Congo River of Africa. It follows, then, that Dr. Blanckenhorn's *Lanistes antiquus* should be the recognized name for this shell. The genus *Lanistes* appears to be entirely restricted to African freshwaters at the present day; and the fossil species now referred to, in all probability, represents the ancestral form of *L. carinatus*, Olivier, sp. (= *L. Bolteniana*), which exists in Birket el Qurun, in the Nile, near Alexandria, and at numerous other places on the same river or its tributaries, as far south as the Victoria Nyanza (according to Professor E. von Martens, Deutsch-Ost-Afrika, vol. iv, p. 169, 1898), Lake Dembea, etc., and occurring also in some profusion in the younger Post-Pliocene deposits of the Fayum depression.

Formation.—Lutetian (Middle Eocene).

Locality.—Near Qasr el Sagha (Dr. C. W. Andrews).

RHOPALITHES GONIOPHORUS, Bellardi. Pl. IV, Fig. 1.

Fusus goniophorus, Bellardi, Cat. Foss. Nummulit. Egitto: Mem. R. Accad. Sci. Torino, ser. II, vol. xv, p. 181, pl. i, fig. 8, 1854.

Clavalithes goniophorus, Oppenheim, Zur Kenntn. alttertiärer Faunen Ägypten: Palæontographica, vol. xxx, pt. iii, fasc. 2, p. 315 pl. xxiii, fig. 6, 1906.

Remarks.—I have regarded this species as belonging to Grabau's genus *Rhopalithes*, which has been established on protoconchal characters besides the presence of two or more oblique plications on the columella, and the type of which is *Fusus Noë* of Lamarck from the Lutetian and Bartonian of the Paris Basin (see *Phylogeny of Fusus and its Allies*: Smithsonian Miscellaneous Collections, vol. xlv, No. 1417, p. 135, 1904). A form from Dimé has been well figured by Dr. Oppenheim agreeing in all essentials with the present specimen from the same series of beds near Qasr el Sagha, although the latter is without its apical whorls. The angulated character of the spire is characteristic. The whorls, of which there are four or five, possess a very narrow and horizontal sutural platform, followed by an obliquity reaching to a median carination, from which proceeds a vertical basal region to the suture. A well-marked obtuse carination occurs on the anterior area of the body-whorl, followed by a prolonged canal. This species is closely related to *Fusus Noë* of Lamarck, but differs in its more angulate whorls, in the much contracted and more elongate aperture, and in the possession of depressed sides to the body-whorl. Bellardi's original figure of the shell represents a very imperfect specimen, although the obliquity of the whorl posteriorly is well seen. We are indebted, however, to Dr. Oppenheim for the most useful figure of this form, which gives a dorsal view of an excellent example exhibiting the early whorls of the spire with their narrowly rounded and elevated vertical costæ, crossed by numerous horizontal spiral striations. In the succeeding volutions of the same specimen the posterior obliquity and the anterior vertical surface of each are well displayed. According to Dr. Oppenheim this fossil belongs to the Upper Mokattam Beds of the neighbourhood of Cairo as well as of the Fayum, and is therefore of Lutetian age.

Formation.—Lutetian (Middle Eocene).

Locality.—Near Qasr el Sagha (Dr. C. W. Andrews).

CLAVALITHES BEADNELLI, n.sp. Pl. IV, Fig. 2.

Shell of large size, robust, scalariform, smooth; whorls deep, laterally compressed, vertical, sulcated posteriorly, and surmounted by a wide horizontal sutural platform (*rampe* of French authors), with projecting margin; last whorl moderately inflated from the lower margin of the sulcation to a depth of 32 millimetres, when contraction sets in to form the narrow anterior canal; columella covered with a spreading callus; sculpture consisting of obscure concentric ridges crossed by numerous, closely set, extremely fine and microscopical striations. Diam. 80 mm.; penultimate whorl, diam. 58, depth 25 mm.

Remarks.—This specimen is a large robust type of shell with remains of the four last whorls, and a very much fractured apertural

region, and is doubtless closely allied to *Fusus scalaris* of Lamarek, found in the Lutetian and Bartonian Beds of Europe, excellent figures of which are to be seen in Deshayes's *Descr. Coq. Foss. Paris*, vol. ii, p. 525, pl. lxxii, figs. 13, 14, 1835. It differs, however, not only in size, but in the possession of the widely excavated sulcation, which forms so prominent a character beneath the margin of the projecting *rampe*. This sulcation has a maximum width of 15 millimetres, the *rampe* also offering a similar measurement. There is no corresponding furrow in Lamarek's species referred to, and only a slight depression exists, which merges rapidly into the ordinary inflation of the whorl. The Fayum shell has besides vertically-sided whorls to the spire, whereas in *scalaris* they are gently sloping. The smoothness of the projecting margins would also separate it from *Murex longævus*, which, according to Solander's old figures, pl. ii, fig. 40, and pl. vi, fig. 73, exhibits a form with mostly irregular and spinous outer margins to the sutural shelf or *rampe*. *Clavalithes* and its species have been studied by Dr. A. W. Grabau, and his work on the *Phylogeny of Fusus and its Allies* (Smithsonian Miscellaneous Collections, vol. xlv, No. 1417, p. 117, 1904) supplies us with much valuable knowledge on the evolutionary characters of this genus. According to M. Cossmann (*Essais de Paléoconchologie Comparée*, 1901, pt. iv, p. 18) the genus ranges through the Eocene, Oligocene, Miocene, and Pliocene formations, and a well-characterized species lives at the present day in Polynesia (*C. serotina*, Hinds).

I have united the name of Mr. Beadnell with this fine example of *Clavalithes* in recognition of his critical and careful work on the geological structure of the Fayum depression.

Formation.—Lutetian (Middle Eocene).

Locality.—Near Qasr el Sagha (Dr. C. W. Andrews).

CLAVALITHES SOLANDERI, Grabau. Pl. IV, Fig. 3.

Murex longævus, Solander, *Fossilia Hantoniensis*, 1766, p. 22, pl. viii, fig. 93 (*non* figs. 40 and 73 = the true *longævus*).

Fusus longævus, J. Sowerby, *Mineral Conchology*, 1814, vol. i, pl. lxiii.

Clavalithes Solanderi, Grabau, Smithsonian Miscellaneous Collections, 1904, No. 1417, p. 123, pl. xiv, figs. 5, 6, pl. xv, figs. 1, 2, and text-figs. pp. 123-5.

C. longævus, Oppenheim, *Palæontographica*, vol. xxx, pt. iii, sect. 2, p. 315, 1906, *non* Solander.

Remarks.—This is a form separated by Dr. Grabau from the true *Murex longævus* of Solander, which possesses irregular and spinous outer margins to the posterior shelves of the volutions. The same author regards as a gerontic example of this species James Sowerby's *Fusus longævus*, figured in 1814, pointing out that the spinous prolongations seen on that specimen are the result of age, and that they are only present on the sutural platform of the last whorl. The Fayum fossil appears to be of medium size, consisting of about seven volutions which are well elevated, closely fitting, and very narrowly shelved. Well-marked sculpture is seen on the three earliest whorls, consisting of fairly distant and swollen longitudinal costæ crossed by

spiral striations; the succeeding whorls are spirally and longitudinally striate. More mature forms of this species from English localities show a greater development of sutural platform.

Distribution.—This form is unknown in the Paris Basin, although it is a frequent British fossil, being found at Barton, in the Upper Eocene, and occurring also in the Lutetian or Middle Eocene of Bramshaw, Bracklesham Bay, Brook, and Huntingbridge.

This specimen was collected from the south of Dimé, and it forms one of the duplicate specimens presented to the British Museum (Nat. Hist.) by the Geological Survey of Egypt.

Formation.—Lutetian (Middle Eocene).

Locality.—South of Dimé (H. J. L. Beadnell).

HEMIFUSUS ERRANS, Solander. Pl. IV, Fig. 4.

Strombus errans, Solander, Brander's *Fossilia Hantoniensia*, 1766, p. 23, pl. ii, fig. 42.

Fusus errans, J. de C. Sowerby, *Mineral Conchology*, vol. iv, p. 139, pl. 400, 1823; and in Dixon's *Geology of Sussex*, 1850, pp. 104, 185, pl. vii, fig. 31.

F. (*Hemifusus*) *errans*, A. von Koenen, "Norddeutsche unter-Oligocän Mollusk.-Fauna": Abhandl. geol. Specialkarte Preussen, etc., vol. x, p. 233, pl. xvii, fig. 5, 1889.

Chrysodomus errans, R. B. Newton, *Syst. List Edwards Coll., Brit. Mus., British Oligocene and Eocene Mollusca*, 1891, p. 157.

Semifusus (*Mayeria*) *errans*, Cossmann, *Essais de Paléoconchologie Comparée*, 1901, pt. iv, p. 93, pl. iv, fig. 13.

Solander's original description of this shell is as follows: "Testa striata, anfractibus carina acuta notatis. Testa oblongo-ovata, utrinque conica, transversim striata, ventre anfractibusque omnibus carina acuta notatis."

Remarks.—With the exception of mineralization the specimen referred to this species is fairly well preserved. The general contour is biconical, while the spire, which is shorter than the aperture, is strikingly carinated on each volution, the posterior surfaces of which are wide and oblique, besides being depressed and spirally striated. The spiral ridges of the body-whorl are coarser and thicker than in European forms of the species, probably largely due to mineralization. Crossing the spiral sculpture are numerous regularly arranged oblique striations, which, however, are more evident on the body-whorl than elsewhere.

A little fracturing has taken place on the front aspect of the specimen, although the straightness and smoothness of the columella are to be observed, as well as the narrow elongate aperture which bends slightly inwards at the base to form a moderately open and short canal; the posterior angulation is rather longer and more sloping than in European examples, although it is noticeable that a fragment of a Spondyloid shell has attached itself to the external surface of that region of the aperture, thus producing a longer obliquity than may really exist there. Length 50, diam. 30 mm.

Distribution.—The species has a wide distribution, being found in

the London Clay, the Bracklesham and Barton Beds of England, and, according to Von Koenen, in the Lower Oligocene deposits of Northern Germany (Helmstadt).

Formation.—Lutetian (Middle Eocene).

Locality.—Near Qasr el Sagha (Dr. C. W. Andrews).

MELONGENA ANDREWSI, n.sp. Pl. IV, Figs. 5, 6.

Shell ovately pyriform, thick, solid, smooth, regularly margined; whorls depressed, only slightly elevated, slightly concave, increasing about one-third, vertical, subangulate, and narrowly exposed at the suture; base terminating in a narrow short canal, and laterally furnished with a thickened, transversely twisted, semicircular wall, which circumscribes an elongate umbilical cavity; aperture elongate, narrow, slightly dilated, bending moderately inwards at base to form anterior canal, posteriorly angulated and oblique; columella smooth, covered with an extensive callus, which extends considerably over the umbilical excavation; sculpture consisting of microscopically fine and obscure spiral striations, crossed by numerous and much more evident longitudinal lines of growth, arranged more or less in equidistant groups, which curve outwards in their descent, then inwards, becoming part of the twisted umbilical wall at the base. Height 52, diam. 35 mm.

Remarks.—This shell, on account of its robust and thick test, is in a remarkably good state of preservation. It is one of the smooth and regularly margined examples of *Melongena*, being related among recent shells to the form of *Pyrum paradisiacum* of Martini, as adopted by Reeve under the genus *Pyrula* (*Conchologia Iconica*, 1847, pl. v, fig. 17b), which may possess either a nodulose or smooth spiral region. The fossil is also characterized by the closely fitting, depressed, and only slightly elevated whorls, which are nearly on the same plane, and by the umbilical details at the base. The extremely fine ornamentation of the surface, when well preserved, amounts almost to a delicate decussation.

It may be mentioned that Mayer-Eymar has described *Melongena* (*Pugilina*) *Koeneni* from the Lutetian (Upper Parisian) of 'Jebel Schweinfurth' to the south of Dimé in the Fayum (Journ. Conchyl., vol. xlv, p. 233, pl. xiv, fig. 1, 1898), which differs from the present shell in possessing strong spiral ridges, a modulated spire, and marginal irregularities.

The specimen appears to represent quite a new type of shell among fossil mollusca, and I am not aware of any similar form having been recorded from the Lower Tertiary strata of Northern Africa, Europe, or India.

According to M. Cossmann (*Essais de Paléoconchologie Comparée*, 1901, pt. iv, pp. 85, 86) the true *Melongena* commenced in the Oligocene (Tongrian) period, and is living at the present day in the Indian Ocean. The specific name is suggested in honour of the collector, Dr. C. W. Andrews, F.R.S., of the British Museum, to whom we are indebted for our knowledge of the fossil vertebrata of the Fayum province of Egypt.

Formation.—Lutetian (Middle Eocene).

Locality.—Near Qasr el Sagha (Dr. C. W. Andrews).

VOLUTA BEADNELLI, nom. mut.

Turbinella prisca, Locard, Moll. Tert. inf. Tunisie, 1888, p. 7, pl. vii, fig. 4 (*non* Conrad).

Voluta (Volutolyria) Arabica, Mayer-Eymar, Journ. Conchyl., vol. xliii, p. 52, pl. iii, fig. 1, 1895 (*non* Gmelin).

V. Arabica, Cossmann, Bull. Inst. Égyptien, 1901, p. 177, pl. i, fig. 2; Oppenheim, Palæontographica, vol. xxx, pt. iii, fasc. 2, p. 327, pl. xxiv, figs. 12, 13, 1906.

Remarks.—This entry is made to call attention to the necessity of introducing a new specific name in place of *Voluta Arabica*, which is preoccupied.

Formation.—Lutetian (Upper Mokattam).

Locality.—Near Dimé.

This species is also found in rocks of the same age in the neighbourhood of Cairo.

TURRITELLA TRANSITORIA, Mayer-Eymar. Pl. III, Figs. 3, 4.

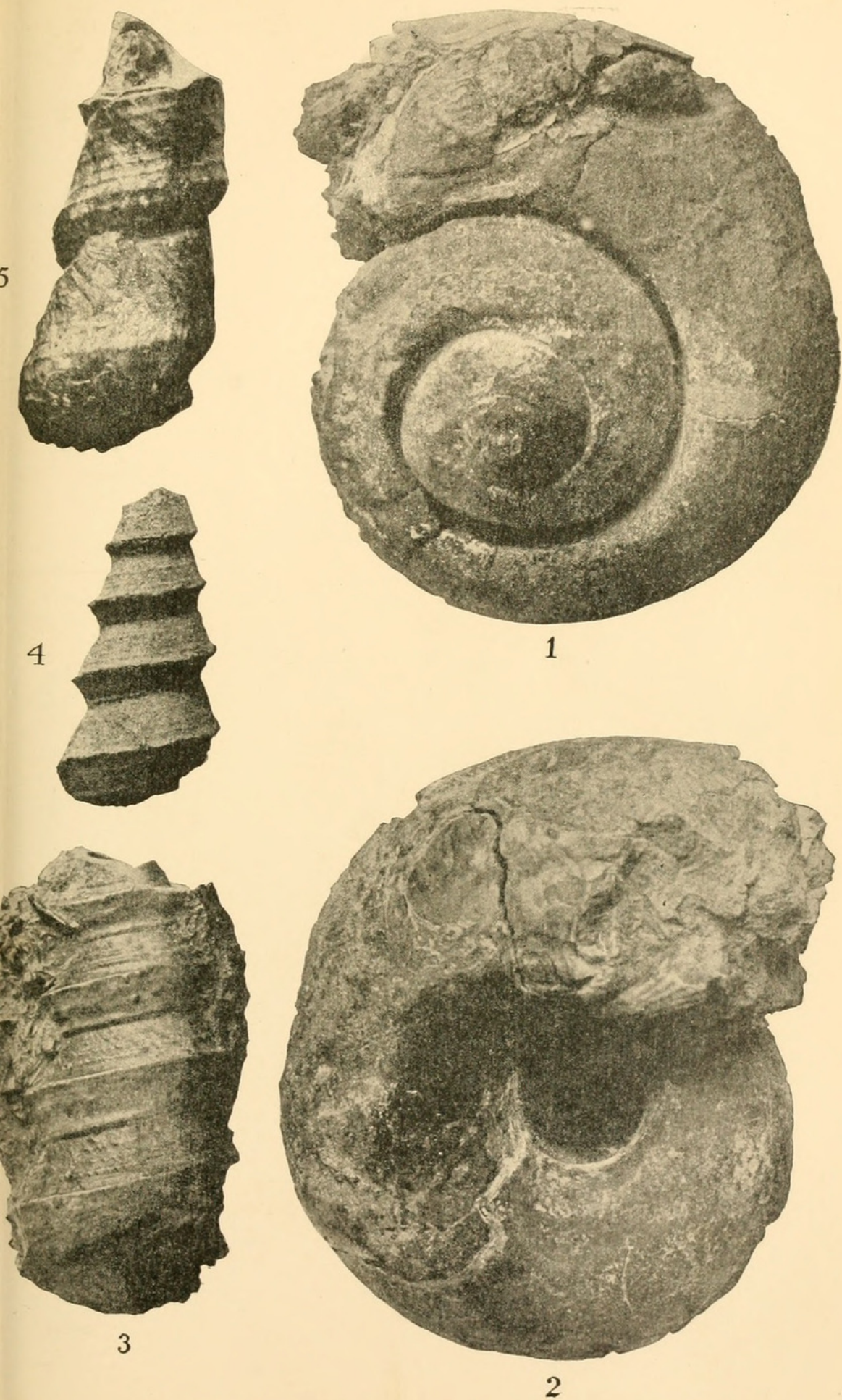
Turritella angulata, Bellardi, Mem. R. Accad. Sci. Torino, ser. II, vol. xv, p. 175, 1854 (*non* J. de C. Sowerby).

T. transitoria, Mayer-Eymar, Palæontographica, vol. xxx, p. 76, pl. xxiii, fig. 6, 1883.

T. Pharaonica, Cossmann, Bull. Inst. Égyptien, 1901, p. 181, pl. ii, figs. 1, 2; Beadnell, Topogr. Geol. Fayum, Egypt, 1905, pp. 34, 35; Oppenheim, Palæontographica, vol. xxx, pt. iii, fasc. 2, p. 237, pl. xxiii, fig. 10, 1906.

Remarks.—This shell was originally recognized from Egypt by Mayer-Eymar as Archiac's *T. angulata* of India, but according to M. Cossmann certain differences exist which demanded their separation, hence his introduction of *T. Pharaonica* for the Egyptian fossil. Previously, however, Mayer-Eymar described *T. transitoria* from the Upper Mokattam deposits of the island (Geziret el Qorn) on Birket el Qurun in the Fayum, which certainly appears to be Cossmann's *T. Pharaonica*, but exhibiting a spirally granulate sculpture, much more clearly preserved than is generally the case with ordinary Fayum fossils, otherwise the ornamentation is quite similar although much more obscure, the granulations having been smoothed down, or sometimes entirely removed by erosive agencies. The mere fact that Mayer-Eymar's figure shows a slightly more slender form of this species than usually obtains, forms no real distinction, as much variation is observable among a number of examples. Strange to say, Dr. Oppenheim admits *T. transitoria* in his synonymy, and yet adopts *T. Pharaonica* for the shell, a name established some eighteen years later. There is no alternative, therefore, but to recognize Mayer-Eymar's name of 1883. Two specimens are now figured, one large form from the Qasr el Sagha deposits, and an intermediate example which is of considerable interest, having been found in the Jebel el Qatrani Series associated with the estuarine mollusca previously referred to in this address.

These specimens were among some duplicates presented to the British Museum (Natural History) by the Geological Survey of Egypt.



EOCENE GASTROPODA FROM THE FAYUM PROVINCE OF EGYPT.

Formations.—Lutetian (Middle Eocene) and Bartonian (Upper Eocene).

Localities.—South of Dimé; Jebel el Qatrani (H. J. L. Beadnell).

TURRITELLA OPPENHEIMI, nom. mut. Pl. III, Fig. 5.

Turritella carinifera, Deshayes, Descr. Coq. Foss. Paris, vol. ii, p. 273, pl. xxxvi, figs. 1, 2, 1833 (*non* Lamarck),¹ 1822; Mayer-Eymar, Palæontographica, vol. xxx, p. 76, pl. xxiii, fig. 8, 1883; Cossmann, Bull. Inst. Égyptien, 1901, p. 181, pl. ii, figs. 5, 6; Oppenheim, Palæontographica, vol. xxx, pt. iii, p. 248, 1906.

Remarks.—The specimen figured on this occasion is in a fragmentary condition, with a somewhat eroded and polished exterior, although, otherwise, it forms a striking example of the adult condition of this species. It exhibits the oblong contour of the whorls, with their slightly excavated surfaces, ornamented with equidistant spiral striations of more or less granulate structure, and crossed by deeply sinuous lines of growth; the doubly margined and prominent anterior carination is, likewise, most evident. Attention is principally called to this shell, however, because of an alteration necessitated in its specific name. Known hitherto as *Turritella carinifera* of Deshayes, it is imperative to point out that the same designation had been previously introduced into literature by Lamarck for quite a different form of *Turritella*; hence the proposed new name of *T. Oppenheimi* is suggested to replace that of Deshayes, in admiration of Dr. Paul Oppenheim's researches on the older Tertiary shells of Egypt.

Distribution.—This species occurs throughout the Eocene series of the Paris Basin (see Cossmann, Ann. Soc. R. Mal. Belgique, vol. xxiii, p. 296, 1888), and in the Middle Eocene or Lutetian beds of England (R. B. Newton, *Syst. List Edwards Coll. British Oligocene and Eocene Mollusca*, British Museum, 1891, p. 205). Mayer-Eymar recorded a well-preserved fragment from the island on Birket el Qurun. Cossmann described it from the neighbourhood of Dimé, and Oppenheim has recognized the shell from similar localities, as well as numerous other places in Egypt, especially in the neighbourhood of Cairo and the Pyramids.

This specimen forms one of the duplicates presented to the British Museum (Natural History) by the Geological Survey of Egypt.

Formation.—Lutetian (Middle Eocene).

Locality.—South of Dimé (H. J. L. Beadnell).

EXPLANATION OF PLATES III AND IV.

All figures are photographed natural size.

PLATE III.

LANISTES ANTIQUUS, Blanckenhorn.

FIG. 1. Spiral view of a large example of this species, preserved as a calcareous sandstone cast.

„ 2. Basal view of same specimen, showing a great umbilical depth with the inner volutions. The costated remains of a small Ostreiform shell are present in the matrix of the aperture.

¹ Hist. Nat. Anim. sans Vert., vol. vii, p. 59, 1822.

TURRITELLA TRANSITORIA, Mayer-Eymar.

- FIG. 3. Front aspect of an adult fragmentary example, much polished from wind and sand erosion, although partially preserving the spirally granulate ornamentation of this species.
- „ 4. Dorsal view of a medium-sized specimen, with four whorls, showing obscure sculpturing and granulated margins to the carinations. This is one of the few marine shells found in the Jebel el Qatrani beds, and is therefore of Bartonian or Upper Eocene age.

TURRITELLA OPPENHEIMI, nom. mut.

- FIG. 5. A fragmentary adult specimen, somewhat polished through sand and wind erosion, showing the elongate and slightly excavated whorls with the basal carination and fairly deep suture. The equidistant spiral striations and sinuous growth-lines are also well seen.

PLATE IV.

RHOPALITHES GONIOPHORUS, Bellardi, sp.

- FIG. 1. Front view of an eroded specimen, showing the narrowly elongate aperture, the vertical and obliquely constituted whorl with its median carination, as well as obscure evidence of sculpture on the earlier whorls (= marginal tuberculation).

CLAVALITHES BEADNELLI, n.sp.

- FIG. 2. Latero-dorsal view of the only example known, showing the prominently sulcated, vertical whorls and the horizontal sutural region. The body-whorl exhibits a part of the columellar callosity. The perforations on the surface of this specimen are probably of some organic origin.

CLAVALITHES SOLANDERI, Grabau.

- FIG. 3. Dorsal view of a medium-sized specimen, showing the tall and closely built whorls, with no evidence of irregular or spiny margins.

HEMIFUSUS ERRANS, Solander, sp.

- FIG. 4. Dorsal aspect of shell, with the characteristic form and ornamentation of this species.

MELONGENA ANDREWSI, n.sp.

- FIG. 5. Front view of the only specimen known, showing the depressed and slightly elevated whorls, the narrow and elongate aperture, and the narrow basal umbilical perforation bounded by an inflated outer margin.
- „ 6. Dorsal view of same, exhibiting fine sculpture striations and the swollen twisted region at the base which circumscribes the perforation.

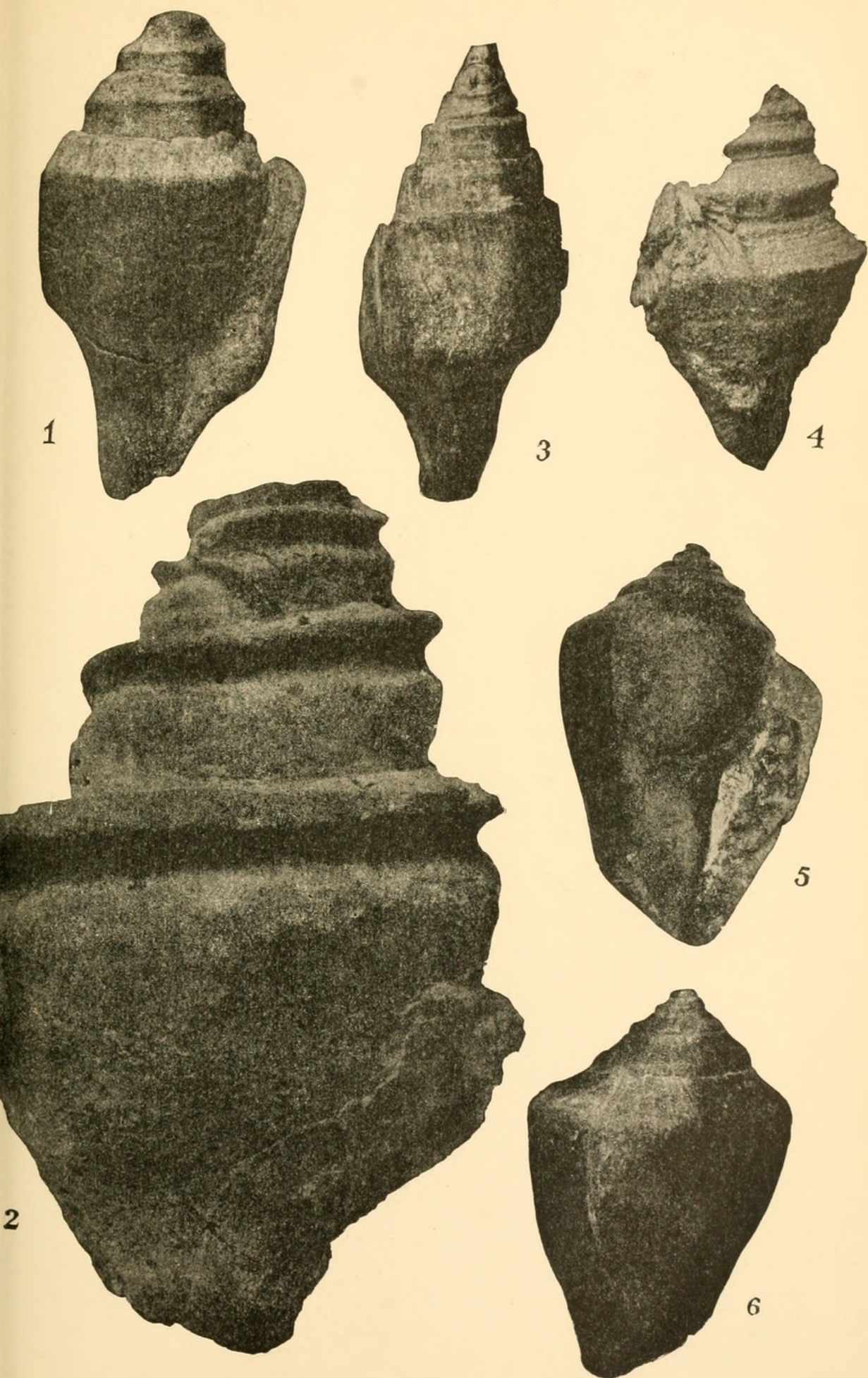
The specimens figured are preserved in the British Museum (Natural History).

V. LITERATURE.

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— "On some Recent Geological Discoveries in the Nile Valley and Libyan Desert": *Geol. Mag.*, 1901, p. 27 (= abstract of French Congress paper).



EOCENE GASTROPODA FROM THE FAYUM PROVINCE OF EGYPT.

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— "Die Geschichte des Nil-Stroms in der Tertiär- und Quartärperiode, sowie des palaeolithischen Menschen in Aegypten": *Zeitsch. Ges. Erdkunde*, Berlin, 1902, pp. 694-762.

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Among other shells the following are figured and described from the Lutetian or Middle Eocene deposits of the Fayum: *Voluta Arabica*, Mayer-Eymar; *Turritella carinifera*, Deshayes; *T. Pharaonica*, Cossmann; *Mesalia fasciata*, Lamarck, sp.; *M. Locardi*, Cossmann; *Carolia placunoides*, Cantraine; *Vulsella deperdita*, Lamarck; *Mactra Fournani*, Cossmann.

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MAYER-EYMAR (C.). "Die Versteinerungen der Tertiären Schichten von der westlichen Insel im Birket el Qurun See": *Palæontographica*, vol. xxx, pp. 67-77, pl. xxiii, 1883.

This memoir contains descriptions and figures of Fayum mollusca collected by Schweinfurth in 1879, which were supposed to possess a Bartonian facies (now regarded as of Lutetian or Middle Eocene age):—

PELECYPODA.—*Ostrea plicata*, DeFrance; *O. digitalina*, Dubois; *O. gigantea*, Solander; *O. longirostris*, Lamarck; *O. producta*, Delbos & Raulin; *Arca Edwardsi*, Deshayes; *Lucina pomum*, Dujardin; *L. cf. tabulata*, Deshayes; *Cardium Schweinfurthi*, Mayer-Eymar; *Isocardia cyprinoides*, Bronn; *Cytherea Newboldi*, Mayer-Eymar; *Tellina pellucida*, Deshayes; *Mactra compressa*, Deshayes; *Corbula pixidicula*, Deshayes.

GASTROPODA.—*Calyptrea trochiformis*, Lamarck; *Turritella angulata*, J. de C. Sowerby; *T. carinifera*, Deshayes; *T. transitoria*,

Mayer-Eymar; *T. turris*, Basterot; *Turbo Parkinsoni*, Defrance; *Pleurotoma* sp.; *Ficula tricarinata*, Mayer-Eymar.

MAYER-EYMAR (C.). "Plicatularum sex novæ e stratis Aegyptiæ Parisianis": Viertelj. Nat. Ges. Zurich, vol. xxxiv, pp. 392-5, 1889.

Describes *Plicatula abundans*, Mayer-Eymar, from the Lutetian or Middle Eocene of the Fayum.

— "Diagnoses Ostrearum novarum ex agris Aegyptiæ nummuliticis": Viertelj. Nat. Ges. Zurich, vol. xxxiv, pp. 289-99, 1889. [Reprint in Mém. Soc. Belge Géol. Pal. Hydrol. (Bruxelles), vol. iii, pp. 401-8, 1889.]

The following forms from the Lutetian of the Fayum are described but not figured: *Ostrea (Alectryonia) Lenzi*, *O. aegyptiaca*, *O. Qeruniana*, *O. Ismaeli*.

— "Description de Coquilles fossiles des Terrains tertiaires inférieurs": Journ. de Conch. [Paris] for 1887, 1888, 1895, 1896, 1898.

The following mollusca from the Lutetian or Middle Eocene formation of the Fayum are described and frequently figured in the various volumes of this periodical: (1887) *Lovellia Schweinfurthi*; (1888) *Ostrea Fraasi* and var. *Fajumensis*, *Pecten Moelhensis*; (1895) *Melongena (Heligmotoma) Nilotica*, *Mesalia Hofana*, *Fusus (Clavellites) spinosus*, *Tudicula umbilicaris*, *Pleurotoma ingens*, *Pereiræa Beyrichi*, *Voluta (Volutolyria) Arabica*; (1896) *Cardita (Cossmannella) Aegyptiaca*; (1898) *Ostrea (Gryphæa) Arabica*, *Tellina Damesi*, *T. grandis*, *T. latissima*, *T. Zitteli*, *Melongena (Pugilina) Koeneni*, *Ostrea Schweinfurthi*, *Ostrea Sickenbergi*, *Crassatella Junkeri*, *C. puellula*, *Chenopus Artini*.

— "Diagnoses Mytilorum ex agris Aegyptiæ nummuliticis": Viertelj. Nat. Ges. Zurich, vol. xxxvi, pp. 169-75, 1891.

Describes, but without figuring, the new species, *Mytilus Niloticus*, from the Lutetian or Middle Eocene of the Fayum.

— "L'Oasis de Moëleh": Bull. Inst. Egypten, ser. III, No. 3, pp. 44-53, 1892.

The following mollusca from the Lutetian deposits are listed from this area of the Fayum:—

PELECYPODA.—*Ostrea Gumbeli*, Mayer-Eymar MS.; *Pecten Moelhensis*, Mayer-Eymar; *P. corneus*, J. Sowerby; *Vulsella chamiformis*, Mayer-Eymar; *Lucina globulosa*, Deshayes; *L. consobrina*, Deshayes; *L. Defrancei*, Deshayes.

GASTROPODA.—*Velates Schmiedeli*, Chemnitz; *Cerithium fodicatum*, Bellardi.

— "*Ampullaria (Lanistes) Bolteni*, Chemnitz": Eclog. Geol. Helvetiæ, vol. vi, p. 120, 1900.

— "Les Ampullaires de l'Éocène d'Égypte": Bull. Inst. Égyptien, ser. iv, No. 2, fasc. 4, pp. 205-7, 1901.

— "Interessante neue Gastropoden aus dem Untertertiär Egyptens": Viertelj. Nat. Ges. Zurich, vol. xlvi, pp. 23-7, pl. i, figs. 1, 2, 1901.



1912. "On the Lower Tertiary mollusca of the Fayum Province of Egypt."
Proceedings of the Malacological Society of London 10, 56–89.

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