are apparently highly specialized, although the present-day aspect of Majorca seems to afford no clue to causes sufficiently powerful to necessitate the peculiar modifications noted above. It is to be hoped that a further and more detailed study of these remains may throw more light on this interesting problem.

My thanks are due to Dr. C. W. Andrews, F.R.S., for his valuable assistance in comparing the above specimens with material in the British Museum (Nat. Hist.).

II.—On some Fossils from the Nubian Sandstone Series of Egypt.

By R. Bullen Newton, F.G.S.

(PLATES XX AND XXI.)

(*Concluded from the August Number, p.* 359.)

DESCRIPTION OF THE FOSSILS.

Group **PELECYPODA.**

Family **Unionidæ.**

Genus UNIO, Retzius (Philipsson).

Dissertatio Historico-Naturalis Nova Testaceorum Genera, 1788, p. 16.
Type = *Mya margaritifera*, Linnæus.

Synonyms—

Margaritana, Schumacher: Essai d'un nouveau Système des Habitations des Vers Testacés, 1817, p. 123, pl. x, fig. 4. Type = *Margaritana fluviatilis*, Schumacher = *Mya margaritifera*, Linnæus.

Alasmidonta, Say: Journ. Acad. Nat. Sci. Philadelphia, 1818, vol. i, p. 459. Type = *Unio undulata*, Say.

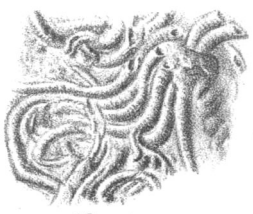
Unio Humei, sp. nov. (Pl. XX, Fig. 1.)

Description.—Specimen consisting of the natural cast of a left valve: form oblong, subtrigonal, mostly compressed; umbo anterior, depressed, incurved, succeeded in front by prominent lunuloid cavity; dorsal margin posteriorly elongate, oblique, continuous with the terminal curvature of margin; anterior region short, deep, slightly inflated on the ventral side of umbonal area; outer margin deeply excavated beneath the umbo, afterwards of oval contour; ventral margin anteriorly inflated, deeply sinuated in rear; posterior region furnished with an obtuse ridge directed obliquely from the umbo to the postero-ventral angle, on each side of which the valve slopes and becomes compressed; lateral face of valve between the anterior inflation and posterior ridge triangularly depressed; sculpture lines obscure.

Dimensions.—Height 35, length 75, diameter 12 mm.

Remarks.—This fossil, although mostly a cast, shows in places certain evidences of shell markings, but which are much too obscure for proper definition; rough lines of growth can also be traced. Its chief characteristics concern the presence of a lunulate area, the great depth of the anterior region being about 1½ times that of the posterior end, and the extensive, somewhat trigonal depression on the lateral face of the valve bordered below by the deeply sinuated margin. There are few forms of fossil Unionidæ which will bear comparison with the Egyptian specimen, although at first sight its affinities might be looked for among Wealden species. Messrs. Koch & Dunker[1] have described *Unio Menkei* from the Wealden deposits of Northern

[1] *Beiträge norddeutschen Oolithgebildes Versteinerungen*, 1837, p. 58, pl. vii, fig. 1.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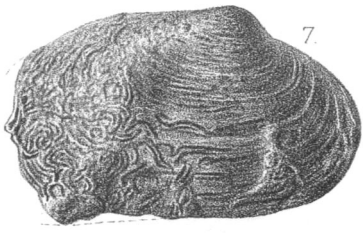
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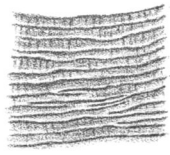
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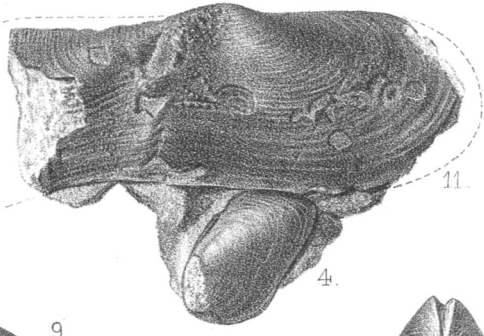
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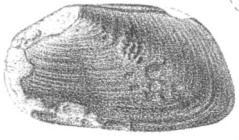
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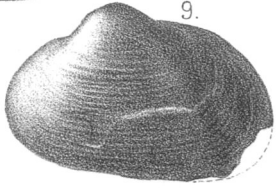
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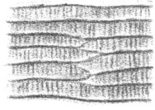
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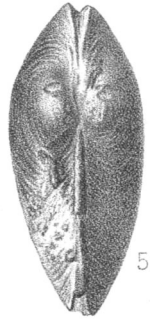
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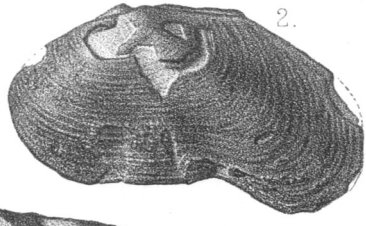

2.


1.


3.

A. H. Searle, del. et lith.

West, Newman imp.

Nubian Sandstone Fossils from Egypt.

Germany which shows a slight basal sinuation, but differing greatly in other respects, such as in its contour lines, being of more equal height throughout, and having relatively shorter valves.

A further comparison with a Wealden species might also be made, as, for instance, with the well-known *Unio porrectus*, found chiefly in British localities and first described by J. de C. Sowerby,[1] the type being a transversely oval sandstone cast with fairly inflated valves, but possessing no basal sinuation, the ventral margin curving distinctly outwards. None of the Unionidæ of higher Cretaceous deposits appear to be in any way related to the present specimen.

Occurrence.—This fossil consists of a reddish-brown ironstone cast of a left valve isolated from the matrix. At the posterior extremity is a small portion of the opposing valve, but being somewhat obscure no details of importance can be cited in connexion therewith, except as illustrating complete compression of the valves in that area. An attempt has been made to develop the cardinal region, but without success.

UNIO JOWIKOLENSIS, sp. nov. (Pl. XX, Figs. 7–10.)

Description.—Shell (with closed valves) compressed, sub-oval; umbones anterior and eroded; dorsal margin horizontal, nearly parallel with ventral border; anterior region sloping from umbones, margins elliptically and moderately produced; posterior part obtusely ridged from umbones to postero-ventral corner, with prominent area sloping to rounded marginal extremity; lateral face sloping from umbonal region to basal margin, which is nearly parallel with dorsal line; sculpture showing nearly equidistant, fine, elevated, closely arranged, concentric striations with intermittent lineations.

Dimensions.—Height 30, length 47, diameter 18 mm.

Remarks.—The greater height and more compressed valves of this species removes it completely from its companion form *Unio Crosthwaitei*, although so far as ornamentation is concerned, and its possession of an obtuse postero-umbonal ridge, there is no doubt that both are allied species. This fossil presents a general resemblance to *Unio Menkei* of Koch & Dunker[2] from the Hanoverian Wealden, but differs in its finer ornamentation and the possession of a narrower and more produced anterior extremity. There is a second example of this species, of smaller size and with anteriorly eroded umbones, showing perhaps more plainly the postero-umbonal elevation and the lunuloid cavity. It is in a fair state of preservation, with the exception of the sculpture lines, which are not so distinct as in the larger specimen.

Occurrence.—The face of the right valve of the specimen described is largely covered with the tubes of the Annelid (*Galeolaria filiformis*), especially in the posterior region, otherwise the surface structure of the shell is well preserved. The left valve has been nearly all eroded away, showing the red-ironstone matrix and its microscopically fine pisolitic character.

UNIO CROSTHWAITEI, sp. nov. (Pl. XX, Figs. 2–6.)

Description.—Shell (with closed valves) sub-cylindrical, inflated; umbones anterior; dorsal margin nearly horizontal, arching posteriorly; ligament elevated, prominent, rounded, moderately thick, tapering in rear; anterior region short, no defined cavity

[1] *Mineral Conchology*, 1828, vol. vi, p. 189, pl. DXCIV, fig. 1.
[2] *Beiträge norddeutschen Oolithgebildes Versteinerungen*, 1837, p. 58, pl. vii, fig. 1.

in front of umbones, margin rounded; posterior region obtusely ridged from umbo to postero-ventral angle, sloping and compressed behind; ventral area sinuated at margin; antero-central face of valves obliquely and somewhat triangularly compressed; sculpture consisting of fine, equidistant, concentric, elevated striations, sometimes wavy, bifurcating, and otherwise irregular, with obscure vertical ridging between; rounded, obscure plications of growth are also present.

Dimensions.—Height 25, length 47, diameter 18 mm.

Remarks.—The specimen described has closed valves, between which reposes a well-developed ligament tapering posteriorly and bearing a few obscure transverse constrictions. The eroded umbones and certain cavities present on both valves indicate the effects of past river action before final deposition. The ornamentation is extremely fine and well preserved, and without a lens appears fairly regular, but a closer inspection shows that filament lines are given off from the main concentric striations producing an appearance of bifurcation, these lines being often gently wavy. Comparing it with *Unio Humei*, the species has relatively more convex valves, a less prominent central depression, and a more cylindroid contour. This new form perhaps compares more readily with *Unio subsinuatus* of Koch & Dunker[1] from German Wealden deposits in possessing the ventral sinuation, although the valves are of greater depth, more convex, less rounded and full anteriorly, whilst the posterior extremity is more produced. Another example of the species, of somewhat shorter axis, possesses a well-preserved test with distinct and regular sculpture lines bearing intermittent vertical ridging; its umbones are a good deal eroded. What appears to be another form of this species is associated in the matrix with *Mutela mycetopoides*, together with fragmentary remains of the same shell standing out in relief on the weathered surface of the rock. This specimen exhibits a left lateral view of evidently a young form having a height of 13 and a length of 25 mm. The sculpture lines are extremely fine and numerous, the postero-umbonal ridge is prominent, and a slightly oblique, narrow furrow proceeds from the umbonal region to the ventral border, which may be of accidental occurrence and not structural. The specimen also shows that the umbo is eroded, and that there is little or no sinuation of the ventral margin.

Occurrence.—The specimens representing this species are in a good state of preservation, although, like the other freshwater shells of this collection, no internal characters are displayed. The matrix is of the same reddish-brown ironstone rock, exhibiting a minutely pisolitic structure, and the shells present a blackish metallic colour with a lighter weathering. On the postero-dorsal surface of the left valve of the principal specimen is an example of the *Galeolaria* situated in close proximity to the elevated ligament.

Genus MUTELA, Scopoli.

Introductio ad Historiam Naturalem sistens genera Lapidum, Plantarum, et Animalium, etc., 1777, p. 397 (No. 83).

Type = "Le Mutel", Adanson: Hist. Nat. Sénégal (Coquillages), 1757, p. 234, pl. xvii, fig. 21. (= *Iridina exotica*, Lamarck.)

Synonym—IRIDINA, Lamarck: Hist. Nat. Animaux sans Vertèbres, 1819, vol. vi, pt. i, pp. 88, 89. Type = *Iridina exotica*, Lamarck.

[1] *Beiträge norddeutschen Oolithgebildes Versteinerungen*, 1837, p. 58, pl. vii, fig. 2.

MUTELA MYCETOPOIDES, sp. nov. (Pl. XX, Figs. 11, 12.)

Description.—Shell (right valve) shallow, soleniform, narrow, sub-cylindrical, sub-arcuate, medially depressed; hinge line straight, linear, parallel with ventral border; umbo nearly central, small, compressed; anterior region obliquely inflated from the umbo, flattened in front, outer margin rounded and gaping; posterior part obliquely and obtusely ridged, having a sloping depressed area in rear; ventral margin concave; surface sculpture consisting of microscopically fine and close striations following the contour lines of the shell, being often irregular and sometimes of network character, and generally grouped within equidistant, rounded plications of growth.

Dimensions.—Height 25, length (approximate) 65, diameter (approximate) 10 mm.

Remarks.—The foregoing description is based upon an external view of a right valve attached to the rock, which, although of fragmentary character, being fractured posteriorly, still preserves some important features of the shell. Through compression and erosion the details of the umbo are not definite, but its almost median position seems to be clearly displayed. The opposing valve is in situ, as can be seen from the presence of the antero-ventral margin, the remainder being entirely hidden in matrix. These front terminal margins are important, since they exhibit the well-marked gape, which is seen to extend ventrally, as in the modern forms of this genus. On the central face of the valve, and near the ventral border, two small vertical depressions occur, produced probably by pressure or otherwise during the life of the mollusc, giving rise to constrictions which locally disturb the regularity of the lines of ornamentation. With regard to sculpture, the growth plications may be said to be fairly well developed in places, whilst the finer striations, only observable with a strong lens, are frequently intertwined and irregular, forming more or less a structure of filaments.

The principal characters of this specimen include the straight hinge line, the nearly median umbo, the posterior ridge, the inward curvature or sinuation of the central region of the valve, the sub-cylindrical contour, and anterior gape. In many of these details it appears to more nearly resemble *Mycetopus* of Orbigny [1] than Scopoli's *Mutela*, that is, judging from the type of the former genus (*M. soleniformis*), which lives in Central South American rivers; but remembering that *Mutela* belongs essentially to African freshwaters, and is moreover found in the alluvial deposits of the Nile,[2] it is more reasonable to suppose that the fossil under consideration represents an ancestral form of that genus rather than of another which belongs to a totally different continent. In order to mark this resemblance the present African fossil has been named *Mutela mycetopoides*.

Occurrence.—The fossil is adherent to a mass of ironstone matrix associated with a small form of *Unio* (*U. Crosthwaitei*). Its surface is mostly of a deep-black colour, besides being much cracked and perforated in places in consequence of erosive agencies. Quite a number of small, rounded, wart-like prominences are present on the fossil, these representing pisolitic grains of iron-ore, the presence of which would denote the highly ferruginous character of the waters

[1] *Voyage dans l'Amérique Meridionale*, 1846, vol. v, pt. iii, Mollusques, pp. 600, 601, pl. lxvi.

[2] Leith Adams, Quart. Journ. Geol. Soc., 1864, vol. xx, p. 15.

prevailing during the period of deposition. The matrix exhibits a light-coloured weathering on the exposed surfaces, and is of minutely oolitic structure.

Family **Aviculidæ.**

Genus INOCERAMUS, J. Parkinson.

Trans. Geol. Soc. [London], 1819, vol. v, pt. i, p. 55, pl. i, fig. 3.
Type = *Inoceramus Lamarcki*, Parkinson.

Inoceramus Balli, sp. nov. (Pl. XXI, Figs. 1–3.)

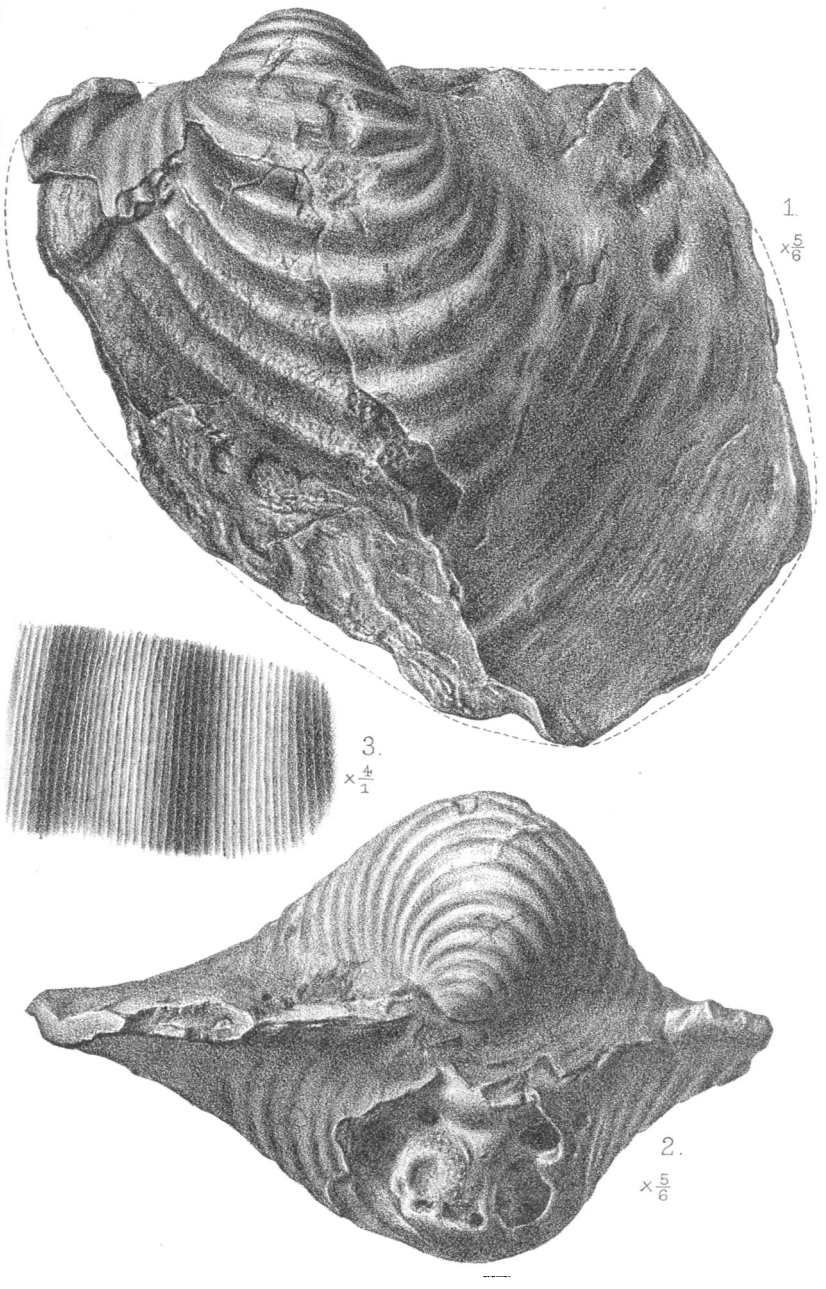
Inoceramus Cripsi, Blanckenhorn MS.: W. F. Hume, "Topography and Geology of the Peninsula of Sinai (south-eastern portion)," Survey Department, Egypt (Cairo), 1906, p. 153; John Ball, "Description of the First or Aswan Cataract of the Nile," Survey Department, Egypt (Cairo), 1907, p. 67. *Non* Mantell *nec* Goldfuss.

Description (specimen with closed valves).—Shell of moderately large size, equivalve, sub-quadrangular from the lateral aspect; valves antero-medially inflated, arched, compressed towards anterior margin, but considerably more so posteriorly and ventrally; cardinal line straight, horizontal, nearly equal in length to the height, longest posteriorly; posterior and ventral margins rounded, anterior, more or less truncated, sub-vertical; umbonal region antero-median, incurved, posteriorly inclined, but with probable anteriorly directed summits; surface of valves with about twenty elevated, prominent, rounded, concentric costæ with laterally attentuated ends, divided by furrows of corresponding width; costæ and grooves broaden as development proceeds, but become lost and insignificant in the area of greatest compression; extremely fine concentric lineations ornament the surface of the ridges and furrows.

Dimensions.—Height 120, length 115, diameter 75 mm.

Remarks.—This *Inoceramus* would appear to belong to the group of which *Cripsi* of Goldfuss (*non* Mantell)[1] might be taken as the type; in fact, the specimen has already been so determined by Dr. Blanckenhorn, although important differences exist which would undoubtedly separate it from the species itself. There is the rather quadrangular outline as opposed to the general transversely oval figure of the typical German shell, the presence of the prominent antero-median elevation from the umbonal part downwards, and the more medially situated umbonal area. Chiefly in the well-sculptured costæ and grooves does it approximate to the Goldfussian shell. The posterior inclination of the umbonal region, mentioned in the diagnosis, need not necessarily imply that the shell was opisthogyrous, as it is more than probable that were the summits in preservation they would be found assuming the usual anterior direction hitherto associated with the genus *Inoceramus*. A similar phenomenon may be observed in large examples of *I. concentricus*, Parkinson, of Albian (= Gault) age, which exhibit the prosogyrous character of the umbones followed by a more oblique

[1] Without attempting a revision of the Inoceramoid shells, it is necessary to remind the student that Orbigny was the first palæontologist to recognize the importance of separating into two species the forms which Goldfuss had included under *Cripsi* in the *Petrefacta Germaniæ*. He therefore substituted *Goldfussianus* for *Cripsi*, because the latter name was preoccupied by Mantell for a shell of different form and horizon (Cenomanian), limiting its application to the example represented by fig. 4*d* of the Goldfuss plate 112; whilst that of *regularis* was acknowledged to embrace figs. 4*a*, *b*, *c* of the same plate (see Orbigny, *Pal. Française Terr. Crétacés Lamellibranchia*, 1845, p. 517, pl. cccxi, and *Prodrome Pal. Strat.*, 1850, vol. ii, p. 250). The nomenclature of some of these Senonian Inocerami has been recently under the consideration of Dr. Joh. Böhm in the *Monatsber. Deutsch. Geol. Ges.*, 1907, No. iv, p. 113.



A. H. Searle, del. et lith. West, Newman imp.

Inoceramus Balli sp. nov.
from the Nubian Sandstone of Egypt.

arrangement of the ridges and grooves anteriorly than on the opposing side, and so producing a posterior curvature of the umbonal region. In its actual marginal contour, judging from the lateral aspect, it follows very much the lines of Zittel's *I. Cripsi*, var. *typica*, a Gosau species of Campanian age (Denksch. k. Akad. Wiss. Math. Nat., 1866, vol. xxv, p. 98, pl. xiv, fig. 1), though not so rounded anteriorly where the costæ are more or less vertically disposed, especially on the right valve. Again, the umbonal region of the Gosau shell is much nearer the anterior margin, besides exhibiting a strong anterior obliquity; the costæ are also more numerous, and the valves have not the prominently arched feature of the specimen from Egypt. In general form, therefore, and sculpture characters the specimen favours an Upper Cretaceous horizon, and it may reasonably be regarded as Senonian; in fact, it is more than possible that its real place in the series would be the Campanian stage of that period, as specified on Blanckenhorn's manuscript label accompanying the specimen, because it is in that stage the so-called *Cripsi* and its allies are more generally found in the world's Cretaceous regions, such as the United States, India, Japan, etc.

Occurrence.—The only specimen available is in a good state of preservation with both valves in the closed position, shell structure being seen in places with the delicate surface lineations. The margins are rather imperfect, especially on the left anterior side, where there is evidence of crushing, which was probably effected during the process of fossilization. Since its arrival from Egypt a large part of the matrix of the left valve has been skilfully removed by Mr. Richard Hall, the senior Formatore of the British Museum (Natural History), thus exposing the centrally arched elevation and the extensive areas of depression at the base and rear. Through mineralization and wind erosion the right valve has to a great extent lost the surface and ornamentation of the umbonal region, but all its later characters are well displayed. The matrix is highly ferruginous and of limonite character, being mostly of a reddish-brick colour. Where wind erosion has taken place through long exposure, the surface of the valves is quite lustrous and polished and of a blackish-brown metallic appearance. There are some obscure remains of Annelid tubes on this specimen which from their fineness might probably be referred to *Galeolaria filiformis*. In a recent letter Dr. John Ball kindly furnished the following particulars as to the locality where he was fortunate enough to discover this unique *Inoceramus*:—"It was obtained from near the west-end of the Aswan dam, on the west bank of the Nile, during excavations for a small reservoir, and, as far as I remember, it was quite low down in the local series not more than 20 metres above the old igneous rocks. From the adherent matter you will see it came from one of the more ferruginous beds in the sandstone." Soon after this information was sent, Dr. Ball, then on vacation in England, called at the British Museum and supplied some further details as to the occurrence of the genus in this part of Egypt. He had subsequently found fragments of another *Inoceramus*, of what might be the same species, near the triangulation station of Abajaj, which is about 17 kilometres E.N.E. of Aswan on the east bank of the Nile, in

a similar ferruginous rock at about 120 metres above the Nile. Unfortunately this later material is in the Survey Museum at Cairo, and not available at the present moment for comparison with the Aswan specimen.

Group **ANNELIDA.**

Family **Serpulidæ.**

Genus GALEOLARIA, Lamarck.

Hist. Nat. Anim. sans Vertèbres, 1818, vol. v, p. 371.

GALEOLARIA FILIFORMIS, J. de C. Sowerby. (Pl. XX, Fig. 13.)

Serpula filiformis, J. de C. Sowerby: Trans. Geol. Soc. London, 1836, ser. II, vol. iv, pt. ii, p. 340, pl. xvi, fig. 2.

Galeolaria (*Serpula*) *filiformis*, Bronn: Handbuch Geschichte Natur., 1848, vol. i, p. 521.

Serpula filiformis, Stoliczka: Palæontologia Indica, 1873, vol. iv, pt. iv, p. 63, pl. xii, fig. 6; Kossmat, "Cretaceous Deposits of Pondicherri," Records Geol. Surv. India, 1897, vol. xxx, pp. 96, 107, pl. x, fig. 7 (translated from the German).

Serpula (*Galeolaria*) *filiformis*, R. B. Newton: Ball & Beadnell's Report, "Baharia Oasis," Survey Dept. Public Works Ministry, Egypt, 1903, p. 55.

Remarks.—The original account states that this species consists of "smooth, round tubes, slightly curved, and aggregated into elongated, often branching masses. The tubes are rather thick, nearly equal throughout their substance". Although not so entirely fasciculate as is usual with this species, the form from the Nubian Sandstone shares most of the characters as indicated in the first description. It is found adherent to the valves of the unioniform shells (especially to *Unio Jowikolensis*), the tubes curving and intertwining in various directions, and sometimes lying side by side in parallel curvatures more or less contiguous, whilst the posterior ends are occasionally acuminate. The tubes are quite small, barely half a millimetre in diameter, and without the aid of a lens present an almost filamentous appearance. Some obscure indications of transverse striations appear to be perceptible, but this is very uncertain, as the surface shows evidence of erosion, making it difficult to say whether it was not originally polished and smooth as in ordinary examples of this species. The more isolated of the tubes are observed to run parallel with the sculpture lines of the valve. The species was first described from the Blackdown Beds of England, now regarded as of Albian age, the same massive fasciculate type having in more modern years been recorded from the Upper Cretaceous rocks of Africa and India, both Stoliczka and Kossmat having recognized it in the Arialyur Group of Southern India (= Senonian), whilst Messrs. Ball & Beadnell collected it in a ferruginous, sandy looking, more or less calcareous rock of Cenomanian age occurring in the Baharian region of the Libyan Desert of Egypt, associated with other true marine fossils such as *Exogyra Olisiponensis*, etc. Good examples of the species have been figured by Pictet & Renevier[1] from the Aptian deposits of Switzerland, so that its geological range appears to extend almost throughout the Cretaceous Series. It is also mentioned by Stoliczka as occurring in

[1] Descr. Foss. Terr. Aptien St. Croix—Matériaux Pal. Suisse, 1854, pt. i, p. 17, pl. i, figs. 10–15.

the Cenomanian, Turonian, Senonian, Quadersandstein, and Pläner of England, France, Germany, and Austria.

Closely allied forms are Dujardin's[1] *Serpula filosa* from the French Cenomanian-Turonian Series (Touraine district), which has exceedingly fine tubes and is also of fasciculate habit, and *Serpula plexus*, J. de C. Sowerby,[2] from British Senonian rocks. It would therefore appear that this particular type of Annelid being fairly representative of Upper Cretaceous rocks, we may assume that the Nubian Sandstone specimen belongs to that part of the Cretaceous system. Following Bronn, the species is included in Lamarck's genus *Galeolaria*, and it is so determined in the British Museum.

Occurrence.—This fossil forms one of those rather rare instances of a marine organism being found in direct association with another of freshwater character, proving that marine conditions prevailed and were in fairly close proximity to the river agencies which had brought down the fluviatile shells to the area where deposition was in progress. A similar combination of organisms may be mentioned in connexion with a piece of limestone of the 'Munder Mergel' Series of North Germany, regarded as the base of the Wealden (=Purbeckian), which exhibits a small form of *Cyrena* in company with *Serpula coarcervata*, Blumenbach, the specimen being in the British Museum with the registered number A–64.

Conclusions.

From a glance at the list of fossils already known to occur in the Nubian Sandstone of Southern Egypt (see p. 358), it will be seen that the formation is of considerable depth in places, and especially in the Wadi Kena, where Figari Bey (according to Zittel) obtained *Mosasaurus* remains at a depth of 400 feet. This Vertebrate belongs chiefly to the uppermost part of the Senonian (Mæstrichtian), although Blanckenhorn regards the Egyptian occurrence as of older Senonian (Santonian) age. From a boring in the neighbourhood of Edfu at a depth of 308 feet, Coquand reported the finding of *Ostrea Verneuili*, which he considered to be of Garumnian age, a member of the Danian; and later Dr. Hume discovered numerous *Lingulæ* and *Mytilus* cf. *lineatus*, etc., in a well boring at Abu Rahal, 164 feet from the surface, which he stated were of Cretaceous age.

The silicified woods (*Araucarioxylon* and *Nicolia*) of this formation and the fern remains described by Professor Seward indicate its estuarine origin, that is so far as Southern Egypt and Nubia are concerned.

A study of the present fossils supports the Cretaceous view as to the age of this part of the Nubian Sandstone, which, it is interesting to observe, was initiated some seventy years ago by Lefévre after an examination of the rocks as exposed at Aswan.

In speaking of the freshwater shells, which appear to be the only mollusca of that character recorded from the Nubian Sandstone since Russegger's discovery of *Cyclas faba*? of Münster in 1843 from near Aswan, they appear at first sight to bear a relation to Wealden forms,

[1] Mém. Soc. Géol. France, 1835, vol. ii, pt. i, p. 233, pl. xvii, fig. 18.
[2] *Mineral Conchology*, 1829, vol. vi, p. 201, pl. dxcviii, fig. 1.

but when carefully examined such resemblance is not maintained, nor do they compare with any closeness to similar shells found in the later deposits of the Cretaceous Series. Russegger regarded his *Cyclas faba*? as indicating Greensand, Quadersandstein, or Wealden, but as the specimen was never figured or described, its scientific value at the present day is unimportant. It may be mentioned, however, that none of the unioniform shells now described could possibly be mistaken for the genus *Cyclas*.

The fact that a marine organism accompanies the shells appears to be ample testimony of the estuarine conditions which prevailed during the deposition of the beds, as doubtless the valves, probably in the dead state, were brought along by river action to the neighbourhood of the sea, and so became associated with marine life.

So far as the Annelid tubes are concerned, their determination as *Galeolaria filiformis* appears to be correct, and although this is a species which ranges throughout the Cretaceous system, it is satisfactory to learn of its occurrence in the Arialyur Group (= Senonian) of India, and in the rocks of the Baharia Oasis of the Libyan Desert of Egypt accompanying Cenomanian mollusca (*Exogyra Olisiponensis*, etc.).

The *Inoceramus*, as pointed out, belongs to a group of forms which are restricted to Upper Cretaceous rocks, and mostly to the Campanian stage of the Senonian period. Paul Choffat[1] records *I. Cripsi*, var. *typica*, of Zittel as having been found in a sandstone outlier at Mira in Portugal associated with *Hoplites Vari*, var. *Marroti*, of Coquand, and determined as of Campanian age. Fournel's[2] *Cripsi* (= *regularis*, Orbigny) is found in the Senonian of Algeria.

According to Madagascar[3] lists *Cripsi* (Goldfuss) occurs in that country, and is regarded as Senonian. Both Stoliczka[4] and Kossmat[5] recognize the same form in the Upper Senonian of Southern India, as also does Professor Yokoyama[6] in the Senonian of Japan. Further, Whiteaves[7] has recognized it in the Senonian of Vancouver, whilst under the names of *Sagensis* of Owen and *Barabini* of Morton, Whitfield[8] has identified it among the fossils of the Raritan Clays, etc., of New Jersey, United States.

When it is considered that the typical form of *Inoceramus* of Turonian times is the *labiatus* of Schlotheim, and that the true *Cripsi* of Mantell belongs to the Cenomanian, there seems little doubt that the new species now described, with a facies peculiarly Senonian, might accurately be relegated to that period and possibly to its Campanian stage.

Although a distance of some 25 miles separates the localities from

[1] Recueil de Monographies Stratigraphiques systeme Crétacique du Portugal, pt. ii, Le Crétacique Supérieur au Nord du Tage, 1900, p. 228.
[2] Richesse Minérale de l'Algérie, 1849, vol. i, p. 370, pl. xviii, figs. 31, 32.
[3] Lemoine, *E'tudes Geologiques dans le Nord de Madagascar*, 1906, pp. 222, 230.
[4] Mem. Geol. Surv. India, Pal. Indica, 1871, p. 405, pl. xxvii, fig. 3.
[5] Records Geol. Surv. India, 1897, vol. xxx, p. 82 (correlation table).
[6] Palæontographica, 1890, vol. xxxvi, p. 175, pl. xviii, figs. 6, 7.
[7] Geol. Surv. Canada, 1879, pp. 170–3.
[8] Mon. United States Geol. Surv., 1885, vol. ix, pp. 75–9, pl. xiv, figs. 15, 16, and pl. xv, figs. 3–5.

which these fossils were obtained, the lithological nature of the matrix is identical in both areas, and may therefore be regarded as of similar age, so that the fauna of the Jowikol Beds exhibiting fresh-water and marine characters is consequently of estuarine origin, and, moreover, may be determined as of Senonian horizon.

EXPLANATION OF PLATES.

Plate XIX.

Topographical sketch-map of Egypt, showing localities of Nubian Sandstone Fossils, from the original designed by Dr. John Ball (see *ante*, p. 353).

Plate XX.

Unio Humei, sp. nov.

FIG.

1. Left lateral view of specimen.

Unio Crosthwaitei, sp. nov.

2. Left lateral aspect.
3. Dorsal view of same, showing ligament and eroded umbones.
4. Younger form of probably the same species, associated with *Mutela mycetopoides*.

4*a*. An enlarged view of the same specimen. × $1\frac{1}{4}$.

5. Dorsal view of another specimen with ligament, and valves slightly open at the ends.
6. Surface structure of same, showing concentric lineations, sometimes bifurcating, and transverse ridging. × 4.

Unio Jowikolensis, sp. nov.

7. Right lateral view of specimen, with adherent Annelid tubes.
8. Surface structure of same, showing irregular lineations with transverse ridges between. × 4.
9. Smaller specimen of the same species, left lateral aspect.
10. Dorsal view of same, showing eroded umbones.

Mutela mycetopoides, sp. nov.

11. Right lateral aspect of specimen on matrix, associated with a probably young form of *Unio Crosthwaitei*.
12. Magnified view of surface structure in the postero-dorsal region. × 4.

Galeolaria filiformis, J. de C. Sowerby.

13. Portion of the colony adherent to the valve of *Unio Jowikolensis*. × 4.

The above specimens were obtained from Jowikol, on the east bank of the Nile, between Kalabsha and Aswan.

Plate XXI.

Inoceramus Balli, sp. nov.

1. Left lateral view of specimen slightly reduced in size. × $\frac{5}{6}$. Showing the prominent costæ and compressed regions.
2. Dorsal view of same, exhibiting the elevated and arched character of the umbonal region and its inclination posteriorly. × $\frac{5}{6}$.
3. Surface structure, showing the fine lineations on the costæ and grooves—a restored figure. × $\frac{4}{1}$.

This specimen was from the west end of the Aswan Dam.

Note.—Unless mentioned to the contrary, the figures on Plates XX and XXI are represented of the natural size. The specimens belong to the Museum of the Geological Survey of Egypt.