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PHILLIPS—SECTIONS NEAR OXFORD.

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- 154–173. These are *Miliolæ* not separable specifically from the type, *Miliola Seminulum*, Linn.
155. *Spiroloculina limbata*, D'Orb. Ann. Sc. Nat. vii. p. 299, No. 12; Soldani, Testaceog. ii. pl. 19. fig. *m*.
160. *Quinqueloculina vulgaris*, D'Orb. Ann. Sc. Nat. vii. p. 302, No. 33; Soldani, Testaceog. i. pt. 3, pl. 152. fig. *E*; *Q. secans*, D'Orb. Ann. Sc. Nat. p. 303, No. 43; Modèles, No. 96; Soldani, Testaceog. i. pt. 3, pl. 152. fig. *C*.
161. *Q. pulchella*, D'Orb. Ann. Sc. Nat. vii. p. 303, No. 42; Soldani, Testaceog. ii. pl. 18. fig. *F*; *Q. Schreibersii*, D'Orb. For. Foss. Vien. p. 296, pl. 19. f. 22–24.
168. *Triloculina reticulata*, D'Orb. Ann. Sc. Nat. vii. p. 299, No. 9; Soldani, Testaceog. i. pt. 3, pl. 159. fig. *bb*, *cc* (by error quoted *ee*, *ff* by D'Orbigny).
170. *Biloculina elongata*, D'Orb. Ann. Sc. Nat. vii. p. 298, No. 4; Soldani, Testaceog. i. pt. 3, pl. 153, fig. *M*, *Q*, *p*.
184. *Lituola Soldanii*. New variety. [Type: *Lituola nautiloidea*, Lamarck.] This is a relatively large and straight *Lituola*, having the shape of a *Nodosaria*. It has a variable number of chambers, from about four to eight, each much subdivided and labyrinthic, as is the case also in the large crozier-shaped variety that occurs in the Chalk. Soldani has figured this straight subcylindrical *Lituola* (Testaceog. ii. pl. 3. fig. *cc*; and Saggio Orittog. pl. 19. fig. 92 *Z*), from San Quirico. Our finest specimens of this variety are from the Miocene sandy clays of San Domingo. It occurs recent at a depth of 40 and 47 fathoms off the Abrolhos Bank (Lat. 23°07'S.; Long. 41°17'W.). The deposits on this bank have peculiar faunal analogies with the Italian Tertiaries.

JANUARY 18, 1860.

James Poyntz M'Donald, Esq., Kingsdown Parade, Bristol; William Purdon, Esq., C.E., Punjab; and James Winter, M.D., Hampstead, were elected Fellows.

The following communications were read:—

1. *Notice of some SECTIONS of the STRATA near OXFORD.*

By JOHN PHILLIPS, M.A., F.R.S., Pres.G.S., Reader in Geology in the University of Oxford.

No. II. *Sections South of Oxford.*

IN England, unconformity between the Cretaceous and the Oolitic strata is discoverable at almost every part of the range of the junction

of deposits, from the coast of Yorkshire to the cliffs of Dorsetshire. Everywhere evidence can be found of the wasting action of the sea on the Oolitic strata before the deposition of the superincumbent rocks, and sometimes evidence of the movement of the sea-bed (to which, perhaps, the watery agitation was due). In the country near Oxford, and from this point south-westward, the Portland Oolite has been thus greatly wasted, so as to remain in only a few detached masses. There seems reason to suppose that movements of the sea-bed of considerable extent followed the deposition of the Oxford Clay; for the Coralline Oolite fails, and the Kimmeridge Clay grows thin, and hardly traceable far from the Shotover Hills, in a direction towards the north-east.

The deposition of the Cretaceous series on the wasted Oolites was thus inevitably irregular; but in addition we have the varieties of littoral, estuary, and fluvial deposits on the boundary-surface of the Oolites; great surface-waste, referable to the Postpliocene age; and faults which seem to be of great effect, but are not yet traced out.

Under these circumstances, it is at once a very interesting and a very perplexing problem of field-geology to trace out the detached, unconformed, and wasted cappings of sand and ferruginous stone which, in several places, lie on the Kimmeridge Clay, and are not themselves covered by strata of more definite character and age.

The conclusions derived from the field-surveys will not be satisfactory until fully supported by the evidence of fossils scrupulously collected by careful hands.

One of the most interesting of the sections near Oxford is seen at Culham, on the northern bank of the Thames; and this may be compared with another in the line of railway near Culham Station, about a mile to the north-east, with a hill-capping at Toot Baldon and a cliff-section at Clifden. I have been in the habit of taking my class to some of these localities for several years.

On entering the excavation at Culham we perceive about 40 feet of level-surfaced clays and sands, under a cover of flint-gravel mixed with worn shells of *Gryphæa dilatata* and other spolia of the adjacent country. Nearly the whole mass of the clays and sands excavated here is employed for brick-making; and the digging-operations mix them much together. A slight glance at the section presents enough of uniformity to induce the belief that the whole might belong to one continuous deposit. If, under this impression, a palæontologist viewing the excavation should pick up *Thracia depressa* and *Cardium striatum*, and obtain from the workmen teeth of *Plotosaurus*, he will probably write Kimmeridge Clay on the whole section. Another geologist, arriving when the clay is not being dug, may examine a different part of the deposit and find *Ammonites dentatus* and *Belemnites minimus*, and may colour on his map, undoubted Gault. But when, instructed by several visits, the whole section is clearly made out, we find two clays in the pit, of entirely different geological age, separated by a bed of sand apparently conformed to each—so far as this very limited area gives any evidence.

Section of the Strata at Culham, South of Oxford.

In descending from the gravelly surface-deposit, we have about 10 feet of blue laminated clay, with the following fossils:—

<i>Ammonites dentatus.</i>	<i>Nucula pectinata.</i>
<i>Ammonites lautus.</i>	<i>Inoceramus concentricus</i> (large).
<i>Belemnites minimus.</i>	<i>Plicatula pectinoides.</i>
<i>Solarium conoideum.</i>	<i>Pecten quinquiesulcatus.</i>
<i>Rostellaria.</i>	<i>Balanus.</i>
<i>Dentalium</i> , probably <i>D. decussatum.</i>	<i>Cyclocyathus Fittoni.</i>
	Coniferous wood.

Below these unequivocal Gault layers, the argillaceous deposits are striated with short drift laminæ of sand and small gravel. In these, by careful search, I found specimens of the *Ammonites* mentioned above. These layers are about 5 feet thick, and gradually pass upward into the ordinary Gault*.

Below these sandy layers is a more specially pebbly band, in some places compacted together, in which I found what seems to be *Pecten orbicularis*. This band agrees in position with what may be termed the basement bed of the Gault or the cap of the Lower Greensand at Folkestone†.

* In this part of the series, probably, occurred a fine specimen of *Ostrea macroptera*, which came into the hands of my friend Professor Walker, who resides at Culham.

† Since the reading of this paper, my friend Mr. Clutterbuck has found in

Passing over for the present the bed of greensand, 9 feet in thickness, which lies under the pebbly bed, and turning to the subjacent clay, which is exposed to a depth of 23 feet in the course of the digging, we find it to contain, especially towards the upper part,—

<i>Pliosaurus</i> of Shotover.	<i>Cardium striatulum</i> .
<i>Ichthyosaurus</i> of Shotover.	<i>Thracia depressa</i> .
<i>Asteracanthus ornatissimus</i> .	<i>Astarte Hartwelliensi</i> .
Ammonites—one species of the group	<i>Cucullæa</i> .
of <i>A. polyplocus</i> , <i>A. triplicatus</i> , or	<i>Perna</i> .
<i>A. giganteus</i> .	<i>Discina Humphreysiana</i> .
Ammonites biplex.	

Towards the bottom of the excavation lies a layer of brown cracked nodules, the cracks partly filled with bisulphuret of zinc. The Ammonites and other fossils occur again below the nodules. No specimen of *Ostrea deltoidea* being found here, but the shells of Aylesbury being abundant, we may infer that it is the upper part of the Kimmeridge Clay which is here seen.

The bed of greensand, 9 feet thick, which separates these two clays, may now be considered. The mineral character of such a deposit is such feeble evidence, that without injustice to that the sand may be referred to any part of the series between the Kimmeridge Clay and the Gault. In appearance, however, it is like some of the dark-green sand-beds at the back of the Isle of Wight (as at Blackgang Chine), and it is not like the Portland Sand or the Iron-sands of Shotover. I find in it none of the fossils of the Gault above, nor any common fossils of the Portland rock or sands, but a few examples of the Ammonite like *A. polyplocus* already mentioned in the Kimmeridge Clay, *Cardium striatulum*, *Thracia depressa*, *Pecten arcuatus*, *Corbula*, and Wood. I do not find a trace of these fossils in the pebbly drifts above, and do not suppose them to have been transported from older strata into this greensand. On further search I discover no sign of unconformity at the junction of the sand with the subjacent clay, nor any mark of wasting on that clay; but, on the contrary, a somewhat gradual introduction of the sandy grains, so as to make an easy passage upwards from clay to sand. I am therefore induced to believe that instead of this being, as at first sight it might be thought, Lower Greensand, it is really a sandy cap of the Kimmeridge Clay—perhaps the first stage of a change towards the Portland series, but still to be classed with the clay.

The information thus gathered from the section now discussed may be increased by observing what occurs in the railway-cutting a mile to the north-east of the Brickyard. According to the working-section prepared by the engineer, Mr. Ward*, it appears that the Gault is there found resting *unconformably* on ferruginous sands

this band a specimen of *Exogyra* resembling *E. haliotidea*, which somewhat strengthens my opinion that this thin layer is all that here represents the Lower Greensand. It thickens towards the westward, retaining its worn sandy and pebbly character. Possibly other observers may prefer to separate from the Gault the five feet of sandy and pebbly layers, and call them Lower Greensand; but this is not my conclusion. - April 11, 1860.

* I am indebted to Mr. Clutterbuck for the sight of this section.

apparently corresponding with those of Shotover; and these rest on the Kimmeridge Clay, but grow thinner and die out to the southward.

Another example of a sandy deposit covering the Kimmeridge Clay occurs at Toot Baldon, a village elevated above the general plain of Kimmeridge Clay, and lying four miles north-east of Culham. Here, some years since, on the very summit I found sandy and stony beds in small quantity and not well exposed. They yielded me no fossils; but my friends of the Geological Survey have since visited the locality, and obtained an Ammonite which they believed to be of the group of *A. Deshayesii* *. I lately re-examined the spot, now less exposed than ever, without finding anything satisfactory. But on proceeding down the sloping road to the eastward, I perceived the clay to be there also covered by ferruginous bands, and commenced a persevering search for fossils. I made a considerable excavation, and obtained several shells, especially a *Mya*, *Pecten*, *Cardium*, *Trochus*, and an Ammonite which appears to be of the group of *A. polyplocus*, *A. triplicatus*, and *A. giganteus*.

The mass is sand and sandstone with small black pebbles, and stained very brown by oxide of iron. It rests immediately on the Kimmeridge Clay, probably on the very top or upper layers. In the hope of revisiting this place and of obtaining more and better evidence, I abstain from further remarks.

A remarkable exhibition of a sand-rock with pebbles occurs in cliffs against the Thames at Clifden Ferry. It is traversed by oxide of iron in nests, laminæ, and veins running in various directions. As far as the composition of the mass is concerned, this sand-rock resembles somewhat the Shotover iron rocks, and somewhat the pebbly Lower Greensand of Farringdon; but no fossils have been found in it.

From what has been said it is evident that I regard as still doubtful and incomplete the evidence according to which Lower Greensand deposits have been admitted to occupy large areas on the maps of the country near Oxford. The evidence from fossils (certainly of paramount importance in deciding between sands of such variable types as those between the Kimmeridge Clay and the Chalk) is either wanting or appears opposed to the claim of large territory for the Lower Greensand. Dr. Fitton quotes no fossils near Oxford, and only casts of *Siphonia* and Coniferous wood from the iron-sands of Bedfordshire; and the Geological Survey has had only a glance at an Ammonite, which was supposed to be *A. Deshayesii*, on the summit of a hill near Oxford, from which I obtained quite a different Ammonite, apparently of an Oolitic group, with other shells not such as to authorize the adoption of their sandy matrix into the Cretaceous family.

* Mr. R. Etheridge has obliged me with this notice of his search.