tate, in the absence of authentic specimens, to extend the Silurian limestone so far*.

We may now then definitely colour the shores of Wellington and Barrow Straits, except the eastern entrance of the latter (which is occupied by igneous or crystalline rocks), as Upper Silurian; and on the return of the expedition under Capt. Belcher, the limits of this formation will be no doubt greatly extended.

I may mention that coal or lignite was picked up at Byam Martin Island, and that a fragment of it occurred in the detritus, 350 feet above the sea, at Kate Austin's Lake, Cornwallis Island. Also at Griffiths' Island and Browne Island fragments of iron were found.

And, in conclusion, it is worth while to observe the occurrence of pleistocene deposits with marine shells of existing Arctic species (Mya truncata, Saxicava rugosa, &c.), which were found on every elevation up to 500 feet on Beechey and Cornwallis Islands.

June 15, 1853.

Robert Philips Greg, Jun., Esq., Edward Wray Winfield, Esq., B.A., and Prof. R. Harkness were elected Fellows.

The following communications were read:—

1. On some Sections in the Oolitic District of Lincolnshire. By John Morris, F.G.S., Professor of Geology and Mineralogy, University College, London.

[Plate XIV.]

The following observations relate to a series of Sections exposed during the progress of the cuttings of the Great Northern Railway in Lincolnshire, and which are considered to be of sufficient interest to be laid before the Society, inasmuch as they afford some novel points connected with the Oolitic series, and also some interesting phenomena relating to the Drift. As many of the sections are now covered up, and as they occurred in a district where good and deep sections are comparatively rare, a brief record of their general character will be useful to those whose future investigation may lead them to examine the local phenomena more in detail.

The line of country traversed by the railway between Grantham and Peterborough being occupied by a portion of the lower oolites (which are here diminished in breadth), exposes the following members of the oolitic series, some of which have not been previously noticed as occurring in that district, in ascending order:—Lias, Inferior Oolite,

* In the collection of rocks from Melville Island, in the Society's Museum, a specimen of the compact limestone and a coral (Favistella Franklinii) occur: the latter was "collected by Lieut. Liddon, second in command in the Expedition of 1819–20," and presented by Dr. Granville, F.G.S.
Great Oolite, a series of shales, sands, and clays (the equivalent of the Upper Sandstone and Shale of Yorkshire), Cornbrash, Kelloway Rock, and Oxford Clay. Covering some portions of these, and in considerable thickness, is a great mass of the northern drift, besides which are thick accumulations of gravel and remains of a fluviatile deposit.

The beds referable to the Drift period which it is intended to describe in the first part of this paper, viz. the superficial detritus occurring in irregular patches on the oolite, the boulder-clay or northern drift, and the gravel beds of the valleys, &c., will be noticed as they occur from north to south, commencing from near Grantham.

**PART I. THE DRIFT.**

*Section 1. Little Ponton Cutting.*—The first indications, in these sections, of deposits connected with the Drift era (and probably towards the termination of it) are met with at the Ponton Cutting, south of the Witham valley, where the oolites are frequently dislocated, the dislocated portions lying at high angles and very irregular. The oolitic rocks, moreover, are here scooped out into hollows of considerable size, sometimes 100 yards in length and 50 feet in depth; these cavities are extremely irregular in form and have a general direction of N.E. and S.W., and apparently follow the direction of the great jointings or fissures of the rock. They are occupied by more or less stratified masses of clays, and sands with pebbles, with occasional rounded boulders of sandstone. Interstratified with these, but more especially towards the upper portion, are thick layers of fragmentary oolite, identical with the enclosing rock, and sometimes, in the lower part, large blocks of the same rock.

*Section 2. Between the two Ponton Cuttings.*—The first appearance of the northern drift is met with in a small section, about 6 feet deep and about 160 yards in length, between the two Ponton Cuttings. The drift here overlies the upper part (shelly beds) of the Great Oolite.

*Section 3. Great Ponton Cutting.*—The surface of the oolite is here excavated by similar hollows to those described in the Little Ponton Cutting, and these are also occupied by a similar debris which is distinct from and probably posterior to the northern drift.

At the southern end of this cutting the drift is again met with. Here a patch of the drift is exposed, 380 yards in length at its upper part and 160 yards at the base (the depth of the cutting being 20 feet), and overlying the shelly beds of the Oolite, which here dip to the S. at a moderate angle (1, 2, 3 in fig. 1). Passing a deeply-denuded valley in the drift, we come to a hill composed of the same formation, through which a tunnel is excavated (see fig. 1). The summit elevation of this hill of drift above the datum line is about 500 feet, and the drift here forms nearly the highest ground of the district. At the northern extremity of the tunnel the drift appears to be divisible into two portions. The upper part, about 25 feet thick, consists of light grey sandy clay, full of angular and rounded flints, some 2 feet in diameter, and rolled fragments of chalk, vary-
ing in size from 8 to 12 inches in diameter to pebbles of the size of a pin’s head. The clay also contains large boulders of oolitic and other rocks, arranged in somewhat parallel lines, the former being very abundant. The lower part, 30 feet thick, consists of dark bluish grey tenacious clay, with traces of chalk and flints, and but few boulders. These latter are generally large and much rolled, and have been derived from the Oxford clay, oolites, marlstone, and lias; there are also pebbles of mountain limestone, granite, and other rocks; and interspersed with these are numerous liassic fossils, as *Ammonites, Belemnites, Gryphaea, Pholadomya,* &c. At the junction of these two divisions the boulders and pebbles occur in greater abundance, lying on an apparently eroded surface of the lower drift, which is readily distinguished from the upper division by the comparative absence of chalk and flint.

Emerging from the south end of the tunnel, which is 880 yards in length, we see the drift on either side of the cutting buoys up an enormous irregular mass of oolitic rock, through which the cutting has passed (see fig. 1, s). This mass of rock is 430 feet long, and, at its deepest part, 30 feet thick; it is much broken and disturbed, but the parts retain to some extent their relative position, and belong to the lower portion of the oolitic beds of the district: the surface is continuous with the hill slope, and is here and there penetrated by intrusive drift; the lower part is eroded and waterworn. The depth of the underlying drift exposed at the lowest part between the broken rock and the level of the railroad is about 7 feet. Unfortunately the character of the neighbouring surface is so much obscured, that it is difficult to estimate the lateral extent of this great mass of disturbed oolite, which, although so distinctly isolated, retains sufficient uniformity of character to lead us to infer that it has not been far removed from its original site. The drift is here of similar character to the upper portion at the north end of the tunnel, and is peculiarly marked by boulders (oolitic chiefly) more or less horizontally arranged, and some of them underlying the uplifted mass of oolite.

Section 4. Basingthorpe Cutting.—Crossing another denuded drift valley, we come to the Basingthorpe Cutting, which extends for about one and a half mile through drift similar to the above. The larger boulders are more abundant; thirty to forty were counted in about sixty yards. They varied in size from 1 to 3 or 4 feet; one, however, a micaceous sandstone, with fossils, much grooved and striated, measured 6 feet 9 inches in its longest diameter and 3 feet in depth. They are generally more or less square in form, and lie on their flat side, are sometimes polished, and frequently grooved or striated; the striae are restricted to their flat surfaces, and are not found on the edges. The boulders assumed, as before noticed, a horizontal arrangement, somewhat following the contour of the surface of the ground. The larger masses consist of micaceous sandstone containing fossils (marlstone and cornbrash), besides which are many rounded and angular flints (sometimes grooved), lias septaria, greystone, mountain-limestone, coarse sandstone, lias and chalk belemnites, and other fossils; occasionally we meet with local patches containing comminuted chalk and flint. Another peculiar feature of interest is the occurrence of large angular masses of soft stratified sand, apparently removed from an upper portion of the oolitic series of the district.

This upper division of the Drift is of somewhat lighter colour than the lower, and its boulders are more numerous and larger than in the latter, and the chalk detritus is more abundant, but the line of separation does not appear so distinct as in that at the northern end of the tunnel, as above described. At the south end of this cutting the drift was observed to repose on a decomposed band of the oolitic rock.

Section 5.—As far as the Railway sections are concerned, the drift is last seen in a small cutting a quarter of a mile south of the last-described, but it occupies the adjacent valleys north and south of this point.

The object of this paper being simply to describe the local phenomena of the Drift exposed by the railway cuttings, the general arrangement of the Drift, the position of its boulders, and the peculiarities of the isolated mass of rock above described are not further treated of; but the author has to observe, that by numerous traverses, both on the east and west of the line, he has found the Drift covering a considerable extent of country, and apparently ranging as a band about six miles wide, in a N.E. and S.W. direction.

Casewick Cutting (fig. 2).—Freshwater beds.—The Casewick Cutting traverses oolitic rock, which represents the Kelloway Rock and Oxford Clay. These strata are overlaid by a deposit of gravel 7 or 8 feet thick. Towards the central part of the cutting a freshwater deposit is intercalated between the oolite and gravel, occupying an excavation in the surface of the former. This deposit is about 30 yards in width, and it has an average thickness of about 8 feet, and varies in thickness and character on each side of the cutting. It consists in the upper part of grey sandy clay, 2 feet; brown sandy clay and veins of gravel, 1 ½ foot; a layer of peaty clay with fragments of plants and shells, 1 ½ foot; dark sandy clay, with plants and shells, pebbles of chalk and flint, and portions of the northern clay drift in fragments. The base of the deposit is extremely irregular in outline (see fig. 2, a), and the surface of the oolitic stratum is slightly disturbed and re-aggregated, as it is throughout the cutting. The following is the list of shells* and plants obtained; no bones, however, were observed:—

| Bithinias tentaculata, | Plentiful. |
| and opercula ...... | | Linneus peregger ...... | Rare and immature. |
| Valvata piscinalis ...... | Rather rare. | Succinea putris ...... | Mature. |
| —— cristata ...... | Rather rare. | Ancylus fluviatilis ...... | Rather plentiful. |
| —— carinatus ...... | Rare. | Veletia laeacris ...... | Milt. |
| —— imbricatus ...... | Only one. | Cyclas corua ...... | Fragments. |
| Pissidium amnicum ...... | Rare. |

* The above list has been corrected by Mr. Pickering, who also kindly examined some portions of the clay from this deposit. To Mr. T. R. Jones I am obliged for determining the above-mentioned Cyprides.
towards the close of the Drift-clay period and subsequently covered by beds of gravel and loam; Sir Charles in that case considering the fresh water stream to have been of sufficient force to counteract the causes by the influence of which the boulder-clay was accumulating in the contiguous spaces. The Caswick deposit affords no evidence of a similar nature.

In estimating the influences which have produced the phenomena, a portion of which only are disclosed by the above sections, it will be necessary to consider the general disturbances which have affected the district and the changes it has undergone, viz. the origin of the great transverse valleys, as the Nen, Welland, Witham, and Ouse—the scooping out of the channels and valleys anterior and posterior to the Northern Drift—the overspread of the Drift itself—the dislocation and undermining of the oolitic rocks, and their subsequent depression into the adjacent valleys—the re-elevation of land; its effects—the accumulation of fresh water strata—the subsequent covering of the valleys and low grounds by thick gravel deposits; their partial elevation and denudation, and the final formation of the present valleys. These phenomena are intimately connected with and succeeded each other, producing the physical contour of the present surface, by which the drainage of the district has been permanently effected.

PART II. THE OOLITES.

Between Barkston and Grantham, including the Peascliff Tunnel, the railway traverses the lower lias, marlstone, and a part of the upper lias, but no detailed descriptions are here given; the sections exposed afforded the usual mineral and paleontological characters of the strata, the characteristic species being very abundant in some places. The lower lias at Jericho-wood consisted, in the upper part, of greyish clays passing into dark, slaty, and finely laminated clays, streaked with ferruginous bands and zones of small and large septaria; the fossils were not distributed throughout, but occurred in bands; among the most abundant were *Ammonites*, *Belemnitae*, *Pecten*, *Inoceramus*, *Cardinia*.

Commencing south of Grantham, the first or Spittlegate Cutting is through the upper lias, consisting of about 30 feet of dark tenacious clays, with four zones of small and large septaria, generally of a tabular form, and dipping with the clays towards the south-east; the upper part of the lias is of a grey or light ash colour, resulting probably from atmospheric action; above this is about 9 feet of very fragmentary oolitic rock, sometimes ferruginous, and associated with siliceous sand; some portions were more solid, and appeared as if in situ, but generally the bedding was very irregular and disturbed; a few fossils only were noticed, chiefly *Pectines* and *Serpula*. The lias, however, was tolerably rich in fossils, especially in some places; among the most abundant were *Nucula ovum*, *Panopea donaciformis* (many in vertical position), *Ammonites Walcottii*, *A. serpentinus*? The railway crosses the deep and narrow valley of the Witham, which flows over a continuation of the upper lias; in the excavations con-
The strata of this cutting, with the exception of the upper portion, are presumed to represent the lowest portion of the white oolitic rocks of the district, or those which immediately overlie the brown or ferruginous rock before noticed, into which the lower sandy bed is considered to pass. These strata offer some peculiar characters in their fossil contents, as compared with other districts, which might lead us to infer a different relative position, and will be hereafter noticed.

The physical characters of these beds also vary over the district, as might be expected from their nature, so that it is difficult to allocate each individual stratum; but a general uniformity is observable; the stratified grey sandy clay is seen occurring about the same position in the quarries at Waltham, nine miles south-west of the railway. As a general rule, it may be observed that these lower beds have a greater amount of marl in their composition than the upper beds, and this character obtains over a large space: in these beds also is found a certain assemblage of Testacea, some of which also occur in the Inferior Oolite of Gloucestershire.

The upper portion, or rag beds, are more shelly and pisolitic in structure, sometimes thin-beded, and frequently showing false bedding or oblique lamination; the inclination of the laminae being about 30°, and having in many instances a south-easterly direction. In this series frequently occur thick beds of freestone; a good section of them is seen in the neighbouring quarries at Houghton Hill.

Between the Ponton Cuttings are two sections of limited depth, from 6 to 9 feet, consisting of the shelly pisolite with false bedding, and containing many small univalve shells, as Cerithium, Nerinea, Patella (P. rugosa), and some small bivalves; the drift, as noticed at p. 318, covering a portion of one of them.

The Great Ponton Cutting differs in its general section from that at Little Ponton, in consisting mostly of the upper beds of the series; at the north end the strata are dislocated and disturbed, having the larger excavations filled with the brown sandy clay, &c., and the smaller ones with rubbly oolite and patches of drift; about the centre the beds are tolerably uniform in position, and continue with a gradual inclination to the southern end (fig. 1), where they are covered by a thick mass of the northern drift, the inclination appearing greater than it really is, from the rise of the railway line to the same point.

A slight fault is visible at the northern end, bringing down the shelly beds. The average thickness of the section is about 30 feet, and, about the middle of the cutting, it exhibits, in descending order—

| Rubbly oolite | 30 feet |
| Compact shelly beds, thick-beded, some pisolitic | 15 feet |
| A thin band of slaty clay—2 to 3 inches. | |
| Compact marly and shelly rock, with Lucina, Pinna, Ostrea, Atricula, Trichites, Corals | 5 feet |
| Marly oolitic rock, containing Gereillia acuta | 3½ feet |
| Compact marly rock, with few oolitic grains | 1 foot |
| Thin vein of clay—2 or 3 inches. | |
| Coarse-grained oolitic rock | 6 feet |
| Stratified grey sandy clay | 1½ feet |
| Marly oolite, full of small Pectens | 0½ feet |
| Compact marly and sandy rock, with Gereillia acuta, Trigonia Phillipisi | 3½ feet |
| Ferruginous sandy oolite, with shells in fragments | 1 foot |

* From the first two localities, Mr. W. R. Binfield has kindly sent me, for comparison, specimens containing insects and the same species of Ammonites. See also Murchison’s Geology of Cheltenham, 2nd edit. by Buckman and Strickland, p. 35; and Brodie’s Fossil Insects, p. 55. The insect and fish remains of Ilminster are noticed in an interesting paper on the fossils of the Upper and Middle Lias of that locality, communicated by Mr. C. Moore to the Somerset Archaeological and Natural History Society, 1853.
The freestones are not continuous, and, with the associated shelly rags and overlying marl, are lost beneath the level of the line towards the south end, near to the point above where the mass of drift first appears, the intermediate space being occupied with the shelly beds and zones of *Terebratula*. Between the oolite, and partly separating it from the drift, is a ferruginous band and about 7 feet of sandy clay and shale, the remnants merely of a thicker series of strata hereafter described (fig. 1, 1, 2, 3).

In the following table are enumerated the shells which have been obtained from the upper shelly beds of this cutting; among the most abundant are *Pecten lens*, *Lucina despecta*, two or three species of *Arca*, *Opis*, *Tancredia*, *Astarte*, and also *Cerithium* and *Nerinae*. Corals, Bryozoa, and Echinoderms were very rare.

### Table I.—List of the Testacea of the Upper Shelly Beds at Ponton, Lincolnshire; and their Distribution in the Great and Inferior Oolite of Yorkshire and Gloucestershire.

<table>
<thead>
<tr>
<th>Yorkshire</th>
<th>Glo'stershire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gr. O.</td>
<td>Inf. O.</td>
</tr>
</tbody>
</table>
---|---|---|---|---|
| Pterocera (Alaria) armata, *Lyctett & Morris* | * | * | * | * |
| Cerithium gemmata, *Bean* | * | * | * | * |
| — limaformae, *Römer* | * | * | * | * |
| — Beani, *Lyctett & Morris* | * | * | * | * |
| Nerinea Volzii, *Deslong* | * | * | * | * |
| — funiculus, *Deslong* | * | * | * | * |
| †Phasianella Pontonis, *Lyctett*, n. sp. | * | * | * | * |
| — cineta, *Phillett* | * | * | * | * |
| — Leymeriei, *D'Arch* | * | * | * | * |
| — latiscula, *Lyctett & Morris* | * | * | * | * |
| Acteonina giabra, *Phillett* sp. | * | * | * | * |
| — cylindrites gradus, *Lyctett* | * | * | * | * |
| †— turriculatus, *Lyctett*, n. sp. | * | * | * | * |
| Natica adducta, *Phillett* | * | * | * | * |
| — Gomondii, *Lyctett* | * | * | * | * |
| Rissoa obliquata, *Sow.* | * | * | * | * |
| — cancellata, *Morris & Lyctett* | * | * | * | * |
| Turbo Labadiei, *D'Arch* | * | * | * | * |
| — elaboratus, *Bean* | * | * | * | * |
| — Philippisi, *Lyctett & Morris* | * | * | * | * |
| †— gemmatus, *Phillett* | * | * | * | * |
| Monodonta Lyelli, *D'Arch* | * | * | * | * |
| — discoidum, *Lyctett & Morris* | * | * | * | * |
| Trochus moniliteus, *Phillett* | * | * | * | * |
| — spiratus, *D'Arch* | * | * | * | * |
| — acis, *D'Arch* (Inf. O. France) | * | * | * | * |
| Belus, *D'Arch* (Gr. O. France) | * | * | * | * |
| †— ornatissimus, *D'Arch* (Inf. O. Fr.), var. Pleurotomaria reticulata, ? *Deslong* | *? | * | * | *|
| Trochotoma extensa, *Lyctett* | * | * | * | * |
| Rimula clathrata, *Sow.* | * | * | * | * |
| Patella rugosa, *Sow.* | * | * | * | * |
| †Tancredia axiniformis, *Phillett* sp. | * | * | * | * |
| †— angulata, *Lyctett* | * | * | * | * |

The rock from whence the majority of specimens were obtained was a soft pisolite, the shells being generally well preserved and rarely broken. Associated with them were rolled fragments of marly rock and casts of shells in a similar matrix (chiefly *Nerinae* and *Cerithia*), much rolled and eroded, some of them being slightly incrusted with calcareous matter, apparently resembling a similar phenomenon of recent origin described by MM. Serres and Figuier as occurring in the Mediterranean, in the vicinity of Algiers.

The oolite rock dips towards the adjacent valley, and has been pierced about 60 feet in sinking a well close to the line of railway: it is also quarried in the vicinity.

† These species are described in the Appendix to this paper, and figured in Plate XIV.
The cuttings continue through the drift for four miles, as above described, Section 4, p. 320; the southern inclination of the line commencing about the north end of the long Drift section.

With the following section commences a new series of beds, the characters of which have not hitherto been fully noticed, and which, from their peculiar features and position between the Olitite and Cornbrash, are the equivalents of strata not heretofore recognized as occurring in this district. Two of the sections only, those of Essendine and Danes' Hill, show their full development; but the descriptions will be continued in regular order, so as to explain the variable nature of the strata, their thinning out, and the demudation to which they have been subjected.

South of the road from Colsterworth to Burton Coggles the section exposes in descending order the following beds:

---

<table>
<thead>
<tr>
<th>Description</th>
<th>Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft brown marly rock, with two intercalated layers of Oysters; the rock contains also <em>Perna quadrata</em>, <em>Modiola</em>, <em>Lima</em>, <em>Serpula</em>, &amp;c.</td>
<td>6</td>
</tr>
<tr>
<td>Striped clays</td>
<td></td>
</tr>
<tr>
<td>Bituminous clay, with marine shells; in this bed was found a large stem of a tree</td>
<td>1½</td>
</tr>
<tr>
<td>Grey clay, with nodules of limestone; and with vertical stems or roots of plants proceeding from the upper bed</td>
<td></td>
</tr>
<tr>
<td>Green and white clays</td>
<td>2</td>
</tr>
<tr>
<td>Slaty rock, shelly, containing <em>Ostrea</em> and <em>Cyrena</em>.</td>
<td></td>
</tr>
</tbody>
</table>

The oolite occurs in the valley between this point and the section at Corby road, where it forms, for 7 feet, the lower part of the cutting; it consists of shelly oolite and freestone with false bedding, the inclination being 30° north. The oolite is covered, as is generally the case throughout the district where the upper clays extend, with a ferruginous band 1 foot thick, with occasional patches of selenite and Websterite; over this is 15 feet of dark and greyish clays, with bands of more bituminous clay and lignite, but no traces of shells were observed. The clays and oolite continue through the next cutting, but the beds are less regular, the clays indenting the oolite, which is very rubbly where exposed, but at the base is fine-grained and occasionally shelly: the principal joints are N.W. and S.E.

The Swayfield Cutting presents a similar section to those just described, consisting of dark green and brown clays, wavy and irregular, overlying the oolite and the intervening ferruginous sand; the oolite is shelly in places, contains marly concretions or pebbles, and is sometimes pinkish and fine-grained, at others coarsely pisolithic, and bluish in the centre of the mass. Over some parts of this, as well as the two preceding sections, traces of small angular flint and oolite gravel were observed.

The Countnorpe Cutting is a continuation of the same series of beds, but increased in thickness and varying in character; in descending order:

---

<table>
<thead>
<tr>
<th>Description</th>
<th>Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mottled clay with bands of Oysters</td>
<td>3</td>
</tr>
<tr>
<td>Dark bituminous clay</td>
<td>1</td>
</tr>
<tr>
<td>Compact sandy and occasionally soft shelly rock, with vertical remains of plants; the shells are not numerous, comprising the genera <em>Natica</em>, <em>Modiola</em>, <em>Trigonia</em>.</td>
<td>3</td>
</tr>
<tr>
<td>Stratified dark green and brown shelly clays</td>
<td></td>
</tr>
<tr>
<td>Stratified dark clays with layers of shells, not broken, and indicating the beds to have been deposited under quiet conditions; the shells are <em>Aviada</em>, <em>Cytherea</em>, <em>Pecten</em>, <em>Lima</em>, <em>Ostrea</em>, <em>Terebratula</em>, <em>Lingula</em>, and probably <em>Cyrena</em>.</td>
<td>4</td>
</tr>
<tr>
<td>Mottled and dark clays</td>
<td>6</td>
</tr>
<tr>
<td>Bituminous band</td>
<td>0½</td>
</tr>
<tr>
<td>Stiff brown and greyish clays; no shells; numerous vertical plant-markings</td>
<td>7</td>
</tr>
<tr>
<td>White and yellow clays</td>
<td>3</td>
</tr>
<tr>
<td>Ferruginous band</td>
<td>1</td>
</tr>
<tr>
<td>Oolite, fine-grained and pinkish, the blocks occasionally with blue centres; some of the beds coarser, and containing small shells, as <em>Cerithium</em> and <em>Nerinea</em>, from 12 to 13 feet.</td>
<td></td>
</tr>
</tbody>
</table>

Two small sections of the oolite occur between this and Cretton Cutting, which latter exhibits the following descending series:

---

<table>
<thead>
<tr>
<th>Description</th>
<th>Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irregular laminated grey and green sands and clays, with layers full of shells in parts</td>
<td>6</td>
</tr>
<tr>
<td>Soft sandy rock full of shells, as <em>Modiola</em>, <em>Ostrea</em>, <em>Pecten</em>.</td>
<td>1½</td>
</tr>
<tr>
<td>Bituminous and dark grey clays, with occasional shelly layers</td>
<td>5</td>
</tr>
<tr>
<td>Greyish clays, in some parts finely bituminous (6 inches), at base</td>
<td>1½</td>
</tr>
<tr>
<td>Greenish sandy rock with vertical plant-markings</td>
<td>1½</td>
</tr>
<tr>
<td>Various-coloured clays, green, grey, brown, without shells.</td>
<td>10</td>
</tr>
<tr>
<td>Ferruginous band</td>
<td>1</td>
</tr>
<tr>
<td>Oolitic rock, thick-bedded and horizontal, with occasional false-bedding at the upper part; inclination of oblique lammine 30° N.</td>
<td></td>
</tr>
</tbody>
</table>

The Little Bytham Cutting presents a similar section, the beds varying somewhat in character (*i.e.* less fossiliferous) and thickness, especially towards the upper part; the sandy rock with *Modiola* is wanting, but the clays are full of small Oysters and much thicker; the total thickness of clays is about 30 feet overlying the oolite†.

* From some recent experiments it would appear that the blue colour of the oolite may be due to the presence of sulphuret of iron: see a paper by M. Ebelman, Bull. Géol. Soc. France, 2 ser. tom. ix. p. 221.

† The clays which here overlie the oolite (and the observation applies to the whole district) have materially tended to its preservation as a solid rock, in preventing the ordinary effects of atmospheric action, which, when the surface is not so covered, causes it to split up into shivers and renders the upper part comparatively useless as a building material. This observation may be useful to those who have occasion to search for or avail themselves of the building-stone of the district.
latter was quarried to some depth below the level of the line and presented the following:

- Pinkish oolitic rock, obliquely laminated (45°), the thicker layers being separated by seams of clay with crystallized gypsum  
  1 foot.
- Oolitic rock  
  4 feet.
- Compact oolite with fragments of shells  
  5 feet.
- Compact marly rock with *Nerita* and *Lucina*  
  3 feet.
- Compact oolitic rock, about  
  8 feet.

The Careby Cutting (denuded in the centre) extends for ¾ of a mile, and exposes the lower bituminous and brown clays overlying the oolite of 15 feet thickness; it is thick-beded, and blue in its centre, sometimes obliquely laminated and shelly, with zones of marly concretions; the shells are chiefly *Lima, Pecten, Ostrea, Terebratula*, and a few corals; some of the beds exhibit a bored surface.

A small section again exposes the lower clays; and, crossing the valley traversed by the river Glen, Danes' Hill Cutting (fig. 3) exhibits a good typical section of the superincumbent clays, viz.:

- Combrash in patches, with the characteristic fossils  
  2 to 3 feet.
- Compact sandy and marly rock  
  3⁵/₈ feet.
- Marly rock full of shells  
  2 feet.
- Oyster-bed, compact at bottom and soft at top, full of oysters flatly arranged, and a few other shells, *Perna*, &c.  
  8 feet.
- Clay and soft marly rock, very irregular  
  4 feet.
- Clay enclosing shelly rock  
  4 feet.
  1 foot.
- Bituminous clay  
  0⁵/₈ feet.
- Concretionary sand and lime rock  
  0 feet.
- Shelly clays, *Neaera*, &c.  
  0 feet.
- Black and green clays (no shells)  
  1⁵/₈ feet.

![Fig. 3.—Section of the Oolites at the Danes' Hill Cutting.](image)

| Layer | Description | Height
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pedicles of <em>Pholadomya</em>, &amp;c.</td>
<td>5 feet</td>
</tr>
<tr>
<td>2</td>
<td>Green and brown clays with marine shells</td>
<td>4 feet</td>
</tr>
<tr>
<td>3</td>
<td>Bituminous bands</td>
<td>1 foot</td>
</tr>
<tr>
<td>4</td>
<td>Green and brown clays with marine shells, <em>Perna</em>, &amp;c.</td>
<td>3 feet</td>
</tr>
<tr>
<td>5</td>
<td>Green and brown clays with marine shells</td>
<td>2 feet</td>
</tr>
<tr>
<td>6</td>
<td>Grey sandy clays with vertical plant-markings</td>
<td>1 foot</td>
</tr>
<tr>
<td>7</td>
<td>Bituminous clay</td>
<td>2 inches</td>
</tr>
<tr>
<td>8</td>
<td>Grey clay with stems</td>
<td>2⁵/₈ inches</td>
</tr>
<tr>
<td>9</td>
<td>White and grey clays</td>
<td>7 feet</td>
</tr>
<tr>
<td>10</td>
<td>Ferruginous band</td>
<td>1 foot</td>
</tr>
</tbody>
</table>

![Diagram](image)

Shelly and sandy clays, bituminous at base and with fragments of plants horizontally disposed  
1 foot.
Grey sandy and marly rock, upper part (9 inches) less shelly than lower, with vertical plant-markings (root- or stem-bed).  
2 feet.
Shaly clay  
1 foot.
Bituminous clay  
1 foot.
Green clays  
3⁵/₈ feet.
Greyish and dark clays, finely laminated  
4 feet.

At the southern end these lower clays are about 15 feet thick between the root-bed and the ferruginous band, upon which latter they repose, and below which the oolite extends a few yards only into this part of the cutting. It may be remarked, that the beds exhibit a synclinal dip towards the centre, at the angle of which a small fault is visible, giving to the position of the stem-bed in this section an irregularity, and somewhat affecting the parallelism of it in regard to the other sections.

The Aunby Cutting, the contour of which is very irregular, although not exposing so complete a series as the last, still presents some differences, more especially observable in the arrangement of the plant-bed, which in this section exhibits a different mode of accumulation, being here replaced by two distinct bituminous layers, each of which has its accompanying root-bed; the upper bituminous clay attaining the thickness of 2 feet, with lignite and impure coal; the lower is about 3 inches, and, with its accompanying root-bed, thins out towards the north end of the cutting. The following is the series about the middle of the cutting:

- Grey and whitish clays, with markings of plants at base.  
  9 feet.
- Sandy and shelly clays  
  3 feet.
- Dark clays  
  5 feet.
- Green clays, finely laminated  
  2 feet.
- Bituminous clays with lignite and coal  
  2 feet.
- Grey sandy clay with vertical plant-markings  
  1 foot.
- Bituminous clay, 2 inches.
- Grey clay with stems  
  2⁵/₈ inches.
- White and grey clays  
  7 feet.
- Ferruginous band  
  1 foot.

The oolite extends along the base of the cutting.

With the Essenden Cutting, now to be described, the argillaceous and shelly series terminate, as far at least as the Railway sections are concerned. In descending order, and with a view of rendering the peculiar characters and affinities of these beds more intelligible, the physical features and organic contents will be more fully detailed. Observing the same order of arrangement, we commence with the upper beds (1), which are full of Oysters, with occasional patches of *Serpula*, 3 to 5 ft.; the rock (2) immediately below the oyster-bed is sandy and marly, becoming occasionally very compact, calcareous,
and bluish, and sometimes shaly, from 10 to 12 ft.*; in the marly portion the fossils are very abundant, as

Cardium. Lima interstincta.
Modiolia imbricata. Ostrea Bathomica.
Trigonia Moretonis. Perna quadrata.
Cyprina. Natica.
Unicardium variscoeum (Sow. sp.). Turbo tuberculatus.
Pholadomya lirata. Phasianella cincta.
Terebratula maxillata. Nautilus.
Pecten annulatus. Granulites.
Lima cardioides. Acrosalenia hemicardioides.

3. Green and irregularly sandy clays, fossiliferous, with layers of Neaera and Pholadomya abundant . . . . . . . 5 ft.
4. Marly, sandy and slaty rock, with Avicula and other shells 2
5. Dark green and bituminous, shelly clays, with Cytherea, Neaera, and Cyrena 4
6. Bituminous band 0½
6. Compact sandy and marly rock full of Cardium, Cytherea, Neaera 2
Variegated clays, bituminous, &c.; these beds contain a zone of dark clays, with Cyrena Cunninghani, C. (sp.?), and a species of Maetra 4

Anomia. Graviera nana.

Some fine saurian remains, obtained from this cutting, were presented by Mr. Reynolds to the Museum of Practical Geology. Among these remains, which have been determined by Prof. Owen, were the tympanic bone of Cetiosaurus longus, the metatarsal bone of Cet. brevis, a fibula, and a fragment of a large vertebra.

The upper part of the Banthorpe Cutting (next in order) consists of about 7 to 9 feet of cornbrash rock, containing the characteristic fossils, and overlying a dark tenacious clay, sometimes laminated with shelly layers, below which, and forming the base of the line, is 7 feet of compact shelly bluish rock, occasionally sandy and becoming shaley, full of Ostrea, Gerovillia, and Avicula.

In the Casewick Cutting the cornbrash, which is a grey, slightly compact and crystalline, shelly, and thin-bedded rock, occurs throughout the base of the cutting; its fossil contents are—

Pholadomya. Pecten lens.
Panopcea calciformis, Phil. sp. Terebratula Bentleyi.
Modiola bipartita. — lens.
Gervillia aviculoides, Sow. — obovata.
Goniomys intacta, Sow. sp. Bernardina diligviana.
Lima rigida, Sow. Serpula, two species.
Ostrea Marthii, Sow. Portion of a jaw of Chimaera.

* The more solid portions of this bed have been recognized by Mr. Prestwich as being of frequent occurrence in the boulder clay of Norfolk and Suffolk.

Resting upon this bed is the equivalent of the Oxford clay, consisting of 10 feet of dark laminated unctuous clay, with grey-brown sandy and ferruginous clay; the dark clay contained Ammonites Herveyi abundantly, as well as Modiola bipartita, Trigonia clavellata, Thracia depressa, Nucula nuda, Phil., and Saurian bones. The brown sandy clay, which passed into ferruginous rock, contained many well-preserved fossils, the most abundant being—

Gryphaea bilobata, in every stage of growth. Panopcea peregrina, Phil. sp.
Beloneites Owen or Puzosimus. Lima rigidula.
Ammonites Calloviensis, Sow. Avicula expansa, Phil.
Nautilus. Nucula nuda.
Pholadomya acuticosta, Sow. Pecten demissus and P. lens.

These fossils would indicate that the ferruginous rock and grey sand were the equivalent of the Kelloway rock, which has not been previously noticed in this district.

Between this point and Peterborough the Cornbrash is exposed along the sides of the railway, covered in some places by thin layers of small gravel.

The facts disclosed in the above oolitic sections might at first sight appear of too limited a nature to warrant any general conclusions, were it not that they are intimately connected with and dependant upon the action of causes which have affected a wider area; more especially also as the peculiar physical features and organic contents exhibited by some of the strata, i. e. the argillaceous series, terminate in the surrounding district (as far as at least as the observations of the author have enabled him to ascertain); which strata are likewise presumed to be the equivalent of beds in the upper sandstone and shales of Yorkshire, which have not been hitherto considered to range south of the Humber.

Before, however, proceeding further, it will be convenient to give a Table illustrative of what we consider to be the development of the lower oolitic series in Lincolnshire and the adjoining counties (Table II.), with a view of facilitating the comparison of them with the lower oolites of the North and South; and also of explaining the beds exposed by railway sections; for it will only be by an attentive study of the features displayed by these deposits in the midland districts, that a correct or clearer knowledge will be obtained of their varying physical characters, and the changes that the area has undergone during their deposition.

* We here refer to the Coast of Yorkshire in the N., and the Counties of Wilts and Gloucester in the S.W.
To those geologists who are familiar with the Lower Oolites of the West of England, more especially as developed in the Cottswold Hills, the above Lincolnshire section will appear somewhat anomalous, while on the other hand it will be readily perceived that in its main features it agrees with those of the Yorkshire coast and the North.

In a short paper communicated by Captain Ibbetson and the author to the British Association, the affinities of the strata near Stamford with those of Yorkshire were briefly noticed, but a subsequent examination of another part of the district has enabled the author to confirm the opinion therein expressed, and to add many new facts, in which respect the Railway sections above described have materially assisted, although there are still some anomalies to be cleared up, dependent on the distribution of the organic life of the period.

Commencing with the inferior oolite: this consists of a brown ferruginous sandy rock with little calcareous matter, and varies in thickness from 80 to 50 and 20 feet, and even less between the slate-beds and the lias near Collyweston; in the Witham valley near Grantham it was estimated about 30 feet; but few organic remains have been found through this district. Some of the beds, as near Wellingborough, have been used for the extraction of iron.

Above the ferruginous oolite, the Fuller’s earth being here wanting, are beds of stratified sand and clays, local in their occurrence, and underlying the white oolite. These beds in some places, as at Ufford and near Kingsthorpe, show traces of bituminous clays from which proceed downwards vegetable markings, as if indicating terrestrial conditions. These beds, although of limited extent and occurring only locally beneath the white oolite, and where the slates are wanting, are of importance as indicating its superior position, and may therefore represent the lower sandstone of the Yorkshire coast, and the equivalent of the Fuller’s earth of the south. The slate-beds, i.e. of Collyweston and Wettering, which also locally underlie the white oolite, were not met with in the railway cutting, but an equivalent bed was found reposing at the base of the series in the Little Ponton Cutting, and containing similar fossils to those found at Easton and Collyweston, such as *Trigonia Phillipsi, T. Moretonis, Gervillia acuta*. The beds, although locally developed, form part of, and pass up into

* Reports of the British Association, 1847, Trans. Sect. p. 127. This communication was the result of a survey of the oolitic quarries in the vicinity and south of Stamford by Capt. E. Ibbetson, accompanied by myself, in which some facts bearing on the present paper are given.

† The acknowledgement of much kind assistance during these investigations is due from the author to some friends, and to no one more than Mr. J. Bentley, of Stamford, who has verified with him the sections above given, as well as many others in the vicinity, and whose residence in the neighbourhood has enabled him to enrich our knowledge of the fossil fauna, but who is not responsible for any opinions herein expressed. Nor must it be forgotten how much the geologist has lost of a knowledge of this district by the non-publication of the observations made by Mr. Lonsdale during his elaborate survey, of which the coloured maps in the archives of the Society are full evidence.
the oolite above; but where the slaty character is wanting, the oolite reposes either on the subjacent sands or the ferruginous beds. The best points for their examination are near Kirby and Dene Park, Barnack, Easton, Collyweston, and Morcott.

The most abundant fossils are the *Gervilla acuta*, Sow., *Trigonia Moretonis, Pecten personatus?*, a species of *Cardium*, and the *Pteroceras Bentley*, of the last of which beautiful specimens have been obtained by Miss Thompson, of Stamford. A fine species of *Astropecten* has recently been found in the slaty beds at Stamford by Mr. S. Sharp of that town. The *Lingula Beau*, Phil., occurs with *Pecten polypodioides*, in the same beds at Edith Weston.

The importance of a clear understanding of the relative position of this slaty bed at the base of the white oolite series will be fully understood, when it is stated that a contrary opinion has been entertained and published, in which the lower marly series of the white oolite beds of this district are stated to be inferior to the slate-beds, and are arranged with the inferior oolite*.

Knowing the anomaly and feeling the difficulty of the subject, and admitting the existence of certain species in the lower marly series which are found in the inferior oolite of the West of England (more especially in the middle beds), as *Natilia cineta*, Phil. = *N. Leckhamptonensis*, Lyco, *Pholadomya fuscus*, Sow., *Ceromya concentrica*, Sow. sp. *Nerinea triplicata*, N. *longiuscula*, Bean, sp. = *N. cingula*, Phil. not Sow., *Modiola plicata*, *Clypeus simulans*, and some others,—I have taken some pains to examine the locality, and have found some or other of these specimens in situ and above the slate-beds in many places, as near Morcot, Collyweston, Barnack, and Stamford†. These lower beds, which may generally be distinguished from the upper by the greater quantity of marl contained in them, form the chief part of the Little Ponton Cutting; these strata contain and are characterized by the occurrence of the *Mya*ae, as *Pholadomya, Panopaea*, and *Ceromya*, &c., with occasional zones of large branched and massive corals, and many specimens of *Nerinea*. These lower marine beds frequently contain the remains of plants that must have been drifted from the neighbouring land. In the marly beds above the slates at Collyweston, the *Pecten polypodioides*, Brong., not Lind., is of frequent occurrence; in a similar position at Tinkler’s quarry near Stamford fronds of *Pterodendrum* are found, as also two species of the same genus at the Barnack quarries. In connection with these facts, it may be observed, that the fern described by Lindley and Hutton* as obtained from the Wealden of Wansford, in Northamptonshire, belongs to the lower oolitic beds above the slates, and consequently the statement of the occurrence of the Wealden in that locality is erroneous. The upper beds or shelly rags of the Great Ponton Cutting, which are equivalent to the freestones of Ketton, Casterton, and Ancaster, and the shelly oolites of Barnack, vary from a coarse to a fine-grained structure, and contain in some places a fine and numerous suite of Testacea indicating somewhat an approach to littoral conditions. In the Ponton Cutting successive zones of *Terebratula* were accumulated, associated with a species of *Lima*; these portions of the rock are more crystalline than that in which the mass of species (before enumerated) were found. One marked feature in these oolitic beds is the almost entire absence of Cephalopoda; in all the collections formed in this district, I have seen but one or two specimens of *Ammonites* and *Belenites*; their entire absence in the middle beds of the inferior oolite of the West of England is well known, and also the comparative rarity of them in the Great Oolite† of the South of England. In the Great Oolite of the Yorkshire coast about four species have been obtained.

The argillaceous strata which next succeed, and form so important a feature in the Railway cuttings, have been traced over a considerable area in this district. Their southern extension has been traced in some spots on the oolite range which separates the Welland and the Nen, as at Weldon and the Woodpit near Wansford; at Ketton and the neighbourhood of Stamford they are fully developed, and they also cover in many places the oolite on each side of the railway, forming a part of the argillaceous lands of the county. In the district of the Drift they appear to cease, having been removed by denudation, and it is very rare to find a trace of them underlying that deposit. North of Grantham they occur at Ancaster and intervening spots towards Lincoln, where patches also are found.

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* Lonchopterus Mantelli*, Fossil Flora, t. 171. See also Mr. Lonsdale’s note in Dr. C. F. Godwin-Austen’s Memoir, Geol. Trans. 2 ser. vol. iv. p. 383*.

† Ten species are described in the Monograph of the Mollusca of the Great Oolite (Paleontographical Society): viz. five Ammonites, three Nautili, and two Belenmites.
Table III.—Exhibiting the varying thickness of the Clays in the different sections.

<table>
<thead>
<tr>
<th></th>
<th>Essendine</th>
<th>Ansty</th>
<th>Doncaster Hill</th>
<th>Little Brompton</th>
<th>Creeton</th>
<th>Countnor or Swanfield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oyster-bed and</td>
<td>ft.</td>
<td>ft.</td>
<td>ft.</td>
<td>ft.</td>
<td>tt.</td>
<td></td>
</tr>
<tr>
<td>marly rock...</td>
<td>11</td>
<td>0</td>
<td>16</td>
<td>8</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Clays between</td>
<td>9</td>
<td>20</td>
<td>6</td>
<td>10</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>the above and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the stem-bed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stem-bed</td>
<td>2½</td>
<td>3</td>
<td>2</td>
<td>1½</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Clays below</td>
<td>4</td>
<td>7</td>
<td>15</td>
<td>10½</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>stem-bed ...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron-band ......</td>
<td>0</td>
<td>present</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Oolitic rock...</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>8</td>
<td>13</td>
</tr>
</tbody>
</table>

With the close of the deposition of the white oolitic rock, a new series of conditions set in, indicating a change from marine to, if not fluvial, at least fluvo-marine action, the whole series of beds resulting from a very slow and gradual accumulation of sediment, as proved by the finely laminated appearance of many of the layers. Oscillations of the surface must, however, have taken place, as the bituminous bands infer a favourable condition for the growth of, perhaps, a marsh vegetation, the roots proceeding downwards amidst the recently elevated marine shelly mud, as seen in the continuous stem-bed of the sections. The bands of Cyrena were very local and confined to the lower portion of the series, being associated in some places with marine shells, as a species of Macrta. Marine conditions succeeded to the termination of the series, changes in the mineral matters occasionally taking place, and a partial different distribution of organic forms obtained, as seen in the layers containing numerous Necea, Pholadomya, Cytherea, Cardium, &c., and scarcely any univalve testacea; above these beds again occurred an irregular muddy deposit, with numerous remains of testacea attaining a full size; amongst these are Modiola, Cardium, Natricl. A zone of Pholadomya occurs in this part of the series, the shells occupying their normal position. A thick deposit of small Oysters, with a few other shells, terminated this succession of strata, above which the Cornbrash series began to be deposited.

We reserve for a future occasion the details of the data, obtained by traversing the intervening district, upon which we consider the synchronism of these marine and estuary beds of Lincolnshire with the Bradford clay and Forest marble of the South established: and, in considering them as the equivalents of the upper sandstone and shale of Yorkshire, it may be observed, that marine remains occur but rarely towards the close of the series in the latter area, the upper beds being almost entirely destitute of organic forms, i.e. Testacea. In a recent examination, however, of the coast of Yorkshire I found

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a marine bed*, about 4 feet thick, intercalated with the upper series, but towards the lower part, and separated from the thicker mass of the Great Oolite by the fine plant-bed of Gristhorpe Bay, containing Unio and Estheria. In the strata above the marine bed, zones of bituminous clays can be traced with their associated root-bearing under-beds, similar to those above described in the Railway sections. That these strata are nearly synchronous with the estuary beds at Brora, described by Sir R. Murchison and by Mr. Robertson, and with those in the Isle of Skye described by Prof. E. Forbes, can scarcely admit of doubt, although in both the latter instances they appear to be intercalated between the mass of lower oolites and the Oxfordian series. Two species of Cyrena, however, described by Prof. E. Forbes are identical with species found at Essendine, and the allocation of genera is somewhat similar.

The above general observations tend to prove that considerable difference of mineral and organic character obtained in the Lincolnshire district, as compared with the south-west of England; the true Fuller's-earth rock of Mr. Smith not furnishing a constant or well-marked line of distinction between the Bath Oolite and the Inferior Oolite†, but being replaced by beds having conditions intermediate to and linked with those on the Yorkshire coast, long ago described by Professor Phillips. Instead of the two separate oolite deposits, Great Oolite and Inferior Oolite†, the Lincolnshire Oolite consists of one mass only (as in Yorkshire), between the Cornbrash and the ferruginous rock immediately overlying the Upper Lias shales, and blending in its fossil contents some of the conditions of the two oolites of the south-west of England.

In concluding this brief notice of the Lincolnshire sections, I must acknowledge my obligations to Mr. Reynolds and Mr. J. Cubitt for the use of the maps and working sections of this portion of the Great Northern Railway.

Description of some New Species of Mollusca from the Lincolnshire Oolites‡.

Lima Pontonis, Lyce. Pl. XIV. fig. 1a, 1b.

Testá convexá, oblíquè ovátá; auriculá parsiv subsphaérilis striátis; margine antico truncato excavato et striato; margine postico rotundo; costulá radianthibus numerosis (circa 60 ad 70) rotundis, interstítia conformibus, densé et transversé striatis.

Shell convex, obliquely ovate, auricles small, nearly equal, and striaté; anterior margin truncated, its slope excavated and striated;

* See also the paper by Mr. Williamson, Geol. Trans. 2nd Ser. vol. v. p. 324.
† Geology of Yorkshire, vol. 1. p. 130.
‡ I am indebted to my friend Mr. Lyce for the examination and descriptions of these species.
posterior border rounded; radiating costae very numerous (about 60 or 70), rounded, with conformable densely striated interstitial spaces.

The costae are elevated, but very narrow and almost thread-like; the intervening spaces are transversely striated and are wider than the costae; the height and opposite diameter are nearly equal.

In Gloucestershire this shell occurs in the middle division of the inferior oolite; its convexity and round elevated costae, and the smaller height of the shell, will serve to distinguish it from _L. punctata_, which occurs with it in the Cotteswolds.

**Locality.**—Ponton, Lincolnshire.

**Ceromya similis**, Lyce. Pl. XIV. fig. 2.

Testá ovato-oblongá, convexá; umbonis magnis anticus curvatis; latere antico brevi convexo, postico elongato mediocrer attenuato; basi curvato; striis concentricis magnis regularibus et crebris.

Shell ovately oblong, convex; umbones prominent, anterior, and curved forwards; anterior side convex, short, its margin rounded; posterior side elongated, the superior border nearly horizontal, the shell becoming attenuated towards the posterior border; the lunule is excavated, the base curved; the sides of the valves have regular strongly impressed and closely arranged concentric striations.

The form of this species presents a near approximation to *Ceromya concentrica*, except that it is more elongated and oblique, the umbones more especially being more produced and having a much greater anterior curvature; the sides of the shell are also much more deeply marked by the striations than in _C. concentrica_. The form is really intermediate between that shell and _C. ecentrica_, being less elongated than the latter species.

Height 15 lines; length 22 lines; diameter through both the valves 14 lines.

**Locality.**—Ponton, in the shelly beds; also in the lower strata of Stamford, Morcot, &c.

**Cyprina nuciformis**, Lyce. Pl. XIV. fig. 3.

Testá subnuciformi, convexá; umbonis magnis curvatis; marginibus rotundis; latere postico angulo obtuso obliquus; lunulá excavata.

Shell subcordiform or nut-shaped, convex; umbones large, prominent and curved forwards; margins of the valves rounded; posterior side with an oblique obtuse angle; lunule large, slightly excavated.

This species is distinguished from *Venus trapeziformis*, Römer, by the greater prominence of the umbones, by their less obliquity, and by the more globose figure of the shell: a Great Oolite Minchinhampton species is distinguished from it by a more compressed form and small umbones. In the Cotteswolds it occurs in the middle portion of the inferior oolite, where it is not uncommon: the height and length are about equal; the convexity of the valves is one-third less.

**Locality.**—Ponton, Lincolnshire.

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**Tancredia axiniformis**, Phil. sp. Pl. XIV. fig. 4a, 4b.

Syn. Nucula axiniformis, Phil. Geol. Yorksh. i. t. 11. fig. 13.

Testá ovato-elongatá, aut subtrigonal, umbonis medianis acuminatis, parvis et depressis, latere postico angulo obliquum subacuto, margine ligamentum recto obliquum elongato.

Shell ovately elongated or subtrigonal, rather compressed; umbones mesial, depressed, but acuminate and small; posterior side with an oblique angle, which is rather acute, and separates a posterior space which is somewhat concave; hinge-margin straight, oblique, and elongated; anterior extremity of the shell pointed; posterior extremity slightly truncated.

This form is intermediate between _T. angulata_ and _T. extensa_, Lyce. The external figure is nearly that of the latter shell, but the posterior angle in that species is much less prominent, and the space posterior to it, which is very narrow, is smaller, and has not the concavity of _T. axiniformis_; the general figure is also somewhat more convex than _T. extensa_.

Height 11 lines; height 6 lines.

**Locality.**—Ponton, Lincolnshire; also in the inferior oolite of Yorkshire and great oolite of Gloucestershire.

**Tancredia angulata**, Lyce. Pl. XIV. fig. 5.

Testá ovato-subtrigonal, umbonis medianis acutis, latere antico compresso, postico angulum obliquum formante, margine cardinali brevi recto, basi curvato.

Shell ovately subtrigonal; umbones mesial, acute and prominent; anterior side compressed, its extremity pointed; posterior side with an oblique obtuse angle separating a flattened posterior portion; ligamental margin short and straight, basal margin with a considerable curvature.

This species is distinguished from *Tancredia curtansata* (Corbula, Phil.) by the more acuminate umbones and by the posterior angle; from the inferior oolite _T. donaciformis_, by the more prominent acute umbones and more lengthened form; the posterior aperture is only slightly indicated.

Height 9 lines; length 14 lines.

**Locality.**—Ponton.

**Neerea Ibbetsoni**, Morris. Pl. XIV. fig. 6.

Testá subglobosa, pyriform, subequivalvi, striatá, umbonis magnis submedianis, latere antico rotundo, postico producito brevi bicornato, basi curvato, lateribus pleris regularibus inconspicuis, nucleo levi.

Shell subglobose, pyriform, subequivalve, striated; umbones large, rounded, mesial; anterior side rounded; posterior side attenuated and produced, and bicornate, the anterior carina sharp; lower margin curved; the sides with regular slightly impressed plications; nucleus smooth.

A very convex and nearly equi valve shell, with an acutely marked
angle upon the posterior produced slope, and with the anterior side short and rounded.

Height 9 lines; length 11 lines; diameter through both the valves 8 lines.

Localities.—Danes’ Hill, Essendine, and the Ketton quarries.

This species is dedicated to Capt. L. B. Ibbetson, F.R.S., in whose company it was first noticed, much compressed in the clays above the Ketton oolite.

**Turbo gemmatus**, Lycett. Pl. XIV. fig. 7.

Testa ovato-turbinate, spirà clatà, anfractibus (5) teretibus biangulatis, carinis tuberculis tribus, anfractu ultimo magno, basi carinis numerosis parvis, aperturâ ovata, umbilico nullo.

Shell ovately turbinated, spire elevated, whorls (5) turreted, convex, biangulated, and ornamented with three tuberculated carinæ, of which the first carina is the smaller; the last whorl is large and ventricose; its base is convex and encircled with numerous small serrated carinæ; the aperture is ovate, its length being equal to two-fifths of the entire shell: no umbilicus.

The Lincolnshire specimens do not exceed five lines in length, but two specimens from the inferior oolite of Rodborough Hill near Stroud have a length of eleven lines, the diameter of the last whorl being seven lines. The presence of a third carina upon each whorl and the more ventricose form of the last will serve to distinguish it from *Turbo capitatus*, Goldf., which in other respects it resembles. It is more slender than *Turbo ornatus*, Sow., and differs in the arrangement of the carinæ.

Localities.—Ponton, Lincolnshire; Rodborough Hill, Gloucestershire.

**Cylindrites turriculatus**, Lycett. Pl. XIV. fig. 8.

Testa elongatâ, subcylindrica; spirâ magnâ, acutâ; anfractibus (8) convexis; suturis profundè impressis; anfractu ultimo ovato; aperturâ angustâ.

Shell elongated, subcylindrical; spire acutæ, its apex acute; whorls (8) convexes, their sutures deeply excavated, the last whorl ovately cylindrical; aperture narrow.

The figure of this species resembles *C. altus* from the great oolite of Minchinhampton, but the whorls are more numerous, and are not flattened as in that shell; the elevation of the spire readily distinguishes it from other contemporaneous species. The length of the aperture is about three-fifths of the entire shell.

Localities.—Ponton, Lincolnshire.

**Phasianella Pontonis**, Lycett. Pl. XIV. fig. 9.

Testa turrita, anfractibus convexis (6), spirâ clatâ, apice acuto, anfractu ultimo permagno ventricoso; aperturâ obliquâ, basi angusto.

Shell with the whorls (6) convex; spire elevated; apex acute; the last whorl very large and ventricose; aperture oblique; base narrow.

The superior size of the last whorl serves to distinguish it from

**Phasianella paludiformis**, Buvignier, which in other respects it nearly resembles: the length of the aperture and spire are nearly equal.

Height 7 lines; diameter of the last whorl 4 lines.

Localities.—Ponton.

**Trocus ornatus**, d’Orb.? var. Pontonis, Morris.

Pl. XIV. fig. 10.


Testa subconica, umbilicata, anfractibus longitudinaliter costatis, costis (20) subacutis interstitiis transversim striatis, ultimo anfractu carinato, basi planulato vel subconvexo, concentricè semin striato.

A small but well-marked shell, rather wider than high, formed of few slightly concave volutions, having 15 to 20 acute and prominent longitudinal ridges, the interspaces marked with a few small costulae; the base flat or but little convex, umbilicated, and the umbilicus surrounded by a few concentric striations, which do not extend to the outer margin.

This species belongs to a small section of the genus *Trocus*, of which but few allied forms are at present recorded in the Jurassic strata, viz. the *T. helicinus*, *T. lamellosus*, and *T. tyturus* of d’Orb., and *T. pyramidalis*, Phillips. Our specimen, which is very imperfect, agrees with *T. ornatus*, d’Orb., but the base of that species is more convex.

Localities.—Ponton and Barnack.

M. d’Orbigny’s specimen is from the inferior oolite of Calvados.


Compared with the well-known Inferior Oolite shell, this variety presents some marked differences: it is more discoidal, the test more delicate: the fine, irregular, concentric striations but faintly represent the prominent large plications of the typical form: the dimensions are at least one-half less; and the greater number of specimens have still smaller proportions. The young examples of this variety, when only 3 or 4 lines in diameter, are equally distinguishable; they are very delicate and flattened, with three or four distinct plications near to the umbones, the remainder of the surface being nearly smooth. The ultimate stage of growth in our variety exhibits a greater thickness of test and convexity of form, therein approaching to the type; and, in fact, but for the inspection of this latter condition, it would be regarded as a distinct species. In the Cottewolds and the West of England the type shell occurs in the lower division of the Inferior Oolite: the freestone beds of the middle division in Gloucestershire contain the variety *compressiuncula*; in the upper division of the Inferior Oolite the type reappears: again, in the Great Oolite of Minchinhampton the variety *compressiuncula* is abundant: the two varieties never occur together.

Dimensions of the largest specimens:—Height, 13 lines; length, 19 lines; diameter through both the valves, 3 lines.
EXPLANATION OF PLATE XIV.

Fig. 1. Lima Pontonis, Lycett.
Fig. 2. Ceromya similis, Lycett.
Fig. 3. Cyprina nuciformis, Lycett.
Fig. 4. Tancredia axinformis, Phillips, sp.
Fig. 5. — angulata, Lycett.
Fig. 6. Neæra Ibbetsonii, Morris.
Fig. 7. Turbo gemmatus, Lycett.
Fig. 8. Cylindrites turriculatus, Lycett.
Fig. 9. Phasianella Pontonis, Lycett.
Fig. 10. Trochus ornatissimus, D'Orb. Var. Pontonis, Morris.

2. On the Insect Beds in the Purbeck Formation of Dorset and Wilts; and a Notice of the Occurrence of a Neuropterous Insect in the Stonesfield Slate of Gloucestershire. By the Rev. P. B. Brodie, F.G.S.

[The publication of this paper is deferred.]


(Communicated by the Rev. P. B. Brodie, F.G.S.)

[The publication of this paper is deferred.]


[Abstract.]

The author first described the general conclusions he had arrived at with respect to the condition of the mineral portion of calcareous organisms, which he considered is first deposited in the form of crystalline granules of variable size, that afterwards undergo more or less of crystalline coalescence. In some cases this scarcely occurs at all; but in others it does to a very considerable extent during the life of the organism, and this produces a great difference in the character of the particles into which it is resolved by decay. The falling to powder that then takes place is the result of the oxidization and removal of the organic portion, and, if no crystalline coalescence had occurred, the shell or other body might be resolved into the very minute, ultimate, crystalline granules; whereas, if much coalescence had taken place, it would break up into much larger ones, showing in many instances its minute organic structure.

* The entire paper is not printed, by desire of the author, who intends publishing a general account of the microscopical structure of British rocks, in a separate form, with very numerous illustrations.
SHELLS FROM THE LINCOLNSHIRE OOLITES.