XVI.—*On the Sands intermediate the Inferior Oolite and Lias of the Cotteswold Hills, compared with a similar deposit upon the Coast of Yorkshire.* By JOHN LYCETT*.

MY friend Professor Buckman having invited me to throw together some geological conclusions to serve as a foundation for a discussion, I select a subject which has already received some consideration at the hands of the Club, and which, from its local position, and a difference of opinion which has arisen with respect to the zoological affinities of its fauna, seems to claim some further examination. I allude to the series of micaceous sands and marls which are situated intermediate the Inferior Oolite and Lias, and which are known to English geologists generally as the Sands of the Inferior Oolite, and to continental cultivators of the science as the Jurensis marls; the Grès Supraliassique; the Hydroxyde Oolithique; the superior portion of the Upper Lias; the Lias *Zeta* of Quenstedt, &c. Dr. Wright† and Mr. Hull‡ have each recently exemplified this deposit in copious and well-known memoirs; but as regards the Cotteswold Naturalists' Club, the present is the first communication which has been presented to it in a written form. The conclusions arrived at by the authors above referred to are based solely upon zoological evidence, and are therefore liable to be affected by subsequent additions, which may tend to alter the relative proportions of Oolitic or of Liassic species found in the deposit; and as some interesting accessions to its fauna have recently been made, more especially in the lower fossiliferous zone, which was but little known until within these few months, I present a notice of them, with the remark, that although as contributions they possess some value, they by no means afford a triumph to any foregone theoretical conclusions;—that they may be compared rather to a portion of the materials forming a part of the structure of a buried edifice whose proportions are not yet fully developed, and of whose full history so much yet remains to be ascertained, that at present it would be injudicious to indulge in absolute conclusions respecting it. This sandy deposit must be seen to be fully appreciated: presenting much variability in its thickness throughout its long course in the Cotteswolds, it is everywhere readily recognized, and even the approximate position of any small exposures of it may be predicated with tolerable exactness. Unfortunately, nearly the whole of the

* Read to the Cotteswold Naturalists' Club, July 28, 1857.

† "On the so-called Sands of the Inferior Oolite." Journ. Geol. Soc. 1856.

‡ Mem. of the Geol. Surv. of Gr. Brit. "The country around Cheltenham." 1857.

Cotteswold sections are of a small and imperfect character, consisting chiefly of cuttings of rock upon deep lane-sides, or upon the banks of water-courses; and although these in the aggregate exhibit the entire physical features of the deposit, they do not enable us to ascertain the thickness of the whole, in particular localities, with any near approach to accuracy. We can therefore only estimate the thickness by tracing upwards the beds upon hill-sides, and occasionally by examining the rock brought up during the process of well-sinking. From information obtained in this manner, it would appear that the thickness of the sands varies in the middle Cotteswolds from 35 to 80 feet; and Mr. Hull has shown that over the northern and southern Cotteswolds they present even a greater amount of variability in thickness. My own observations lead to the conclusion, that, like the mass of the Inferior Oolite generally, the thickness is greater upon the outer western escarpment of the Cotteswolds than in the interior valleys, where they are far remote from the outer range. In tracing upwards the beds from the Lias there occurs the following general order of succession :—

A. Upper Lias clay, grey or blue, soft, and clearly distinguished from

B. Brown or chocolate-coloured, marly, micaceous sandstone, with frequent red ferruginous stains between the lamination; occasionally the stone is more argillaceous, and buries the hammer when struck; in other instances, from the presence of portions of shells, it is more hard, but is peculiarly irregular and uncertain both in hardness and colour, varying from a blackish-grey to a bright foxy or reddish hue, everywhere glittering with micaceous particles. At about 4 feet from the base are usually one or two thin bands charged with fossils, the greater number of which are very imperfectly preserved: this may be designated as the lower shelly zone, and may be studied in small lane-side sections at Nailsworth and at Brimscombe. In the Yorkshire exposition of the deposit, I shall subsequently show that a shelly zone occurs in a similar position. Passing upwards from 10 to 20 feet, there occurs a general diminution of compactness in the rock, and of its marly structure; there gradually sets in

C. Micaceous, foxy-coloured or yellowish, incoherent sands, seldom much compacted, but locally becoming soft sandstone, from 20 to 40 feet, abruptly terminated upwards by

D. Concretionary marly bed, usually darker in colour than the sands, but varying much in structure and aspect within short distances, and everywhere more or less fossiliferous; the tests of Mollusca are less frequently preserved than in the lower

zone. A constant mineral feature is the presence of small oval grains of hydrate of iron disseminated through the rock; a structure which, however, is not peculiar, as it is present in the Inferior Oolite at Dundry and in the Lias of France. From 2 to 4 feet is the thickness of this bed in the Cotteswolds.

Immediately overlying this upper Ammonitiferous bed are several others of hard brown or yellowish calcareo-siliceous sandstones, in which fossils are usually very sparingly distributed, and, from the evidence these afford, the beds have by universal consent been assigned to the Inferior Oolite.

In Yorkshire, the lofty iron-bound coast at the Peak and at Blue Wick exhibits the same remarkable deposit in considerable thickness, and slightly modified in its mineral character from the Cotteswold Sands. In a visit which I recently made to this coast, in company with my friend Professor Morris, the identity of the lower portion of the Dogger or Inferior Oolite of Phillips with the Gloucestershire Sands was strongly impressed upon my mind. At Blue Wick the Dogger is altogether about 80 feet in thickness, and rises in successive beds in descending order from the rocky beach into the face of the lofty cliff, the lower 40 feet representing the sands of the Cotteswolds. Beneath these succeed the hard beds of the Upper Lias Shale, 200 feet thick, followed by the Middle Lias, nearly equal in mass; ultimately, at the Peak, facing Robin Hood's Bay, these great deposits are all exposed in one vast unbroken section, forming a lofty mural cliff, nearly 400 feet in height and three miles in length, in the course of which the Dogger attains the summit of the cliff. Words are scarcely adequate to express my admiration of this grand exposition of the lower Jurassic rocks, which for extent and completeness can scarcely be paralleled. Proceeding northwards, the upper 40 feet of the Dogger loses more than half its thickness, and the lower portion, or representative of the Sands, thins out altogether; a great fault then succeeds, by which the Middle Lias is upraised to the summit of the cliff.

The highest bed of the Upper Lias consists of black, finely laminated shale, the transition to the sandstone above being abrupt and very distinctly marked. The sands are here compacted into thick-bedded, dark grey micaceous sandstones in the lower part, and into brownish or foxy-coloured micaceous sandstones in the upper part, so that the whole nearly resembles the Cotteswold Sands, and differs chiefly in its greater compactness. Fossils are distributed very sparingly throughout the mass of the sandstones, but they are present more abundantly, as in the Cotteswolds, in two calcareo-argillaceous zones, situated in like manner, the one at the top, the other near to the base of

the series. The lower fossiliferous zone is a dark grey concretionary band of rock crowded with valves of *Lingula Beanii*; in smaller numbers are *Orbicula reflexa*, *Vermetus concinnus*, *Avicula inæquivalvis*? and another *Avicula*, a small smooth *Pecten*, *Cerithium*, &c. Belemnites are not uncommon, but Ammonites are rare, and are obtained singly and at intervals throughout the sandstones; these are, *A. variabilis*, var. *Beanii*, *A. striatulus*, and *A. Aalensis*; the latter form has not been observed in the Cotteswolds, but occurs in the same stage (Lias *Zeta* of Quenstedt) in the Jura. *Vermetus concinnus* occurs at intervals throughout the sandstones in small groups, and usually isolated. The dark grey colour of the lower beds of sandstone changes upwards to a foxy hue, and at the summit is the upper fossiliferous zone, from 14 to 18 inches thick, concretionary and dark-coloured; altogether it nearly resembles the Cotteswold bed at Haresfield Hill, with Cephalopoda. In like manner, each abounds with a Terebratula, which is its predominating fossil; the Yorkshire shell is the *Terebratula trilineata* of Young and Bird, *T. ovoides*, Sow., a larger form than the *subpunctata* of Haresfield, but which very much resembles the latter shell when collected indiscriminately at each locality, and without preference to presumed typical forms: unfortunately, the Blue Wick specimens are more frequently compressed and distorted. Other fossils recognized are, *Pleurotomaria subdecorata*, D'Orb., which also occurs at Nailsworth; *Belemnites compressus*, *B. irregularis*, and portions of Ammonites. *Rhynchonella cynocephala* has occurred very rarely, and several specimens of *R. bidens* are also recorded. The thick sandstones of the Dogger which overlie this zone abound with small quartzose pebbles, which are never seen beneath the *trilineata* bed.

In Gloucestershire, the lower zone at Brimscombe and Nailsworth has produced the Liassic *Orbicula reflexa*, *Avicula inæquivalvis*?, *Lima Galathea*, *Ammonites Raquinianus*, which is the *crassus* of Phillips, and another tumid form which much resembles it, and may be only a distinct variety. These have not been found to pass into the upper zone; but the oolitic element is fully represented in this lower zone by certain Conchifera, as *Myoconcha crassa*, *Perna rugosa*, *Trigonia striata*, *Pholadomya fidicula*, *Modiola cuneata*, *Goniomya angulifera*, *Mytilus lunularis*, *Modiola ungulina*, *Gresslya abducta*, and *Modiola compressa*. The upper zone contains in addition the following Oolitic species:—*Cypricardia cordiformis*, *Hinnites abjectus*, *Astarte excavata*, Sow., var., *A. detrita*, *Macrodon Hirsonensis*, *Modiola Sowerbii*, *Gervillia Hartmanni*, *Gresslya conformis*, *Homomya crassiuscula*. *Pecten textorius* and *Turbo capitaneus* appear to have a considerable stratigraphical range, as they are

found from the Upper Lias to the Inferior Oolite inclusive. Of the eighteen Ammonites, which appear to include fifteen distinct species, several are undoubtedly derived from forms which occur in the higher beds of the Upper Lias shale of the counties of York and Somerset; others seem to be proper to the stage, and not one of the Ammonites passes upwards into the Inferior Oolite. The Brachiopoda appear to be entirely Liassic derivatives; and even *Rhynchonella cynocephala*, which, from its abundance and wide diffusion, seems to offer a good designation for the stage (Cynocephala-stage), is perhaps nothing more than a variety of *R. acuta*,—the number of plaits, whether anterior or lateral, affording no constant or reliable distinctive character; in other respects the general figure of both is absolutely the same. The single Nautilus, *N. latidorsatus*, is also Liassic. On the other hand, in the numerous Conchifera the Liassic element nearly disappears altogether, and we find a considerable infusion of the Oolitic, leaving, however, no inconsiderable number of species which appear to be proper to the stage. It is indeed a very striking but undoubted fact, that of the very numerous Liassic Conchifera and Gasteropoda, not more than four or five are continued into the Cynocephala-stage, and even of these two only are found in the upper zone. The more common Upper Lias Ammonites (Lias *Epsilon*) are equally absent in the Cynocephala-stage, as *A. communis*, *A. serpentinus*, *A. bifrons*, *A. annulatus*, *A. exaratus*, *A. elegans*, Y. & B., *A. fimbriatus*. *A. striatulus* is strictly identical with the Liassic form; but the common Cotteswold form of *A. variabilis* var. *dispansus* offers well-marked distinctions from the Liassic variety, which, as it is the *A. Beanii* of Simpson, may be termed the variety *Beanii*. The variety *dispansus* is more compressed, the volutions more enveloped; both the fasciated tubercles and the ribs are smaller, less prominent and more numerous; the ribs being much more curved near to the keel. The Liassic variety, however, occurs very rarely at Frocester Hill. *Ammonites opalinus* I have omitted altogether, as the single specimen found lying upon the ground at Haresfield Hill may have been derived from those superincumbent Inferior Oolite beds to which it has been referred by Quenstedt and Oppel. The species alluded to is the *opalinus* of Reinecke, Zieten, and Quenstedt, but not the *primordialis* of Schlotheim and D'Orbigny, which is sometimes confounded with it. *A. primordialis* is an Upper Lias species. Two forms of these Cotteswold Ammonites appear hitherto to have been undescribed; these will shortly appear, under the names of *A. Moorei* and *A. Leckenbyi**; the former is allied to *Aalensis*, the latter to *hircinus*.

* The Cotteswold Hills: Handbook to their Geology and Palæontology.

The statement that these Ammonites all cease with the highest bed of the stage, needs some little qualification: a single specimen of *A. striatulus* and *A. variabilis* has occasionally been detected in the lowest of the hard brown beds which overlie the Cephalopod-bed at Frocester Hill; *Belemnites* and *Rhynchonella cynocephala* are more frequent. Whether, however, these Testacea may have been washed into the newer bed, or may for awhile have lingered there as living denizens, is of little moment, as it is certain that the occurrence is of a local nature, and extends only to the lowest bed of the Inferior Oolite.

In assigning to the Sands the provisional rank of a distinct zoological stage, my conclusions are founded upon a review of its fossils compared with those of the Upper Lias "*Epsilon*" on the one hand, and of the Inferior Oolite on the other, to each of which they offer certain approximations, in some instances amounting to absolute identity, in others to the more distant affinities of varieties; after deducting these, a considerable number still remain, which appear to be proper to the stage. This view is to some extent in accordance with that of Quenstedt, who, in his 'Jura,' has separated the Jurensis marls from his Lias "*Epsilon*," or Upper Lias shale, into a distinct subdivision or stage of the Lias, under the name of Lias "*Zeta*." It may be preferable for the present to allow it to remain as an independent stage until more extended observations shall have been made,—more especially until the Testacea of the Lias "*Epsilon*" shall have been more fully figured and described. In this respect it may rank as of the same stratigraphical value as the Cornbrash or the Kelloway Rock, a theoretical arrangement which will leave the problem to be determined by future researches, viz. to which of the two great formations bordering it, its fossils offer as a whole the nearest approximation. Considerable as the list of these has now become, it is evident that much still remains to be done; other localities require to have their fossils better collected and examined. How insufficient is our list from Dorsetshire; how few species have been distinctly assigned to the stage in Yorkshire; how short a time has elapsed since the fossils of the lower zone have been collected in the Cotteswolds; how meagre is the list of M. Eugène Deslongchamps from Calvados; and, in the Mozelle, how considerable a number of the species remain undetermined! The recollection of these deficiencies should induce us to discourage for awhile all decisive conclusions, and lead us rather to compare our acquisitions from time to time, carefully and rigidly subjecting them to the necessary comparisons, free from the bias of preconceived opinions.

In the Cotteswolds, 56 Testacea have been obtained in the upper, and 54 in the lower zone; in all, 81 species,—divided

into, Cephalopoda, 22; Brachiopoda, 4; Gasteropoda, 9; Conchifera, 46.

The following amended list of fossils from the Cynocephala-stage of the Cotteswolds offers some additions and corrections to those previously published, and is divided into two distinct zones.

Upper Zone at Frocester Hill, at Haresfield Hill, and at various other smaller sections.

Ammonites variabilis, *D'Orb.*, var. Beanii.
—— variabilis, var. dispansus.
—— striatulus, *Sow.*
—— radians Orbignianus, *Schlot.*
—— radians Dewalqueanus, *Rein.*
—— comensis, *De Buch.*
—— insignis, *Schub.*
—— ——, var. with compressed back.
—— subinsignis?, *Op.*
—— Jurensis, *Ziet.*
—— discoides, *Ziet.*
—— Boulbiensis, *Y. & B.*
—— Levesquei, *D'Orb.*
—— torulosus, *Schub.*
—— Moorei, *Lyc.*
—— Leckenbyi, *Lyc.*
Belemnites tripartitus, *Schlot.*
—— irregularis, *Schlot.*
—— compressus, *Voltz.*
Nautilus latidorsatus, *D'Orb.*
Turbo capitaneus, *Münst.*
Cerithium papillosum, *Desh.*
Cypricardia cordiformis, *Desh.*
—— brevis, *Wright.*
Cucullæa ferruginea, *Lyc.*
Tancredia, n. sp.
Cardium Hullii, *Wright.*
Opis lunulatus, *Sow.*, var.
Opis carinatus, *Wright.*
Trigonia Ramsayi, *Wright.*
—— striata, *Sow.*
—— costata?
Astarte complanata, *Rœm.*
—— excavata, *Sow.*, var.
—— detrita, *Goldf.*
—— lurida, *Sow.*, short, gibbose var.
Macrodon Hirsonensis, *D'Arch.*
Gryphæa plicata, *Lyc.*
Hinnites abjectus, *Phil.*, sp.
Lima Electra, *D'Orb.*
—— bellula, *Mor. & Lyc.*, var.
Modiola Sowerbyi.
Pecten textorius, *Schlot.*
Gervillia Hartmanni, *Goldf.*
Pinna fissa, *Goldf.*
Goniomya angulifera, *Sow.*, sp.
Pholadomya fidicula, *Sow.*
—— arenacea, *Lyc.*
Gresslya abducta, *Phil.*, sp.
—— conformis, *Ag.*
Myacites arenacea, *Ag.*, sp.
——, species undet.
Homomya crassiuscula, *Mor. & Lyc.*
Terebratula subpunctata, *Dav.*
Rhynchonella cynocephala, *Rich.*
—— Jurensis, *Quenst.*, var.

Lower Zone at Nailsworth and Brimscombe.

Ammonites variabilis, var. dispansus.
—— Raquinianus, *D'Orb.*
——, species allied to Raquinianus.
—— Jurensis, *Ziet.*
—— radians Orbignianus, *Schlot.*
—— striatulus, *Sow.*
—— subinsignis?, *Op.*
—— concavus, *Sow.*
Belemnites compressus, *Voltz.*
—— tripartitus, *Schlot.*
Nautilus latidorsatus, *D'Orb.*
Turbo capitaneus, *Münst.*
Trochus duplicatus, *Sow.*
Pleurotomaria subdecorata, *D'Orb.*
Chemnitzia lineata, *Sow.*, sp.
——, species undet.
Natica adducta, *Phil.*
—— Oppelensis, *Lyc.*
Orbicula reflexa.
Astarte lurida, *Sow.*
—— complanata, *Rœm.*
—— rugulosa, *Lyc.*
Trigonia striata, *Sow.*
Cypricardia brevis, *Wright.*
—— cordiformis, *Desh.*
Cucullæa ferruginea, *Lyc.*

Cucullæa olivæformis, *Lyc.*
Nucula Jurensis, *Quenst.*
Cardium Hullii, *Wright.*
Unicardium, sp. indet.
Myoconcha crassa, *Sow.*
Perna rugosa, *Münst.*
Goniomya angulifera, *Sow.*, sp.
Gervillia Hartmanni, *Münst.*
—— fornicata, *Lyc.*
Avicula inæquivalvis?, *Sow.*
Modiola cuneata, *Sow.*
—— Sowerbii, *Sow.*, sp.
—— compressa, *Münst.*
—— ungulina, *Y. & B.*
Mytilus lunularis, *Lyc.*
——, sp. indet.
Lima Electra, *D'Orb.*
—— bellula, var., *Mor. & Lyc.*
—— Galathea, *D'Orb.*
—— ornata, *Lyc.*
——, n. sp.
Pholadomya arenacea, *Lyc.*
—— fidicula, *Sow.*
——, sp. indet.
Myacites arenacea, *Lyc.*
——, sp. indet.
Rhynchonella cynocephala, *Rich.*
—— plicatella, var.

XVII.—*Descriptions of new Ceylon Coleoptera.*

By John Nietner, Colombo, Ceylon.

[Continued from vol. xix. p. 388.]

In the first of these papers (Annals, xix. p. 247) I have described a winged species of *Œdichirus*, a genus supposed to be without organs of flight; and I have since (xix. p. 385) given publicity to the more important discovery of wings in the single genus which forms the family of the Georyssi, also hitherto supposed to be apterous; I am now about to announce to some and confirm to others the existence of these organs in the family of the Scydmænidæ, a fact, although incomplete, of more importance than either of the former, considering the extent of the family and the difference of opinion which appears to exist on the subject amongst the most eminent entomological authorities. It is this importance which induces me to enter more fully on the subject.

I am not acquainted with the famous monograph of the family of the Scydmænidæ by Dr. Schaum; however, from the manner in which it is quoted by Lacordaire in his 'Genres des Coleopt.,' I should infer that these two celebrated authors agree in all vital points. In Lacordaire's diagnosis of the family, these insects are described as having (with the exception of the American genus *Brathinus*, of which Lacordaire is not quite sure that it belongs to the family) the elytra soldered together, and being destitute of wings. Now, it is scarcely credible that on a point so easily ascertained as this, any difference of opinion should exist; still, Westwood, in his 'Modern Classification of Insects,' in describing the same family, makes statements which imply the contrary. However, Lacordaire's description, being by fifteen years more recent, and, in fact, the latest, is, if only for