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A MONOGRAPH

OF THE

MOLLUSCA FROM THE GREAT OOLITE,

CHIEFLY FROM

MINCHINHAMPTON

AND

THE COAST OF YORKSHIRE.

BY

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PART I.

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## INTRODUCTION.

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THE authors of the present Monograph, after due consideration of the materials at their disposal, have thought fit to limit their illustrations to the Testacea of the Great or Bath Oolite; a term under which they would include the series of beds situated between the Fullers-earth strata upon which they repose, and the Bradford clay to which they are subjacent. To have enlarged the plan, so as to include the Testacea of the Cornbrash and Forest marble, would doubtless have been more comprehensive; but in the present state of our knowledge, the advantage would have been rather apparent than real. It will be found that the very few univalves which have been assigned to those deposits are almost without exception contained likewise in the Great Oolite, and will be found in the Monograph. It is, moreover, not impossible, that at some future time a series of univalves may be obtained from the Cornbrash, or Forest marble, differing specifically from those of the Great Oolite, in which case a separate Monograph, or an appendix to the present one, might be given.

It is much to be regretted, that collections of shells should have been procured from so few situations in the long course of the formation in this country; and when it is remembered, that the Great Oolite constitutes a member of that series of secondary rocks which first engaged the attention of geologists, some surprise will mingle with our regret. The defect, however, would appear to be of easy explanation. The shells do not lie upon the surface, or become separated from the matrix by the action of the weather; they are to be procured only by carefully working away the investing stone when practicable, which is not always the case: there are likewise large areas constituting, probably, the greater portion of the formation, which are altogether destitute of organic remains, or contain only a finely comminuted shelly drift; the areas containing assemblages of well-preserved shells, would appear to be of small extent, and the presence of several of these in the vicinity of the residence of one of the authors, together with the great profusion of undescribed testacea which they have produced, have constituted the principal inducement to the present attempt of describing them; these favorable circumstances have enabled them to ascertain the position and vertical range of the species with a greater degree of accuracy than would otherwise have been possible.

Beyond the limits of the Minchinhampton district, the number of species procured

has been but inconsiderable; these latter belong chiefly to Ancliff,<sup>1</sup> and to the vicinity of Scarborough. The parallelism of the deposits at the two former places would appear to be well ascertained, but with respect to the rocks which are so extensively exposed upon the coast of Yorkshire, although the evidence of geological position appears to be satisfactorily determined, they possess but few mineral features which serve to connect them with their supposed equivalents in Gloucestershire, Wiltshire, and Somersetshire; they constitute a great carboniferous deposit of the Oolitic period, abounding with land plants, and containing intercalated bands or thin beds of dark gray argillaceous shales, limestones, and sandstones, containing marine shells, of which only a minority of species have been identified in other localities. The evidence afforded by the few species of univalves which have been forwarded to the authors from Scarborough, through the kindness of Mr. Bean, though not conclusive, tends rather to assimilate them with the Inferior Oolite; and it will be perceived on consulting the table of species at the end of the Monograph, that of the twenty-one Yorkshire species, none have been identified with Great Oolite shells of Minchinhampton or Ancliff, but that seven agree specifically with Inferior Oolite shells of the Cotteswold hills. The Yorkshire deposits to which these remarks refer constitute the entire series of plant-bearing beds numbered 11, 12, and 13 in Phillips's 'Geology of Yorkshire,' reposing on No. 14, or the Dogger, which is proved by its fossils to be the equivalent of the Inferior Oolite, or at least to a portion of that formation. Admitting, therefore, the parallelism of the deposits containing somewhat distinct Faunas, in the north-eastern and south-western parts of the present area of England, we are naturally led to infer, either that the physical conditions might be favorable to the continuance of species in one locality, or that species characteristic of an older deposit, in a more distant region, may have migrated and lived on during the formation of a newer deposit in another, the conditions having become unfavorable to the perpetuity of their development in the latter deposit over the original region whence they had migrated.<sup>2</sup>

For the above-mentioned reasons, it has been deemed desirable to separate the

<sup>1</sup> The section at Ancliff, near Bradford, is as follows:

Rubble	. 5 feet.	. . .	Abounding with Polyparia.
Soft Oolite	15	„ . .	This is the bed celebrated for the Ancliff fossils.
Clay	. 1	„ . .	Containing small sponges, and many fragments of shells.
Rag	. 6½	„ . .	Very coarsely Oolitic.
Soft Oolite	5	„	

From Mr. Lonsdale's interesting memoir, "On the Oolitic District of Bath," in the 'Geol. Trans.,' vol. iii, p. 252, in which many other sections of the Great Oolite are given, and the range of the deposit in that neighbourhood is accurately traced.

<sup>2</sup> Unfortunately the entire character of the fauna of the Great Oolite in the centre of England is not well ascertained, nor is the range and extent, southerly, of the fluvio-marine conditions of the Yorkshire Oolite accurately determined. As bearing on this point, the reader is referred to a paper by Captain L. L. B. Ibbetson and Mr. Morris, "On the Geology of Stamford" ('Brit. Assoc. Rep.,' 1847, p. 127). The subject of migration of species, during the Oolitic epoch, is ably treated in a valuable memoir by M. Gressly, 'Observations Geologiques sur la Jura Soleurois.'

Yorkshire shells from those of the West of England, and to have them figured on separate plates, as by this arrangement it is trusted that confusion will be avoided, whatever may ultimately be determined with regard to the position of these deposits.

It will be observed that several characteristic groups of shells have been arranged into new genera and sub-genera, the knowledge of which, it is believed, will conduce materially to the identification of the members of the lower Oolitic system of rocks; of these *Ceritella*, *Brachytrema*, *Alaria*, *Cylindrites*, and *Trochotoma*, are likewise represented in the Inferior Oolite, but by other species; in no instance has any species of these genera been found common to the two formations. Other genera occur whose species are equally characteristic of the two formations; the table of comparison at the end of the memoir will indeed serve to show how small a number of the spiral univalves are really common to both formations; with the *Patelloidea* the case is somewhat different, but the entire number, excluding the Yorkshire species, is very small; a fact the more worthy of notice as a much larger number of the bivalves are common to both, or if capable of being separated, can only be regarded as sub-species, or varieties of the same species. The literature of the science has hitherto been singularly deficient in illustrations of English Great Oolite univalves; Lhwyd's '*Lithophylacii Britannici Ichnographia*' contains a few; Conybeare and Phillips, in their '*Geology of England and Wales*,' p. 210, enumerate three species. Sowerby's '*Mineral Conchology*' contains thirteen, one only of which is from the Minchinhampton district. Mr. Lonsdale's paper on the '*Oolitic district of the neighbourhood of Bath*' has only three identified species. In Prof. Phillips's '*Geology of Yorkshire*,' (part I, p. 123,) fifteen species of univalves are enumerated, which are reproduced in Mr. Williamson's paper on the '*Yorkshire Oolites*,'<sup>1</sup> but without descriptions. Dr. Fitton's notice of the strata at Stonesfield<sup>2</sup> gives an accurate enumeration of the different beds, but with few organic remains. In the paper by Capt. L. L. B. Ibbetson and Mr. Morris, on the '*Geology of Stamford*,'<sup>3</sup> a few univalves are mentioned; and, lastly, in the '*Geology of Cheltenham*,' edited by Messrs. Strickland and Buckman, a list is given from the Stonesfield slate of East Gloucestershire of six Echinodermata, or at least fragments of them, and nineteen gasteropoda, remains of which, however, are sometimes very imperfect.<sup>4</sup> It may be

<sup>1</sup> Geol. Trans., 2d Ser., vol. v, Part i, p. 240.

<sup>2</sup> Zool. Journal, vol. iii.

<sup>3</sup> Brit. Assoc. Reports, 1847.

<sup>4</sup> The following is a section of the quarry on Sevenhampton Common, whence most of the fossils were obtained:

Soil . . . . .	2 feet.
A yellow clay, of a somewhat soapy feel, very rich in fossil shells . . . . .	6 „
Ragstone, similar to the Stonesfield slate . . . . .	— „ 4 inches.
Thin seam of soft stone, with <i>Ostrea acuminata</i> , and small joints of <i>Apiocrinites</i> . . . . .	— „ 3 „
Blue marl . . . . .	8 „
Ragstone . . . . .	14 „
Stonesfield slate . . . . .	4 „
Fullers-earth . . . . .	— „

gathered from these details, that in undertaking the present work, the authors have necessarily, to a great extent, entered upon an unexplored field of study,—have been compelled to investigate the relations of forms which, in very many instances, have only recently been brought under their notice, and respecting whose analogues some doubt or difference of opinion may occasionally exist: with a sincere desire to avoid error, they have in every instance rejected species of which the examples were imperfect or doubtful.

It is with pleasure and gratitude they acknowledge the assistance which they have received in the prosecution of their task, and their thanks are especially due to Professor Edward Forbes, for his valuable memoir on the Echinodermata; to D. Sharpe, Esq., for his copious notes on the Nerineæ, and other valuable suggestions; to Wm. Bean, Esq., of Scarborough; to M. Bouchard, of Boulogne; to Professor Tennant, F.G.S.; to S. V. Wood, Esq., F.G.S.; to Professor Buckman; to — Bravender, Esq., of Cirencester; and to J. Bentley, Esq., of Stamford, for the loan of specimens for comparison and figuring: to M. A. Buvignier, of Verdun, for his little work on the ‘Oolitic Fossils of the Ardennes;’—also for the opportunities afforded them in consulting the important collections of the Viscomte D’Archiac; J. Baber, Esq., F.G.S.; J. S. Bowerbank, Esq., F.R.S.; J. G. Lowe, Esq. of Chippenham; Rev. P. B. Brodie, F.G.S.; E. H. Bunbury, Esq., M.P., F.G.S.; S. P. Pratt, Esq., F.R.S.; and to Professor E. Deslongchamps, of Caen, for his obliging kindness in forwarding to them a suite of specimens typical of some of the species figured by him in a series of memoirs, containing many valuable observations, published in the seventh and eighth volumes of the ‘Mémoires de la Société Linnéenne de Normandie;’ as well as to J. de Carle Sowerby, Esq., for the loan of many of the original specimens described in the ‘Mineral Conchology;’ and to G. R. Waterhouse, Esq., and S. P. Woodward, Esq., for the facilities afforded to the authors in their examination of the species contained in the National Collection. To the artists, Messrs. Bailey and C. R. Bone, of the Ordnance Geological Survey, the authors tender their acknowledgments for the pains they have taken in the general accuracy of the lithographs.

# A MONOGRAPH

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## MOLLUSCA FROM THE GREAT OOLITE.

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### GENERAL GEOLOGICAL REMARKS.

THE Minchinhampton district of the Great Oolite has produced by far the greater number of our illustrative specimens; and as the formation at that locality exhibits features of a very varied as well as comprehensive character, we may be excused for entering somewhat more into detail in our remarks upon it. The Great Oolite in this portion of Gloucestershire constitutes the uppermost rock of the Cotteswold Hills; it everywhere overlies the Fullers-earth, which, in turn, reposes upon the uppermost beds of the Inferior Oolite;—there is, therefore, a regular unbroken sequence of the Oolite rocks exposed on the flanks of the various deep valleys of denudation which pervade the district. The physical features of the district are strongly marked; the larger valleys have a mean depth of about 500 feet, and exhibit what can scarcely be met with in any other part of England; a single unbroken declivity comprising the Great Oolite, Fullers-earth, Inferior Oolite, and upper portion of the Lias. The Inferior Oolite at these escarpments has a thickness of about 230 feet, the Fullers-earth of 70 feet, and the different beds of Great Oolite of 120 feet; but of these latter, only about the lower 40 feet anywhere approach to the brow of the escarpments. The narrow and deep vale of Chalford, with its lateral branches, intersects the strike of the Great Oolite, and divides the fossiliferous portion of the district into two parts; another and wider valley, further south, likewise intersects the strike of the formation. In this are situated the villages of Woodchester, Hailsworth, and Avening; but here the amount of denudation, horizontally, has been more extensive; and as the Great Oolite is likewise much less fossiliferous, it need only be adverted to as supplying many additional positions, where the rock can conveniently be quarried by open-work excavations. It will, therefore, be perceived that the natural features of the district eminently conduce to the study of its organic remains.



The mineral masses which constitute this series of beds are exclusively of marine origin, the varying character of their organic contents being connected both with the mineral character of the deposit spread upon the floor of the ancient sea, and with its depth. These deposits may be conveniently divided into three groups :

1st. The Weatherstones ;      2d. The Sandstones ; and      3d. The Limestones.

The weatherstones, which are situated at the base of the formation, average about 40 feet in thickness. They consist of shelly sandstones, abounding with crystalline carbonate of lime, and having Oolitic grains irregularly and sparingly distributed throughout their mass. The variety of mineral character is so great, that no two quarries, or beds of the same quarry, or even distant parts of the same bed, are alike in structure, aspect, hardness, durability, or in the abundance of their included organic relics ; and they appear to have constituted a deposit both littoral and formed in a shallow sea, exposed to the influence of tides and currents. The beds, which are sometimes of considerable thickness, consist of layers of testacea, in a fragmentary state, piled confusedly, but forming, obliquely, laminated surfaces, often interrupted and crossed by others which proceed in different directions. The shelly relics often constitute a considerable proportion of the whole mass ; they are converted into crystalline carbonate of lime, which frequently fills the interior of the univalves ; and it is to the abundance of this mineral, disseminated everywhere, that the weatherstones owe their superior durability upon exposure to the atmosphere. As a general rule, therefore, the beds which contain the greatest abundance of shells are those which are most fitted to resist the action of frost ; water percolates their structure in much smaller quantity, and more slowly, and, on escaping, carries away but little lime in solution. The open joints of the Great Oolite, adjacent to the shelly beds, are therefore nearly free from the large stalactitical masses which load the joints of the freestone in the Inferior Oolite.<sup>1</sup> With the testaceous fragments are associated shells in a perfect condition, though frequently worn and abraded, the valves of the conchifera being rarely in apposition ; also, palatal bones and teeth of fishes, portions of crustacea, spines of cidaris, ossicula of pentacrinites and asterias, rolled fragments of zoophytes, and dicotyledonous wood, the partitions of the beds disclosing not unfrequently the ripple-marks of a beach. It might be imagined that beds of such a littoral character would be unsuited to the propagation and development of the Cephalopoda ; and it will occasion no surprise when we find that

<sup>1</sup> For economic purposes, the weatherstones are valuable on account of their durability. In proof of this, we may refer to the good state of preservation which the ancient part of the church at Minchinhampton exhibits, and which shows a care and judgment in the selection of materials not always to be found in modern edifices. It is rather a singular fact, that Caen and Minchinhampton, the two places which have produced by far the most extensive series of Great Oolite shells, are connected historically as well as geologically. Matilda, wife of William the Conqueror, founded the nuns of the Holy Trinity at Caen, of which body one of her daughters became a member. William endowed them with the manor of Minchinhampton, at which place they had a religious establishment. They built the church, and dedicated it to the Holy Trinity. It would seem that William despoiled the Saxon Countess Goda of the manor, which she possessed in the time of Edward the Confessor, and bestowed it upon the favorites of his wife.