

THURSDAY, MAY 11, 1882

BRITISH FOSSIL CEPHALOPODS

A Monograph of the British Fossil Cephalopoda. Part I. Introduction and Silurian Species. By J. F. Blake, Esq., M.A., F.G.S., Professor of Natural Science in University College, Nottingham. (London: J. Van Voorst, 1882.)

FOR the first time has just appeared Part I. of a monograph upon the British Palæozoic Tetrabranchiate Cephalopoda, and important as this group of Mollusca has ever been regarded by all palæontologists and badly as such has been wanted by all students of British Palæozoic geology, no one has hitherto attempted any history of this group for Britain. Barrande has elaborately done so for Bohemia and De Koninck for Belgium, both have extensively written upon the older Cephalopoda [Cambrian, Silurian, Devonian, and Carboniferous]. Barrande in his exhaustive work illustrates no less than 1620 Silurian species. De Koninck in his last important work upon the Carboniferous Limestone of Belgium enumerates 170 species, amongst them many new forms and many common to British strata. Prof. J. F. Blake intends completing this history of the British Palæozoic Cephalopoda in two volumes. The part now issued, being part or vol. i., treats only of Silurian species. No less than 244 quarto pages and 31 plates are devoted to the description of 11 genera and 6 sub-genera, and 143 species. The great genus *Orthoceras* being illustrated by 76 species, and its 4 sub-genera by 6 species, *Cyrtoceras* 23 species, *Poterioceras* 2, *Gomphoceras* 11, *Phragmoceras* 7, *Ascoceras* 3, *Nautilus* 4, its sub-genus *Trochilites* 3, *Trochoceras* 12, *Lituites* 2, *Ophidioceras* 2, and *Goniaticites* (?) 2 species. These 143 species range from the Tremadoc Rocks, of the Cambrian series, to the Tile-stones of the Upper Ludlow. Forty of the 145 species also occur in Europe and America, or 32 are common to Europe and 6 to America, thus showing the wide distribution of certain genera and species. Thirty-one plates accompany the letterpress or text, every species being figured, and more than 2000 specimens have been examined by the author having reference to the history and description of these 143 species. Prof. Blake has given on pp. 233-6 a table of the distribution in time of all the species, and on p. 237 a condensed table showing the "growth, culmination, and decay of the genera and group." These two tables are suggestive, and the outcome of their study shows that there were two maxima of individual abundance, one occurring in the older group of rocks, the Caradoc or Bala, and the other, in the Lower Ludlow, yet we feel assured that there was no real diminution or falling off in the variety of forms between these two deposits. The tables clearly show that the species in the Wenlock Limestone were (or are now found to be) comparatively few as compared with those in the shales above and below, and would indicate that the Cephalopoda of the Wenlock seas were not commonly frequenters of clear and shallow waters, but were partly pelagic and possibly gregarious in more or less turbid waters, as indicated by the impure sediments composing the Ludlow shales.

Prof. Blake has proposed a classification of the Nau-
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tiloidea based upon the general form of the shell, and having a variable siphuncle. He places all the Palæozoic forms under four groups: 1, the *Conici*; 2, the *Inflati*; 3, the *Spirales*; and 4, the *Irregulares*. The 18 genera being naturally distributed through these four groups.

Group 1. The *Conici*.—Receives the genus *Orthoceras*, with its 5 sub-genera: *Endoceras*, *Actinoceras*, *Tretoceras*, *Conoceras*, and *Gonioceras*, all having straight conical shells; also the curved genus *Cyrtoceras* with its sub-genus *Piloceras*.

Group 2. The *Inflati*.—Receives the well-known genera *Poterioceras*, *Gomphoceras*, *Phragmoceras*, *Ascoceras*, and *Glossoceras*, all possessing species with curved inflated shells, and contracted apertures.

Group 3. *Spirales*.—Those species with the whorls in contact, of simple form and considerable curvature, illustrate this group. The characteristic genera are *Trochilites* (Silurian), *Clymenia* (Devonian), *Aturia* (Tertiary and Cretaceous), *Discites* (Carboniferous), and *Nothoceras* (Silurian), a Bohemian form.

Group 4. *Irregulares*.—The genera comprising this group are all unsymmetrical in form, and greatly curved, the genus *Lituites*, *Trochoceras*, and *Ophidioceras* illustrate this division.

Prof. Blake does not lay much stress upon the contraction of the aperture in the shell classification, although it is important and recognised by Barrande as of much significance, doubtless other features in the general structure of the shell weigh equally in the determination of species. Such variations as are seen in rare or little known forms become matters of individual opinion to the species maker. As no Dibranchiate Cephalopod is known, or has no representative in the Palæozoic rocks, they may be dismissed as having no place or value amongst the Silurian species; therefore the whole group, whose entire history Prof. Blake has so ably described, belong to the Tetrabranchiata in its two great families, the *Nautilidae* and *Orthoceratidae*, especially the latter. Most, if not all, naturalists now agree in separating or excluding the *Bellerophon*s from the Cephalopoda, although Prof. McCoy, Ferrussac, D'Orbigny, Latreille, and Sowerby formerly believed they belonged to the "Argonautidae," and so placed them.

There is still difference of opinion as to the exact limits and sub-divisions of the order Orthocerata. Barrande has given all the known classifications, and the characters on which they have been founded by different authors. They are based (1) upon the position of the siphuncle; (2) the form of the suture; (3) the involutions of the shell; (4) the form of the aperture; (5) the symmetry or asymmetry of the shell; (6) the direction of the septa; (7) the simplicity or complexity of the siphuncle.

In Palæozoic forms the siphuncle played a very important part in the life and history of the species, being simple in one genus, complicated in another, dorsal in one, and ventral in another, and medial in some; the genera and species have been mostly founded on these changes and elements.

The earliest group to make its appearance in time was that of the Orthocerata, and out of it from the peculiarities of the siphuncle and shape of transverse sections, have been formed or established six genera, viz. *Gonioceras*, *Tretoceras*, *Endoceras*, *Actinoceras*, *Bathmoceras*, and *Bactrites*, all these constitute one natural group, placed

by Mr. Blake under the "*Conici*," diverging from this and more restricted in time, having variously shaped apertures, and singularly inflated, fusiform, pyriform, or flask-shaped shells, are the genera *Phragmoceras*, *Gomphoceras*, *Poterioceras*, and *Ascoceras*, and placed under the group "*Inflati*" by the author. The other two groups of the Nautiloidea—the *Spirales* and the *Irregulares*—possess so great a shell curvature that they assume the form of whorls, which may or may not be in contact. This fact appears of sufficient importance to justify Mr. Blake in regarding it as the basis for establishing the group "*Spirales*," in which is placed the genera *Nautilus*, *Gyroceras*, *Trochilites*, and *Clymenia*, &c., finally through peculiarity of form, such as want of symmetry, or loss of, or changes in curvature, are many of peculiar aspect, which Mr. Blake places under the group "*Irregulares*," the genera contained in which are *Trochoceras*, *Lituites*, *Ophidioceras*, and *Cryptoceras*. These researches have led to the construction of the table of classification above given.

Prof. Blake commences his systematic description of the species with the genus *Orthoceras*. No less than 70 species in this genus are described by the author, ranging from the Tremadoc rocks to the uppermost Ludlow beds (the Tile-stones). The species mostly abound in the Bala beds, the Wenlock shales, and the two Ludlows. The literature or bibliography of the species of the Orthocerata, their descriptions, and that of the 5 sub-genera is of the greatest value, and an addition to our knowledge of this oldest known genus in the British rocks; *Cyrtoceras* being its only associate in the Tremadoc beds. The sub-divisions of the genus by Quenstedt, M'Coy, De Koninck, and Barrande are given. Mr. Blake adopts Barrande's views and grouping of the Orthocerata into two groups: (1) the *Brevicones*; and (2) the *Longicones*. The latter, which is very numerous represented, Mr. Blake divides into the *Annulati*, the *Angulati*, the *Lineati*, the *Imbricati*, and lastly the group *Leves*. In this latter group is temporarily placed all species whose external surface is unknown. Then follows concise but clear descriptions of the five sub-genera—*Actinoceras*, *Endoceras*, *Tretoceras*, *Conoceras*, and *Gonioceras*. For the first time we now have the 70 British species of Orthocerata brought together, and most ably described and figured; 3 species belong to the group "*Brevicones*," and 67 to the group "*Longicones*." Of these, 20 species fall under the group *Annulati*, 6 under the *Angulati*, 13 under the *Lineati*, 7 under *Imbricati*, and 22 in the group *Leves*. We are now able to investigate all the known species of this extensive Palæozoic genus, and no student need be at a loss to determine, either through original description and drawing, or the reproduction of type species, any forms that he may meet with in the Silurian rocks of the British Islands. The author's plan of first describing in every instance the type of the species, is of extreme value, as it at once (if a known species) clears up its history; this with reference to the original figure and description by the author, and its reproduction in the monograph, ensures and affords every chance of right determination. Following the "type" is the general description, then its relation to other known forms, British or foreign, followed by its distribution in time or space; this plan is implicitly followed throughout the entire

volume—it is clear, definite, and systematic. The next important group described by Mr. Blake are the *Cyrtoceri*, numbering 22 species. These curved *Cyrtoceri* Deshayes termed *Campulites*, restricting the term to those species having the siphuncle on the inner side. Goldfuss, however, regardless of the position of this organ, named them *Cyrtoceras*; Billings, De Koninck, Sandberger, Giebel, and Barrande have all proposed divisions for the classification of *Cyrtoceras*. Blake follows Barrande, who divides them into two series, according to the position of the siphuncle: (1) the *Exogastric*, in which that organ is external; and (2) *Endogastric*, in which it is internal. Prof. Blake proposes a third grouping for these species, in which the siphuncle is near the centre, calling it "*Mediogastric*." The Bala, Wenlock, and Lower Ludlow beds contain most species of *Cyrtoceri*. The species *C. precox*, from the Tremadoc beds of Garth, in North Wales, and from Llanerch in Pembrokeshire, with *Orthoceras sericeum* are probably the oldest forms known.

The singular genus *Gomphoceras* receives much careful analysis from Prof. Blake. Six of the 11 species are new, and there appears to be good reason for their establishment; with one exception the species are all (10) Upper Silurian, 8 of the 11 are in the Lower Ludlow beds, and 5 in the Wenlock Limestone. Two quarto plates are devoted to this remarkable genus. Four of the 7 species of Sowerby's genus *Phragmoceras* are also new, and for the first time figured. Like *Gomphoceras* this genus is chiefly Upper Silurian, the Wenlock and Ludlow strata being characterised by them. Mr. Blake adds much to our knowledge respecting the species of the genus *Ascoceras* of Barrande, hitherto little known or understood; the species in Britain are confined to the Ludlow rocks.

The group *Spirales*, illustrated by the genus *Nautilus* and its sub-genera, receives ample and critical notice, and shows how varied have been the views of naturalists upon the affinities of this old genus, established by Breynius in 1732. The value of the sub-genera in this as in all the large groups is of much significance in tracing the history of the obscure forms classed under the genus *Nautilus* or *Nautiloid* remains in the Lower Palæozoic rocks. Five of the so-named genera—*Trochilites*, *Clymenia*, *Aturia*, *Discites*, and *Nothoceras* are placed under the genus *Nautilus* as sub-genera. Mr. Blake gives Quenstedt's, D'Orbigny's, and De Koninck's classification or sub-divisions, and suggests one of his own. Quenstedt proposed to subdivide the genus *Nautilus* into 8 groups: (1) the *Insecta*, (2) *Clymenia simplices*, (3) *Clymenia angulosa*, (4) the *Moniliferi*, (5) *Bisiphites*, (6) *Simplices*, (7) *Undulati*, (8) *Aganides*.

This and the classification by De Koninck ("*Terr. Carb. de Belg.*"), in which he partly follows Quenstedt, are the only two hitherto recognised divisions of the genus. The Belgian Professor places his Palæozoic species under the following six heads: (1) *Imperfecte*, (2) the *Striati*, (3) the *Radiati*, (4) *Lævigati*, (5) *Clymenia simplices*, and (6) *Clymenia angulata*; four of the six being those of Quenstedt. Prof. Blake proposes or suggests a simpler grouping. No. 1, *Simplices*, illustrated by the sub-genus *Trochilites*; 2, the *Radiati*, those species having radiating, sigmoidal, or angular ribs; 3, the *Ornati*, variously ornamented, chiefly Carboniferous,

equivalent to M'Coy's sub-genus *Temnocheilus*; 4, the *Sinuosi*, those with sinuous sutures; and 5, those species with nummuloid siphuncles (Trias only).

Probably only three species of *Nautilus* occur in the Silurian rocks—*Nautilus quadrans*, *N. Holtianus*, and *N. Bohemicus*. This last-named species appears to be the *Lituities Biddulphi* of Sowerby (1838); but his insufficient description, in the "Sil. Syst." of Murchison, prevents true identification. They are all three Upper Silurian forms. The Lower Silurian rocks of Newfoundland and Canada have yielded eleven species. In the Carboniferous strata *Nautilus* attains through *Discites* its maximum development. In the Permian only one species is British, and three American, and is now the only living representative of the Tetrabranchiata. The sub-genus *Trocholites* (three species are Lower Silurian. These six forms are the only true Nautiloidea in the Silurian rocks.

The last group (4, the *Irregulares*) in Mr. Blake's classification receives three genera: *Trochoceras*, with 12 species; *Lituities*, 2; and *Ophidioceras*, 2 species. We have no representative of either the *Endogastric* or *Exogastric* group of Barraude in this country. American and Swedish Lower Silurian species are somewhat abundant, in Britain it is chiefly an Upper Silurian genus. Of the 12 species known 8 are Upper Silurian—Wenlock and Ludlow—and the Llandilo, Bala, and Llandovery beds yield the remaining *Trochoceri*. Five of the 12 species are new to Britain, described and figured by Prof. Blake for the first time. The two type species—*Trochoceras* (*Lituities*) *cornu-arietes* (Sowerby), and *Trochoceras* (*Lituities*) *giganteum* (Sowerby)—are admirably refigured and described by Mr. Blake, the general descriptions adding to their specific value, and the determination of Bohemian forms of *Lituities* in Britain materially adds to the correlation of the two faunas. Barrande's genus *Ophidioceras* (*Lituities*, *auct.*) seems to have been recognised by Mr. Blake; it differs from typical *Lituities* by the whorls being accurately in contact. The *Lituities articulatum*, Sow., was long ago figured as *Lituities* in the "Sil. System," p. 622, t. 11, f. 5, and adopted by Salter. The straight ribbing and band distinguishes this genus from *Lituities*. This volume concludes with general observations, and highly suggestive many of them are. Prof. Blake endeavours to throw some light upon the laws which govern the appearance and disappearance of forms of life, and into the nature of those groups of individuals to which we assign the term species.

Mr. Blake prepares a table, condensed from the larger and preceding one on pp. 233-236. This condensed table shows the numerical value of the species occurring in the 11 genera, and ranging through the ten formations or horizons, thus showing their increment, decrement, and stratigraphical distribution. Both tables show three maxima in the Ludlow, Wenlock, and Bala beds—in the Ludlow 65 species, the Wenlock 43, and the Bala 39. Mr. Blake does not believe that there was a corresponding falling off between these epochs; he draws conclusions from the comparative fewness of species in the *Wenlock Limestone* as compared with the Ludlow shales above and Wenlock shales below that formation. Of the four groups given the *Conici* first appear, and constitute the bulk of the Lower Silurian fauna, 31 species occurring in the Bala rocks [the Tremadoc only yielding

two species, the Llandilo 9, and the Lower Llandovery 8, or 19 for the three horizons]. The *Conici* and *Spirales* are the only two groups which continue on in time or range into the higher divisions of the Palæozoic rocks (the Devonian and Carboniferous), the *Inflati* being represented by *Poterioceras*, &c., in the Carboniferous series.

Mr. Blake next considers the characters of the individual genera and their appearance in time, but somewhat begs the question to suit his particular view upon evolution; it surely can hardly be safe to speculate upon any particular curve or part of the curve in any particular genus, to argue for descent through evolution, other conditions not known. Neither *Cyrtoceras precox* or *Orthoceras sericeum*—which are the oldest species known in Britain—"are transitional forms, both being well characterised," and it is questionable whether the group which has been longest in existence in a given area, will there most abound, many physical conditions may tend to prevent that, "though we grant that possibly the greater the abundance of individuals, the greater is their chance of preservation in the rocks, the nature of the deposit admitted.

In the paragraph on p. 239, having reference to the genera *Cyrtoceras*, *Phragmoceras*, and *Gomphoceras*, more evidence is wanting before we can draw any conclusion as to priority of appearance, or show that those having the siphuncle internal (*Endogastrica*) appeared first or preceded the *Exogastrica* (with the siphuncle external); it is true we must take the evidence as it stands, or as we find it; it is, however, wiser not to theorise upon such slender materials.

Prof. Blake next notices and discusses the question of species (pp. 239-243), and has pronounced opinions upon this vexed, complicated, and philosophical question, naturally the old idea of the independence of species is rejected. Mr. Blake adopts all through his book the method of "actually describing a type-specimen around which the other forms designated by the same name may cluster." When the original type has not been seen or found, a type is selected to which others are compared. In attempting the explanation of the phenomenon of distinct species or specific groups, it is well known that two theories are now held: (1) that which considers each species a "special creation, though inexplicable"; or, (2) "that which asserts the development of one from the other by a process of evolution." Mr. Blake appeals to palæontology to show, through its researches, the gradations between one species and another. The result to Mr. Blake's investigation in this and other groups is against "fixity of species." He states, that "if species were such definite entities as they were once supposed to be, they ought to be much more easily distinguished than they are, and that the many variations of form which will be found included, and necessarily included under one specific title, whose 'general description' thereby becomes one of considerable latitude, show that different specimens are not so closely linked as that theory would imply." On the other hand, "Does this present study," asks Mr. Blake, "give any positive aid to the theory of evolution?" He fails to see any reasonable solution or answer. It is evident that among "the many forms which flourish in any one epoch, it must be impossible to say with certainty which was the descendant of any particular form in the preced-

ing epoch, especially as the intervening links are, in all probability, absent."

Mr. Blake selects certain species of Orthocerata which may have been produced by descent; at the least it is only supposition, and he states that there is no proof that they are actually so connected, but to the general theory of evolution—which merely states that every form of life has been developed from a preceding one nearly allied to it—the present study affords no contradiction or difficulty, but affords aid—which if not so great as could be desired, is yet as much as could be expected. In the present study of the Palæozoic Cephalopoda we have a fair representative of a successive fauna of the same class, and the species are grouped round a series of central types; and so long as the surrounding circumstances remain constant and the same, the process of evolution by indefinite variation and survival of the fittest should either be uniform, and leave relics having no special grouping, or it should cease when the best adaptation to the surrounding circumstances or conditions had been acquired. These views are expressed and carefully argued by Prof. Blake, in the concluding pages of his work. "The great defect," writes Mr. Blake, "of the theory of natural selection is that it leaves the original variation, which is the basis of the whole to chance; chance variations are not likely to lead to any law." "The part which it has effectually performed is to show how variations of the individual may produce permanent changes in the species, and thus break down the idea of the fixity and independence of the latter." "We are, perhaps," says the author, "as yet too dazzled by the brilliancy of the theory to perceive its inadequacy as a complete account of life or to place it as one link only in the chain of explanations."

The "General Observations" of Prof. Blake on pp. 237-44 are a fitting termination to the laborious part undertaken by him in describing the 145 Silurian species. The work has been most carefully and honestly done, and now for the first time we possess a complete monograph upon the Tetrabranchiate Cephalopoda of the oldest Palæozoic rocks; no less than 31 quarto plates illustrate the species, and all are drawn life-size. Mr. Blake has examined 2000 well-characterised specimens, and has visited all the museums and private collections in Britain likely to contain materials for his work, and as he remarks, the work includes a description of every known specimen so far as it presents any available characters.

The fragmentary state of nine-tenths of the specimens collected, demanded from the author the most careful examination, whether by comparison or through description of specimens, and those who know the condition of Silurian Cephalopoda as occurring in this country will indeed appreciate the critical labour of Prof. Blake; he has rendered great service to palæontology. The book was the one want, as a completion to the works of Murchison, McCoy, Salter, and Sowerby in Britain; a companion to the grand monographs by Barrande upon the Cephalopoda of the Silurian Rocks of Bohemia, also a fitting accompaniment to the monograph by De Koninck upon the same group for the Silurian and Carboniferous Rocks of Belgium. No library devoted to natural science should be without this first volume, and no student of Palæozoic species can do without it. No group of invertebrata are of such importance to the stratigraphical

geologist as the Cephalopoda; in Britain alone the Palæozoic species number nearly 400, and in Bohemia the *Silurian Cephalopoda*, as described by Barrande, reach the great number of 1600, the Devonian species 500, and the Carboniferous species of Europe 350 species; these totals will at least give some idea of the life and distribution of this class of mollusca through time in Europe, and as Prof. Blake's first volume only treats of the Silurian of Britain, we wish him further success in his continued work upon the British Devonian and Carboniferous species, the fossil forms in which require the most minute, careful, and detailed study. R. E.

OUR BOOK SHELF

Social History of the Races of Mankind. Fifth Division: Aramaeans. By A. Featherman. (London: Trübner, 1881.)

WE do not like to discourage a student who has evidently a zeal for knowledge, and must have given great labour to compiling the comprehensive account of human society, of which this volume is the first instalment published. But we are bound to say he does not seem alive to the differences of value among the travellers' books of which he gives a list at the end of each section, and out of which he has pieced together extracts describing Jews, Arabs, Egyptians, &c. Thus some statement about the Copts may be out of Lane's "Modern Egyptians," or it may be out of Miss Lot's "Nights in the Harem," and the reader would rather like to know which is which. Mr. Featherman writes in his preface: "The facts have been selected with critical discernment, and no doubtful or incredible statements are admitted in the text, unless controverted in a footnote." Then follows an introduction, which begins: "The primæval man did not spring from a single stock, or from one ancestral type. He arose under varying conditions, and at different geological periods. The initiatory forces of nature which caused his primitive development, existed in the same degree in all the isothermal regions of the earth, and whenever the favourable circumstances were capable of producing and fostering into maturity the human animal, there he appeared," &c., &c. Putting preface and introduction together, it is plain that the author's critical discernment does not enable him to know a doubtful statement when he sees it, even when it is of his own making. In fact he does not quite know where he is, or a casual look into his volume would not show the ancient Egyptians classed among the Aramaean or Semitic nations without mention of their great physical difference from Jews and Arabs, nor would there be found in the account of the Egyptian religion a mention of Isis as being Ceres and Proserpine, mother and daughter at once. The book deserves a place on the library shelf, and will be useful to students, especially for its descriptions of Druses, Talmud Jews, and other little-known minor groups. It is doubtful if its reception by the public will justify the series being continued; but in case it goes on, the materials ought to be more carefully selected, and references given.

Commercial Organic Analysis. By A. H. Allen. Vol. II. (London: Churchill, 1882.)

THE first volume of Mr. Allen's work treated of cyanogen compounds, alcohol derivatives, phenols and acids; in this second part the very useful and practical character of the work has been fully maintained in the description of the properties, tests and assay of the hydrocarbons, fixed oils, and fats, sugars, starch and its isomers, alkaloids and organic bases, &c. The author has omitted, as stated in his preface, all mention of dyes and colouring matters, coal-gas, and animal products, on the ground that their consideration would have inconveniently in-