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RHYNCHONELLIDAE OF THE ENGLISH CHALK.

N. E. PETTITT.

(ABSTRACT)

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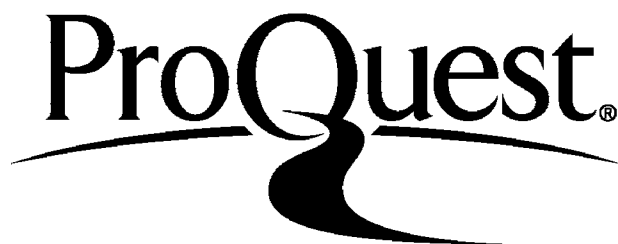
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Summary.

An examination has been made of the more important forms previously referred to the genus Rhynchonella Fischer de Waldheim which occur in the Chalk, with special attention to their internal structure.

The morphology of the Mesozoic Rhynchonellidae is discussed, and reference is made to the types of crura.

Previous work on subdivision of the Mesozoic forms of Rhynchonella is reviewed. Reference is made to Wisniewski's description of Rhynchonella; it is evident that no representatives of this genus sensu stricto have ~~been~~ been recorded from the Chalk. The internal structure of Cyclothyris McCoy and that of Buckman's genus Stolporhynchia to which he referred the Cretaceous species Laukrataia Rhynchonella sulcata (Parkinson), are discussed. Reference is also made to other Mesozoic Rhynchonellid genera including Lauronella Wisniewski.

Many Chalk Rhynchonellids were found to possess an internal structure similar to that of Stolporhynchia Buckman and Lauronella Wisniewski, and ~~they~~ have been grouped in a new genus Platyrhynchia. They include the species Rhynchonella mantallegna (J. de C. Sowerby), R. alvilli (Luchstedt), R. envieri d'Orbigny, R. reedensis Etheridge and Laukrataia obliqua James Sowerby, together with fourteen new species which are described in the paper.

Rhynchonella olivallia (James Sowerby) was found to have similar crura to those in Cyclothyris McCoy, but the median septum in the former is better developed. This species has been assigned to a new genus Cretirhynchia together with Rhynchonella acicillata (James Sowerby), Rhynchonella woodwardi Davidson, and Rhynchonella ligata (Schlotheim) and four new species.

Rhynchonella graciana d'Orbigny, which is characterised by a well developed median septum and very fine costae is assigned to a new genus Capillirhynchia.

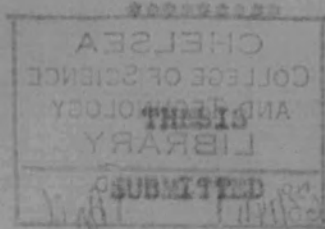
summary

The stratigraphical distribution of the genera and species is discussed. Platyrhynchia occurs throughout the Chalk, but is mainly developed in the Middle Chalk, where it is the only Rhynchonellid found. Camilirhynchia occurs with other undescribed genera in the Lower Cenozoic. Cretirhynchia is found in the Upper Chalk of this country in and above the Planus zone.

RHYNGONELLIDAE

OF THE

ENGLISH CHALK.



FOR

H. D.

King Street
Birmingham

N. B. PETTIT.

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1. Introduction.

No account of the Cretaceous Brachiopoda assigned to the genus Rhynchonella Fischer de Waldheim having appeared since the publication of Davidson's monograph in 1862-65, it was decided to re-examine the more important Chalk forms, paying special attention to internal structure. This work has been facilitated by the advances which have been made in the sorting of the Chalk during the intervening period.

Neumayr in 1889 (p. 521) commented on the fact that systematic works on the Brachiopoda and the establishing of their individual forms are among the most laborious and difficult exercises, in which even considerable effort often leads to no satisfactory result. In the light of present knowledge, this is bound to be the case, if no attention is paid to internal structure. Since Neumayr's time, such attention has been paid to the internal structure of these forms, and, as a result, considerable progress has been made in the classification of Palaeozoic and Jurassic Brachiopoda.

The application of this method to the present investigation of Chalk Rhynchonellids has shown the existence of three separate genera each with characteristic internal structure. Having established these three genera (Platyrhynchia, Cretirhynchia and Capillirhynchia) by the study of their internal structure, it has since been possible to select certain of their external characters which also permit their ready identification.

During examination of the Chalk Rhynchonellids, it was necessary to refer to the literature dealing with the internal and external features found in Mesozoic forms in general. These features are briefly discussed and reference is made to the work of Rothpletz, Buckman, Wisniewska, and Muirwood, and also to that of Lang dealing with form in fossils. Special attention has been paid to the types of orura found in the Rhynchonellidae; they are of considerable systematic importance.

During the course of the work, it was necessary to study and make comparisons with the following genera:- Rhynchonella Fischer de Waldheim, Cyclothyris McCoy, Stolmerhynchia Buckman and Lacunosella Wisniewska. A few notes are given describing the internal structure of Rhynchonella and Lacunosella as revealed by Wisniewska. It is evident that no representative of the genus Rhynchonella sensu stricto has hitherto been recorded from the Chalk. The internal structure of Cyclothyris and of Stolmerhynchia has been investigated and is discussed.

The internal structure was investigated by means of serial sections in the case of specimens with a hard matrix and by removal of the matrix in the case of those specimens in which it was soft.

The following Chalk species possess crura with suspended crural plates, but no dorsal median septum:- Rhynchonella mantolliana (S. de C. Sowerby), R. viestii (Quenstedt), R. cuvieri d'Orbigny, R. rathenensis Etheridge, and (?) Terebratula obliqua James Sowerby. They have been assigned to the new genus Platyrhynchia; fourteen new species belonging to this genus are described.

A strongly marked developed dorsal median septum is present in Rhynchonella grasianna d'Orbigny, which is assigned to the new genus Capillirhynchia.

In R. plicatilis (James Sowerby), the crura are ^{narrow,} ventrally recurved processes similar to those in Cyclothyris, but the median septum is developed to a greater extent than in Cyclothyris. This species is assigned to the new genus Cretirhynchia together with R. contollicata (James Sowerby), R. woodwardi Davidson, R. limbata (Schlotheim), and ^{two} ~~two~~ new species.

The Chalk species described in this paper have been diagnosed chiefly by means of external characters. The rather large number of new species is not surprising, considering the extent of the Chalk sea and the thickness

introduction

4

of strata. Numerous local variations occur and also forms with characters intermediate between those of two or more species. Similar conditions were found by Wisniewska (p. 44). Progressive change of individual characters or groups of characters is seen in successive species of the same genus. There still remain a number of rarer forms to be named and described.

2. Earlier Work on Chalk Rhynchonellidae.

The first British Chalk species to be named was called Terebratula sulcata by Parkinson in 1811, and it was said to occur in the Chalk and the Gault and at Cambridge. The name is a nomen nudum and pre-occupied, having been used by Fischer de Waldheim in 1809; no description or figure was given. Mantell used the name for a form which J. de C. Sowerby later called Terebratula mantelliana.

Schlotheim in 1813 gave the name Terebratula limbata to a form figured by Faujas de Saint-Fond in 1799 (pl. Xvii, fig. 4).

The "Mineral Conchology of Great Britain" was issued by James Sowerby and later by J. de C. Sowerby over a number of years. In 1816 appeared figures and descriptions of Terebratula plicatilis and T. octoplicata, in 1821 those of T. obliqua and in 1826 those of T. mantelliana. The T. pisum of J. de C. Sowerby from Hamsey was stated by Davidson (p. 35, 1855) to be a synonym for T. martini Mantell, 1822, although d'Orbigny (1847, pp. 38-39) compared it with his own species Rhynchonella graciosa, at the same time admitting differences between the two. Terebratula rostrata J. de C. Sowerby was stated by Davidson (1851, Cretaceous and Eocene Brachiopoda, p. 89) to be not of Cretaceous age.

Mantell in 1822 described the following species: T. sulcata, T. martini, and T. subplicata. T. sulcata, being preoccupied, was later called T. mantelliana by J. de C. Sowerby. T. subplicata was stated by Davidson to be (p. 79, 1855) a synonym for T. limbata Schlotheim 1813.

d'Orbigny in 1847 figured and described twelve species of Rhynchonella from the Cenomanian, Turonian and Senonian of France, two of which, R. graciosa and R. cuvieri are common in the English Chalk.

Davidson's monograph (1852-55) included figures and descriptions of the British species of Rhynchonella recognised at that time. One new variety, R. plicatilis var. woodwardi was described.

Quenstedt (1871), in dealing with the fossil Brachiopoda of Germany, included three Rhynchonellid specimens from beds between the Gault and Chalk at Chardstock, which he called Terabretula weistii.

In 1881, Etheridge figured and described a form from the Chalk Rock near Cambridge and named it Rhynchonella readensis.

Little has been published concerning the internal structure of Chalk Rhynchonellids apart from the work of Fage, who in 1935 investigated the Rhynchonellids of the Upper Cretaceous of the Charentes in the Arnaud collection, and divided the eleven species recognised into two groups. The first group, of the type Rhynchonella vespertilio (Brocchi), comprised five species with symmetrical internal and external structure; the second group, of the type R. difformis (Lamarck), consisted of six species with asymmetrical structure. Figures are given of the internal structure of the two types. In R. vespertilio there are two simple crura of radulifer type, a septum and septalium. In R. difformis the crura are similar but asymmetrical, the septum is weak and there is no septalium. Varieties occur within each group, but there are no passage forms between the two groups. Fage concluded that, except for four cases cited in the paper, the Rhynchonellids cannot be considered as zone fossils.

3. MORPHOLOGY.

Lang (1929) showed that form in fossils might be influenced by various phenomena such as the pull of gravity or conditions of life on the sea-floor. In a group like the Rhynchonellids it seems that similar conditions in the environment would give rise to the same kind of variation in each species. Lang, in dealing with 'form specific' (p. 437), maintained that under similar environmental conditions, two most closely allied species will yet retain a rigid specificity of form. Specific form also applies to the lineage and lineages are often characterised by structural modifications of no conceivable value, the terms of the lineage being determined by the nature of the organism, rather than by the environment. Such modifications are obviously of great taxonomic value when dealing with lineages.

Morphology

Muir-Wood (1934, 1936) has described the morphology of various types of Mesozoic Brachiopoda and the terminology which is generally used in describing these forms. The same terminology has been used in the present work and it is not proposed to reproduce the definitions given here. It is, however, necessary to make a number of supplementary remarks.

In most Rhynchonellids, the anterior part of the pedicle valve is sufficiently depressed to form a concave surface or sinus, but in some species of Platyrhynchia (e.g. P. cuvieri) the depression is only sufficient to form an anterior flattening of the surface. In this case the term "sinus" has not been used. A similar condition was noticed by Muir-Wood in Kallirhynchia, K. lauta for instance having a pedicle valve medianly flattened anteriorly, the median sinus being rarely developed. In such cases the corresponding median fold in the brachial valve is very slightly defined.

In ^{most} ~~several~~ species of Platyrhynchia the linguiform extension is quite small and is bounded by a gentle flexure of the anterior commissure forming an arc; it is then described as arcuate ^(pl. i, fig. 13c). In species of Cretirhynchia (e.g. C. plicatilis) the linguiform extension is terminated by a straight edge and bounded laterally by two straight edges which, if continued in the anterior direction, would eventually meet; this type is described as trapezoidal ^(pl. ii, fig. 6c).

In Platyrhynchia there are two types of anterior contour, that is the contour of the shell seen from the anterior direction, which are noteworthy. In the case of the oval or elliptical contour ^(pl. ii, fig. 2c) there is no sudden change of direction where it intersects the lateral commissure. The lenticular contour, on the other hand, is angular where it intersects the lateral commissure ^(pl. i, fig. 6c).

Variations were noticed in the umbonal slopes in Chalk Rhynchonellids. In Cretirhynchia cuneiformis the umbonal slopes are long and straight. In other

forms they are curved and may be concave or convex.

In some species (e.g. Cretirhynchia plicatilis, Platyrhynchia pulchra), the hinge or cardinal margin is notched and the surface of the brachial valve is slightly concave on either side of the umbo. This is due to accelerated growth along the lateral commissure and is rather characteristic of these species (pl. i, fig. 1a).

In the Chalk species studied, the umbo is usually erect or suberect. No incurved forms have been noticed. In many species the extremity of the umbo is sharply pointed.

Although the number of costae is more characteristic of the species, it was found that in Platyrhynchia there are usually between 15 and 46 costae, and in most cases the number lies between 18 and 32. In Cretirhynchia, however, there are usually more than 40 costae. It was also found that, in general, within the genus, the number of costae shows progressive change according to the stratigraphical horizon.

During growth of the shell, the costae are at first depressed, but may later become elevated. They are at first rounded, but may later become sub-rounded, sub-angular or angular. They may increase in number by dichotomy (e.g. Leucosella), or decrease in number by fusion (e.g. Cretirhynchia). The intervening sulci may be wide or narrow, shallow or deep, and may become angular.

The internal structure of the Chalk Rhynchonellids has been studied by means of serial sections and by removal of the matrix when it is sufficiently soft for the purpose. Various techniques have been described by Mair-Wood, Wisniewski and other authors. Burning the test, which is of advantage in the case of Jurassic forms, is unnecessary with Chalk species. Muscle impressions or casts are not seen very clearly in Chalk specimens.

The dental lamellae appear in transverse sections as two more or less parallel lines of varying thickness extending from the hinge teeth to the inner surface of the pedicle valve. The lamellae appear on casts as ^{inwards} slits or as straight lines which are white in the case of burnt specimens. Buckman describes them as seen when the pedicle valve is facing the eye, with the dorsal away (i.e. the ventral view). He states (1917, p. 19) that the trend of evolution is from short, parallel and approximate to long, divergent and distant, with a possible return to obsolete. Kothpletz (1886), quoting Kocshinsky throws doubt on the ^{taxonomic} value of the dental lamellae and states that they may disappear during the evolution of a group. According to Mair-Wood, the dental lamellae diverge from the umbo at an angle more or less constant for the species.

The median septum in the brachial valve may, according to Kothpletz, be absorbed during growth of the shell.

Rothpletz (1886) described three types of crura, radulifer, falcifer and septifer. The radulifer type he described as being like a radula or scraper. Wisniewska described these crura as narrow, ventrally recurved crura, slightly enlarged at the extremity. They occur in Cyclothyris McCoy, Rhynchonella Fischer de Waldheim (sensu stricto), and Septaliphoria Leidehold.

The falcifer crura of Rothpletz have the form of broad, pointed septa, nearly parallel to the plane of symmetry of the shell and are crescent or sickle-shaped (when seen in transverse section) ^(pl. iii, fig. 3; text-fig. 2). Wisniewska referred to them as crura with large suspended crural plates. They occur in Lacunoseella Wisniewska.

The radulifer crura are easily broken, leaving only the crural bases. The falcifer crura in hollow Chalk Rhynchonellid specimens are usually replaced by two small calcite crystals.

The septifer crura of Rothpletz touch (the inner surface of) the dorsal valve, and have the appearance of projecting septa. According to Wisniewska, they are short crura, supported on long crural plates meeting the valve. They are found in Septocrurella Wisniewska.

Wisniewska described crura with expanded hammer-shaped bases and short suspended plates and called them arcuifer crura. They are found in Montiolarella Wisniewska.

The calcarifer crura described by Muir-Wood (1936, p. 14), consist of two flattened, curved, posteriorly concave laminae which project from the hinge-plate into the cavity of the valve. These laminae each unite with a second lamina which appears to be suspended from it and projects dorsally like a spur. A ventral extension of the second lamina terminates in a hook-shaped process, the apex of which is directed medianly. These crura occur in Kellichynchia Suckman and Rhynchonelloidella Muir-Wood.

4. PREVIOUS WORK ON SUBDIVISION OF THE GENUS RHYNCHONELLA.

[A considerable amount of work has been done by Hall and Clarke and Keller on the subdivision of Palaeozoic Rhynchonellids, based on differences in internal structure, but it is not proposed to discuss that work here.

Davidson (1853, pp. 41-50) has summarised the earlier classifications of the Brachiopoda, although his reproduction of Phillips's table (p. 45) was inaccurate.]

The early species of Rhynchonellids were included under the name Terebratula Llywd, 1696. The name Rhynchonella was used by Fischer de Waldheim first in 1809, and again in 1825, but was not commonly adopted by other authors until 1847, when d'Orbigny assigned to the genus certain of the forms he was describing.

Phillips in 1841 made use of the following Brachiopod subdivisions:-

Cyclothyridae (perforation not reaching the hinge-line).

Epithyris (beak truncate, perforate).

Hypothyris (beak acute, the perforation below it).

Hypothyris was invalid, having been used previously.

M'Coy in 1844 (p. 150) divided the family Terebratulidae into five genera, Deltthyridaea M'Coy, Terebratula (restr.), Cyclothyris M'Coy, Atrypa (restr.), and Seminula. Cyclothyris M'Coy was stated to consist of those curious species in which the deltidium completely encircles the foramen. M'Coy did not name a genotype but gave a line drawing of an unnamed species (fig. 1, (p. 150) in illustration of the genus. Davidson (1853, p. 93) and Buckman (1906, p.) both considered that this figure represented Rhynchonella latissima Sowerby 1825.

D'Orbigny in 1847 made use of the name Rhynchonella Fischer de Waldheim in describing the French Cretaceous Brachiopoda. He was followed by the majority of later authors including Davidson who used the name in his monograph, the first part of which appeared in 1851. Quenstedt, however, in 1871 continued to include under Terebratula, T. alata and other Rhynchonellid forms.

By 1852, McCoy had abandoned the name Cyclothyris, and referred to the families Terebratulidae and Rhynchonellidae. D'Orbigny (1847, p.13) and Davidson (1853, p.93) both included Cyclothyris as a synonym for Rhynchonella.

Rothpletz (1886) in dealing with the systematic arrangement of the Brachiopoda, with special reference to Terebratula and Rhynchonella, quoted Quenstedt's subdivision of the genus Rhynchonella based on external form, which was as follows:

1. Highly protruding beaks. (= Acuta-Sippe).
2. Coarsely-folded smooth shells. (= Triplicosa-Sippe).
3. Bifurcating striated shells. (= Rimosa-Sippe).
4. Tube-bearing round-ribbed. (= Spinosen-Sippe).
5. Roof-ribbed forms. (= Costaten-Sippe).

Rothpletz studied the internal structure of Rhynchonellids by the decalcification of silicified specimens and sections of calcified specimens. He described four types of inner structure:

1. Radulifer. Inner structures usually consisting of two dental lamellae in the large valve, a median septum in the small valve, two united hinge-plates at the apex of the small valve and two small narrow crura curved towards the large valve, with barbed hooks at their lower end.

2. *Falciferas*. In otherwise similar structures, the crura less frequently have the form of broad pointed septa which are approximately parallel to the plane of symmetry of the shell and possess a sickle-shaped form.

3. *Septiferas*. Such crura may extend until they touch the inner surface of the small valve and become united with it, thus appearing as septa projecting from the inner surface of the valve.

4. Importance of the median ^{septum} has been lost, or it may be completely missing.

Rothpletz thus laid the foundations of a classification of the genus Rhynchonella based on internal structure. He made little further use of it, however, and no serious attention appears to have been paid to it until Wisniewska's work. Rothpletz was unable to make full use of his classification owing to the fact that he had not investigated the internal structure of all the species with which he was dealing. Buckman, who referred to Rothpletz's work in 1917, appears to have considered it a disadvantage that "ten clans have the same type of process", and thought that the preparation of serial sections would prove a laborious task. This is true of course, but once genera have been established by means of serial sections, it is usually possible to recognise them by ^{external} characters alone.

Rothpletz, in the same work, subdivided Rhynchonella into seven groups based on ornamentation:-- 1. *Inversae*, 2. *Laeven*, 3. *Semicostaten*, 4. *Costaten*, 5. *Striaten*, 6. *Rimosen*, 7. *Spinosa*. The seven groups were divided into 34 Sippen, the internal structure of 15 of which were investigated.

Buckman, in his paper on Brachiopod nomenclature, published in 1906, wrote "further division of the Mesozoic Rhynchonellids is imperative, if only for the sake of classificatory convenience; for the present genus is unwieldy, and therefore very troublesome for any systematic arrangement." In the same paper he stated (p.325), "it will be more correct at present to turn over to Cyclothyris the bulk of the Mesozoic Rhynchonellidae... all those which are multiplicate and hypothyrid; leaving in true Rhynchonella only the species which are pauciplicate and hypothyrid, congruous with R. loxia -- such series as the R. acuta group."

Examination of the Chalk Rhynchonellids has shown that the multiplicate forms include several types with internal structures which are fundamentally different. To assign all of these to Cyclothyris would obviously be incorrect. However, any classification of the Cretaceous Rhynchonellids will have to take into consideration the genus Cyclothyris, and to do this it is desirable to follow Davidson and Buckman and adopt R. latissima Sowerby as the type.

In 1917 Buckman wrote (p.27), "it is not too much to say that all species of Rhynchonellidae will have to be restudied and refigured before correct conclusions can be drawn concerning them", and (p. 235), "brachiopod identifications recorded by authors are almost useless."

In his 1917 paper, Buckman named and described several new genera of Jurassic Rhynchonellidae partly based on internal characters such as muscle impressions, dental lamellae and median septum, revealed wholly or partly by burning and removal of the shell from the internal cast. The work of Muir-Wood and Wisniewska has shown that to give reliable diagnoses, it is necessary to take into consideration the crura and other features revealed by sections. It is therefore impossible at present to make any satisfactory comparison between Cretaceous forms and Buckman's genera with the exception of those which

have been re-investigated by Muir-Wood and of which amended diagnoses have been given.

In the introductory part of his 1917 paper, Buckman gave ^(p.14) a brief diagnosis of the genus Cyclothyris and referred to the features revealed by burning. In the descriptive part of the paper, he included one Cretaceous species, Stolmorhynchia sulcata (Parkinson) from what he called the Aptian of Cambridge. The name is however a nomen nudum and pre-occupied.

Stolmorhynchia will be referred to later ^(p.24) in dealing with the Chalk Rhynchonellidae. Buckman's generic definition is as follows:-

Hypothyrid (beak short, suberect, foramen elliptical, deltidial plates small, disjunct (conjunct in lacunosa series). Often irregularilobate; crassiplicate, subpauciplicate. Dental plates short approximate, more or less buried in posterior shell thickening; dorsal septum ill-developed, muscle scars small, prominent, umbonal, appear like small, raised lumps in cast.

As distinctive features Buckman cites the irregularity of shape, umbonal position of the small, rather deep-set muscles, and feeble development of the dorsal septum. The rather fine-channelled vascular system also appears to be peculiar.

Serial sections have been made of ~~the~~ specimens of Stolmorhynchia stolidota, the genotype, from the Inferior Colite (Humphriesianum zone) of Louse Hill, Sherborne, Dorset, which demonstrate that the crura are of the falcifer type. Buckman's method of examining the inside of the shell by burning shows the extension of the dorsal septum and dental lamellae along the inner surface of the shell, but does not show their extension into the interior. Transverse sections show that for some distance the lamellae are continuous from the hinge plate to the inner surface of the shell. Buckman stated that the dorsal

septum is ill-developed; transverse sections of S. stolidota show that there is no dorsal septum extending into the interior of the shell. Wisniewska (p.31) referred to the fact that Buckman had assigned H. arolica Oppel, ~~to Stolidota~~ ^{Wisniewska} ~~the~~ the genotype of Lacunosella, to Stolmorhynchia, and pointed out that the latter has a dorsal septum, basing this statement on Buckman's fig. 12 on plate 13. It will be seen later, in discussing Lacunosella, that there is considerable similarity between the two genera, although there is no dorsal septum in Lacunosella.

Leidhold in 1920 (p. 352) remarked that Buckman's description of Cyclothyr
thyris was insufficient and defined the genus with reference to a figure
 given by Schloenbach in 1867 (pl. 23, fig. 2) of the interior of a Rhynchonellid
 which the latter called T. latissima Sow., a fine-ribbed variety of B. dimidiata
 Sow. This specimen, however, was from the Lower Cenomanian of Essen, and is
 obviously a younger species than Cyclothyr
thyris latissima.

Leidhold also described three new Rhynchonellid genera, Septaliphoria,
Blochmanella, and Thurmanella. Septaliphoria and Blochmanella are character-
 ized by the possession of a septum and septalium; in Blochmanella, the septum
 is strong and longer than in Septaliphoria; in Thurmanella, the crura are
 provided with a descending branch, and may correspond ^{to} ~~with~~ the calcarifer crura
 of Muir-Wood.

Leidhold proposed in 1922 to make Rhynchonella loxia Fischer de Waldheim
 the type of a new genus Eurhynchonella, retaining the name Rhynchonella for the
 multiply forms. This step, however, would not be in accordance with the
 rules of nomenclature.

Wisniewska in 1932 published a monograph on the Upper Jurassic Rhynchonellidae of Poland, in which reference was made to the external features and internal structure of Rhynchonella Fischer de Waldheim, Cyclothyris McCoy, Septaliphoria Leidhold, and to Buckman's genera, and a description was given of three new genera, Lacunosella, Monticlarella and Septocrurella. Various internal features such as the septum, the septalium, and four types of crura were described. Buckman's classification based on external characters and the features revealed by burning was criticised.

Wisniewska (p. 9) was able to examine specimens of Rhynchonella lexia Fischer de Waldheim, the genotype of Rhynchonella, from the Upper Jurassic of Moscow, and the following details of the internal structure and external characters were made out:— Hinge-plate divided; septum and septalium present; narrow recurved crura (radulifer type). Dental lamellae vertical, not adhering to lateral walls. Shells small, pyramidal with narrow well-marked sinus and carina; few costae; test radially striated completely or only at summit; ventral beak pointed, bordered with narrow pseudo-area. It is evident, from Wisniewska's description of Rhynchonella, that no examples of this genus sensu stricto have as yet been found in the English Chalk.

(text-fig. 1)

Wisniewska assumed the presence of a median septum in Cyclothyris, based on Leidhold's description of a figure given by Schloenbach of a Cenomanian Rhynchonellid.

In the genus Monticlarella Wisniewska, the hinge-plate is undivided, reduced, crura with extended bases, provided with short suspended plates at the ends (arcuifer type); septum faint or absent. Dental lamellae thin. They are small shells, with pointed ventral umboc; pseudo-area well marked; test radially striated.

In Septocurella Wisniewska the hinge-plate is divided; there is no septum; crura short, supported on long crural plates resting on base of valve (septifer type). Vertical dental lamellae. Adult shell norelliform; dorsal sinus and ventral fold. Few costae. Poorly marked pseudo-area.

The following are the chief characters of Lacunocella Wisniewska (genotype Rhynchonella arolica Oppel):- Hinge-plate divided; short, wide crura, very feebly curved ventrally, each crus with a crural plate suspended on all its length with the exception of the apical part where it meets the end of the valve (falcifer type). Dental fossula long, transversely crenulated. No septum, no septalium. Muscular and genital impressions form an oval or rounded field, extending about one third of the valve. The adductors separated in the middle by a bulge. In the ventral valve, large foramen; pedicle collar divided or forming narrow tube; large thick teeth, transversely crenulated. No distinct pseudo-area; folding nearly always dichotomous. Wisniewska divided the species into two groups based on external characters.

There is considerable similarity between Lacunocella and Stolmerhynchia as shown by the existence of falcifer crura and the absence or feeble development of the septum in the two genera. Buckman and Wisniewska were apparently unaware of the presence of the falcifer type of crura in Stolmerhynchia. Wisniewska remarked that Rhynchonella arolica had been assigned by Buckman to the genus Stolmerhynchia, but concluded from Buckman's fig. 12 on pl. xiii that a dorsal septum is present in that genus, whereas in Rhynchonella arolica there is no septum.

Muir-Wood (1934) described the internal features found in a number of genera of Jurassic Brachiopoda, including one Rhynchonellid, Kallirhynchia S. S. Buckman. In this genus the median septum is short, low, only supporting hinge-plates posteriorly; crura are long, curved, in adult slender laminae, terminating ventrally in a hook-shaped process (calcarifer type). Dorsal lamellae subdivergent; teeth terminally flabellate; pedicle collar developed.

In 1936 Muir-Wood gave further descriptions of the features present in Mesozoic Brachiopoda. The internal structure of Rhynchonelloidea Buckman and Rhynchonelloidella Muir-Wood was also described. In Rhynchonelloidea the median septum supports the hinge-plates and divides the cavity of the brachial valve into two parts posteriorly. In Rhynchonelloidella the median septum is low and only united with the septalial plates in the earliest growth stages. Calcarifer crura. The umbo is shorter, more massive and obtuse than in Kallirhynchia which has a long tapering umbo.

Muir-Wood in 1939 mentioned the following internal characters present in Parvirhynchia S. S. Buckman:- Dorsal septum low, not supporting hinge-plates in umbonal region. Hinge-plates not fused posteriorly, inclined dorsally at a low angle to the horizontal, scarcely differentiated from inner socket-ridges. Septalium and cardinal process absent. Crural bases given off ventrally. Crura calcarifer. Pedicle-collar not developed.

Chiplonker (1938) described Malwirhynchia with calcarifer crura and a weak median septum.

It is now necessary to return to the consideration of Cyclothyris.

"
McCoy's description was brief; he merely referred to "these curious species in which the deltidium completely encircles the foramen." Davidson (1853, p. 93) and Buckman (1906, p. 325) have interpreted his figure as Terebratula latissima J. Sowerby. Sowerby (1825, vol. v, p. 165) ^{pl. dii, fig. 1} described his species under the name of Terebratula lata, but in 1829, in the index to vol. vi, p. 245 he changed the name to T. latissima, lata being a homonym, previously used for a Terebratulid from the Drift. There are three specimens on the tablet in the Sowerby Collection, from Devises Canal, from near Sidmouth and from Farringdon (Berkshire). In the index to vol. vi, p. 245, Sowerby gave the horizon as "U. G. S.", but the figured specimen ^(pl. v, figs. 2a-c) has the usual ochreous staining of the Aptian sand at Farringdon. For some time, however, there was some confusion as to the age of the two greensands, and several of the Rhynchonellids from the Upper Greensand were figured by Davidson as Rhynchonella latissima, although he afterwards rectified his mistake and renamed them (1874, vol. iv, Suppl. Cret. Brach.)

Buckman (1917, p. 14) defined Cyclothyris as "hypothyrid, foramen tabular; multiplicate; dental plates short, divergent; dorsal septum absent or very feeble; (anterior dorsal muscle-scars broad-spreading)." The muscle impressions are not easily seen in the Farringdon specimens and Buckman's observation regarding them was based on a Rhynchonellid which he called

Brocchi sp.

H. aff. vesmertilis ⁿ from the Senonian of Saintes (Charente Inf.), given him by Prof. J. Selech.

Leidhold (1920, p. 352) gave an erroneous diagnosis of Cyclothyris, based on a figure which Seleenbach gave in 1867 (pl. xxiii, fig. 8) of a Rhynchonellid he called Terebratula latissima, fine-ribbed variety of Rhynchonella dimidiata Sow. sp. from the Cenomanian greensand of Essen. This form is of much later age than Cyclothyris latissima (J. Sowerby) from the Aptian of Farrington. Leidhold was in error when he referred to a strong dorsal median septum in Cyclothyris; the septum in this genus being absent or very feeble, as stated by Buckman (1917, p. 14).

Emended diagnosis: shell biconvex; brachial valve moderately convex, medianly flattened, with slight but broad fold near the anterior margin; pedicle valve less convex, with anterior flattening or broad shallow sinus; linguiform extension short, broad; hypothyrid, beak erect; foramen large, circular to elliptical; deltidial plates conjunct; beak-ridges fairly distinct; multiplicate, costae fine near umbo, becoming sub-rounded to sub-angular towards the commissure; a few concentric growth-lines. Dental lamellae short, divergent; dorsal septum absent or feeble; septalium absent; cardinal process absent; crura radulifer; muscle-scars indistinct (?wide-spreading).

Genus PLATYRHYNCHIA gen. nov.Genotype: Platyrhynchia intermedia sp. nov.

Shell biconvex, pedicle valve flattened anteriorly or with shallow sinus, brachial valve with barely perceptible or slight median fold.

Hypothyrid, umbo short, suberect to erect. Beak-ridges absent or faint. Deltoidal plates conjunct,

Shell nearly smooth umbonally, costate on remainder of shell. Concentric ornament of very fine closely-set growth-lines with occasional laminae.

Dental lamellae short, divergent.

Dorsal septum absent; septalium absent. Cardinal process absent.

Crura short, with suspended crural plates (falcifer crura). (Pl. iii, fig. 3)

Muscle scars small, prominent, umbonal.

P. compta sp. nov.

Chalk species.-- P. bella sp. nov.; P. cuvieri (d'Orbigny); P. demissa sp. nov.; P. disparua sp. nov.; P. extensa sp. nov.; P. granum sp. nov.; P. heberti sp. nov.; P. intermedia sp. nov.; P. mantelliana (J. de Sowerby); P. multicostata sp. nov.; P. mammilae sp. nov.; P. parva sp. nov.; P. pisiformis sp. nov.; P. praedisparua sp. nov.; P. pulchra sp. nov.; P. reedensis (Etheridge); P. tringensis sp. nov.; P. wiesti (Quenstedt).

Range.-- Lower, Middle and Upper Chalk.

Remarks.-- Platyrhynchia resembles the Jurassic genera Lacunosella Wisniewska and Stolmorhynchia Buckman in the possession of falcifer crura and in the absence

of a median septum in the brachial valve. It differs from these genera in being generally smaller, more nearly circular and in having a shorter umbo. Dichotomous branching of the costae which is typical of Lacunoseella rarely occurs in Platyrrhynchia. Stolmerhynchia stolidota is crassiplicate, subpauciplicate. Small, prominent, umbonal muscle-scars, appearing like small raised bumps in the cast are typical of both Platyrrhynchia and Stolmerhynchia.

Internally, Platyrrhynchia differs from Rhynchonella and Cyclothyris in having falcifer crura and in addition, from the ~~latter~~^{former}, in not possessing a median septum in the brachial valve. Externally, it differs from the former in having a smaller fold, shallower sinus and no radial striae; from the latter in having fewer costae and no beak-ridges.

Cretirhynchia gen. nov. differs from Platyrrhynchia in having radulifer crura and a low median septum, and externally in being wider and having beaks well-developed beak-ridges, and more numerous costae which are at first more depressed and later become reduced in number by fusion and angular along the anterior commissure.

In Capillirhynchia gen. nov. there is a well-marked median septum in the brachial valve; that genus also differs in its relatively greater width, its small umbo and more numerous capillate costae.

Externally, Platyrrhynchia is characterized by its outline which is usually circular or modifications of circular, that is sub-pentagonal or oval. It is seldom markedly angular. The linguiform extension is usually small and arcuate. The costae, between 15 and 46, in most species between 18 and 32; they are rounded, but may become sub-rounded to sub-angular near the commissure; they do not become reduced in number by fusion near the commissure. A tendency to asymmetry is common in some species in which the linguiform extension may be

per-laevo-plicate or the opposite. A few broad forms (P. extensa, P. discansa) occur which have in the past been confused with species now assigned to Cretirhynchia (C. plicatilis).

Platyrhynchia is a variable species genus; forms which are intermediate in character between the various species are common. Within the genus, the number of costae is usually fairly characteristic of the stratigraphic horizon. Thus in the Subglobosus zone, the number increases from about 18 at the base of the zone to about 28 at the top. P. multicostrata with 40 costae is an exceptional development. In the Cuvieri zone the number is usually between 28 and 32. In the higher zones the number tends to decrease. In the Lata zone there are about 24, in the Planus zone about 20, and in the succeeding zones about 18. At the top of the Varians zone and to a less extent in the Cor-anguinum zone, the costae become sub-angular near the anterior commissure.

In view of the numerous forms with intermediate characters, it is not proposed at present to subdivide the genus into subgenera. Depressed forms occur at several horizons but they are not necessarily closely related.

Jukes-Browne (1896, p.147) commented on the resemblance between certain species now included in the genus Platyrhynchia. He believed the specimens named as cuvieri and mantelliana to be extreme varieties of one species which might be called Rhynchonella wiestii and regarded as the ancestor of Rhynchonella cuvieri and R. reedensis Etheridge which occurs still higher in the zone of Holaster planus.

Frič (1889, p.89) and Scopin (1913, pl. xiv, figs.5 and 6) were wrong in regarding R. cuvieri and as a variety of R. plicatilis, since it is evident from the internal structure that these two species belong to different genera.

PLATYRHYNCHIA MANTELLIANA (J. de C. Sowerby).

(Pl. iii, figs. 1a-c).

1826. Terebratula mantelliana J. de C. Sowerby. Mineral Conchology of Great Britain. vol. vi. p. 72, pl. 537, fig. 51. pl. xv, fig 26.

1838. Terebratula mantelliana Sow. De Buch. Mem. Soc. géol. Fr. iii, p. 154, 1.

Non 1847. Rhynchonella mantelliana D'Orbigny. Paléontologie Française. Terrains Cretacés. Vol. iv, p. 40, pl. ccccxcv, figs. 1-5. xvii, fig. 17.

Non 1850. Terebratula mantelliana Sow. Seinitz, H.B. Char. Kreide, 2 Ausg. pl. 1.

1855. Rhynchonella mantelliana J. de C. Sowerby. Davidson, F. British Cretaceous Brachiopoda, pp. 87-88, pl. xii, figs. 20-21 (non 22, 23).

Non 1871. Terebratula mantelliana Quenstedt, F.A. Petr. Deutschl. I. ii. Brach. pl. xli, fig. 77.

Platyrhynchia, subpentagonal in outline, anterior contour oval, about 12mm. long, 13mm. wide and 9 mm. thick.

Brachial valve moderately convex, with very slight but broad fold on anterior margin. Pedicle valve with broad sinus on anterior part. Linguiform extension broad, U-shaped.

Umbo erect, with pointed extremity.

Ornament of about 18 sub-angular costae, 4 on fold and 3 in sinus; intervening sulci fairly deep. Concentric ornament of fine striae with a few ⁱⁿ laminae.

Apical angle 96°.

Type-specimen. Holotype from the Lower Chalk of Hamsey, Sussex, preserved in the British Museum (Natural History) (B. 61490).

Dimensions of holotype.- Maximum length 12 mm.; maximum width 13.2 mm.; maximum thickness 9.5 mm.; of l; l.1; 0.79.

Material and localities.- Specimens from the Lower Chalk of England.

Bedfordshire: Aston. Cambridgeshire: Burwell; Fulbourn. Kent: Burham, Dover. Surrey: Reigate. Sussex: Hamsey. (B.M. (N.H.) and G.S.M.)

Description.- The shape is subpentagonal with the anterior margin slightly concave. The anterior contour is oval, ^{not lenticular} ~~and~~ (the junction of the valves seen from this aspect is not angular).

The brachial valve is moderately convex with a broad but depressed fold on the anterior margin. The dorsal umbo is considerably infolded. The pedicle valve is thickest near the umbo; it then becomes medianly flattened at about 1/3 of its length; on the anterior third a broad sinus is developed. The linguiform extension is broad and its anterior margin straight; it forms ~~an~~ almost a right angle with the remainder of the valve.

The umbo is erect, with a pointed extremity. The foramen is circular to pear-shaped. Deltoidal plates are conjunct. Beak-ridges are fairly well marked.

On the brachial valve there are 18 costae, two of which are quite faint. On the pedicle valve there are 20 including two faint ones. The costae start at the apex and are depressed at first but later become subangular and elevated with flattened sides. There are four costae on the fold and three in sinus, with one on each flank. The costae on the flanks are asymmetric. The four lateral costae on each side of the valve bend outwards slightly in the lateral direction. There are fine concentric striae with a few lamⁱⁿellae.

Internal characters: *Falxifer* crura are present; there is no median septum.

mantelliana

Remarks.- According to Spath (1926, p. 425), the beds at Hamsey are of rhotomagense age, that is at the top of the Varians zone. F. parva, which occurs in the Totternhoe stone and lower beds of the Subglobosus zone, is smaller than F. mantelliana, more depressed, the costae are less angular and the sulci shallower. Related forms from lower horizons in the Genomanian are in course of investigation.

PLATYRHYNCHIA PARVA, n. sp.

(Pl. I, figs. 7a-c).

Platyrhynchia, circular to transversely ~~an~~ oval in outline, oval in contour, about 10 mm. long, 10.5 mm. wide, and ~~10~~^{7.0} mm. thick.

Brachial valve convex, with slight median fold on anterior part.

Pedicle valve less convex, with slight median sinus. Anterior commissure deflected towards brachial valve, forming small arcuate linguiform extension.

Umbo suberect to erect.

Ornament of about 18 sub-angular or sub-rounded costae, 5 on fold and 4 in sinus, with fairly deep intervening sulci. Concentric striae with occasional lamellae^{inae}.

Apical angle 106° .

Type-specimen.-- Holotype from the Cenomanian (base of Subglobosus zone), Cherry Hinton, Cambridgeshire, preserved in the Geol. Surv. Mus. (Δ 3662).

Dimensions of Holotype.-- Maximum length 9.7 mm.; maximum width 10.8 mm.; maximum thickness 7.2 mm.; or 1:1.1:0.74.

Material and localities.-- ^{About} 20 specimens from the Lower Chalk (Cenomanian) of England. Cambridgeshire: Cherry Hinton; Burwell; Fulbourn; Haslingfield. Hampshire: Burghclere Sta. Kent: Burham; Dover. Surrey: Reigate.

Description.-- The shell is small, circular to transversely oval in outline, oval in contour. The brachial valve is moderately convex, with a fairly broad but slight median fold near the anterior commissure. The pedicle valve is almost equally convex with a fairly broad median sinus which commences at about two-thirds of the distance between the umbo and the anterior margin. At its commencement, the sinus is quite shallow, but broadens and becomes

parva

deeper along the commissure. The costae along the flanks of the fold and sinus are slightly asymmetrical. The linguiform extension is arcuate and moderate in size.

The umbo is erect to suberect, moderate in size. The foramen is small, circular. Deltoidal plates are conjunct and slightly produced in short tubular extension. Beak-ridges are not developed.

There is a very restricted area on the umbonal region which is smooth. The costae are depressed for a distance, but become elevated on the anterior third to a half of the shell. Concentric striae are developed.

~~Internal characters. - similar to P. cuvieri.~~

Remarks.- This species differs from P. mantelliana in its smaller size, less angular costae, and ^{smaller} ~~less angular~~ linguiform extension, and shallower sinus.

PLATYRHYNCHIA WIESTII (Quenstedt, 1871). (Pl. i, figs. 9a-c).

1871. Terebratula wiestii Quenstedt, F.A. Petrefactenkunde Deutschlands I. Vol. 2, Brachiopoden. Pp. 166-7, pl. 41, figs. ~~53~~. 53 (non 52, 54).
1874. Rhynchonella wiestii. Davidson, T. Supplement to Cretaceous Brachiopoda. British Fossil Brachiopoda (Monogr. Palaeont. Soc.), vol. 4, p. 66, ^{pl. viii,} figs. 31a, b.
1896. Rhynchonella wiestii. Jukes-Browne, A.J. and Hill, W. Quart. Journ. Geol. Soc. vol. 52, pp. 99-177.

Platyrhynchia, circular in outline, oval in profile, oval in contour, about 18mm. long, 19 mm. wide, and 14 mm thick.

Brachial valve convex, with scarcely perceptible fold near anterior margin; pedicle valve convex, with slight median flattening near on anterior part.

Anterior commissure gently deflected towards brachial valve, giving rise to short arcuate linguiform extension.

Umbo small, erect.

Ornament of about 28 depressed, rounded costae, about 7 on fold. Fine concentric striae with occasional growth-lamellae.

Apical angle 92° .

Figured specimen.— From the Plenus zone, Hooken Cliff, Beer, Devon.

B.M. (BB 7110).

Dimensions of Figured ^{specimen (BB 7110)} ~~specimen~~— Maximum length 16.5 mm.; maximum width, 15.8 mm.; maximum thickness 11.9 mm.; or 1:0.96:0.72.

Material and localities.— Specimens from the Lower Chalk (Cenomanian) of England. Devon: Hooken Cliff; Beer Head; Chardstock.

Specimens preserved in the British Museum (Nat. Hist.) and Geological Survey Museum.

wiestii

Description.- The shell is almost circular in outline, oval in contour, and oval in profile with a slight angularity along the anterior commissure. The brachial valve is convex, with a scarcely perceptible ~~valve~~^{fold} near the anterior margin. The pedicel valve is less convex than the brachial valve and is slightly flattened near the anterior commissure; the linguiform extension is quite short, arcuate.

The umbo is small, erect, and the extremity is pointed. The foramen is small; the deltidial plates are conjunct and produced in a short tube around the foramen. Beak-ridges are not developed.

The shell is ornamented with about 26 wide depressed rounded costae, with shallow intervening sulci. The posterior part of the shell is smooth. Concentric striae are well developed and become wavy near the commissure. There are occasional thick growth ~~lamellae~~ⁱⁿ.

The shell is sometimes asymmetric (usually per-laevo-plicate).

Internal characters.- The dental lamellae are ill-developed or ~~is~~ absent.

The descending crural lamellae extend almost to the inner dorsal surface of the shell; they are comparatively thick.

Remarks.- Quenstedt in 1871, under the heading of Terebratula & alata, Valenciennes (in Lamarck, pl. 245, fig. 2), ^{figured} several Rhynchonellids from various localities including Chardstock (pl. 41, figs. 45-48), where, according to Wiest, beds between the Gault and Chalk were well exposed. Davidson (1855, p. 114), had previously given a table of the Lower Chalk and Upper Greensand formations on either side of the valley of the Kit, based on information supplied by Wiest. Davidson's section comprised the following beds:-

- I. Lower Chalk.
- II. Chalk Marl.
- III. Scaphites Bed.
- IV. Green Bed.
- V. Crustacean Stratum.
- VI. Nautilus laevigatus. layer.

According to Jukes-Browne (1903, p. 120), the quarries at Chardstock were in 1903 abandoned and overgrown. However, similar forms to those described by Quenstedt are obtainable from the Lower Chalk of the Devon Coast near Seaton.

Under the heading of local forms (of Terebratula alata), Quenstedt said (pp. 166-167) that local forms were innumerable and referred to a second form from Chardstock which might be called Terebratula wiestii (pl. xli, figs. 52-54) as it corresponded completely to no other.

The three forms depicted by Quenstedt obviously belong to the genus Rhynchonella, the chief characters supporting this view being the rounded shape, absence of beak-ridges, gently curved commissure, small arcuate linguiform extension, short rounded umbro and the number of costae.

Of the three forms depicted, the original of fig. 53 is selected as the lectotype, being apparently the most commonly occurring form in the beds exposed in South Devon. It is proposed to exclude the other two forms from consideration until further examination can be made of the stratigraphical distribution of the three forms.

Jukes-Browne in 1896 (p. 147), referring to the common occurrence of Rhynchonella wiestii in bed 13 of Meyer, overlying the zone of Aspidites mantelli in Devon, described the species as being variable, closely allied to Rhynchonella cuvieri, but with fewer and larger costae (average number 24-26). Some forms he said have as few as 18 costae, others as many as 30; the former resemble Rhynchonella mantelliana, the latter are indistinguishable from the broader varieties of Rhynchonella cuvieri.

Evidence both as to the stratigraphical distribution of R. wiestii and as to the age of the beds in which it occurs is unsatisfactory. The cliff sections in South Devon are often inaccessible and many of the specimens in collections are from fallen blocks on the beach. Also, as remarked by Spath (1926, p. 427), in the West of England, the mixture in the basal bed of fossils derived from different pre-existing zones of the Cenomanian in different localities makes correlation very difficult.

Meyer in 1874 (p. 388) suggested correlating his beds 10, 11, and 12 with beds IV, V, and VI of Wiest; he recorded R. wiestii from bed 12. Davidson (1874, p. 66), however, recorded this fossil from the Chloritic Marl (beds II and III of Wiest) at Chardstock. Jukes-Browne (1896, p. 147) said

the shells referred by Davidson to this species are very common in bed 13 (of Meyer), the sandy chalk which overlies the zone of Ammonites mantelli in Devon. In the table on p. 160 he recorded P. wiestii from beds B(=12) and C(=13).

Jukes-Browne (1903, p. 130) divided the Lower Chalk of the Devon coast into three beds A, B, and C; he included A and B in the zone of A. mantelli and correlated A with beds 10 and 11 of Meyer and B with bed 12 (except at the Hecken). C is glauconitic and contains derived and phosphatised fossils and there is a strong unconformity at its base. It passes up into the Middle Chalk and Jukes-Browne correlated it with the Flenus Maris and with Meyer's bed 13.

It is thus evident that further investigation of the stratigraphical distribution of P. wiestii and the forms related to it is desirable.

In addition to P. wiestii, other Rhynchonellids occur in the Cenomanian beds of South Devon, which are wide depressed forms, with a rather deep sinus, and a pronounced umbo, distinct beak-ridges, greater number of costae which are subangular on the flanks of the fold. Davidson possibly had these forms in mind when he referred (1874, p. 66) to the strongly marked beak-ridges in P. wiestii.

P. wiestii is medianly depressed and has fewer costae than P. cuvieri. The test is thick and the suspended crural plates are thicker and deeper than in P. cuvieri. The dental lamellae are frequently fused to the side of the shell. The costae are less well defined than in P. tringensis and P. de-rigera. The species is larger than P. mantelliana, and the costae are more numerous and not angular, and the sulci are shallower.

PLATYRHYNCHIA ~~PLATYRHYNCHIA~~ DEMISSA, sp. nov.

This species
is not
intended
for publication

Platyrrhynchia, sub-pentagonal in outline, oval to sub-circular in contour, about 13 mm. long, 14 mm. wide, and 10 mm. thick.

Brachial valve convex, with median fold on anterior part of valve. Pedicle valve convex, with faint and fairly broad sinus on anterior part. Anterior commissure deflected towards brachial valve, giving rise to moderately broad linguiform extension.

Umbo erect.

Ornament of about 24 rounded to subangular costae, about 7 on fold and 6 in sinus. Fine concentric striae are present.

Apical angle 88°

Type-specimen.-- ^{Two syn} ~~Two~~ type from the Subglobosus zone, 18 inches below the Plenus marls, Tring Hill, Buckinghamshire, preserved in the Geological Survey and Museum (Pe. 3805, Pe. 3807)

Dimensions of ^{syn} ~~two~~ types. Maximum length 13.8 mm.; maximum width 14.5 mm.; maximum thickness mm.; or 1 : 1.05: .

Material and localities.-- Seven specimens from the Upper Cenomanian (Upper Subglobosus zone) of England. Buckinghamshire:

Tring Hill (North side of road, 1 1/4 miles West of Tring).

Description.-- The brachial valve is of considerable convexity ~~and~~ except on each side of the umbo where it is rather less convex. There is a slight but broad, rather flat anterior fold. The pedicle valve is less convex and has a shallow median sinus. The linguiform extension is moderate in size. The umbo is erect, with a pointed extremity.

There are about 24 rounded to sub-rounded costae, asymmetrical and almost subangular on the flanks of the fold. They commence at the umbo and increase slightly in height towards the anterior commissure. There are about 7 on the fold. The intervening sulci are somewhat shallow. Fine concentric growth-lines are present.

Remarks.-- The costae are less angular than in P. muntelliana and less numerous than in P. cuvieri. The sulci are not as deep as in P. pisiformis, and the costae are less rounded. The dorsal umbo is more conspicuous than in P. winetii.

PLATYRHYNCHIA TRINGENSIS, sp. nov.

(Pl. i, figs. 8a-c).

Platyrrhynchia, circular to subpentagonal in outline, about 15mm. long, 15 mm. wide, and 9 mm. thick.

Brachial valve convex, with slight median fold on the anterior part of the valve.

Pedicle valve convex, with broad anterior flattening or faint sinus.

Anterior commissure deflected towards brachial valve, giving rise to short arcuate linguiform extension.

Umbo erect.

Ornament of about 26 rounded costae, about 8 on fold, and 7 in sinus, with shallow to moderately deep intervening sulci. Fine concentric striae.

Apical angle 104° .

Type-specimen.— Holotype from the Plenius zone, Tring, Buckinghamshire.

Dimensions of Holotype.— Maximum length 15.3 mm.; maximum width 16.6 mm.; maximum thickness 10.3 mm.; or 1; 1.09; 0.67.

Material and localities.— 5 Specimens from the Lower Chalk (Plenius zone) of England. Buckinghamshire: Tring Tring.

tringensis

Description.-- The shell is circular to sub-pentagonal. It is thickest near the umbo.

The brachial valve is convex, with a broad but slight sinus near the anterior margin. The pedicle valve is convex, with a broad flattening on the anterior half, developing into a faint sinus on the anterior margin. The linguiform extension is broad and short.

The umbo is fairly massive, erect, and ends in a sharp point directed in the dorsal direction. Beak-ridges are absent. The foramen is fairly small; The deltidial plates are conjunct and are produced in a labial or tubular extension.

The posterior part of the shell is smooth. The costae are rounded and moderately elevated; they become sub-angular along the flanks of the fold. The intervening sulci are shallow to moderately deep.

Concentric ornament consists of fine concentric striae with occasional growth lamellae.

Internal characters.--

Remarks.-- This form differs from P. multicostrata, ^{also from the Plenus zone,} in having fewer costae and in the absence of beak ridges; it is also smaller. It resembles P. pulchra but is larger and the costae differ from those of the latter species in being somewhat angular along the flanks of the median fold.

PLATYRHYNGHIA MULTICOSTATA, sp. nov.

(Pl. I, figs. 5a-c).

Platyrrhynchia, subpentagonal in outline, about 16 mm. long, 18 mm. wide, and 11 mm. thick.

Brachial valve convex, with slight median fold near the anterior margin of the valve.

Pedicle valve convex, with slight anterior median sinus.

Anterior commissure deflected towards brachial valve, giving rise to a broad arcuate linguiform extension.

Umbo erect.

Ornament of about 40 rounded costas, about 12 on fold, and 11 in sinus, with moderately deep intervening sulci. Fine concentric striae are also present.

Apical angle 106° .

Type-specimen.— Holotype from South of Littleington, Cambridgeshire.

G.S.M. (Δ 3143).

Dimensions of Holotype.— Maximum length 14.5 mm.; maximum width 16.5 mm.; maximum thickness 10.0 mm.; or 1: 1.14: 0.69.

Material and localities.— Specimens from the Lower Chalk (Subglobosus and Flenus zones), England. Surrey: Betchworth; Buckinghamshire: Butler's Cross; Bedfordshire: near Sundon church; Sussex: Boddington. Cambridgeshire: South of Littleington.

multicostata

Description.-- The width of the shell is slightly greater than the length. The shell is fairly thick in the centre, but rapidly thins towards the commissure so that the two valves meet at a fairly sharp angle (*lenticular contour*).

The brachial valve is convex; there is a very faint median sinus in the posterior part of the valve.

The pedicle valve is convex, with a rather broad sinus.

The linguiform extension is broad.

The umbo is moderate in size and erect; it ends in a sharp point directed in the dorsal direction. Beak ridges are present but are not well-marked. The foramen is relatively small; the deltidial plates are conjunct and produced in a labial extension.

The costae are narrow and rounded, becoming ~~six~~ sub-angular on the flanks of the median fold; they curve outwards in a lateral direction along the lateral margin, but become only slightly broader. The intervening sulci are moderately deep.

Very fine concentric ornament can be seen in places, but is best distinguished in decorticated specimens.

Internal characters.-- The vertical crural plates, as seen in transverse sections, extend for a relatively long distance in the dorsal direction, and nearly touch the interior surface of the brachial valve. In addition, the plates appear to be relatively thick.

Remarks.—This species is comparatively large and is confined to the Pliocene zone and the uppermost part of the subglobosus zone. It differs from Platyrhynchia trinacensis ~~from this zone~~ which also occurs in the Pliocene zone and from P. gavioli in having costae which are finer and more numerous. Concentric ornament is very well developed in this species and is especially well seen in decalcified specimens. This form is usually slightly wider than long. The above characters together with the faint beak-ridges and deep vertical spiral plates separate this species fairly distinctly from other members of the genus. Unfortunately, specimens from the Pliocene Marl are ^{usually} somewhat crushed, although the finer details are well preserved.

PLATYRHYNCHIA CUVIERI (D'Orbigny, 1847). (Pl. 1, figs. 13a-c).

1847. D'Orbigny, A.S. Paléontologie française. Terrains crétacés. Tome 4: Brachiopodes. P. 39, pl. 497, figs. 12-15.
1855. Davidson, T. Monograph of British Cretaceous Brachiopoda. Palaeont. Soc. pp. 88-89, pl. x, figs. 50-54.
- Non 1915. Seupin, H. Die Lowenberger Kreide und ihre Fauna. Palaeontographica, Sonderb. vi. pl. xiv, figs. 5, 6.

Platyrrhynchia, circular in outline, subcircular to oval in profile, oval in contour, 15-17mm. long, 15-17 mm. wide, 12-14mm. thick.

Brachial valve convex, with barely perceptible median fold near anterior margin of valve.

Pedicle valve convex, slightly flattened anteriorly but without pedicle sinus.

Anterior commissure gently waved, giving rise to short arcuate linguiform extension.

Umbo erect to suberect.
Ornament of 30-34 rounded costae, about 10 on fold.

Apical angle 90° - 98° .

Figured specimen.- From Middle Chalk (base of Cuvieri zone), Betchworth, Surrey.

Dimensions of figured specimen.- Maximum length, 15.6 mm, maximum width, 16.0 mm, maximum thickness, 12.0 mm., or 1: 1.03: 0.77.

Material and localities.- Numerous specimens from the Middle Chalk (Cuvieri zone) of England. Buckinghamshire: Tring Hill. Cambridgeshire: Gogmagog Hills. Devon: Seaton to Hooken beach. Hampshire: Chiles. Chilcomb, Winchester. Hertfordshire: Kitchen Heights. Kent: Burham; Dover. Oxfordshire: Watlington. Surrey: Betchworth; Reigate.

Description.- The shell is nearly spherical. The brachial valve is very convex, and a slight median fold is barely perceptible on the anterior margin. The pedicle valve is convex over its whole surface, with a slight median depression or flattening of the surface in the gerontic stage scarcely sufficient to form a sinus. The anterior commissure is deflected dorsally in a gentle rounded uniplica forming a short arcuate linguiform extension. The lateral commissure is not angular.

The umbo is very short but massive, erect to suberect. The foramen is small. There are no beak-ridges.

In the earliest growth stages the surface of the shell is nearly smooth. In later stages it is ornamented with 30 to 34 moderately elevated costae with shallow intervening sulci. The surface of the shell is ~~usually~~^{often} somewhat rough and concentric ornament ~~usually~~^{consequently} absent, although it is occasionally present along the commissure.

Internal characters; Falcifer crura are present; there is no median septum.

Rhynchonella cuvieri has in the past been considered an unsatisfactory zone fossil, probably due to the inclusion within the species of related forms occurring in higher horizons. ~~Jukes-Browne (38, p.) substituted Inoceramus as the zone fossil.~~ However, if we examine d'Orbigny's description, we find that he includes among the characters of the species, a length of 17 mm., ~~width/length ratio of 100%,~~ a width/length ratio of 100%, and a thickness/length ratio of 85%, and the possession of 32 to 34 equal obtuse costae. Forms having these characters occur at the base of the Cuvieri zone, and appear to be confined to a few feet above the Plenus marls.

It has been found that specimens of Platyrhynchia which fall within this restricted conception of R. cuvieri are also characterized by the absence of a distinct median sinus in the pedicle valve, the absence of concentric striae, and costae which are relatively coarse.

Unfortunately there are discrepancies between d'Orbigny's figures and his text. In the text, the proportion between ^{thickness} ~~width~~ and ^{width} ~~thickness~~ is given as 85% for R. cuvieri, whereas in fig. 15 on pl. cccxvii it is 66%. d'Orbigny mentions the thickness as a distinctive feature of R. cuvieri compared with R. missiana, but the proportion between thickness and width is approximately the same in the figures of these two species.

PLATYMYNCHIA EXTENSA, SP. NOV.

47.

(Pl. ii, figs. 5a-c).

PLATYMYNCHIA

Platyrynchia, transversely oval in outline, oval in anterior contour, about 15 mm. long, 17 mm. wide, and 11 mm. thick.

Brachial valve moderately convex, with slight median flattening, and with slight fold on anterior margin. Pedicle valve less convex, with fairly wide, asymmetric median sinus. Linguliform extension short, broad, asymmetric.

Umbo short, moderately thick, erect to suberect. Beak-ridges absent. Foramen small, circular. Deltoidal plates conjunct.

Ornament of about 30 narrow rounded costae, with fairly shallow intervening sulci. Concentric ornament of fine striae; lamellae are developed near the commissure.

Apical angle 105° .

Type-specimen.—Holotype from the Middle Chalk, cliff west of Branscombe Coastguard station, Devon, preserved in the Geological Survey and Museum (Rh 4683).

Dimensions of holotype.—Maximum length 15.3 mm.; maximum width 17.2 mm.; maximum thickness 11.2 mm.; or 1: 1.12: 0.73.

Material and localities.—Five specimens from the Middle Chalk of England. Devon: Cliff west of Branscombe Coastguard station; Beer Freestone Quarry (Cuvieri zone).

Description.—The brachial valve is slightly flattened in the middle from the umbo towards the anterior margin. This flattening gradually develops into one of the flanks of the broad but slight median fold, which appears

extensa

near the anterior margin, and is asymmetric. The pedicle valve is less convex than the brachial valve and is thickest near the umbo. A fairly wide asymmetric sinus is developed on the anterior two-thirds. The linguiform extension is about 9 mm. in width and about 4 mm. long. It is asymmetric and developed, together with the fold and sinus, to the right or left of the median line.

The umbo is short and moderately stout; the extremity is only slightly pointed. The deltidial plates are well developed and slightly produced around the foramen.

The costae are rather fine and appear at a short distance from the umbo; they are feeble at first but become moderately well developed on the anterior half of the shell. They bend outwards slightly along the lateral commissure.

The concentric ornament is fine and well developed; there are a few lamellae near the commissure.

Internal characters.— Not examined.

Remarks.—The greater width of this shell compared with the length and the asymmetric folding are both noteworthy features. This form has hitherto only been recorded from Devon.

It is distinguished from Platyrhynchia ovieri by the greater width, the asymmetric folding and the greater development of concentric ornament. It is larger than P. intermedia and the costae are not so fine, as in that species. It may be distinguished from Cretirhynchia plicatilis by its lack of angularity, shallower sinus, the absence of beak-ridges and its rounded costae. It is smaller but thicker than the Rhynchonella woodwardi Davidson (pl. 10, figs. 45 and 46) from Charing, Kent, and has more numerous costae.

PLATYRHYNCHIA PRAS-DISTANSA sp. nov.

49

Pl. i, figs. 6a- c.

Platyrrhynchia, circular to sub-pentagonal in outline, lenticular in anterior contour, about 14 mm. long, 15 mm. wide, and 8 mm. thick. Brachial valve moderately convex, with broad scarcely perceptible fold. Pedicle valve almost equally convex, with faint anterior sinus or median flattening. Linguiform extension short, broad.

Umbo erect to suberect.

Ornament of 30-32 rounded costae, with 8 on fold and 7 in sinus.

Concentric growth-lines.

Apical angle 110°.

Type-specimen. Holotype from the base of the Cuvieri zone, near Fairseat, Kent, preserved in the Geological Survey Museum (C.F. 40).

Dimensions of holotype.- Maximum length 14 mm.; maximum width 15.0 mm.; maximum thickness 8.6 mm.; or 1:1.07:0.61.

Material and locality.- Two specimens from the Chalk (?base of Cuvieri zone) of England. Kent: near Fairseat. Surrey: Betchworth.

Description.- The brachial valve is of moderate convexity; a faint median fold is barely perceptible along the anterior commissure. The pedicle valve is posteriorly convex, but is medianly flattened near the anterior margin; where a faint median sinus is developed.

The umbo is short, erect to suberect.

The shell is ornamented with 30 to 32 low rounded costae, with 8 on fold. Near the umbo it is nearly smooth. Concentric ornament is observable. In the young stage this produces the appearance of obscure cancellation where it crosses the costae: in the later stages, particularly towards the commissure,

praedispanea

the concentric ornament appears as definite laminae.

Remarks.-- This species can be distinguished from *F. cuvieri* chiefly by its being depressed and relatively shorter. The number of costae is the same. It differs from *F. dispanea* in having more numerous and narrower costae.

PLATYRHYNCHIA INTERMEDIA, sp. nov.

(Pl. i, figs. 3a-c, 12a-c; text-fig. 2).

Platyrhynchia, subpentagonal to transversely oval in outline, oval in contour, about 12 mm. long, 13 mm. wide, and $\frac{9.0}{8.5}$ mm. thick.

Brachial valve convex, with faint median fold near anterior margin of valve.

Pedicle valve convex, with slight median sinus.

Anterior commissure deflected towards brachial valve, giving rise to broad arcuate linguiform extension.

Umbo suberect to nearly straight.

Ornament of about 32 narrow rounded costae, about 8 on fold, and about 7 in sinus, with moderately wide intervening sulci.

Fine concentric striae with occasional lamellae, especially near the commissure.

Apical angle 106° .

Type-specimen.— Holotype from the Cuvieri zone, Burham, Kent, preserved in the Geol. Surv. Mus. (AT 2222c).

Dimensions of Holotype.— Maximum length 12.3 mm.; maximum width 13.8 mm.; maximum thickness 9.3 mm.; or 1:1.12:0.76.

Material and localities.— Numerous specimens from the Middle Chalk.

BUCKINGHAMSHIRE: $\frac{1}{2}$ mile North of Aston Hill (near Halton). HERTFORDSHIRE: Hitchin. KENT: Burham. SURREY: Betchworth; Reigate; Shore.

Description.- The width of the shell is slightly greater than the length. In early growth stages the shell is nearly smooth, and for two-thirds of the length the costae are not very pronounced.

The brachial valve is convex and has a faint, narrow, median depression or flattening, which starts near the umbo and continues to the anterior margin, where it is replaced by a broad but slight median fold.

The pedicle valve is convex and has a median sinus which commences about midway between the anterior posterior and anterior margins and gradually becomes broader in the anterior direction.

The anterior commissure is deflected towards the brachial valve in an arcuate uniplica.

The umbo is short, massive, suberect to nearly straight. The foramen is small; the deltidial plates are conjunct and are produced into a short tubular extension. Beak-ridges are not developed.

The shell is ornamented with about 32 narrow, rounded costae with fairly wide intervening sulci. Regular concentric ornament is developed and in places occurs as distinct lamellae, especially near the commissure.

Internal characters.- Falcifer crura; no median septum. (Text-fig. 2)

Dental lamellae short, divergent.

Dorsal septum absent; septalium absent; cardinal process absent.

Crura short, with suspended crural plates (falcifer crura).

Muscle scars small, prominent, umbonal.

Remarks.- This species differs from Platyrhynchia cuvieri in being smaller and less inflated. It is relatively shorter and the thickness ratio is less. It also differs in having a distinct median sinus in the pedicle valve and in having well-marked concentric ornament on both valves. The costae are finer than in P. cuvieri.

P. intermedia has more costae a greater number of costae than those members of the genus occurring at higher stratigraphical horizons. It differs from P. prae-dispana in being shorter, less depressed and in having a well-marked sinus in the pedicle valve.

PLATYRHYNCHIA COMPTA, sp. nov. (Pl. ii, figs. 1a-c).

Platyrhynchia, about 10 mm. long, 10 mm. wide and 8 mm. thick, circular in outline and oval to lenticular in anterior contour and lateral profile.

Brachial valve convex, without fold. Pedicle valve almost equally convex, with slight anterior flattening or very shallow sinus. Linguiform extension short, arcuate.

Umbo suberect. Ornament of about 30 rounded costae with shallow intervening sulci. Concentric ornament of san growth-lines, especially well seen in decorticated specimens. Apical angle, 95° .

Type-specimen.- Holotype from the Cuvieri zone, Branscombe and Berry Cliffs, Devon. (B 93679)6.

Dimensions of Holotype.- Maximum length 11.0 mm., maximum width 11.0 mm., maximum thickness 8.6 mm.; or 1:1.0 :0.78.

Material and localities.- Numerous specimens from the Middle Chalk of England. Devon: Beer Freestone quarry; Branscombe and Berry Cliffs; Cuvieri zone); Old quarry, Court Barn Hill, Beer; White Cliff to Hooken (Lata zone). Dorset: Lulworth Cove (Cuvieri zone).

Description.- The brachial valve is almost uniformly convex; there is no perceptible fold. The pedicle valve is almost equally convex, with a slight anterior said flattening which may develop into a shallow sinus. The umbo is moderate in size, sub-rect to erect. The foramen is moderate in size, pear-shaped. There are no beak-ridges. The umbonal area is nearly smooth; the costae commence at a short distance from the umbo; they are rounded and fairly narrow. The linguiform extension is often slightly asymmetric. There is concentric ornament of growth-lines; it is especially well seen in decorticated specimens, where the striae are extremely regular.

Remarks.- This species resembles P. cuvieri but is considerably smaller.

compta

It differs from other small forms in being more tumid and having more numerous costae. The very regular concentric striae seen in decorticated specimens is also characteristic. It is common in the Cuvieri zone of south-western England.

PLATYRHYNCHIA PULCHRA, sp. nov.

(Pl. 1, figs. la-c).

Platyrhynchia, subpentagonal in outline, lenticular in contour, about 13 mm long, 13 mm. wide, and 8 mm. thick.

Brachial valve convex, with anterior median fold; pedicle valve convex, with slight median fold on anterior half of valve.

Anterior commissure deflexed towards brachial valve, giving rise to arcuate linguiform extension.

Orbs erect.

Ornament of about 26 fine rounded costae, about 7 on fold, and 6 in sinus. Fine concentric striae, with occasional lacellae.

apical angle 110° .

Type-specimen.-- Holotype from the Lata zone,

700 yds. N.N.W. of Wrotham Church, Kent. G.S.M. (Sch. 353).

Dimensions of holotype.-- Maximum length 12.5 mm.; maximum width 13.5 mm.; maximum thickness 8.0 mm.; or 1:1.08:0.64

Material and localities.-- Specimens from the Turonian (Lata zone) of England. Kent: Wrotham; Surrey: Albury Downs (east end); Devon: White Cliff to the Hocken; Isle of Wight: Compton Bay.

pulebra

Description.- The shell is fairly thick near the umbones, but thins towards the commissure where the valves meet at a ^{low} angle. In early growth-stages the brachial valve is convex; in later stages it is less convex along the lateral and postero-lateral margins. During middle and later growth-stages new shell material was added along the posterior as well as along the lateral and anterior margins of the valve (holo-peripheral growth). There is a slight sin fold near the anterior margin of the valve. In the earliest growth stages there is a very faint sinus.

The pedicle valve is convex, with a faint median sinus on the anterior third. There is a short arcuate linguiform extension.

The umbo is moderate in size, short, erect, and with a sharply pointed extremity directed in the dorsal direction. Rather faint beak ridges are present. The foramen is small and pear-shaped; the deltidial plates are conjunct and produced in a short ~~shell~~ tube.

In early growth-stages the ornamentation is cancellate, due to the intersection of the radial costae with the concentric striae. In later stages the costae are rounded and moderately elevated. The concentric striae are very fine; they continue across the interareas. There are also occasional growth lamellae.

Remarks.- This species is characterized by its pentagonal outline; it is more depressed than P. heberti or P. reedensis. It may also be distinguished by its lenticular anterior contour, that of P. heberti being oval. The slight depression on each side of the dorsal umbo, associated with growth along the postero-lateral margin is also rather typical. The sharp extremity to the umbo is found in other species of Platyrhynchia, but the faint beak-ridges are an unusual feature in this genus. Well preserved specimens of this form are uncommon, but crushed specimens are frequent.

PLATYRHYNCHIA HEBERTI, sp. nov.

(Pl. II, figs. 2a-c).

Platyrynchia, subtrigonal to subcircular in outline, transversely oval in contour, about 15 mm. long, 13 mm. wide, and 10 mm. thick.

Brachial valve convex; pedicle valve convex, with slight anterior flattening. Anterior commissure deflected towards brachial valve, giving rise to arcuate linguiform extension.

Umbo erect.

Ornament of about 24 broad rounded costae, 6 above and 5 within the anterior flattening, with fairly deep intervening sulci. There is little concentric ornamentation.

Apical angle 96° .

Type-specimen.— Holotype from the Lata zone, Compton Bay (Isle of Wight), preserved in the British Museum (Natural History) (B. 97245).

Dimensions of holotype.— Maximum length 12.8 mm.; maximum width 13.0 mm.; maximum thickness 9.8 mm.; or 1: 1.02: 0.77.

Material and localities.— Specimens from the Turonian (Lata zone) of England. Isle of Wight: Compton Bay.

heberti

is

Description.-- The shell ^{is} subtrigonal to subcircular in outline; it is transversely oval in contour, and there is no appreciable change in contour at the commissure. The anterior margin of the shell is slightly compressed. The brachial valve is convex; in early growth stages there is a slight median flattening. The pedicle valve is convex but is slightly flattened on the anterior part; the linguiform extension ^{turns} ~~is~~ towards the brachial valve fairly sharply.

The umbo is moderate in size, slightly produced, and erect. The deltidial plates are conjunct. The foramen is moderate in size. The costae are broad and ~~the~~ ~~valve~~ rounded, and the sulci narrow and fairly deep. The ~~e~~ surface of the shell ~~is~~ ^{being} rather rough; there is little concentric ornament ^{to be} observed.

Remarks.-- P. heberti closely resembles P. resdensis but has from 24 to 28 costae, compared with about 20 in the latter species. It occurs in the late zone, that is at a slightly lower horizon than P. resdensis. It is thicker than P. pulchra which also occurs in the late zone, and the anterior contour is oval, whereas in the latter species it is lenticular (see pl. i, fig. 1 and pl. ii, ^{fig. 2} _h). The linguiform extension is shorter and wider in P. pulchra and the apical angle greater.

PLATYRHYNCHIA DISPANSA, sp. nov.

(Pl. ii, figs. 4a-c).

- ? 1855. *Rhynchonella* ^{*plicatilis* var} woodwardi. Davidson, T. Monograph of British Cretaceous Brachiopoda. Palaeont. Soc. Vol. 1, ~~pl. 10~~ * * * pl. 10, figs. 45 & 46. (non 43, 44).

Platyrhynchia, subpentagonal to transversely oval in outline, about 16 mm. long, 17mm. wide, and 10 mm. thick.

Pedicle.

Brachial valve convex, flattened anteriorly, or with slight sinus.

Brachial valve convex, with barely perceptible fold.

Anterior commissure gently waved, with short arcuate linguiform extension, which may be asymmetric. Linguiform extension inclined in brachial direction at low angle.

Umbo erect to suberect.

Ornament of about 22 rounded costae, with intervening shallow sulci, 8-10 on fold, 7-8 in sinus.

Fine concentric striae, appearing in some cases as growth-~~lines~~ ^{laminae}; also seen on interarea.

Apical angle 106° .

Type-specimen.- Holotype from the Planus zone, ^BPostal Manor, Rochester, preserved in the Rowe collection, British Museum (Natural History) (B. 80113).

Dimensions of Holotype.- Maximum length 15.5 mm; maximum width 16 mm.; maximum thickness 10.5 mm.; or 1 ; 1.03; 0.68.

Material and localities.- ^{about 20} specimens from the Planus zone of England.
Kent: Borstal Manor (near Rochester), Bluebell Hill (near Burham). Bucking-
hamshire: Wycombe Marsh.

Description.- In early growth stages, the brachial valve is moderately convex; it then becomes considerably less convex for about half its length; near the anterior margin, the convexity increases again suddenly. Only on the anterior margin can a median fold be discerned, and there it is quite faint. The pedicle valve is moderately convex; it becomes medianly flattened about midway between the umbo and the anterior margin and on the anterior half of the valve a faint, rather broad median sinus is developed.

The umbo is fairly massive, erect, and with a fairly sharp extremity. The foramen is small, elongate-oval to pear-shape. The deltidial plates are conjunct and produced in a labial extension.

There are about 22 rounded costae with broad shallow intervening sulci. The costae increase considerably in width towards the anterior and lateral commissures. When the shell is about half grown, the lateral costae bend outwards toward the lateral commissure. Concentric ornament consists of fine striae with occasional growth-laminae.

The linguiform extension, which is broad and short is also asymmetric.

Internal Characters.- *Falcifer crura*; no median septum.

Remarks.- This species differs from P. reedensis in being larger, wider, and more depressed in the middle. It appears to be an exceptional development, the size is greater, since although the number of costae agrees with that of other forms of Platyrhynchia at this horizon.

P. dispanna resembles Rhynchonella woodwardii Davidson (1855, pl. 10, figs. 45 and 46) from the Chalk Detritus of Charing, Kent, ^(pl. iv, figs. 3a-c) the type of which is preserved in the British Museum (Natural History) (No. B. 143). The latter is, however, considerably larger. It has not been possible to investigate the internal structure of this form owing to lack of material. Davidson figured a specimen from Norwich (1855, pl. 10, figs. 43 and 44), which he also called R. woodwardii; this is evidently from a higher horizon than P. dispanna, and has been assigned to the genus Cretirhynchia. The costae in P. dispanna are more elevated than in C. woodwardii, but ~~the~~ are not split, the sulci are not so sharp, and there are no beak-ridges.

PLATYRHYNCHIA REEDENSIS (Etheridge, 1881) (Pls. iii, figs. 2a-c).

1881. Etheridge, R. in Geology of Cambridge, by Woodward, H. B. and Etheridge, R. Mem. Geol. Surv., 1881, pp. 136, 147, pl. iii, fig. 12.

Platyrrhynchia, subpentagonal to circular or oval in outline, oval in contour, being 12.6 mm. in length, ^{about} ^{13mm in width} and 7.8 mm. in thickness.

Brachial valve convex. Pedicle valve somewhat less convex, and with a slight, rather broad median sinus.

Anterior commissure deflected slightly towards the brachial valve in a broad arcuate uniplica.

Umbo small, hypothyrid, suberect to erect.

Ornament of about 20 broad rounded costae, 7 or 8 on fold, and 6 or 7 in sinus, with fairly shallow intervening sulci.

Concentric ornamentation well developed.

Apical angle, 101° .

Type specimen.-- Holotype from the Chalk Rock, North of Barkway, Cambs., preserved in the Geological Museum (No. 38679).

Dimensions of Holotype.-- Maximum length, 12.6 mm.; ^{max. width 13mm;} maximum thickness, 7.8 mm.; or $1:0.63$.

Material and localities.-- Many specimens from the Chalk (Planus zone) of England. Cambridgeshire: Barkway.

Dent: Dover; Burham; Rochester (Borstal Manor).

Sussex: Lewes.

reedensis

Description.- The width of the shell is equal to or slightly greater than the length. The ratio of thickness to length is between 0.6 and 0.7.

The brachial valve is convex, and a slight median flattening may be present which continues from the posterior almost to the anterior margin, and in places may almost give form a faint sinus.

The pedicle valve is somewhat less convex, and the shallow median sinus is confined to the anterior third or half of the valve.

The deflection of the anterior commissure is rounded and gentle .

The umbo is small and there are no beak-ridges. The foramen is small and round to pear-shaped; the deltidial plates are conjunct and slightly produced below the foramen into a short labile extension.

The costae become broader towards the commissure, especially towards the lateral margins. The lateral costae also gradually bend outwards towards the lateral margin. In one or two places the costae may be seen to branch dichotomously.

Concentric ornament consists of very fine striae, with a few laminae developed near the commissure.

Internal characters.- *Falxifer crura* are present; there is no median septum .

reedensis

Remarks.-- Etheridge referred to the similarity between Rhynchonella reedensis and Rhynchonella woodwardi Davidson (pl. x, figs. 45 and 46) from the Chalk Detritus of Charing, Kent. The latter is, however, considerably larger. Further reference is made to this form in the remarks upon Platyrhynchia dispansa.

Platyrhynchia dispansa occurs in the Planus zone with P. reedensis but is larger.

P. reedensis differs from P. mantelliana in having a shallower sinus, a more rounded linguiform extension, costae which are rounded and more numerous on the fold, and shallower sulci.

P. parva differs from P. reedensis in having costae which are slightly subangular along the commissure. In P. heberti, which is closely similar to P. reedensis, the costae are more numerous.

Other Rhynchonellids ^(C. minor) occur in the Planus zone, similar in size to P. reedensis, but are distinguished by their distinct beak-ridges and more numerous costae.

Etheridge remarked ^(p. 136) that P. reedensis occurs also in the upper part of the underlying zone, but has not been found above ^{the Chalk Rock} ~~it~~ in the Cambridge area.

PLATYRHYNCHIA FISIFORMIS, sp. nov.

(Pl. i, figs. 4a-c; Pl. iv, figs. 2a-c).

Platyrrhynchia, circular to sub-pentagonal in outline, sub-circular in contour, about 10 mm. long, 10 mm. wide, and 7 mm. thick.

Brachial valve convex, with slight fold on anterior part of valve.

Pedicle valve convex, with slight median sinus. Anterior commissure deflected towards brachial valve, giving rise to small linguiform extension.

Umbo short, erect.

Ornament of 18 rounded, elevated costae, with deep, narrow intervening sulci. Fine concentric striae.

Apical angle 109° .

Type-specimen.-- Holotype from the Cor-anguinum zone, Thanet Coast, preserved in the British Museum (Natural History) (B 79913).

Dimensions of holotype.-- Maximum length 9.8 mm.; maximum width 9.7 mm.; maximum thickness 7.7 mm.; or 1:0.99:0.79.

Material and localities.-- 18 specimens from the Senonian (Cor-anguinum zone) of England. Locality: Thanet Coast. Wiltshire: Quidhampton, near Salisbury.

Description.-- Both valves are markedly convex. The ratio of thickness to length is about 0.7. The brachial valve is of fairly uniform convexity; a tendency to holo-peripheral growth results in a slight depression on either side of the umbo; there is a slight median fold on the anterior part of the valve. The pedicle valve is not quite so convex as the brachial valve; there is a slight median sinus on the anterior third or half of the valve.

pisiformis

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The pedicle valve is thickest near the umbo; the brachial valve is thickest at about midway between the umbo and the anterior margin. The anterior commissure is deflected towards the brachial valve forming a small linguiform extension.

The umbo is short, erect. The foramen is oval or pear-shaped, moderately small. Deltoidal plates conjunct, slightly produced. Beak-ridges are not developed.

Ornament of about 18 rounded costae, about 5 on fold and 4 in sinus, with deep intervening sulci. In addition, very fine, rather faint concentric striae.

* This specimen is mounted
with a figure "1" and
is exhibited to me
figured (pl. col. xvii)
(fig. 1)

* This specimen is marked
with a figure "2" and
is evidently the one
figured (pl. cclxxvii,
fig. 2)

pisiformis

Remarks... James Sowerby in 1821 ^(p. 137) described a Rhynchonellid ^{said to come} from Ramsgate which he called Terebratula obliqua. This specimen is preserved in the Brit. Mus. (Nat. Hist.) (B 61512), ^{*} and it is characterized by subangular costae, the summit of each costa a narrow, rather sharp ridge; the sulci are of considerable depth; the anterior commissure is strongly asymmetrical (see pl. iv, figs. 1a-c). As the Stranguinum zone is exposed at Ramsgate, one would expect to find ~~x~~ this species among the forms from that zone, but none of the specimens which have been examined, resembles it closely. Platyrhynchia pisiformis differs from it in having rounded costae with broad rounded summits, and sulci, which although deep, are not as deep as those of T. obliqua.

T. obliqua possesses the external characters of Platyrhynchia and resembles P. mantelliana; one specimen of the latter (BB 5523a) from the Lower Chalk of ^{Folkestone} ~~Folkestone~~, and preserved in the B.M.(N.H.), is very similar to the former species and has the same type of asymmetrical anterior commissure. Morris (p. 150) listed T. obliqua as a synonym of P. mantelliana, but it predates the latter name.

In the Sowerby collection (B.M.(N.H.)), with the holotype of T. obliqua, is a Rhynchonellid from Norfolk, which Sowerby does not mention in his text, but which is possibly in part figured by him as T. obliqua (pl. colxxvii, fig. 2). It differs from the holotype of T. obliqua in the same way as does P. pisiformis, in having rounded costae and intervening sulci which are only moderately deep (see pl. iv, figs. 2a-c). This specimen (B 61511) closely resembles P. pisiformis and evidently should be assigned to that species.

P. pisiformis is more tumid than P. reedensis, and the sulci in the former are rather deeper than in the latter. ~~The costae in P. pisiformis~~

PLATYRHYNCHIA BELLA ~~sp.~~, sp. nov.

(Pl. i, figs. 10a-c).

Platyrhynchia, sub-circular to sub-pentagonal in outline, oval in contour, about 10 mm. long, 10 mm. wide, and 7 mm. thick.

Brachial valve convex, with median fold on anterior margin; pedicle valve convex, with slight median sinus; linguiform extension narrow, arcuate to V-shaped.

Umbo fairly stout, erect to sub-erect. No beak-ridges. Foramen small, oval to pear-shaped.

Posteriorly nearly smooth. Ornament of about 18 costae, 4 on fold and 3 in sinus. Concentric ornament of fine striae.

Apical angle, 106°.

Type-specimen.- Holotype from the Upper Chalk (quadratus zone) of East and West Harnham, near Salisbury, Wiltshire, preserved in the British Museum (Natural History) (B 92971).

Dimensions of holotype.- Maximum length 9.2 mm.; maximum width 8.9 mm.; maximum thickness 6.8 mm.; or 1: 0.97: 0.74.

Material and locality.- Six specimens from the Upper Chalk (Quadratus or Pillula zones) of England. Wiltshire; East and West Harnham, near Salisbury.

Description.-The two valves are moderately convex; in the brachial valve there is a narrow, fairly sharp median fold near the anterior margin; in the pedicle valve there is a slight sinus on the anterior third of the valve. The linguiform extension is narrow and of moderate length.

The umbo is short, fairly stout, with rounded, convex lateral slopes;

there are no beak-ridges. The foramen is small, apically hypothyril; the deltidial plates are slightly produced, tubular.

The shell is nearly smooth for about half the distance from the umbo to the anterior margin; on the remaining area the ^{rounded} costae are faint and depressed, with wide, shallow intervening sulci, except along the anterior commissure, where the costae become more pronounced and almost sub-angular, and the sulci deeper. On the nearly smooth part of the shell, the concentric ornament consists of very fine, regularly arranged striae; near the commissure the striae become more pronounced and a few thin laminae occur. Small brown patches and spots on the surface of the shell appear to be characteristic of this species.

Remarks.-- An early smooth stage also occurs for a short distance around the umbo in Platyrhynchia pisiformis and P. granum, but in these species the costae commence much earlier and become more elevated, and the intervening sulci are deeper and narrower. An early smooth stage is also developed in Cretirhynchia, in certain species.

PLATYRHYNCHIA GRANUM, sp. nov.

(Pl. I, figs. 11a-c).

Platyrynchia, weak circular to lozenge-shaped in outline, about 7 mm. long, 7 mm. wide, and 5 mm. thick.

Brachial valve convex, with slight fold on anterior part of valve.

Pedicle valve convex, with slight median sinus. Linguliform extension moderate in size.

Umbo small, sharp, slightly produced; ~~erect~~ ^{erect to suberect}.

Ornament of about 18 rounded costae, with deep intervening sulci; about 6 on fold.

Apical angle 85°-105°.

Type-specimen.- Holotype from the Quadratus or Pillula zone, E. and W. Harnham, near Salisbury, Wiltshire, preserved in the British Museum (Natural History) (B 92807).

Dimensions of holotype.- Maximum length 7.2 mm.; maximum width 7.0 mm.; maximum thickness 5.1 mm.; or 1:097: 0.71.

Material and localities.- Twelve specimens from the Upper Chalk (Quadratus and Pillula zones) of England. Wiltshire: E. and W. Harnham, near Salisbury.

Description.- The valves are moderately convex; the fold and sinus are developed on the anterior part of the valves. The umbo is sharp and narrow at first, and then rapidly broadens; it is erect. The foramen is moderate in size, pear-shaped; the deltidial plates are slightly produced laterally. The posterior part of the shell is nearly smooth. The rounded costae rapidly become elevated, and are almost subangular along the anterior commissure; the sulci are fairly deep. Fine concentric striae are present, together with a few weak laminae.

Remarks.- This species can be distinguished from P. pisiformis and other forms by its very small size and acute ^{tapering} umbo. The nearly smooth umbonal area is also characteristic.

Genus CRETIRHYNCHIA gen. nov.

(Genotype Rhynchonella plicatilis (J. Sowerby).)

Brachial valve convex, with flattened median fold on anterior part of valve. Pedicle valve less convex, with broad, well-developed but flat-bottomed sinus on anterior part. Linguiform extension trapezoidal (with straight terminal edge and oblique lateral edges).

Hypothyrid; umbo short, erect; foramen small, circular. Deltoidal plates conjunct. Beak-ridges distinct. Interarea well-defined.

Shell, ornamented with numerous low rounded costae, feeble near umbo, becoming angular and elevated along commissure, with intervening angular sulci.

Dental lamellae divergent. Teeth large.

Median septum of dorsal valve moderately developed. No septalium. No cardinal process. Hinge-plates broad; dental sockets large. *Crura radulifer.*

Muscle-scars broad-spreading.

Species recognised.- C. cuneiformis sp. nov., C. exsculpta sp. nov., C. limbata, (Schlotheim), C. minor sp. nov., C. norvicensis sp. nov., C. octoplicata (J. Sowerby), C. plicatilis (J. Sowerby); C. woodwardi (Davidson).

Range.- Senonian.

Table showing the Characteristic Features of the Species of Cretirhynchia.
~~xxxxxTable showing the characteristic features of the species of Cretirhynchia~~

Species	Form	Characteristic Features
<u>C. norvicensis</u>	Macronata	Lateral profile depressed. Broad, flat, well developed dorsal fold; moderately deep with sawtoothed sinus; linguiform extension trapezoidal, turning at low angle to plane of junction of valves. Costae greatly reduced in number from about 60 to about 20 near commissure, becoming broad and angular.
<u>C. woodwardi</u>	..	Short depressed form. Large foramen. Linguiform extension broad, arcuate. Few costae (about 30), broad.
<u>C. exsculpta</u>	Marsupites	Domical sinuous anterior contour. Linguiform extension trapezoidal; turna nearly vertical. About 40 clearly defined costae, with fairly deep intervening sulci; costae with incipient splitting near commissure; costae not reduced in number.
<u>C. plicatilis</u>	Cor-anguinum	Tumid form; sub-circular lateral profile. Brachial valve very convex, median fold slight, broad. Sinus shallow (or absent); linguiform extension trapezoidal, turning until vertical to plane of junction of valves. Small foramen. Costae numerous (about 70), moderately reduced in number (to about 40); do not become broad. Umbo smooth. 12 costae on fold.
<u>C. octoplicata</u>	(Cor-testudinarium)	Slight rounded sinus in pedicle valve; linguiform extension turns nearly vertical. About 35 costae, with eight on fold. Concentric ornament mainly developed near commissure.
<u>C. cuneiformis</u>	Planus	Cuneiform lateral profile. arcuate linguiform extension. Smooth umbo. Costae about 50, reduced in number to about 30.
<u>C. minor</u>	..	Small form. Trapezoidal linguiform extension. About 36 costae.

remarks.-- There appear to be two series of forms in the genus Cretinophylaxia. In the first series there are numerous costae, usually more than 50, with a reduction in the number in the later stages of growth, usually along one or more of the growth laminae. In the other series there is a tendency to incipient splitting in the latest stage of growth; in this series there are usually about 40 costae. With individuals in which the ^{adult} latest stage ~~is~~ is absent, it is often difficult to assign them to any particular species. Incipient splitting first appears as a median line or ridge on each costa, and develops anteriorly as a narrow slit, particularly well seen where decorticated, and continues across the closely set growth laminae along the commissure. The following table shows the stratigraphical distribution of the members of the two series:--

Stage	Species with incipient splitting of costae	Species with reduction in number of costae
Proterista	<u>C. like woodwardi</u>	<u>C. norvicensis</u> <u>C. limbata</u>
Mesostaria	<u>C. cf. exsculpta</u>	<u>C. cf. norvicensis</u>
Parastaria	<u>C. exsculpta</u>	
Orthostaria		
Orthostarium	<u>C. cf. exsculpta</u>	<u>C. plicatilis</u>
Orthostodiarium	<u>C. cf. exsculpta</u>	<u>C. octoplicata</u> <u>C. cuneiformis</u>
Planis	<u>C. minor</u>	<u>C. cuneiformis</u>

Reduction in the number of costae is carried a stage farther in C. norvicensis, where the costae become fused along the commissure, and still farther in C. limbata where they become almost obsolete.

CRETIRHYNCHIA MINOR sp. nov.

(Pl. 1, figs. 2a-c).

Cretirhynchia about 12 mm. long, 12 mm. wide, and 9 mm. thick, sub-circular to sub-pentagonal in outline, oval to sub-circular in profile and anterior contour.

Brachial valve of considerable convexity, with flattened, barely perceptible fold on the anterior commissure. Pedicle valve less convex, with broad, shallow median sinus. Linguiform extension trapezoidal, long and fairly broad.

Hypothyrid; umbo short, erect, extremity pointed. Foramen moderate in size. Deltoidal plates conjunct, produced (tubular, alar). Beak-ridges distinct; interarea well-defined.

Ornament of about 28-36 rounded to subangular costae, with angular intervening sulci; 8 costae on fold, and 7 in sinus. Concentric ornament faint; fine striae and a few lamellae.

Apical angle 105°.

Holotype. From junction of Late and Planus zones, New Pit, Lewes, Sussex.

Dimensions of holotype.—Maximum length 12.3 mm.; maximum width 12.1 mm.; maximum thickness 8.9 mm.; or 1: 0.98 : 0.72.

Material and localities.—10 specimens from the Chalk (Planus zone) of England. Kent: Wrotham. Sussex: Lewes.

Description.—The convexity of the brachial valve is considerable, particularly in the later stages of growth, when the lateral parts of the valve grow in a direction towards the pedicle valve and at a rate faster

minor

than that of the median part of the valve. The resultant flexure of the commissure corresponds to the outline of the linguiform extension of the pedicle valve. A slight median fold is only perceptible along the anterior margin of the brachial valve; an extremely faint depression or flattening occurs along the median line of the valve.

The pedicle valve is less convex than the brachial valve, but the linguiform extension is long and turns rapidly towards the brachial valve, finally growing in a direction opposite but parallel to that of the lateral parts of the latter valve. The linguiform extension is trapezoidal in shape, the anterior edge being straight, and the lateral edges straight and oblique. A broad, shallow sinus is present on the anterior third to one half of the valve.

The umbo is short, erect, with a pointed but not prominent extremity. The beak-ridges are distinct, curved; the interareas well-defined and traversed by the fine concentric striae. The deltidial plates are produced into a tubular or wing-shaped extension.

The posterior part of the shell is nearly smooth, the costae being quite faint at first; they are then rounded and depressed for a considerable distance, finally becoming subangular near the commissure and angular along the commissure. The sulci are narrow and become rather deep and angular near the commissure. In some cases the costae are slightly split along the commissure. The concentric ornament is best seen near the commissure; elsewhere it is faint. In addition to fine striae, there are a few fine growth-laminae.

minor

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Remarks.- This small species is similar in size to several members of the genus Platyrrhynchia, but may be distinguished by its internal structure and externally by its distinct beak-ridges, broad, flat sinus, trapezoidal linguiform extension, numerous costae and angular sulci.

(Pl. ii, figs. 8a-c).

Cristirhynchia, about 19 mm. long, 22 mm. wide, and 15 mm thick, sub-triangular to sub-pentagonal in outline, semi-circular to oval in contour, and cuneiform in lateral profile.

Brachial valve of considerable convexity, but medianly flattened, with broad, somewhat faint median fold on the anterior commissure. Pedicle valve less convex, with broad median sinus, and large linguiform extension. Linguiform extension broad, long, arcuate to trapezoidal, turning until almost at right angles to the line of junction of the valves.

Umbo short, erect; lateral slopes nearly straight, long. Foramen moderately large, near circular; deltidial plates slightly produced around foramen. Beak-ridges distinct, only slightly curved.

Ornament of about 80 fine depressed costae, becoming sub-angular and reduced in number to about 35 near the commissure; the intervening sulci are narrow. Concentric ornament of very fine striae and a few lamellae, especially near the commissure.

Apical angle 104° .

Type specimen.— Holotype from the Planus zone of ^{Aston Hill, near} Stokenchurch, Oxfordshire, preserved in the Geological Museum (P. 1228).

Dimensions of holotype.— Maximum length, 18.9 mm.; maximum width 21.4 mm.; maximum thickness 15.1 mm.; or 1:1.13:0.80.

Material and localities.— 30 specimens from the Chalk (Planus zone) of Barvel ^{Aston Hill,} Kent; ^{Stokenchurch,} Oxfordshire; Hog's Back, near Guildford, Surrey; Lewes, Sussex; Lewes.

During

Description.- In the early and intermediate stages of growth, both valves are only moderately convex, the brachial valve being medianly depressed. During the later stages of growth, a broad but faint fold is developed on the median part of the ~~valve~~ brachial valve, while the lateral parts of the valve grow at a very much faster rate than the part on which the fold is developed. These lateral parts are of considerable convexity, and they continue in the ventral direction on either side of the linguiform extension of the pedicle valve. In the pedicle valve, the linguiform extension grows rapidly in the later stages of growth, simultaneously with the development of the median sinus, and gradually turns in the dorsal direction until at right angles to the line plane of junction of the valves. As a result of the rapid increase of convexity during the later stages of growth, the shell seen in lateral profile has a wedge-shaped appearance (pl. II, fig. 86)

The umbo is short, fairly massive and with pointed extremity. The beak-ridges are distinct and the interarea well-defined. The lateral slopes continue in a straight line almost to the widest part of the shell.

During the early stages of growth of the shell, the ornament is faint and the surface of the shell appears smooth. There are about 50 costae which become reduced by fusion in the later stages of growth to about 35. The costae are at first very fine. They then gradually increase in width, but remain depressed for most of their length, then become rounded and finally sub-angular along the commissure.

Remarks.--This species differs from Cretirhynchia plicatilis in its lateral profile which is cuneiform, that of C. plicatilis being sub-circular. In addition, the smooth area around the umbo extends for a greater distance than that of C. plicatilis, while the beak-ridges are more distinct, the lateral slopes straight, not convexes in the latter species, and the inter-area less curved. There is no depression on either side of the brachial umbo as in C. plicatilis, due to growth along the postero-lateral margin of the valve. The foramen in C. cuneiformis is larger than that in C. plicatilis.

CRETACEOUS OCTOPLICATA (James Sowerby).

(Pl. vi, figs. 1a-c).

1816. Terebratula octoplicata James Sowerby. Mineral-Conchology of Great Britain, vol. ii, p. 57, pl. 118, fig. 2 (first fig. only).
- Terebratula octoplicata
non 1822. Brongniart, A. Descr. géol. des Environs de Paris, pl. iv, fig. 8.
- non 1837. Terebratula octoplicata Hisinger, W. Lithaea Suevica, pl. xxii, fig. 12.
1838. Terebratula octoplicata Sow. Buch, L. de. Mem. Soc. géol. France, vol. iii, pl. xv, fig. 13. (first)
- non 1846. Terebratula octoplicata Sow. d'Orbigny. Géol. Russie, vol. ii, partie 3, pl. xliii, figs. 15-17.
- ? 1846. Terebratula plicatilis var. octoplicata Geinitz, H.B. Grundriss der Verst. pl. xxi, fig. 9 (c and d).
- non 1847. Rhynchonella octoplicata d'Orbigny, A. Paléontologie Française. Terrains crétacés Tome iv: Brachiopodes, pl. 499, figs. 9-12.
- ? 1850. Terebratula octoplicata Geinitz, H.B. Charakt. Kreide, 2 Ausg. pl. xvi, fig. 16.
- non 1855. Rhynchonella plicatilis var. octoplicata Sow. Davidson, T. Monogr. Cret. Brach. pl. x, figs. 1-17.
- non. 1889. Rhynchonella plicatilis Sow. var. octoplicata Frič, A. Böhm. Kreideform. IV. fig. 91.

oostrophia

Oostrophia, about 21 mm. long, 23 mm. wide, and 17 mm. thick, transversely oval to sub-circular in outline, sub-cuneiform in lateral profile, and sub-circular in anterior contour. Brachial valve convex, with slight, rounded anterior fold. Pedicle valve less convex, with slight rounded sinus. Linguliform extension broad U-shaped. Umbo erect.

Ornament of about 40 depressed costae, about eight on fold. Concentric laminae chiefly developed along commissure.

Apical angle 110° .

Type specimen.— Lectotype from Chalk (?Cor-testudinarium zone) of Lewes, Sussex, preserved in the British Museum (Nat. Hist.) (B 61478).

Dimensions of holotype.— Maximum length 21.6 mm., maximum width 23.2 mm., maximum thickness 17.0 mm.; or $l: 1.08 : 0.79$.

Material and localities.— Two specimens from the Chalk (?Cor-testudinarium zone) of England. Devon: Beer Head. Sussex: Lewes.

Description.— The brachial valve is somewhat flattened posteriorly, but the convexity increases considerably towards the anterior margin; the median fold is rounded. The pedicle valve is less convex; the linguliform extension is rounded, broad U-shaped, and turns in the dorsal direction until nearly vertical; the lateral parts of the valve also turn dorsalwards in the adult stage, forming a lip to the valve. The median sinus is rounded and only of moderate depth.

The umbo is short, erect; beak-ridges distinct. The interarea continues into the lip on the pedicle valve.

The costae are low, but become slightly more elevated near the commissure. They are worn on the lateral parts of the shell, but a slight reduction in number is observable along the growth laminae. There are eight costae on the

octoplicata

median fold, and two on each flank, with 14 or more to the left of the fold, becoming reduced to about 12 on the commissure, and 17 or more to the right of the fold, reduced to about 12 on the commissure. There is no incipient splitting of the costae near the commissure.

Closely set growth laminae occur along the commissure.

Remarks.--Of Sowerby's two syntypes, the specimen with gaping valves has eight costae and is labelled octoplicata; it is therefore selected as lectotype. It is an unsuitable specimen for a type, being a gerontic individual and very badly worn.

In the ^{other} syntype there are nine costae on the median fold. This form requires further investigation.

G. plicatilis resembles G. cuneiformis, which occurs in the planus and Con. testudinarius zones, in having a cuneiform lateral profile and rounded linguiform extension, but the latter species differs in being rather more cuneiform and has a larger linguiform extension.

G. plicatilis is thicker, has a flatter sinus, a trapezoidal linguiform extension, and more numerous costae.

In G. exsculpta the linguiform extension is trapezoidal, the costae show incipient splitting, the sulci are deeper and there is no reduction in the number of costae.

CRETIRHYNCHIA Plicatilis (James Sowerby).

(Pl. v, figs. 1a-c)

1816. Terebratula plicatilis James Sowerby. Mineral Conchology of Great Britain, vol. ii, p. 37, pl. 118, fig. 1.

Non 1822. Terebratula plicatilis Brongniart, A. Description géol. Environs de Paris, pl. iv, fig. 5.

1833. Terebratula plicatilis Sowerby. Buch, L.de. Mem. Soc. géol. France, vol. iii, pl. xv, fig. 24.

Non 1846. Terebratula plicatilis Goinitz, H.B. Grundriss der Verst. pl. xxi, fig. 2a-b.

Non 1855. Rhynchonella plicatilis James Sowerby. Davidson, T. British Cretaceous Brachiopoda, pl. x, figs. 37-42.

Non 1860-66. Rhynchonella plicatilis Br. Bronn, H.G. Lethaea Geognostica, 3 Aufl. pl. xxx, fig. 9.

Cretirhynchia, about 22 mm. long, 26 mm. wide and 19 mm. thick, transversely oval to subpentagonal in outline, sub-circular in lateral profile.

Brachial valve of considerable convexity, with faint broad flattened fold on anterior part. Pedicle valve less convex, with broad flat shallow sinus on anterior part. Linguiform extension broad, trapezoidal, nearly rectangular, turning sharply in the dorsal direction until at right angles to the plane of junction of the valves.

Umbo small, erect; lateral slopes concave. Deltoidal plates small, just conjunct. Foramen small, circular to longitudinally oval. Beak-ridges distinct, curved.

Ornament of about 40 or more depressed rounded costae, about 11 on fold and 10 in sinus, and about 3 on each flank, with shallow subangular intervening sulci. Many closely set and very fine concentric striae with several lamellae near the commissure.

Apical angle 105° - 120° .

Type-specimen.- Holotype from the Upper Chalk, Northfleet, near Gravesend, Kent, preserved in the British Museum (Natural History) (Sowerby collection) (B. 61513).

Dimensions of holotype.- Maximum length 22.3 mm.; maximum width 28.6 mm.; maximum thickness 19.5 mm.; or l: l.28: 0.87.

Material and localities.- Ten specimens from the Senonian zone (Coranguinum zone) of England. Kent: Northfleet, near Gravesend.

Description.- There is a broad, faint median fold on the brachial valve which commences at about two-thirds of the distance from the umbo. A faint median depression on the fold gives rise to a slightly concave anterior margin. During growth, the increase of convexity in the brachial valve is accompanied by increased growth along the posterior margins and lateral margins, tending to the formation of a depression on either side of the brachial umbo.. Along the anterior margin, the rate of growth is much reduced on the fold, while the flanks progress so as to lie along each side of the linguiform extension when the valves are closed.

The pedicle valve is less convex and is thickest at about the middle of the valve. The sinus commences about midway between the umbo and the anterior margin, broadens and becomes of moderate depth. The linguiform extension is nearly rectangular and is about 12 mm. wide and 7 mm. long. It bends sharply until approximately at right angles to the plane of junction of the valves.

The umbo is small in relation to the whole shell and is erect; the lateral slopes are concave. The beak-ridges are distinct and curved; the interarea is curved. The foramen is quite small in relation to the whole

shell and is circular to slightly oval.

Within an area extending for about 10 mm. from the umbones, the costae are indistinct and extremely fine and are less conspicuous than the concentric striae. For a short distance beyond this area the costae and striae form a cancellate pattern. The costae then become more prominent. They are depressed until about midway between the umbo and anterior commissure and then become slightly more elevated. They are rounded in section as far as the anterior margin and become sub-angular along the commissure ^{but not split}. The sulci are shallow and moderately wide, and are angular along the commissure.

The concentric striae are extremely fine and closely set. There are a few faint laminae on the surface of the shell. Near the commissure the laminae become more numerous and coarser but are not so well defined on the fold and in the sinus.

A decrease in the number of costae takes place along one of the growth laminae near the commissure. This decrease ~~is~~ affects the costae on the lateral parts of the shell but not ^(or only slightly) those on the fold and in the sinus. There are about 70 costae on the posterior part of the shell and about 42 on the commissure including twelve on the fold and one to three on the flanks.

Internal characters.-- The hinge-plate in the brachial valve is small, divided. The dental sockets are transversely striated. Crural bases are moderate in size. The crura consist of two small laminae with expanded ends and curved in the ventral direction and slightly towards each other. The dorsal side of each of the crura is concave, with a prominent ridge along each edge. In the holotype the crura and one crural base are missing. The median septum commences at a short distance from the umbo and extends for approximately one third of the length of the valve. It is about two millimetres high in the middle but gradually disappears towards the extremities. Septalium and cardinal process are both absent. The muscle scars are broad-spreading.

In the pedicle valve a short pedicle collar extends between the dental lamellae. The latter are divergent. The teeth are transversely striated.

Remarks.-- C. plicatilis is relatively short, with transversely oval outline. It is of considerable thickness, and the lateral profile is sub-circular, compared with the cuneiform profile of C. cuneiformis and the depressed profile of C. norvicensis.

The smooth area around the umbo is usually not so extensive as in C. cuneiformis. The latter species also differs from C. plicatilis in having a larger foramen, straight beak-ridges and an arcuate linguiform extension.

In C. norvicensis there is a greater reduction in the number of costae, giving rise to about 20 broad angular costae along the commissure; in addition, the costae on the fold are reduced. The median fold and sinus in this species are developed to a greater extent.

CRETIRHYNCHIA EXSCULPTA sp. nov.

(Pl. vii, figs. 1a-c)

Cretirhynchia, about 19 mm. long, 20 mm. wide, and 16 mm. thick, sub-pentagonal in outline, domical in anterior contour, and sub-domical in lateral profile. Brachial valve very convex, domical, with slight, fairly broad and flat median fold on the anterior part. Pedicle valve slightly convex, with shallow to moderately deep median sinus. Linguiform extension trapezoidal, almost quadrate. Umbo erect.

Ornament of about 40 rounded, clearly but defined costae, with incipient splitting near the commissure; with moderately deep intervening sulci. Concentric growth-lines, with occasional laminae, especially near the commissure.

Apical angle 109° .

Type specimen.-- Holotype from the Marsupites zone, Brighton and Friar's Bay, Sussex, preserved in the British Museum (Nat. Hist.) (B 79824).

Dimensions of holotype.-- Maximum length, 19.2 mm.; maximum width 20.5 mm.; maximum thickness 16.6 mm.; or 1: 1.07 : 0.86.

Material and localities.-- About 40 specimens from the Upper Chalk of England. Sussex: Brighton cliffs; Brighton and Friar's Bay; Meeching quarry, Newhaven. (Marsupites zone). Sussex coast (quadratus zone).

Description.-- The brachial valve is very convex, in the form of a low dome. The median fold only occurs on the anterior part of the valve; it is flat and in some cases slightly depressed in the middle.

The pedicle valve is only slightly convex; the linguiform extension in the adult stage attains a considerable length and turns until at right angles to the plane of junction of the valves; it is trapezoidal to quadrate. The lateral parts of the pedicle valve also turn at right angles in the dorsal direction during the adult stage, forming a lip, or rim. Closely set growth ^{laminae}

exsculpta

are conspicuous on this lip.

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The umbo is erect, short and fairly massive, with a pointed extremity. The beak ridges are distinct. The foramen is fairly small, circular; the deltidial plates are only very slightly produced. The lateral slopes are fairly straight.

There are about 40 well-defined, moderately elevated costae, with fairly deep, clearly cut sulci; there are about eight costae on the fold. The costae are at first fine and quite low, later become rounded, and finally, with the development of a slight flattening on the sides of each costa, almost obtusely angular. In the later stages of growth, a line or faint ridge develops along the summit of each costa, finally giving rise to incipient splitting. The costae do not become reduced in number along any of the growth laminae.

There are a few growth laminae, chiefly near the commissure.

Remarks.-- This species is chiefly characterised by the well defined costae, with incipient splitting near the commissure, and the rather deep sulci. It differs from C. octoplicata in the above characters and also in its domical contour, trapezoidal to quadrate linguiform extension and in the absence of any reduction of the number of costae along the growth laminae.

It resembles C. minor in the Planus zone, but is considerably larger.

A possibly identical or closely similar form which occurs in the Quadratus zone is being investigated.

Pl. 11, figs. 7a-c.

1838. Terebratula gallina Woodward, S. Geology of Norfolk, pl. vi, fig. 12.

1858. Rhynchonella olicatilis var. woodwardi Davidson, T. Cretaceous
Brachiopoda, pp. 77, 78, pl. x, figs. 43, 44 (non 45, 46).

Cretirhynchia, about 17 mm. long, 22 mm. wide, and 12 mm. thick, trans-
versely oval in outline, depressed oval to lenticular in anterior contour.
Brachial valve slightly convex with broad, faint anterior fold. Pedicle
valve less convex, with broad, shallow sinus. Umbo erect.
Ornamented with about 35 costae, with narrow intervening sulci.
Apical angle 114° .

Figured specimen.- From the Upper Chalk of Norwich, preserved in the
British Museum (Nat. Hist.). (B 467a).

Dimensions of figured specimen.- Maximum length 17.6 mm., maximum width
22.8 mm., maximum thickness, 12.2 mm.; or 1: 1.30 : 0.69.

Material and localities.- 10 Specimens from the Upper Chalk of England
(Magnonata zone). Norfolk: Harford Bridge, Norwich; Norwich. Essex: Walton.

Description.- The shell is broad and depressed, the fold only slightly
elevated and the sinus shallow. The linguiform extension is broad, arcuate,
and inclined at a low angle (about 45°). The umbo is erect, with pointed
extremity; the foramen is moderate to large. Beak-ridges are indistinct. The
low costae are fine at first, the umbo being nearly smooth, and become
broader and slightly elevated towards the anterior commissure, where they
show incipient splitting. The sulci are narrow and fairly deep. Concentric
laminae are especially well developed along the commissure.

Remarks.- Davidson in his description, referred to a figure given by

woodward of a specimen from Harford Bridge, which the latter called Terebratula
collina. Davidson figured two forms, one ^(lectotype) from Norwich (pl. x, figs. 43 and 44)
 and one ^(figs. 45+46) from the Chalk Detritus of Charing, Kent. The latter, ^(pl. iv, figs. 3a-c) in the British
 Museum (Nat. Hist.) (B 113), is of doubtful age, but resembles Platyrhynchia
dispanna.

G. woodwardi is characterised by its width, broad arcuate linguiform
 extension,, few broad costae showing incipient splitting, and absence of
 fusion or reduction in number of costae. It differs from G. exsculpta in being
 broader, having fewer costae and an arcuate linguiform extension. It differs
 from G. dispanna internally, and in the possession of faint beak-ridges, and
 moreover more numerous costae and narrower sulci.

CRETIRHYNCHIA NORWICENSIS sp. nov. (Pl. ii, figs. 6a-c).

1885 *Rhynchonella plicatilis* var. *octoplicata* ~~Sowerby~~. Davidson, *l.* British Cretaceous Brachiopoda, pl. x, figs. 1-11.

Cretirhynchia, about 25mm long, 27 mm. wide, and 18 mm. thick, sub-triangular to sub-pentagonal in outline, depressed oval in lateral ^F profile.

Brachial valve moderately convex, with broad, flattened fold on the anterior third of the valve. Pedicle valve less convex, with broad, moderately deep but somewhat flattened median sinus. Linguliform extension trapezoidal.

Umbo short, erect; beak-ridges distinct. Foramen small, quadrifid; deltidial plates slightly produced.

Ornament of about 50 fine depressed costae, reduced in number to about 20 near the commissure, with about 7 on fold and 6 in sinus; the intervening sulci are narrow but are wide and deeper near the commissure. There are fine concentric growth-lines and occasional laminae; they are particularly well developed near the commissure.

Apical angle 99° .

Type specimen.— Holotype from the Mucronata zone, Household pit, Norwich, preserved in the British Museum (Natural History) (B 93138).

Dimensions of holotype.— Maximum length 24.5 mm.; maximum width 26.6 mm.; maximum thickness 17.5 mm.; or l: 1.08; 0.71.

Material and localities.— Numerous specimens from the Upper Chalk (Mucronata zone) of England. Norfolk: Norwich.

Description.- The broadest part of the shell lies towards the anterior margin, resulting in a sub-triangular shape. The brachial valve is at first moderately convex, but in later stages of growth it is less convex and a broad flat median fold is developed. The pedicle valve is much less convex; it is thickest near the umbo, and the median sinus starts to develop at an early stage, about one third to one half the distance from the umbo to the anterior margin. The sinus is broad, fairly deep, steep-sided, but nearly flat at the base. The linguiform extension measures about 13 mm. wide across the extremity, 18 mm. across the base, and is about 8 mm. long; it turns in the dorsal direction at an angle between about 45° and 60° to the plane of junction of the valves.

The umbo is erect to slightly incurved; the extremity is pointed. The foramen is very small and quadrifid; the deltidial plates are slightly produced, forming three small lobes at the apex and one in the anterior direction.

The costae commence at the umbo; they are at first extremely fine, the surface of the valve being nearly smooth. Until they approach the anterior commissure they number about 50; they are depressed, almost flat, and are separated by narrow intervening sulci. A few millimeters from the commissure they become fused, two or three together, giving rise to about 20 new costae which are considerably wider, more elevated and angular. There are about seven of these wide costae on the median fold. The reduction in the number of costae is a late stage in development and may be absent in young individuals. Concentric growth-lines and laminae are well developed, especially near the commissure where the costae are reduced in number.

Remarks.-- Seen in lateral profile, the shell is slightly longer and more depressed than C. plicatilis; it is not cuneiform as in C. cuneiformis. The median fold in the Brachial valve is developed to a greater extent than in C. plicatilis or C. cuneiformis. The sinus in the pedicle valve is deeper than in C. plicatilis. The linguiform extension is trapezoidal, compared with the arcuate one in C. cuneiformis and the short arcuate one in C. woodwardi. It turns in the dorsal direction at a lower angle than in C. plicatilis or C. cuneiformis.

The reduction in the number of costae is greater in C. norvicensis than in C. plicatilis or C. ceterlicata, except in the case of young forms. In the last two species there is little reduction in number on the fold.

Fusion of the costae along the anterior commissure is a characteristic feature in C. norvicensis.

Genus CAPILLIRHYNCHIA gen. nov.

(Genotype Rhynchonella ^afrasina d'Orbigny.)

Brachial valve convex, with a faint median depression, and slight anterior fold. Pedicle valve less convex, with broad shallow median sinus. Linguliform extension broad, arcuate to U-shape.

Hypothyrid; suberect to erect. Foramen moderately in size, circular. Deltidial plates conjunct, produced, tubular or winged. Beak-ridges indistinct. Interarea small.

Ornament of numerous fine, rounded costae.

Dental lamellae *divergent, approximate.*

Median septum well-developed. No septalium; no cardinal process. Crura radulifer.

Species recognised.- C. frasina(d'Orbigny).

Range.-Cenomanian.

Remarks.- Other forms occurring in the Cenomanian are being investigated. No representatives of this genus have been found in the E Turonian or Senonian.

CAPILLIRHYNCHIA GRASIANA (d'Orbigny)

(Pl. 11, figs. 3a-c). (text fig 3)

1847 Rhynchonella grasiana d'Orbigny. Paléontologie Française. Terrains Crétacés. Tome quatrième. Brachiopodes, pp. 50-59, pl. 497, figs. 7-10 (non 11).

1855 Rhynchonella grasiana d'Orbigny. Davidson, T. British Cretaceous Brachiopoda. Paleont. Soc. Vol. ¹¹ ~~10~~. Pp. 96-97, pl. xii, figs. 17-19.

Capillirhynchia about 14 mm. long, 15 mm. wide and 10 mm. thick, transversely oval to sub-pentagonal in outline, semi-circular in anterior contour. Brachial valve of considerable convexity with very faint median depression, and broad but faint median fold near the anterior margin; pedicle valve less convex with shallow anterior sinus; linguiform extension large, arcuate to semi-circular.

Umbo small, erect to suberect; foramen moderate in size, deltoidal, plates produced. Beak-ridges indistinct; interarea small.

Ornament of about 50 fine rounded costae, with 12 on fold and 11 in sinus. Apical angle 105° .

Figured specimen.- A young individual from the Warminster Greensand, Warminster, Wiltshire. B.M. (B 25316c).

Material and localities.- 20 specimens from the Cenomanian of England, Wiltshire: Warminster.

Description.- The anterior margin of the shell is truncated, particularly in young specimens, where the depression of the brachial valve meets the sinus in the pedicle valve. The brachial valve is of considerable convexity, and

the faint broad fold is barely discernible. The slight median depression occurs at all stages of growth. In the later stages of growth, the lateral parts of the valve grow more rapidly than the median part. The pedicle valve is less convex. The broad median sinus commences about midway between the umbo and the anterior commissure. The broad arcuate linguiform extension turns in the dorsal direction until vertical to the plane of junction of the valves.

The umbo is small, sharp. The foramen is moderate in size, circular.

The deltidial plates are produced into a wing-shaped or tubular extension.

There are about 50 fine, rounded costae, with narrow intervening sulci. The costae which are capillate in appearance, commence at the umbo, and are extremely fine at first, becoming broader near the commissure. The lateral costae gradually bend outwards in the lateral direction. The concentric ornament is obscure and is only seen on the sides of the costae.

Remarks.-- Closely allied forms belonging to the same genus occurring at various horizons in the Cenomanian are being investigated. A Platyrhynchia goepta bears some resemblance to this species but differs internally and possesses a stouter umbo and much smaller and narrower linguiform extension.

Type-specimen.-- D'Orbigny gives the following dimensions in his description: width 15 mm. Ratio of length / width, 91/100; ratio of thickness/width, 71/100.

6. STRATIGRAPHICAL.

As a result of the present work, it is possible to recognise three groups in the Rhynchonellid fauna of the British Chalk ⁱⁿ stratigraphical sequence sections.

The first group consists of the Rhynchonellid forms in the Lower Cenomanian, including Capillirhynchia grasiata, "Rhynchonella" martini and a number of other forms, none of which has been found above the Totternhoe Stone. With the exception of C. grasiata, these forms have not been examined in detail in the present work. A few forms of Platyrhynchia have been found in the Lower Cenomanian, but the material is at present insufficient for proper study, except in the case of P. mantelliana which occur near the top of these beds.

In the series of strata above the Totternhoe Stone and up to the Chalk Rock, the Rhynchonellid fauna consists ofly of species of Platyrhynchia. No other Rhynchonellids occur in these beds in Britain so far as is known although similar forms may conceivably occur abroad. The Totternhoe Stone and the Chalk Rock thus mark horizons of major change in the Rhynchonellid fauna of the Chalk Seas.

The third group of the fauna is that which occurs in the beds above the Chalk Rock, that is the Senonian fauna; it includes Cretirhynchia plicatilis and allied forms, and a few small forms of Platyrhynchia.

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Table showing Stratigraphical Distribution of the
Chalk Rhynchonellids.

Zone	Species of <u>Platyrhynchia</u>	Species of <u>Cretirhynchia</u> and <u>Capillirhynchia</u> .
Mucronata		(<i>Cretirhynchia limbata</i> (<i>C. norvicensis</i> (<i>C. woodwardi</i>
Quadratus	<i>P. bella</i>	
	<i>P. granum</i>	<i>C. sp.</i>
Pillula	<i>P. cf. pisiformis</i>	
Thrupites		<i>C. exsculpta</i>
Urtacrinus	<i>P. pisiformis</i>	
Cor-anguinum	<i>P. pisiformis</i>	<i>C. plicatilis</i>
Cor-testudin- arium		<i>C. octoplicata</i>
Planus	(<i>P. dispana</i> (<i>P. reedensis</i>	<i>C. cuneiformis</i> <i>C. minor</i>
Lata	(<i>P. heberti</i> (<i>P. pulchra</i>	
	(<i>P. compta</i> (<i>P. cuvieri</i>	
Cuvieri	(<i>P. extensa</i> (<i>P. intermedia</i>	
Planus	(<i>P. tringensis</i> (<i>P. multicosata</i>	
Subglobosus	(<i>P. demissa</i> (<i>P. multicosata</i>	
Varians	(<i>P. mantelliana</i> (top) (<i>P. parva</i> "	<i>Capillirhynchia graciana</i>

The genus Platyrhynchia occurs at levels in the Chalk of England from the Varians zone in the Lower Chalk up to the Quadratus zone near the top of the Upper Chalk. There were three major periods of development, the first in the Middle Cenomanian at about the time of deposition of the Totternhoe Stone, when F. costelliana, F. parva and similar forms were abundant, the second marked by the Melbourn Rock with F. cuvieri and F. intermedia, and the third by the Chalk Rock with F. reedensis and F. dispersa. The facies at these three horizons are considered to indicate conditions of shallow water and contemporaneous erosion. The genus is also represented in the shallow water deposits of the Cenomanian in South Devon by F. wissti.

Platyrhynchia is the only ^{genus} Rhynchonellid found in the Subglobosus, Plenus, Cuvieri and Lata zones of southern England. The other Rhynchonellid forms found in the Cenomanian did not survive the end of the Varians zone of this region, except perhaps in the Upper Cenomanian of South Devon, but here the succession is in doubt owing to redeposition of the beds. In the Chalk Rock Platyrhynchia is accompanied by Cretirhynchia minor and C. cuneiformis and in the Cor-anguinum zone by C. plicatilis, and in the higher beds of the Chalk by other species of Cretirhynchia. Above the Chalk Rock, Platyrhynchia is represented by dwarf forms such as P. pisiformis, P. vella, and P. granum.

It has not been possible to investigate in detail the Rhynchonellid fauna of the Lower Cenomanian. This episode concluded at about the horizon of the Tottenham Stone with abundant Platyrhynchia mantelliana, P. parva and other species. During the succeeding Subgloboeus zone of South-East England a few specimens of Platyrhynchia are the only Rhynchonellids found. They display characters intermediate between those of P. mantelliana and P. suviari. They include the rather tumid P. demissa with between 20, and 24 costae, and, in the Planus sub-zone, P. triprensis, also tumid and with between 24 and 28 costae. In the Planus sub-zone occurs also the finely costate P. sulcicostata which has about 40 costae, more than any other species belonging to the genus.

There is some resemblance between the forms of Platyrhynchia found in the Subgloboeus zone and those from the Lata zone in the number of costae, but in general the former are rather more tumid and the costae are somewhat more angular. Similarly, the species of Platyrhynchia from the Upper Varian zone (P. mantelliana and P. parva) have approximately the same number of costae as species from the Planus zone (P. reedensis) and higher zones (P. pieiformis and P. granum), although minor differences facilitate the identification of the various forms.

Although it is still doubtful with which horizon within the Cenomanian the beds containing P. wiestii should be correlated, the affinities of the species appear to lie with forms from the Upper Cenomanian and with P. suviari.

In the Cuvieri zone occur the large P. cuvieri and P. extensa, the small and tumid P. compta, the depressed form, P. praedispansa and the sulcate P. intermedia, all with approximately 30 costae.

In the Lata zone are found P. heberti, intermediate in its characters also between P. cuvieri and P. reedensis, and P. pulchra, both with about 26 costae. P. reedensis also makes its appearance in this zone but is more abundant in the succeeding zone.

In the Planus zone, in addition to P. reedensis and P. dispansa, the first representatives of the genus Cretirhynchia appear, namely C. minor and C. cuneiformis.

Cretirhynchia plicatilis appears to be confined to the Cor-anguinum zone. Platyrhynchia is represented in this zone by small forms including P. nivaliformis. In this and succeeding zones, the costae in this genus become on the commissure subangular and the sulci are quite deep. In addition, the costae start at a relatively late stage of growth; this trend is particularly well developed in P. bella where the costae do not commence until a very late stage and are only seen near the commissure, the surface of the shell being consequently nearly smooth. A similar trend is found in Cretirhynchia, the resultant nearly smooth member of the genus being C. limbata, which occurs, however, at a higher horizon in the Macronata zone.

The species of Platyrhynchia from these higher zones bear some resemblance to P. mantelliana in the number of costae and the depth of the sulci. They may be distinguished, apart from the obvious difference in matrix, by minor differences in outline and other characters; in particular, the costae and sulci in P. mantelliana are more angular.

The decrease in size of Platyrhynchia continues in the Pillula and Quadratus zones, where the minute P. granum occurs with P. bella; Cretirhynchia

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is also found.

In the Macrénata zone, Cretirhynchia is abundant, being represented by the species C. limbata, C. norvicensis and C. woodwardi.

It may be mentioned in this section, that a number of Rhynchonellid forms from Lincolnshire which were examined, appeared to represent a different facies from that occurring in the South of England.

Unfortunately, good specimens of several of the species described in the paper are comparatively rare. Damaged specimens, however, are usually of little use for indicating the stratigraphical horizon, as some of the characteristic features are probably missing. In addition, determinations in the field are rather difficult; many of the features to be observed in the specimen can often only be revealed by carefully removing the matrix and cleaning the surface of the shell.

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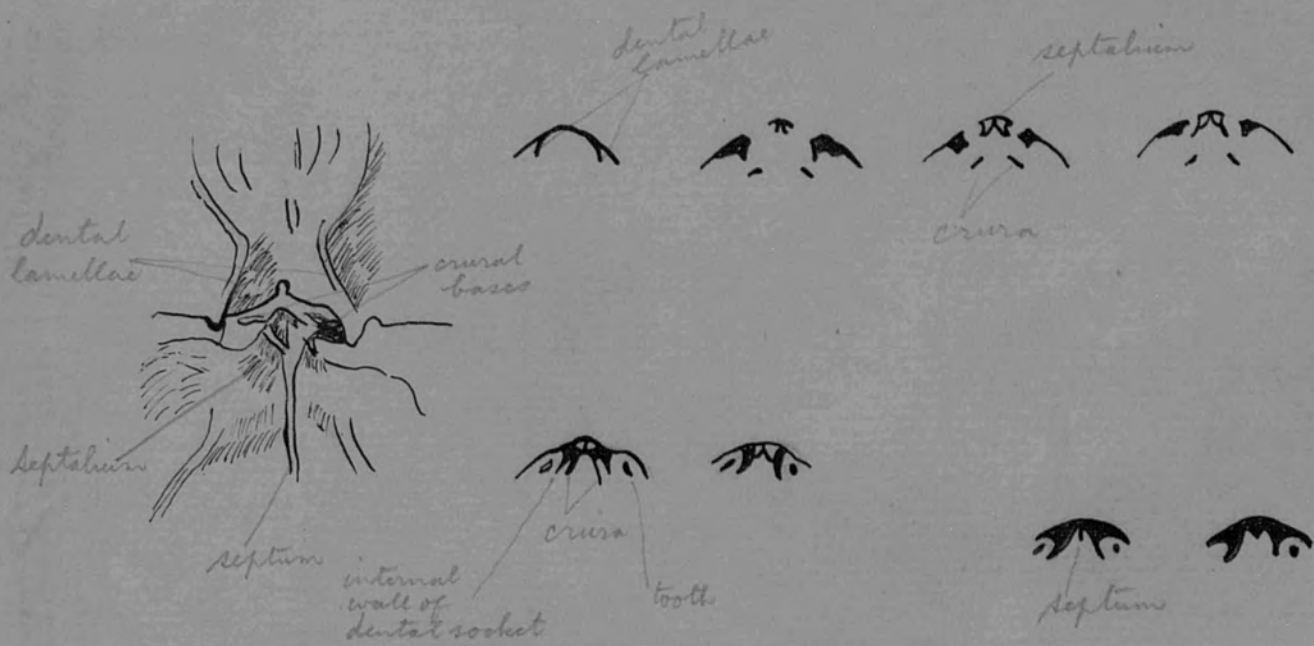
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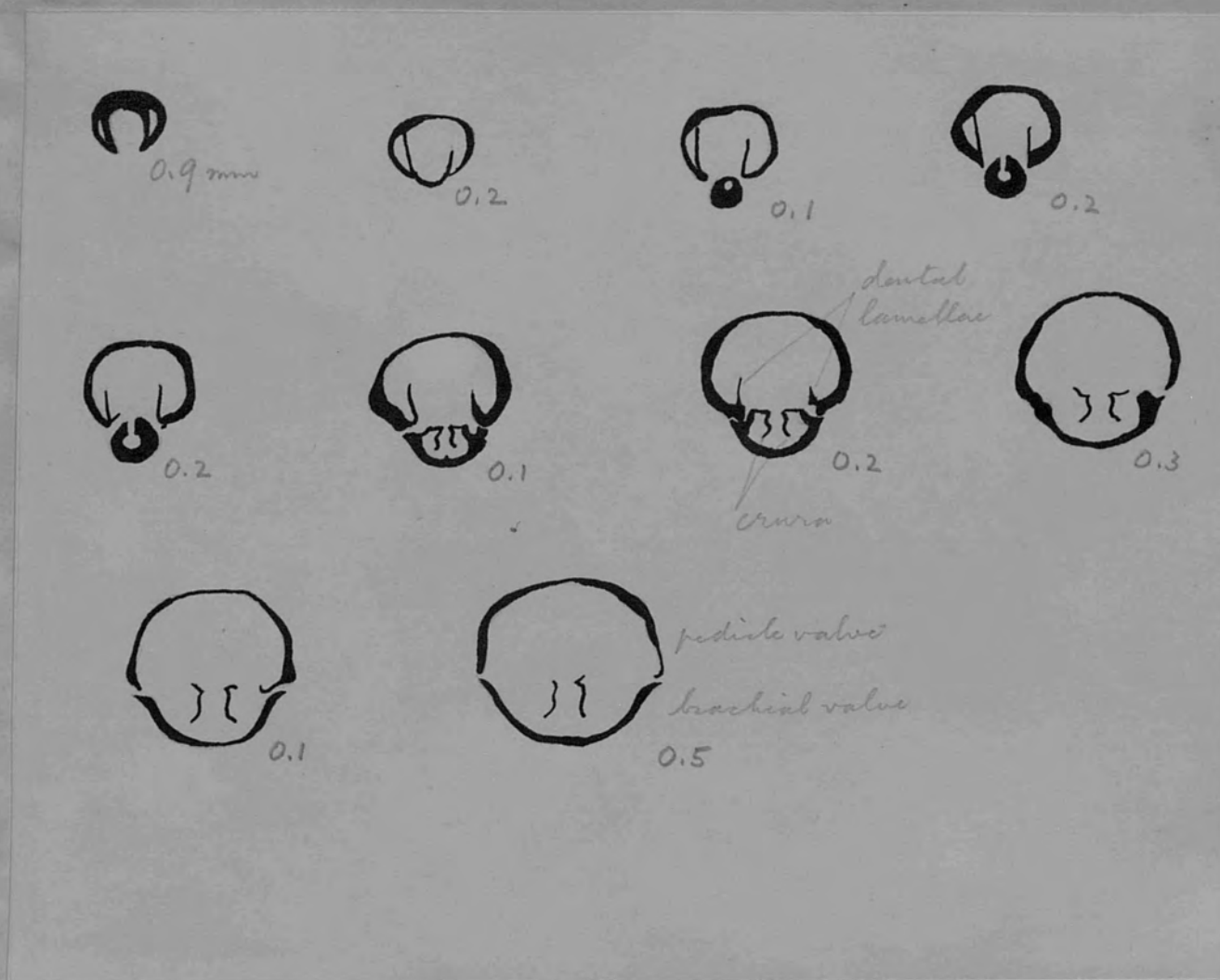
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Woodward, S. 1833. An Outline of the Geology of Norfolk.



Text-fig. 1. *Rhynchonella loxia* Fischer de Waldheim, Bononian, Moscow district. X 3. A-H, series of eight transverse sections through the umbonal region. (After Wisniewska).



Text-fig. 2. Platyrhynchia intermedia sp. nov. Paratype;
 transverse sections through the posterior part of the shell.
 Cuvieri zone, Burham, Kent. G.S.M. (AT 2222e). X3.



Text-fig. 3. Capillirhynchia graciana (d'Orbigny). transverse sections through the posterior part of the shell. Cenomanian, Warminster Greensand, Warminster, Wiltshire. B.M. (N.H.) (B 25316c). X2.8.

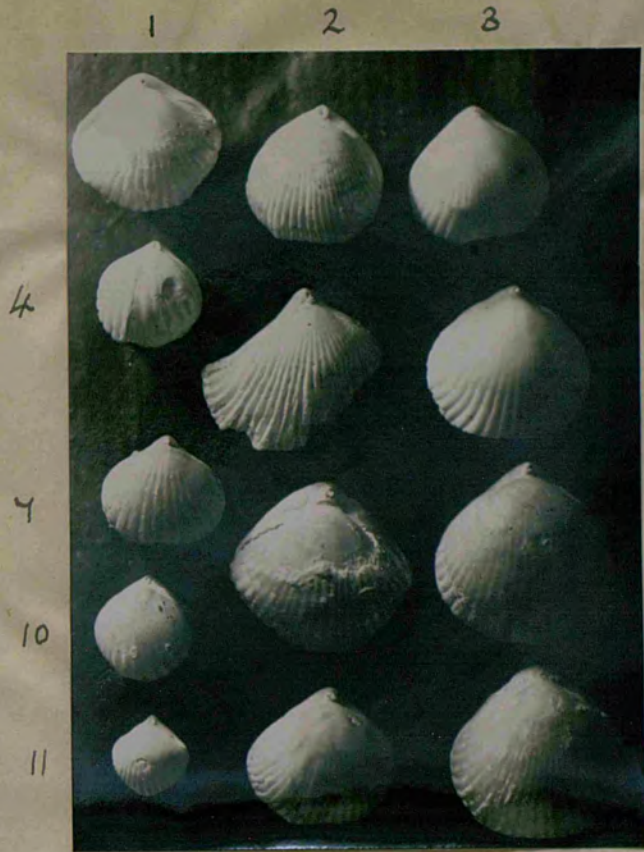
PLATE I.

a. Dorsal view. b. Lateral view. c. Anterior view.

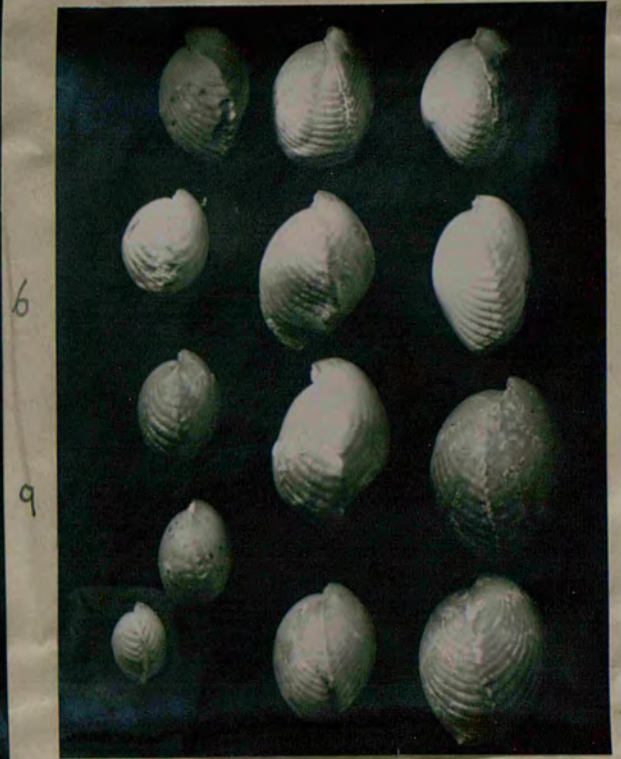
All specimens X 1.4.

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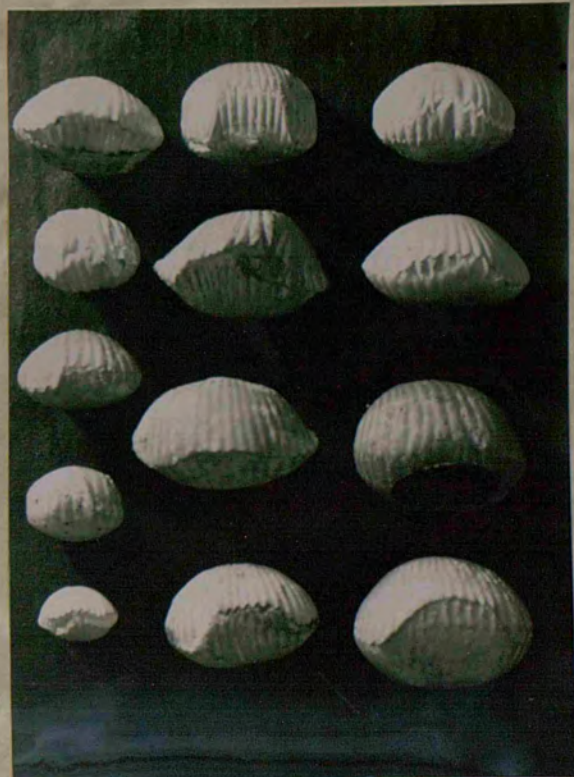
B.M.—British Museum (Natural History).
G.S.M.—Geological Survey and Museum.



Figs. 1a- a.



Figs. 1b- b.



Figs. 1c- c.

Figures not intended for publication

PLATE II.

a. Dorsal view. b. Lateral view. c. Anterior view.

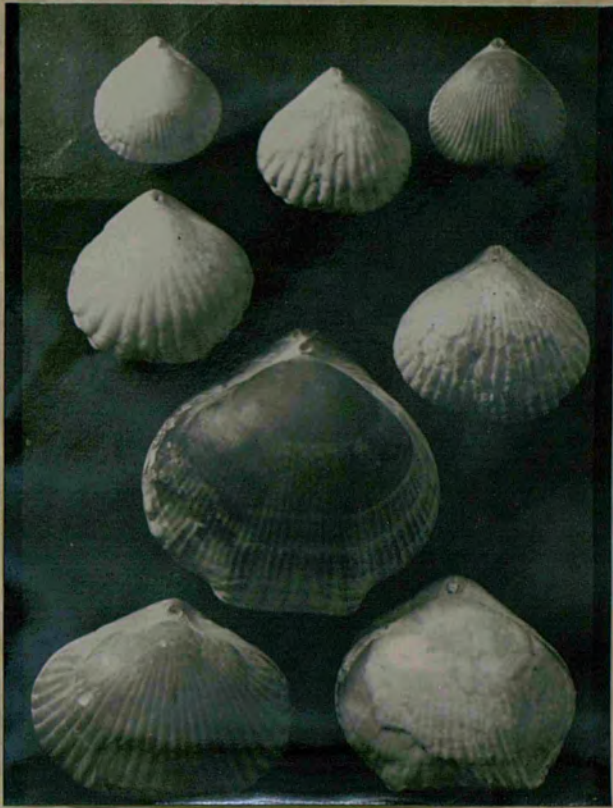
All specimens figured X 1.4.

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5a-c.	<u>Platyrrhynchia extensa</u> sp. nov. Holotype; Middle Chalk, cliff west of Branscombe coastguard station, Devon. G.S.M. (Nn 4683).	47
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B.M. = British Museum (Natural History).

G.S.M. = Geological Survey and Museum.

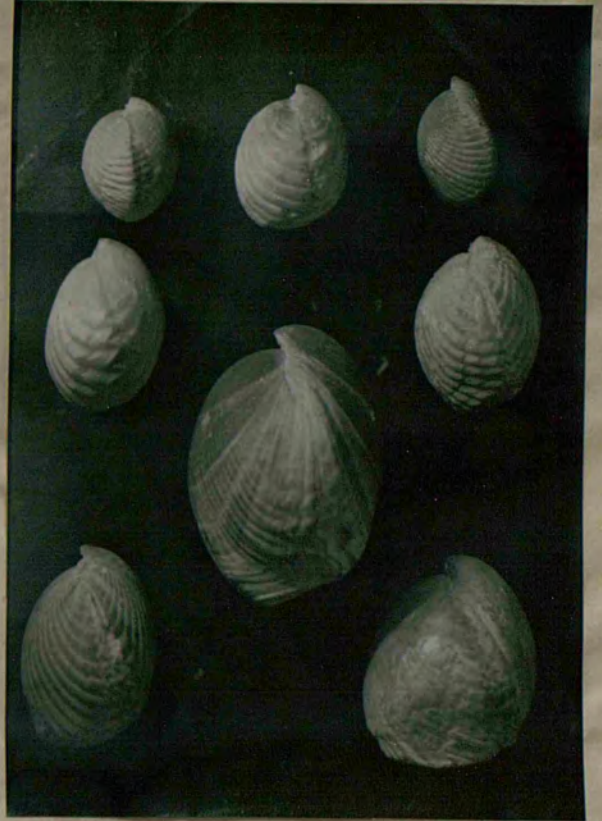
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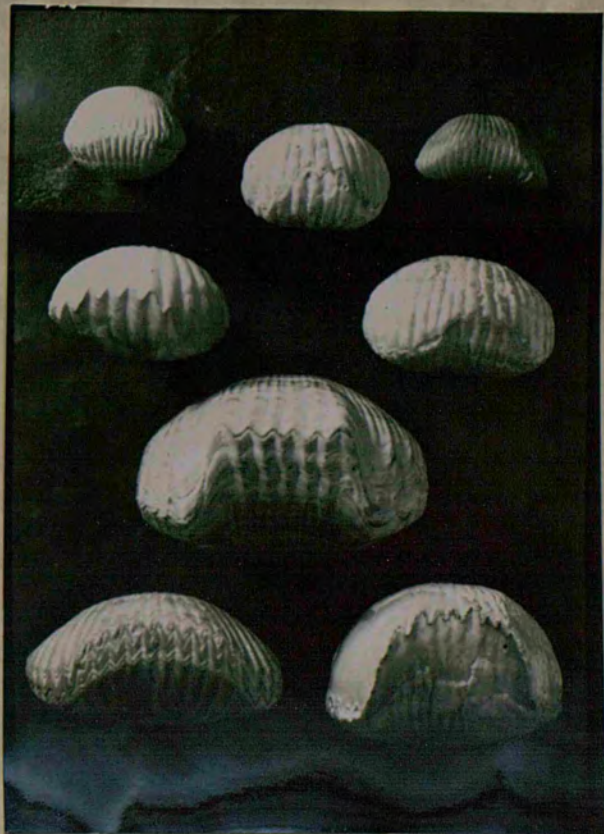


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8

Figs. 1a-8a.

Figs. 1b-8b.



Figs. 1c-8c.

PLATE III.

a. Dorsal view. b. Lateral view. c. Anterior view.

All specimens figured X 2.

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| 1a-c. | <u>Platyrhynchia mantelliana</u> (J. de C. Sowerby). Holotype (figd. J. de C. Sowerby, 1826, pl. dxxxvii, fig. 5); Lower Chalk, Hamsey, Sussex. Sowerby coll., B.M.(B 61490). 27 |
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1a



1b



1c



2a



2b



2c



3

PLATE IV.

All figured specimens X2.

Figs. 1a-c. Platyrrhynchia obliqua (J. Sowerby). Holotype; (figured J. Sowerby, 1821, pl. cclxxvii, fig. 2) Chalk, Ramsgate. Sowerby coll. B.M. (B 61512). Page 68

Figs. 2a-c. Platyrrhynchia pisiformis sp. nov. (^{para}~~syn~~type of P. obliqua (J. Sowerby)); Chalk, Norfolk. Sowerby coll. B.M. (B 61511). Page 68

Figs. 3a-c. Platyrrhynchia cf. dispansa sp. nov. (figured Davidson, 1855, pl. x, figs. 45,46, as Rhynchonella plicatilis var. woodwardi Dav.); Chalk Detritus, Charing, Kent. Davidson coll. B.M. (B 113). Pages 62,92.

1a



1b



1c



2a



2b



2c



3a



3b



3c



PLATE V.

All figures X2.

Figs. 1a-c. Cretirhynchia plicatilis (J. Sowerby). Holotype (figured J. Sowerby, 1816, pl. cxviii, fig. 1); Upper Chalk, Northfleet, Kent. Sowerby coll. B.M. (B 61513). Page 84.

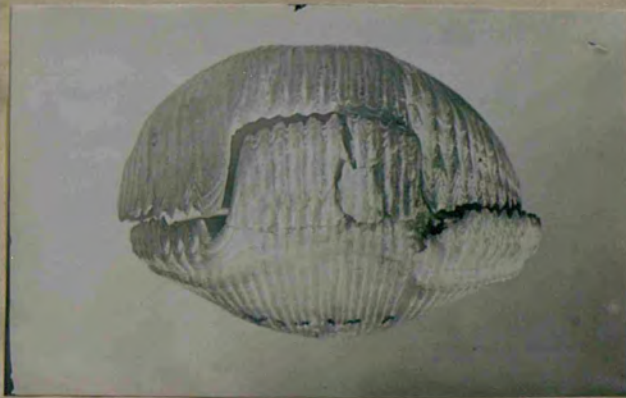
Figs. 2a-c. Cyclothyris latissima (J. de C. Sowerby). Holotype (figured J. de C. Sowerby, 1825, pl. dii, fig. 1); Lower Greensand, Faringdon, Rr Berkshire. Sowerby coll. B.M. (B 61499). Page 22



1a



1b



1c



2a



2b



2c

PLATE VI.

PLATE VI.

Figs. 1a-c. Cretirhynchia octoplicata (J. Sowerby). Lectotype; (figured J. Sowerby, 1816, pl. cxviii, fig. 2) from the Chalk of Lewes, Sussex. Preserved in the B.M. (N.H.) (B 61478). Page 31.

Figs. 2a-c. Cretirhynchia octoplicata (J. Sowerby). Syntype; (figured J. Sowerby, 1816, pl. cxviii, fig. 3) from the Chalk of Lewes, Sussex. Preserved in the B.M. (N.H.). (B 61479). (Figure not intended for publication)

Figures X 2.

51

52

52

52

1a



1b



1c



2a



2b



2c



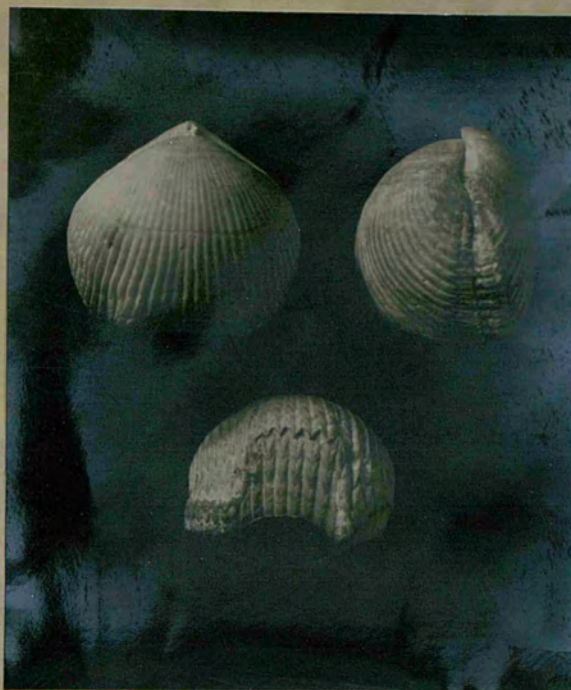


Plate VII

Specimens figured X 1.4

Figs. 1a-c. Cretirhynchia exsculpta sp. nov. Marsupites band, Brighton and Friar's Bay, Sussex. A.W. Rowe coll. B.M. 1a, Holotype (B 79824); 1b, Paratype (B 79827); 1c, Paratype (B 79832). (1b and 1c not for publication).