28. *The MOLLUSCA of the CHALK ROCK: PART II.* By HENRY WOODS,
M.A., F.G.S. (Read May 12th, 1897.)

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I. INTRODUCTION.

THE first part of this paper, dealing with the Cephalopoda, Gastropoda, and Scaphopoda, appeared in the preceding volume of this Journal.¹ In the present communication I propose to consider the Lamellibranchia, and to discuss the relations and distribution of the fauna of the Chalk Rock and the conditions under which that fauna lived.

The Lamellibranchs are represented by a larger number of species than either the Cephalopoda or the Gastropoda, but, on account of the imperfect manner in which their remains are preserved, greater difficulty has been found in studying them than was the case with the groups considered in Part I. Again, there is evidence of the existence of forms other than those herein described, but the specimens now at my disposal are not sufficiently good for determination. I shall hope, after more collecting has been done, to be able to supplement this work, and shall be grateful for any opportunity of examining specimens from this zone.

For further assistance I must again thank the gentlemen mentioned in Part I., particularly Mr. Jukes-Browne, Mr. E. T. Newton, Mr. G. C. Crick, and Mr. R. M. Brydone.

II. Class LAMELLIBRANCHIA.

Family Nuculanidæ, Stoliczka.

Genus NUCULANA, Link, 1807

[=*Leda*, Schumacher, 1817].

NUCULANA cf. *SILIQUA* (Goldfuss).

1837. *Nucula siliqua*, A. Goldfuss, 'Petref. Germ.' vol. ii. p. 156, pl. cxxv. f. 13;
1846. A. E. Reuss, 'Die Verstein. der böhm. Kreideformat.' pt. ii. p. 7, pl. xxxiv.

¹ Vol. lii. (1896) pp. 68-98 & pls. ii-iv. Correction to be noted there:—
pp. 88 *et seqq.*, for *Trochus berocscirens* read *Trochus berocscirensis*.

f. 11; 1889. O. Griepenkerl, 'Die Verstein. der Senon. Kreide von Königsutter,' Paläont. Abhandl. vol. iv. p. 57.

1850. *Leda siliqua*, A. d'Orbigny, 'Prodr. de Pal.' vol. ii. p. 236; 1877. A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. II. Die Weissenberger u. Malnitzer Schichten,' p. 117, f. 81; 1889. E. Holzapfel, 'Die Mollusken der Aachener Kreide,' Paläontographica, vol. xxxv. p. 203; 1893. A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. V. Priesener Schichten,' p. 92; 1895. F. Vogel, 'Die holländ. Kreide,' p. 37.

1885. *Nuculana siliqua*, F. Nötling, 'Die Fauna d. baltisch. Cenoman-Geschiebe,' Paläont. Abhandl. vol. ii. pt. iv. p. 27, pl. iv. f. 15.

[Non *Nucula siliqua*, H. B. Geinitz, 'Char. d. Schichten u. Petref. d. sächs.-böhm. Kreidegeb.' pt. iii. (1842) p. 77, pl. xx. f. 28 & 29.]

Remarks.—There are two specimens in the Montagu Smith Collection which agree well with the figures given by Goldfuss and Reuss, but since, like the figured specimens, they are in the form of casts, it is difficult to be sure of their identity. The approximate size of one of the specimens is:—length=16 mm.; height=6 mm. The type of the species comes from the Aachen Greensand (Lower Senonian).

Distribution.—*England*: Chalk Rock of Cuckhamsley. *North-western Germany*: Maestrichtian of Konrath near Aachen; *Hervien* of Aachen. *Bohemia*: Weissenberg and Priesen Beds.

Family Nuculidæ, Gray.

Genus NUCULA, Lamarck, 1799.

NUCULA sp. (Pl. XXVII. figs. 1 & 2.)

Remarks.—A species of *Nucula* is represented in the Montagu Smith Collection by eleven specimens; it approaches closely in form d'Orbigny's *N. Renauxiana*¹ found in the Turonian of Uchaux, but, unfortunately, all the specimens are internal casts, so that an exact determination is impossible. Size of an average specimen: length=13 mm.; height=10 mm.

Distribution.—Chalk Rock of Cuckhamsley.

Family Arcidæ, Lamarck.

Genus ARCA, Linnæus, 1766.

ARCA sp., cf. GALLIENNEI, d'Orbigny. (Pl. XXVII. fig. 3.)

There are two casts from Cuckhamsley in the Montagu Smith Collection which agree with *A. Galliennei*, d'Orbigny,² from the Cenomanian of Le Mans, Rouen, etc., except that they are rather shorter. Size of a specimen: length=33 mm.; height=19 mm.

ARCA (BARBATIA) sp., cf. GEINITZI, Reuss, 1844. (Pl. XXVII. figs. 5 & 6.)

[See especially, Reuss, 'Geogn. Skizzen,' vol. ii. (1844) p. 192, and 'Die Verstein. der böhm. Kreideformat.' pt. ii. (1846) p. 11, pl. xxxiv. f. 31; Geinitz, 'Das

¹ 'Pal. Franç. Terr. Crét.' vol. iii. (1843-47) p. 179 & pl. ccxiv. figs. 7-9. This is regarded by Pictet & Campiche, 'Foss. Terr. Crét. Ste. Croix,' pt. iii. (1866) p. 418, as a synonym of *N. impressa*, Sowerby.

² *Op. supra cit.* p. 218 & pl. ccxiv.

Elbthalgeb. in Sachsen,' pt. ii. (1873) p. 55, pl. xvi. f. 78; Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. IV. Die Teplitzer Schichten' (1889), p. 79, fig. 63; Favre, 'Moll. Foss. de la Craie des Envir. de Lemberg' (1869), p. 125, pl. xii. f. 15 & 16.]

Remarks.—A specimen, consisting of an internal, and part of an external mould, agrees with *A. Geinitzi* in form, but differs in possessing rather finer and more numerous ribs. It is probably the form figured by Sowerby as *Byssarca marullensis*¹ from the Chalk of Kent. Size of specimen from Cuckhamsley: length (approximate)=23 mm.; height=11 mm.

A. Geinitzi occurs in the Pläner-Kalk of Strehlen (Saxony), in the Teplitz Beds of Bohemia, etc.

Distribution.—Chalk Rock of Cuckhamsley.

ARCA sp. (Pl. XXVII. fig. 4.)

Description.—Shell oblique, elongate, anteriorly very short and rounded. Posterior margin oblique, somewhat rounded. Umbones sharp. Surface with concentric lines of growth; and with radiating ribs extending from the umbo to the posterior margin. Size: length=13 mm.; height=6 mm.

Remarks.—This species is at present known by one specimen only. It resembles *Arca strehlensis*, Geinitz, from the Pläner-Kalk of Strehlen, but in that form the shell is less oblique, and the surface is generally smooth, except on the anterior part which is marked with radiating ribs.

Distribution.—Chalk Rock of Cuckhamsley (Montagu Smith Collection).

Genus *LIMOPSIS*, Sassi, 1827.

LIMOPSIS sp. (Pl. XXVII. figs. 7 & 8.)

Description.—Shell small, oval, convex, a little oblique, wider than long; margins of valves not crenulate. Casts show fine radiating striae, sometimes crossed by a few shallow concentric furrows. Size: length=8 mm., height=7 mm.

Remarks.—At present this species is known only from the casts, so that a complete description cannot yet be given; it seems, however, quite distinct from the other forms. I have not been able to make out the hinge-plate in a satisfactory manner, and it is possible that this species may really belong to *Avincea*.

Affinities.—Römer's² *Pectunculus planus* is similar to this species, but the valves are flatter and the umbones less prominent.

Distribution.—Chalk Rock of Cuckhamsley.

¹ Sowerby (*non d'Orbigny*) in F. Dixon's 'Geol. Sussex' (1850), p. 355 & pl. xxviii. fig. 11. I have not been able to find the original of Sowerby's figure.

² 'Die Verstein. des norddeutsch. Kreidegeb.' 1841, p. 69 & pl. viii. fig. 24.

Family Mytilidæ, Lamarck.

Genus MODIOLA, Lamarck, 1799.

MODIOLA COTTÆ, Römer, 1841. (Pl. XXVII. figs. 9-12.)

1840. *Modiola Cottæ*, H. B. Geinitz, 'Char. der Schicht. u. Petref. des sächs. Kreidegeb.' pt. ii. p. 56, pl. x. f. 5; 1873. H. B. Geinitz, 'Das Elbthalgebirge in Sachsen,' Palæontographica, vol. xx. pt. i. pl. xlviii. f. 4-8, p. 214.

1841. *Mytilus Cottæ*, F. A. Römer, 'Die Verstein. des norddeutsch. Kreidegeb.' p. 66, pl. viii. f. 18; 1843. H. B. Geinitz, 'Die Verstein. von Kieslingswalda,' p. 15; 1846. A. E. Reuss, 'Die Verstein. der böhm. Kreideformat.' pt. ii. p. 14, pl. xxxiii. f. 4; 1850. A. d'Orbigny, 'Prodr. de Pal.' vol. ii. p. 246; 1889. A. Fritsch, 'Stud. im Geb. der böhm. Kreideformat. IV. Die Teplitzer Schichten,' p. 79, f. 66.

1842. ? *Mytilus Cuvieri*, P. Matheron, 'Cat. méth. et descript. des Corps org. foss. du Dép. des Bouches-du-Rhône,' p. 179, pl. xxviii. f. 9 & 10.

1850. *Modiola quadrata*, J. de C. Sowerby, in F. Dixon's 'Geol. Sussex,' p. 347, pl. xxviii. f. 13 [p. 382, 2nd ed.]; 1854. J. Morris, 'Cat. Brit. Foss.' 2nd ed. p. 211.

Remarks.—This species was figured by J. de C. Sowerby as *Modiola quadrata*; but I have not been able to find the type, which was stated to come from the Lower Chalk, no locality being mentioned. The figures of *M. Cottæ* given by different authors vary considerably, but a careful comparison of the Chalk Rock specimens with the figures in Geinitz ('Das Elbthalgebirge in Sachsen') and Fritsch leaves practically no doubt that *M. quadrata* is identical with *M. Cottæ*. The type of the latter comes from the Cenomanian of Plauen, near Dresden. In England the species is not common.

Distribution.—*England*: Chalk Rock of Winchester, Cuckhamsley, Luton cutting, and Underwood Hall near Dullingham. Upper Chalk of Northfleet. *Saxony*: Cenomanian Pläner of Plauen; Lower Quader Sandstone (Cenomanian) of Golberoda, and Klein-Nauendorf; Pläner-Kalk of Strehlen. *Bohemia*: Teplitz Beds.

Family Pernidæ, Zittel.

Genus INOCERAMUS, Sowerby, 1819.

INOCERAMUS BRONGNIARTI, Sowerby, 1823.

1823. *Inoceramus Brongniarti*, J. de C. Sowerby, 'Min. Conch.' vol. v. pl. ccccxli. f. 2 & 3, p. 60; 1854. J. Morris, 'Cat. Brit. Foss.' 2nd ed. p. 169.

[*Non I. Brongniarti*, G. A. Mantell, 'Foss. S. Downs' (1822), p. 214, pl. xxvii. f. 8.]

1822. *Inoceramus Lamarcki*, G. A. Mantell (*non* Parkinson), 'Foss. S. Downs,' p. 214, pl. xxvii. f. 1.

Remarks.—In the present paper I shall refrain from giving a full account of the synonymy and distribution of the species of *Inoceramus* which occur in the Chalk Rock, as I hope to deal at another time with all the species of this genus. The specimen figured by Mantell is different from Parkinson's species, and is probably identical with Sowerby's *Brongniarti*. Mantell's *Brongniarti* appears to be the same as Parkinson's. Sowerby's types (without locality) are preserved in the British Museum, and also the originals of Mantell's *I. Lamarcki*, from near Lewes, and of his *Brongniarti* from Sussex.

Distribution.—*England*: Chalk Rock of Cuckhamsley, Oldborough Castle, and Luton. Upper Chalk.

INOCERAMUS STRIATUS, Mantell, 1822. (Pl. XXVII. fig. 13.)

1822. *Inoceramus striatus*, G. A. Mantell, 'Foss. S. Downs,' p. 217, pl. xxvii. f. 5; 1828. J. de C. Sowerby, 'Min. Conch.' vol. vi. p. 160, pl. dlxxii. f. 2; 1854. J. Morris, 'Cat. Brit. Foss.' 2nd ed. p. 170; 1872-73. H. B. Geinitz, 'Das Elbthalgeb. in Sachsen,' Palæontographica, vol. xx. pt. i. p. 210, pl. xlvi. f. 9-13; pt. ii. p. 41 (?? pl. xiii. f. 1, 2, 9, 10).

Remarks.—The specimens found in the Chalk Rock differ from the types in being less rounded—they are higher than long. If this character be constant it may indicate a different species, but this cannot be determined until a much larger collection has been obtained. At present I have seen only three or four specimens from the Chalk Rock; they agree in form with some which were collected from the Upper Chalk of Newmarket. Size of Chalk Rock specimens:—(1) Length=24 mm.; height=33 mm. (2) Length=30 mm.; height=38 mm.

Both Mantell's and Sowerby's types are in the British Museum; the former was obtained at South Street, Lewes; the latter near Heytesbury (? Lower or Middle Chalk).

Distribution.—*England*: Chalk Rock of Roman Road (south-east of Calstone Willington) and Cuckhamsley. Lower, and perhaps also Middle and Upper, Chalk. *Ireland*: Hibernian Greensand—Chloritic Sandstone division (*vide* Tate).

INOCERAMUS sp. (Pl. XXVII. figs. 14-17.)

Remarks.—A small species, which is unlike any described form with which I am acquainted, but is at present represented by casts only, is moderately common in the Chalk Rock. The shell is rather convex, higher than long, with shallow concentric furrows and prominent pointed umbones.

Distribution.—Chalk Rock of Lichfield (Hants), Winchester, Roman Road south-east of Calstone Willington, Cuckhamsley, Luton cutting, Wallington near Baldock, and Underwood Hall near Dullingham.

Family Ostreidæ.

Genus OSTREA, Linnæus, 1766.

OSTREA SEMIPLANA?, Sowerby, 1825.

1825. *Ostrea semiplana*, J. de C. Sowerby, 'Min. Conch.' vol. v. pl. cccclxxxix. f. 3, p. 144.

Remarks.—The genus *Ostrea* is poorly represented in the Chalk Rock. The specimens which I believe to be referable to *O. semiplana* are rather small, and this probably accounts for the fact that the plications of the marginal part of the valves are only faintly indicated. Sowerby's types came from Norwich, and are now in the British Museum.

Distribution.—*England*: Upper and Middle Chalk; Chalk Rock of Cuckhamsley, and Underwood Hall near Dullingham. *Ireland*: Hibernian Greensand. *Northern France*: zone of *T. gracilis* in the Yonne and Aube, zone of *Epiaster brevis* at Thiernu, zone of *M. breviporus* at Cambrai, Senonian of the neighbourhood of Eprenay and

Reims. *Aachen*: *Quadrata*- and *Mucronata*-beds. *North-western Germany*: Senonian of Salzberg, Cæsfeld, etc. *Saxony*: Cenomanian of Plauen, Pläner-Kalk of Strehlen and Weinböhl. *Silesia*: Cenomanian of Bladen. *Bohemia*: Weissenberg, Malnitz, Iser, Teplitz, and Priesen Beds. *Bavaria*: Kagerhöh Beds. *Galicia*: Chalk of Nagozany and Lemberg.

Family Pectinidæ, Lamarck.

Genus CHLAMYS, Bolten, 1798.

CHLAMYS TERNATA (Goldfuss), 1833.

1833. *Pecten ternatus*, A. Goldfuss, 'Petref. Germ.' vol. ii. p. 52, pl. xci. f. 13; 1841. F. A. Römer, 'Die Verstein. des norddeutsch. Kreidegeb.' p. 53; 1842. H. B. Geinitz, 'Char. d. Schichten u. Petref. des sächs.-böhm. Kreidegeb.' pt. iii. p. 83; 1850. A. d'Orbigny, Prodr. de Pal. vol. ii. p. 252; 1889. O. Griepenkerl, 'Die Verstein. der Senon. Kreide von Königslutter,' Paläont. Abhandl. vol. iv. p. 43.

1837. *Pecten septemplex*, F. Dujardin (*non* Nilsson), Mém. Soc. géol. France, vol. ii. p. 227, pl. xvi. f. 11.

1841. *Pecten Dujardini*, F. A. Römer, 'Die Verstein. des norddeutsch. Kreidegeb.' p. 53; 1843-47. A. d'Orbigny, 'Pal. Franç. Terr. Crét.' vol. ii. p. 615, pl. ccccxxxix. f. 5-11; 1846 ?? A. E. Reuss, 'Die Verstein. der böhm. Kreideformat.' pt. ii. p. 30, pl. xxxix. f. 17; 1850. J. de C. Sowerby, in F. Dixon's 'Geol. Sussex,' p. 356, pl. xxviii. f. 4; 1850. A. d'Orbigny, 'Prodr. de Pal.' vol. ii. p. 251; 1850. H. B. Geinitz, 'Das Quadersandsteingeb. oder Kreidegeb. in Deutschland,' p. 184; 1854. J. Morris, 'Cat. Brit. Foss.' 2nd ed. p. 176; 1870. F. Römer, 'Geol. von Oberschlesien,' p. 340, pl. xxix. f. 2, pl. xxxvii. f. 5; 1870. F. J. Pictet & G. Campiche, 'Foss. du Terr. Crét. de Ste. Croix,' Matér. Pal. Suisse, ser. 5, pt. iv. p. 219; 1872. H. B. Geinitz, 'Das Elbthalgeb. in Sachsen,' Paläontographica, vol. xx. pt. ii. p. 36, pl. x. f. 10-12; 1877. A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. II. Die Weissenberg. u. Malnitzer Schichten,' p. 136, f. 137; 1883. A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. III. Die Iserschichten,' p. 116; 1889. Fritsch, *ibid.* IV. 'Die Teplitzer Schichten,' p. 85; 1893. Fritsch, *ibid.* V. 'Die Priesener Schichten,' p. 100; 1893. R. Michael, Zeitschr. d. Deutsch. geol. Gesellsch. vol. xlv. p. 242.

1842. ? *Pecten squamifer*, H. B. Geinitz, 'Char. d. Schichten u. Petref. des sächs.-böhm. Kreidegeb.' pt. iii. p. 83, pl. xxi. f. 5; 1850 ? Geinitz, 'Das Quadersandsteingeb. oder Kreidegeb. in Deutschland,' p. 184.

Remarks.—I have seen only two specimens of this form from the Chalk Rock. The species was founded by Goldfuss on a cast from the Quader Sandstone of Schandau. A specimen from Touraine was described by Dujardin as *P. septemplex*, Nilsson, but it was shown to be distinct from that species by Römer, who changed the name to *P. Dujardini*, by which it has since been generally known. Geinitz's *P. squamifer* and Reuss's *P. Dujardini* appear to be distinct from this species.

Distribution.—*England*: Chalk Rock of Winchester, and Clothall near Baldock. *Upper Chalk of Sussex* (*vide* Morris). *France*: zone of *Micraster breviporus* at Cambrai, zone of *Epiaster brevis* east of the Paris basin, zones of *Spondylus truncatus* and *Sp. spinosus* in Loir-et-Cher, zone of *Micraster cor-testudinarium* in the Nord, Upper Chalk of Tours (Indre-et-Loire). *Saxony*: Middle Quader Sandstone (*Inoceramus labiatus*-beds) of Rottwernsdorf and Gross-Cotta, Upper Pläner of Kritschwitz near Pirna, Glauconitic Sandstone (*Brongniarti*-beds), and Pläner-Kalk of Strehlen and Weinböhl. *Silesia*: *Scaphites*-beds of Oppeln. *Bohemia*: Weissenberg, Malnitz, Iser, Teplitz, and Priesen Beds. *Bavaria*: Kagerhöh Beds.

Family Limidæ, d'Orbigny.

Genus LIMA, Chemnitz, 1784.

LIMA GRANOSA, Sowerby, 1850.

1850. *Lima granosa*, J. de C. Sowerby in F. Dixon's 'Geol. Sussex,' p. 347, pl. xxviii. ff. 24 & 25 [p. 382, 2nd ed.]; 1854. J. Morris, 'Cat. Brit. Foss.' 2nd ed. p. 171.

Remarks.—Sowerby does not state from what locality his specimens came, and I have not been able to find the type. I have seen only two examples from the Chalk Rock.

Distribution.—*England*: Chalk Rock of Winchester (coll. R. M. Brydone). Chalk of Sussex. Upper Chalk of Norwich.

Subgenus PLAGIOSTOMA, Sowerby, 1812.

LIMA (PLAGIOSTOMA) HOPERI, Mantell, 1822.

1822. *Plagiostoma Hoperi*, G. A. Mantell, 'Foss. S. Downs,' p. 204, pl. xxvi. f. 2, 3, 15; 1822. J. Sowerby, 'Min. Conch.' vol. iv. p. 111, pl. cccclxxx; 1850. var. J. de C. Sowerby in F. Dixon's 'Geol. Sussex,' p. 345, pl. xxvii. f. 21 (p. 383, 2nd ed.).

1822. *Plagiostoma Mantelli*, A. Brongniart, 'Descr. géol. des Environs de Paris,' p. 600, pl. iv. f. 3; 1839. H. B. Geinitz, 'Char. d. Schichten u. Petref. des sächs. Kreidegeb.' p. 24.

1836. *Lima Mantelli*, A. Goldfuss, 'Petref. Germ.' vol. ii. p. 92, pl. civ. f. 9; 1841. F. A. Römer, 'Die Verstein. des norddeutsch. Kreidegeb.' p. 58; 1846. H. B. Geinitz, 'Grundriss der Verstein.' p. 472, pl. xx. fig. 13; 1847. R. Kner, 'Verstein. des Kreidemerg. v. Lemberg,' Haidinger's Naturwiss. Abhandl. vol. iii. pt. ii. p. 29. 1877? A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. II. Die Weissenb. u. Malnitzer Schichten,' p. 134, f. 122.

1825. *Pachytos Hoperi*, DeFrance, 'Dict. des Sci. naturelles,' vol. xxxvii. p. 207.

1827. *Plagiostoma punctatum*, S. Nilsson, 'Petref. Suecana,' p. 24, pl. ix. f. 1; 1837. W. Hisinger, 'Lethæa Suecica,' p. 54, pl. xv. f. 3.

1830. *Lima Hoperi*, G. P. Deshayes, 'Encycl. méth., Hist. nat. des Vers,' vol. ii. p. 349; 1836. A. Goldfuss, 'Petref. Germ.' vol. ii. p. 91, pl. civ. f. 8; 1836. G. P. Deshayes & H. Milne-Edwards, 'Hist. nat. des Animaux sans Vert.' (Lamarck, 2nd ed.) vol. vii. p. 120; 1838. H. G. Bronn, 'Lethæa Geogn. 2nd ed. vol. ii. p. 682, pl. xxxiii. f. 8; 1839. H. B. Geinitz, 'Char. der Schicht. u. Petref. des sächs. Kreidegeb.' p. 24; 1841. F. A. Römer, 'Die Verstein. des norddeutsch. Kreidegeb.' p. 58; 1846. H. B. Geinitz, 'Grundriss der Verstein.' p. 473, pl. xx. f. 14; 1846. A. E. Reuss, 'Die Verstein. der böhm. Kreideformat.' pt. ii. p. 34, pl. xxxviii. f. 11 (? 12); 1850. A. Alth, 'Geogn.-pal. Beschreib. der nächst. Umgeb. von Lemberg,' Haidinger's Naturwiss. Abhandl. vol. iii. pt. ii. p. 240; 1850. H. B. Geinitz, 'Das Quaderstandst. oder Kreidegeb. in Deutschland,' p. 192; 1854. J. Morris, 'Cat. Brit. Foss.' 2nd ed. p. 171; 1863. A. v. Strombeck, Zeitschr. d. Deutsch. geol. Gesellsch. vol. xv. p. 148; 1863. R. Drescher, *ibid.* vol. xv. p. 355; 1869. E. Favre, 'Descr. des Moll. Foss. de la Craie des Envir. de Lemberg,' p. 137, pl. xii. f. 19; 1870. F. Römer, 'Geol. von Oberschles.' p. 315, pl. xxxiv. f. 10; 1870. F. J. Pictet & G. Campiche, 'Foss. du Terr. Crét. de Ste. Croix,' ser. 5, pt. iv. Matér. Paléont. Suisse, pp. 171, 173; 1872. H. B. Geinitz, 'Das Elbthalgeb. in Sachsen,' Palæontographica, vol. xx. pt. ii. p. 40, pl. ix. f. 11 & 12; 1877. A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. II. Die Weissenb. u. Malnitzer Schichten,' p. 134, f. 121; 1882. H. Schröder, Zeitschr. d. Deutsch. geol. Gesellsch. vol. xxxiv. p. 263; 1887. A. Peron, 'Notes pour servir à l'Hist. du Terr. de Craie,' Bull. Soc. des Sci. hist. et nat. de l'Yonne, ser. 3, vol. xii. p. 149; 1889. E. Holzapfel, 'Die Mollusken der Aachen Kreide,' Palæontographica, vol. xxxv. p. 240, pl. xxvii. f. 5; 1889. A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. IV. Die Teplitzer Schichten,' p. 84, f. 78; 1893. A. Fritsch, *ibid.* V. 'Die Priesener Schichten,' p. 100; 1895. B. Lundgren, 'Molluskfaunan i Mammillatus- och Mucronata-zonerna i nordöstra Skåne,' K. Svenska Vet.-Akad. Handl. n. f. xxvii. no. 6, p. 62. [Non 1843-47. *Lima Hoperi*, A. d'Orbigny, 'Pal. Franç. Terr. Crét.' vol. iii. p. 564, pl. cccccciv. f. 10-13.]

1893. ? *Lima* sp., cf. *Hoperi*, R. Michael, Zeitschr. d. Deutsch. geol. Gesellsch. vol. xlv. p. 234.

1850. *Lima Sowerbyi*, H. B. Geinitz, 'Das Quadersandst. oder Kreidegeb. in Deutschland,' p. 192; 1851. J. Müller, 'Mon. der Petrefact. der Aachener Kreideformat.' pt. ii. p. 67; 1851-52. H. G. Bronn, 'Lethæa Geogn.' 3rd ed. vol. ii. p. 278, pl. xxxii. f. 8; 1870. F. J. Pictet & G. Campiche, 'Foss. du Terr. Crét. de Ste. Croix,' ser. 5, pt. iv., Matér. Paléont. Suisse, p. 173; 1872. H. B. Geinitz, 'Das Elbthalgeb. in Sachsen,' Paläontographica, vol. xx. pt. ii. p. 41, pl. ix. f. 13 & 14; 1883. A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. III. Die Iserschichten,' p. 115, f. 87.

1841. *Lima Nilssoni*, F. A. Römer 'Die Verstein. des norddeutsch. Kreidegeb.' p. 57.

1842. *Lima Goldfussi*, F. v. Hagenow, Leonhard's Neues Jahrb. p. 555.

1892. *Lima (Plagiostoma) Hoperi*, E. Stolley, 'Die Kreide Schleswig-Holsteins,' Mitth. aus dem Min. Inst. Univ. Kiel, vol. i. p. 237; 1888. O. Gripenkerl, 'Die Verstein. der Senon. Kreide von Königslutter,' Paläont. Abhandl. vol. iv. p. 40.

Remarks.—The ornamentation varies considerably in this species. In some examples the shell is almost smooth, except near the anterior and posterior margins; in others the whole surface is marked with pitted grooves, which, however, are usually less distinct near the centre than on the anterior and posterior parts of the shell. There is every gradation between these two extremes; in some cases the differences are due to imperfect preservation. Some specimens show the ornamentation near the umbo, but not on the rest of the shell.

Geinitz considers that Sowerby's *L. Hoperi* is distinct from Mantell's; the former (which he names *L. Sowerbyi*) is for the most part smooth; the latter possesses grooves over the whole surface. These differences, as I have pointed out above, are not of specific value; there can be no doubt whatever that Mantell's fig. 2 is the same species as Sowerby's, and moreover Sowerby received his specimens from Mantell. The examples figured by both authors came from Lewes: Sowerby's specimens are in the British Museum, but I have not seen Mantell's.

The species described by Brongniart as *Plagiostoma Mantelli* was considered by Mantell¹ to be identical with *L. Hoperi*.

Different specimens of *L. Hoperi* show a considerable amount of variation in the relative proportions of the length and height, some being higher than long, others longer than high.

Distribution.—*England*: Chalk Rock and Upper Chalk—not common in the former. Chalk Rock of Luton cutting, Westley Waterless, and Underwood Hall near Dullingham. *Ireland*: White Limestone. *France*: zone of *Micraster breviporus* at Cambrai; zone of *Epiaster brevis* at St. Clément and Guise; zone of *M. coranguinum* at Banogne and Lezennes. *Belgium*: Senonian of Limbourg. *Aachen*: *Mucronata*-beds of Vaals and Henry-Chapelle. *Westphalia*: Senonian of Cöesfeld; *Mucronata*-beds of Haldem, etc.; *Quadrata*-beds of Ilsenburg; *Scaphites*-beds of Quedlinburg; and *Inoceramus Brongniarti*-Pläner. *Brunswick*: Upper Senonian of Königslutter. *Saxony*: Pläner-Kalk of Strehlen and Weinböhla. *Silesia*: *Scaphites*-beds of Oppeln. *Schleswig-Holstein*: *Quadrata*-beds of Lägerdorf. *Bohemia*: Weissenberg, Malnitz, Teplitz, and Priesen Beds. *Bavaria*: Grossberg Beds. *Galicja*: Chalk of Nagorzany (Lemberg). *Scania*: *Mammillatus*-zone of Ignaberga, etc.

¹ Trans. Geol. Soc. ser. 2, vol. iii. (1835) p. 206.

Subgenus *ACESTA*, Adams, 1855.*LIMA* (*ACESTA*?) *SUBABRUPTA*, d'Orbigny, 1850.

1846. *Lima abrupta*, A. d'Orbigny (*non* Goldfuss), 'Pal. Franç. Terr. Crét.' vol. iii. p. 559, pl. ccccxiii. f. 6-9.

1850. *Lima subabrupta*, A. d'Orbigny, 'Prodr. de Pal.' vol. ii. p. 167; 1870. F. J. Pictet & G. Campiche, 'Foss. du Terr. Crét. de Ste. Croix,' Matér. Pal. Suisse, ser. 5, pt. iv. p. 169.

Remarks.—I have seen only two imperfect specimens of this species; it has not been previously recorded in England.

Distribution.—*England*: Chalk Rock of Winchester. *Northern France*: in the zones of *Scaphites æqualis*, *Pachydiscus peramplus*, and *Spondylus truncatus* of Loir-et-Cher.

Family Spondylidæ, Gray.

Genus *SPONDYLUS*, Linnæus, 1766.*SPONDYLUS SPINOSUS* (Sowerby), 1814.

1814. *Plagiostoma spinosa*, J. Sowerby, 'Min. Conch.' vol. i. p. 177, pl. lxxviii. f. 1-3; 1822. G. A. Mantell, 'Foss. S. Downs,' p. 203, pl. xxvi. f. 10; 1822. A. Brongniart, Descr. géol. des Envir. de Paris, pp. 251, 320, pl. iv. f. 2.

1827. *Plagiostoma spinosum*, S. Nilsson, 'Petrif. Suecana,' p. 25; 1833? (young), S. Woodward, 'Geol. Norfolk,' p. 40, pl. v. f. 25; 1837. W. Hisinger 'Lethæa Suecica,' p. 54, pl. xv. f. 4.

1819. ? *Spondylus podopsideus*, J. B. de Lamarck, 'Animaux sans Vert.' vol. vi. p. 194.

1819. ? *Plagiostoma sulcata*, J. B. de Lamarck, 'Animaux sans Vert.' vol. vi. p. 161.

1820. *Pectinites aculeatus*, E. T. v. Schlotheim, 'Die Petrefactenkunde,' p. 228.

1822. ? *Plagiostoma brightonensis*, G. A. Mantell, 'Foss. S. Downs,' p. 204, pl. xxv. f. 15.

1825. *Pachyos spinosus*, DeFrance, 'Dict. des Sciences nat.' vol. xxxvii. p. 207, pl. lxxviii. f. 2, pl. lxxix. f. 1.

1825. ? *Pachyos striatus*, DeFrance, 'Dict. des Sciences nat.' vol. xxxvii. p. 207.

1836. *Spondylus spinosus*, A. Goldfuss, 'Petref. Germ.' vol. ii. p. 95, pl. cv. f. 5; 1838. H. G. Bronn, 'Lethæa Geogn.' p. 684, 2nd ed. (p. 280, vol. ii. 3rd ed.), pl. xxxii. f. 6; 1839. H. B. Geinitz, 'Char. d. Schicht. u. Petref. des sächs. Kreidegeb.' pt. i. p. 24; 1841. F. A. Römer, 'Die Verstein. des norddeutsch. Kreidegeb.' p. 58;

1843-47. A. d'Orbigny, 'Pal. Franç. Terr. Crét.' vol. iii. p. 673, pl. cccclxi. f. 1-4; 1846. H. B. Geinitz, 'Grundriss der Verstein.' p. 474; 1846. A. E. Reuss, 'Die Verstein. der böhm. Kreideformat.' pt. ii. p. 36; 1849. H. B. Geinitz, 'Das Quadersandst. in Deutschl.' p. 196; 1850. A. d'Orbigny, 'Prodr. de Pal.' vol. ii. p. 254;

1850? A. Alth, 'Geogn.-pal. Beschreib. der nächst. Umgeb. von Lemberg, Haidinger's Naturwiss. Abhandl. vol. iii. pt. ii. p. 250; 1854. J. Morris, 'Cat. Brit. Foss.' 2nd ed. p. 182; 1869? E. Favre, 'Moll. Foss. de la Craie des Envir. de Lemberg,' p. 158; 1870. F. Römer, 'Geol. von Oberschlesien,' p. 315, pl. xxxiv. f. 11; 1872. H. B. Geinitz, 'Das Elbthalgeb. in Sachsen, Palæontographica, vol. xx. pt. ii. p. 31, pl. ix. f. 1-3; 1889. A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat.' IV. Die Tepitzer Schichten,' p. 85, f. 81; 1889. E. Holzapfel, 'Die Mollusken der Aachener Kreide, Palæontographica, vol. xxxv. p. 243, pl. xxvii. f. 12 & 13.

1836. *Spondylus duplicatus*, A. Goldfuss, 'Petref. Germ.' vol. ii. p. 95, pl. cv. f. 6; 1839. H. B. Geinitz, 'Char. d. Schicht. u. Petref. des sächs. Kreidegeb.' pt. i. p. 25; 1841. F. A. Römer, 'Die Verstein. des norddeutsch. Kreidegeb.' p. 58.

1854. ? *Spondylus brightonensis*, J. Morris, 'Cat. Brit. Foss.' 2nd ed. p. 182.

1877. *Spondylus spinosus* var. *duplicatus*, A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. II. Die Weissenberger u. Malnitzer Schichten,' p. 138, f. 132.

1891. *Lima spinosa*, R. Etheridge, in Penning & Jukes-Browne's 'Geol. neighb. of Cambridge,' Mem. Geol. Surv. pp. 65, 69 & 72.

Q. J. G. S. No. 211.

Remarks.—This species is fairly common in the Chalk Rock. In Westphalia it is a characteristic fossil of the *Reussianum*-zone, and in Saxony of the *Scaphites*-beds. Sowerby's types are preserved in the British Museum, but I have not been able to trace the specimens figured by Mantell. Judging from the figure alone, I think it probable that Mantell's *Plagiostoma brightonensis* will prove to be identical with this species. *Sp. spinosus* shows considerable variation in proportions and in the number of spines, but there is a perfect gradation between the different forms.

In various Memoirs of the Geological Survey of England (for example, nos. 15, 17, 21, 25, & 31 of the bibliographic list given on p. 71 of Part I. of this paper) this species has been referred to the genus *Lima*, but I do not know on what grounds, since it differs from *Lima* in the inequality of the valves, the absence of the area on the right valve, and the character of the ornamentation. As long ago as 1828 it was clearly shown by Deshayes¹ that this and other Cretaceous species on which the genera *Dianchora*, Sowerby,² *Podopsis*, Lamarck,³ and *Pachytos*, DeFrance,⁴ were founded, differ from *Spondylus* only in the fact that certain parts of the shell have been removed by water in solution. Deshayes states that the shell in existing species is formed of an outer thin layer and an inner thick layer, and that the former is absent on the area. The inner layer has been removed from the Chalk specimens, and this accounts for the thinness of their shells, and the absence of the muscular impression and area. The greater solubility of the inner layer is due to the fact that it consists of aragonite,⁵ whereas the outer layer is calcite. The triangular opening under the umbo, which results from the removal of the area, was regarded by Sowerby as having served for the passage of the byssus; but, since these forms were attached by the left valve, an organ of fixation would have been useless. In no case have I seen the teeth of *Sp. spinosus*, but certain casts, which probably belong to this species, give indications of them. Since the area is missing, the teeth would obviously not be found on the left valve; a specimen of the right valve in the Wiltshire Collection (Woodwardian Museum) shows distinctly the interior of the shell and the hinge-line, but there are no teeth visible; another specimen which I cleaned out agrees with this one. The absence of teeth is explained by the circumstance that they consist entirely of aragonite: a section of *Sp. aurantius*, Lamk., which I have had prepared shows this clearly. The section is cut perpendicular to the hinge-line, and passes through a tooth, the area, and the umbo. The thin outer layer referred to by Deshayes consists of fine prisms arranged obliquely and rather irregularly; it does not pass beyond the umbo. The inner layer

¹ Ann. Sci. Nat. vol. xv. (1828) p. 427; also 'Coq. Foss. des Envir. de Paris,' vol. i. (1830) p. 318.

² 'Min. Conch.' vol. i. (1815) p. 183.

³ 'Hist. nat. des Animaux sans Vert.' vol. vi. pt. i. (1819) p. 194.

⁴ 'Dict. Sci. Nat.' vol. xxxvii. (1825) p. 207.

⁵ Sorby, Pres. Addr., Quart. Journ. Geol. Soc. vol. xxxv. (1879) *Proc.* p. 60.

near the middle of the valve is about three times the thickness of the outer layer; it possesses an indistinct and irregular prismatic structure, but a high power shows two sets of fibres crossing each other obliquely; this layer is traversed by numerous parallel tubes placed at right angles to the surface, but at the umbo, where the shell is thicker, they radiate outward so as to become perpendicular to the outside of the shell. This layer thins out on the area towards the hinge-line. The teeth and the main part of the area are formed of large distinct prisms placed more or less parallel to the surface, but bending inward, and they are crossed obliquely by tubules. On the outer surface of the area is a thin layer which tapers in passing from the hinge-line, and is absent in the neighbourhood of the umbo; this layer has a finer structure, and under a high power appears to be fibrous; it is not traversed by tubules.

Distribution.—*England*: in the upper part of the Middle Chalk (namely: zones of *Terebratulina gracilis*, *Holaster planus*, & *Heteroceras Reussianum*), and throughout the Upper Chalk. Chalk Rock (*Reussianum*-zone) of Shalcombe and Brixton (Isle of Wight), Winchester, Cuckhamsley, Bledlow, Wycombe, Princes Risborough, Boxmoor, Luton, Reed, Barkway, Great Chesterford, Westley Waterless, and Underwood Hall near Dullingham. *Ireland*: Hibernian Greensand (Chloritic Sandstone division) and White Limestone. *France*: zone of *Inoceramus labiatus* at Joigny (Yonne), etc.; zone of *Terebratulina gracilis* at Hauteville, Cyosing, in the Yonne and Aube, etc. zone of *Micraster breviporus* of Cambrai, and at Partout (Yonne), zone of *Holaster planus*, east of the Paris basin; zone of *Epiaster brevis* at Guise, etc.; zones of *Spondylus spinosus* and *Sp. truncatus* in Loir-et-Cher; zone of *Micraster cor-anguinum* at Lezennes. *Belgium*: Hervien of Limbourg. *North-western Germany*: zone of *Heteroceras Reussianum* in Westphalia. *Saxony*: Pläner-Kalk of Strehlen, Weinböhl, etc.; *Brongniarti*-Pläner of Cottauer Berge; and the Glauconitic Marl and Pläner. *Silesia*: *Scaphites*-beds of Oppeln. *Bohemia*: Weissenberg, Malnitz, and Teplitz Beds. *Bavaria*: Kagerhöh Beds.

SPONDYLUS LATUS (Sowerby), 1815.

1815. *Dianchora lata*, J. Sowerby, 'Min. Conch.' vol. i. p. 184, pl. lxxx. f. 2; 1822. G. A. Mantell, 'Foss. S. Downs,' p. 205, pl. xxvi. f. 21.

1822. ? *Dianchora obliqua*, G. A. Mantell, 'Foss. S. Downs,' p. 206, pl. xxv. f. 1 & pl. xxvi. f. 12.

1836. *Spondylus lineatus*, A. Goldfuss, 'Petref. Germ.' vol. ii. pl. cvi. f. 3, p. 97; 1839. H. B. Geinitz, 'Char. d. Schichten u. Petref. des sächs. Kreidegeb.' pt. i. p. 25 (pl. xx. f. 39 ?); 1841. F. A. Römer, 'Die Verstein. des norddeutsch. Kreidegeb.' p. 59; 1846. A. E. Reuss, 'Die Verstein. der böhm. Kreideformat.' pt. ii. p. 36, pl. xl. f. 7-9; 1847. J. Müller, 'Petref. der Aachener Kreideformat.' pt. i. p. 34; 1850. H. B. Geinitz, 'Das Quadersandsteingeb. in Deutschl.' p. 194 (*partim*); 1850. A. d'Orbigny, 'Prodr. de Pal.' vol. ii. p. 254; 1850? A. Alth, 'Geogn.-pal. Beschreib. der nächst. Umgeb. von Lemberg,' Haidinger's Naturwiss. Abhandl. vol. iii. pt. ii. p. 250; 1869? E. Favre, 'Moll. Foss. de la Craie des Envir. de Lemberg,' p. 158.

1841. *Spondylus latus*, F. A. Römer, 'Die Verstein. des norddeutsch. Kreidegeb. p. 69; 1842. H. B. Geinitz, 'Char. d. Schichten u. Petref. des sächs.-böhm. Kreidegeb. pt. iii. p. 82; 1850. J. de C. Sowerby in F. Dixon's 'Geol. Sussex,' p. 356, pl. xxviii. f. 30 & 31; 1854. J. Morris, 'Cat. Brit. Foss.' 2nd ed. p. 182; 1872. H. B. Geinitz, 'Das Elbthalgeb. in Sachsen,' Palaeontographica, vol. xx. pt. i. p. 187, pl. xlii. f. 4-f

& pt. ii. p. 32, pl. viii. f. 18-21; 1877. A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. II. Die Weissenberger u. Malnitzer Schichten,' p. 138; 1889. Fritsch, *ibid.* IV. 'Die Teplitzer Schichten,' p. 86, f. 82; 1889. E. Holzapfel, 'Die Mollusken der Aachener Kreide,' *Paläontographica*, vol. xxxv. p. 244, pl. xxvii. f. 11, 14; 1892. E. Stolley, 'Die Kreide Schleswig-Holsteins,' *Mitth. a. d. mineralog. Institut der Univ. Kiel*, vol. i. p. 236.

1842. *Spondylus obliquus*. H. B. Geinitz, 'Char. d. Schichten u. Petref. des sächs.-böhm. Kreidegeb.' pt. iii. p. 82; 1846. A. E. Reuss, 'Die Verstein. der böhm. Kreideformat.' p. 36, pl. xl. f. 4; 1850. H. B. Geinitz, 'Das Quadersandsteingeb. in Deutschl.' p. 194 (*partim*).

1870. *Spondylus striatus*, F. Römer, 'Geol. von Oberschlesien,' p. 315, pl. xxxvii. f. 3 & 4.

Remarks.—This species is much less common in the Chalk Rock than is *Sp. spinosus*. Sowerby's type came from the Chalk of Lewes, and is now in the British Museum, as is also the specimen figured by Dixon. Mantell's *Dianchora obliqua* (from near Lewes and Brighton) is probably identical with this species, but I have not been able to find the type.

Affinities.—*Sp. latus* is related to *Sp. striatus*, Sowerby, the type of which comes from the Warminster Greensand (Rye Hill Sand¹); but its length is proportionately greater, it is more oval, and the ribs are finer and more numerous.

Distribution.—*England*: Lower and Middle Chalk (zones of *Terebratulina gracilis*, *Holaster planus*, & *Heteroceras Reussianum*), and Upper Chalk. Chalk Rock of Brixton, Winchester, Cuckhamsley, Thickthorn Hill (Bledlow), Boxmoor. *France*: zone of *Terebratulina gracilis*, at Voulpaix, in the Yonne and Aube, etc.; zone of *Micraster cor-anguinum* at Lezennes. *North-western Germany*: in the zone of *Heteroceras Reussianum*. *Aachen*: *Mucronata*-beds of Schneeberg. *Saxony*: Unter-Pläner (Upper Cenomanian) of Gross-Sedlitz near Pirna; Pläner-Kalk of Strehlen and Weinböhla. *Silesia*: *Scaphites*-beds of Oppeln. *Schleswig-Holstein*: *Quadrata*-beds (Senonian) of Lägerdorf. *Bohemia*: Teplitz Beds.

Genus PLICATULA, Lamarek, 1801.

PLICATULA BARROISI, Peron, 1887. (Pl. XXVII. figs. 18 & 19.)

1846. *Plicatula pectinoides*, A. E. Reuss (*non* Sowerby), 'Die Verstein. der böhm. Kreideformat.' pt. ii. p. 37, pl. xxxi. f. 16 & 17.

1872. *Plicatula nodosa*, H. B. Geinitz (*non* Dujardin), 'Das Elbthalgeb. in Sachsen,' *Paläontographica*, vol. xx. pt. ii. p. 32, pl. ix. f. 5; 1878. C. Barrois, 'Terr. Crét. des Ardennes,' *Ann. Soc. géol. Nord*, vol. v. p. 391; 1889. A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. IV. Die Teplitzer Schichten,' p. 86, f. 83; 1895.

Plicatula cf. nodosa. B. Lundgren, 'Molluskfaunan i Mammill.- och *Mucron.*-zonerna i nordöstra Skåne,' K. Svenska Vet.-Akad. Handl. n. s. vol. xxvi. no. 6, p. 41.

1887. *Plicatula Barroisi*, A. Peron, 'Notes pour servir à l'Hist. du Terr. de Craie,' *Bull. Soc. Sci. hist. nat. de l'Yonne*, ser. 3, vol. xii. p. 167, pl. ii. f. 5-7.

Remarks.—D'Orbigny² considered that this species (which was figured by Reuss as *P. pectinoides*) was identical with *P. nodosa*, Dujardin,³ and this view has been adopted by Geinitz and Fritsch. Barrois pointed out that the species under consideration differs considerably from *P. nodosa*, and Peron has since described it under

¹ See Jukes-Browne, *Geol. Mag.* 1896, p. 261.

² 'Prodr. de Pal.' vol. ii. (1850) p. 254.

³ *Mém. Soc. géol. France*, vol. ii. (1837) p. 228 & pl. xv. f. 14.

the name of *P. Barroisi*. The only English specimens that I have seen were collected by Mr. R. M. Brydone. *P. nodosa* itself comes from Touraine.

Affinities.—*P. nodosa*, Dujardin, differs from *P. Barroisi* in being about four times larger, more elongated, and ornamented with large, simple, widely-separated ribs.

Distribution.—*England*: Chalk Rock of Winchester. *France*: zones of *Belemnitella plena*, *Inoceramus labiatus*, *Terebratulina gracilis*, *Epiaster brevis*, & *Belemnitella quadrata*, north and east of the Paris basin. *Saxony*: Pläner-Kalk of Strehlen. *Bohemia*: Reuss's specimens came from the Pläner-Kalk and Pyrope-Sand of Triziblit, and the Pläner-Mergel of Weberschan. Fritsch's examples are from the Teplitz Beds.

Family Cardiidæ, Lamarck.

Genus CARDIUM, Linnæus, 1758.

CARDIUM TURONIENSE, sp. nov. (Pl. XXVII. figs. 20–22.)

Description.—Shell small, oblique, oval, inflated, higher than long; umbones prominent. Ornamented with plain ribs, separated by furrows of about the same width; with indistinct pits in the furrows. About ten ribs in a space of 3 mm. Size of a specimen: length=6 mm.; height=7 mm.

Affinities.—The ornamentation is coarser and the shell more oblique than in *C. lineolatum*, Reuss. The ornamentation is somewhat similar to that in *C. cenomanense*, d'Orbigny, but the ribs are less numerous than in that species, and the form of the shell is quite different.

Remarks.—This is a rare species; the only forms seen are in the Montagu Smith Collection.

Distribution.—Chalk Rock of Cuckhamsley.

CARDIUM sp., cf. CENOMANENSE, d'Orb. (Pl. XXVII. figs. 23 & 24.)

1843–47. A. d'Orbigny, 'Pal. Franç. Terr. Crét.' vol. iii. p. 37 & pl. cclix. f. 5–9.

Remarks.—A species of *Cardium*, agreeing in form with *C. cenomanense*, is represented by several specimens from Cuckhamsley, but all are in the condition of internal casts, so that their determination must remain doubtful for the present. Size of a specimen: length=9 mm.; height=9 mm.; thickness=8 mm.

Distribution.—Chalk Rock of Cuckhamsley (Montagu Smith Collection.)

CARDIUM sp., cf. MAILLEANUM, d'Orbigny.

1843–47. A. d'Orbigny, 'Pal. Franç. Terr. Crét.' vol. iii. p. 40 & pl. cclvi. f. 7–12.

Remarks.—There is one specimen in the Montagu Smith Collection which probably belongs to this species, but only a small portion of the shell on the posterior part of the right valve is preserved.

Distribution.—Chalk Rock of Cuckhamsley. D'Orbigny obtained specimens from the Lower Chalk of Rouen, etc.

Family Astartidæ, Gray.

Genus *CARDITA*, Bruguière, 1789.*CARDITA CANCELLATA*, sp. nov. (Pl. XXVIII. figs. 2-5.)

Cf. *C. tenuicosta*, F. Nötling (*non* Sowerby), 'Die Fauna der baltisch. Cenoman-Geschiebe,' Palæont. Abhandl. vol. ii. (1885) p. 29 & pl. v. f. 4; and Geinitz, 'Das Elbthalgebirge in Sachsen,' Palæontographica, vol. xx. pt. ii. pl. xvii. f. 11-13.

Description.—Shell oval, somewhat inflated, with the part from the umbo to the posterior margin slightly depressed; a little longer than high. Anterior side shorter and smaller than the posterior. Ventral margin curved. Ornamentation cancellated, consisting of numerous concentric and radiating ribs—the two sets being of about equal size. Size of an average specimen: length=16 mm.; height=14 mm.

Remarks.—This is a fairly common species at Cuckhamsley, but seems to be rare in other places.

Affinities.—This species is related to *C. tenuicosta*, Sowerby, found in the Gault, but that form has a more quadrangular and compressed shell, and its ornamentation consists of radiating ribs only, crossed by growth-lines.

Distribution.—Chalk Rock of Cuckhamsley, Thickthorn Hill (Bledlow), and Luton.

Family Arctidæ, Newton.

Genus *ARCTICA*, Schumacher, 1817.*ARCTICA QUADRATA* (d'Orbigny), 1843. (Pl. XXVII. fig. 25; Pl. XXVIII. fig. 1.)

1840. *Isocardia cretacea*, H. B. Geinitz, 'Char. d. Schicht. u. Petref. des sächs. Kreidegeb.' pt. ii. p. 53, pl. xi. f. 6 & 7.

1843. *Cyprina quadrata*, A. d'Orbigny, 'Pal. Franç. Terr. Crét.' vol. iii. p. 104, pl. cclxxvi.; 1850. A. d'Orbigny, 'Prodr. de Pal.' p. 161; 1850. H. B. Geinitz, 'Das Quadersandst. oder Kreidegeb. in Deutschland,' p. 156; 1869. F. J. Pictet & G. Campiche, 'Foss. des Terr. Crét. de Ste. Croix,' Matér. Pal. Suisse, ser. 5, pt. iii. p. 225, pl. cxv. f. 3-5; 1877? A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. II. Die Weissenberger u. Malnitzer Schichten,' p. 116, f. 76; 1873. H. B. Geinitz, 'Das Elbthalgeb. in Sachsen,' Palæontographica, vol. xx. pt. ii. p. 62, pl. xvii. f. 14-16; 1883. A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. III. Die Isersschichten,' p. 100, f. 65; 1895. E. Tiessen, Zeitschr. der Deutsch. geol. Gesellsch. vol. xlvii. p. 486.

Remarks.—This species was founded by d'Orbigny on casts from the French Cenomanian. Mr. Jukes-Browne has sent me specimens from the Chloritic Marl of Chard, one of which has the shell preserved. I have seen only four specimens from the Chalk Rock; one (fig. 25) is in the form of an internal mould of both valves, but the others have a considerable portion of the shell present. The latter agree with the Chard specimen, and the internal mould is like d'Orbigny's figure.

Affinities.—Geinitz considers that d'Orbigny's *Cyprina ligeriensis* and *C. Noueliana* are identical with this species. *C. Noueliana* was founded on a cast. D'Orbigny considered that his *C. quadrata* was

distinguished from *C. ligeriensis* by its more quadrate form, the short anterior part of the shell, and the larger posterior part. The type of *quadrata* is a more convex shell than *ligeriensis*.

The species under consideration differs from *C. regularis* in the umbones being more oblique and the posterior margin more truncated.

Distribution.—*England*: Chloritic Marl of Chard; Chalk Rock of Morgan's Hill near Devizes, Cuckhamsley, and Luton cutting. *France*: Cenomanian of Rouen; zone of *Pecten asper* at Savigny; zone of *Ammonites laticlavus* at Blanc-Nez. *Switzerland*: 'Grès vert supérieur' of Ste. Croix. *Saxony*: Cenomanian Pläner of Plauen; *Brongniarti* Quader Sandstone of Posta, etc.; Pläner-Kalk of Strehlen and Weinböhla. *Bohemia*: Weissenberg, Malnitz, and Iser Beds.—*Bavaria*: Regensburg Beds.

ARCTICA? *EQUISULCATA*, sp. nov. (Pl. XXVIII. figs. 6–8.)

Description.—Shell moderately convex, subquadrate, oblique; umbones pointed, rather anterior. Shell rather thick, ornamented with numerous regular, parallel, concentric grooves—about 15 in 10 mm. Hinge unknown. Adductor-impressions well marked. Approximate size: length=32 mm.; height=29 mm.

Remarks.—This species is imperfectly known at present, but since the ornamentation appears to be quite distinct I have ventured to give it a specific name. There are seven examples of it in the Montagu Smith Collection, six being internal casts.

Distribution.—Chalk Rock of Cuckhamsley.

Genus *TRAPEZIUM*, Megerle v. Mühlfeldt, 1811.

TRAPEZIUM TRAPEZOIDALE (Römer), 1841. (Pl. XXVIII. figs. 9 & 10.)

1841. *Crassatella trapezoidalis*, F. A. Römer, 'Die Verstein. des norddeusch. Kreidegeb.' p. 74, pl. ix, f. 22; 1846. A. d'Archiac, Mém. Soc. géol. France, ser. 2, vol. ii. p. 302.

1849. *Cyprina trapezoidalis*, H. B. Geinitz, 'Das Quadersandst. in Deutschl.' p. 158 (*partim*); 1873. H. B. Geinitz, 'Das Elbthalgebirge in Sachsen,' Palaeontographica, vol. xx. pt. i. p. 229, pl. l. f. 6 (? f. 5).

1850. *Cypricardia trapezoidalis*, A. d'Orbigny, 'Prodr. de Pal.' vol. ii. p. 240; 1889? E. Holzapfel, 'Die Mollusken der Aachener Kreide,' Palaeontographica, vol. xxxv. p. 179.

Description.—Shell inflated, trapezoidal, anteriorly short and rounded, posteriorly elongate and angular. Ventral margin slightly curved, nearly parallel to the hinge-line. Posterior margin nearly straight, forming an obtuse angle with the hinge-margin. Umbones much curved, reaching almost to the end of the hinge-line. A sharp carina, gently curved, extends from the umbo to the posterior angle, and cuts off a slightly concave and triangular area. Surface with concentric lines.

Remarks.—This is a very rare species in the Chalk Rock; all the specimens seen are casts, but one shows a small fragment of shell. The type is stated by Römer to have come from the Pläner-Kalk of Strehlen; but Geinitz has never found the species in that locality.

Affinities.—The shell in *Cypricardia galiciana*, E. Favre¹ (from near Lemberg), is relatively shorter, more ovoid, and the umbones less recurved. *Crassatella tricarinata*, Römer,² is also more ovoid than *trapezoidalis*, and the umbones are less anterior in position.

Distribution.—*England*: Chalk Rock of Cuckhamsley, Princes Risborough, Thickthorn Hill (Bledlow), and Luton cutting. *Ireland*: White Limestone. *Saxony*: Cenomanian of Plauen (*fide* Geinitz); Pläner-Kalk of Strehlen (*fide* Römer). *Bavaria*: Kagerhöh Beds of Kagerhöh.

TRAPEZIUM RECTANGULARE, sp. nov. (Pl. XXVIII. figs. 11 & 12.)

Description.—Shell oblong, moderately convex, anteriorly short and rounded, posteriorly elongate. Hinge-margin and the ventral margin nearly straight and parallel. Posterior margin nearly straight, and almost at right angles to the hinge-margin. Umbones not prominent. Carina obtuse, extending in a curve from the umbo to the posterior angle, and cutting off a triangular and slightly convex area. In the interior a septum extends from the umbo towards the anterior-ventral margin. Size of a specimen: length=19 mm.; height=11 mm.

Affinities.—The shell in this species is flatter than in *T. trapezoidale*, the umbones are less prominent, and the posterior margin forms a right angle with the hinge-margin. It differs from *T. parallelum*, Alth.,³ in being relatively shorter, in the anterior part being very short, and in the ventral margin being nearly straight.

Distribution.—I have seen only four examples of this species, all of which come from Cuckhamsley, and are in the Montagu Smith Collection. A small piece of shell is preserved on one specimen, and is almost smooth.

Family Lucinidæ, Deshayes.

Genus CORBIS, Cuvier, 1817.

CORBIS? MORISONI, sp. nov. (Pl. XXVIII. figs. 13 & 14.)

Description.—Shell much inflated, rounded, inequilateral, slightly longer than wide. Umbones moderately prominent, close together, curved anteriorly. Surface with well-marked lines of growth. Hinge unknown. Size of a specimen: length=14 mm.; height=13 mm.

Remarks.—I have seen only two specimens of this species; one is a cast of the left valve, the other is a right valve with a portion of the shell preserved. With this limited material at my disposal it is impossible to give a full description of the characters of this species.

Distribution.—Chalk Rock of Cuckhamsley.

¹ 'Descr. Moll. Foss. de la Craie des Envir. de Lemberg en Galicie,' 1869, p. 109 & pl. xii. f. 3.

² 'Die Verstein. des norddeutsch. Kreidegeb.' (1841) p. 74 & pl. ix. f. 23.

³ 'Geogn.-pal. Beschreib. der nächst. Umgeb. v. Lemberg,' Haidinger's Naturwiss. Abhandl. vol. iii. pt. ii. (1850) p. 229 & pl. xii. f. 8.

Family Pholadidæ, Leach.

Genus *MARTESIA*, Leach, 1824.*MARTESIA*? *ROTUNDA* (Sowerby), 1850. (Pl. XXVIII. figs. 15–18.)1850. ? *Teredo rotundus*, J. de C. Sowerby in F. Dixon's 'Geol. Sussex,' p. 346, pl. xxviii. f. 27 & 28.

Description.—Umbonal groove well marked, only a little oblique; in front of it the surface is ornamented with strong radiating ribs crossed by finer and closer concentric ribs; just behind the groove are two radiating ribs and on the rest of the shell concentric grooves only are seen.

The cast of the interior is oval in form, narrowing posteriorly, rounded in front and apparently also behind; it shows that the large anterior gape was closed by a callus; behind the umbonal groove is a cast of a ridge or process extending towards the posterior margin. Size of the cast: length=7 mm.; height=5.5 mm.

Remarks.—I have seen only one specimen of this, consisting of a perfect internal cast and a mould of a portion of the exterior; it is not sufficiently perfect to enable me to determine the genus with certainty; but I think that, on the whole, it is more likely to be *Martesia* than *Pholadidea*. Sowerby figured, under the name of *Teredo rotundus*, a fragment from the Chalk of Kent showing the ornamentation, and also a cast; from the former, I believe it is probable that the Chalk Rock specimen belongs to the same species, but I have not been able to confirm this view by an examination of the type, which appears to have been lost.

Distribution.—Chalk Rock of Cuckhamsley.

Family Cuspidariidæ, Fischer.

Genus *CUSPIDARIA*, Nardo, 1840.*CUSPIDARIA CAUDATA* (Nilsson), 1827. (Pl. XXVIII. figs. 19 & 20.)

1827. *Corbula caudata*, S. Nilsson, 'Petrif. Suecana,' p. 18, pl. iii. f. 18; 1837. W. Hisinger, 'Lethæa Suecica,' p. 66, pl. xix. f. 12; 1840. A. Goldfuss, 'Petref. Germ.' vol. ii. p. 251, pl. cli. f. 17; 1846. A. E. Reuss, 'Die Verstein. der böhm. Kreideformat.' pt. ii. p. 20, pl. xxxvi. f. 23; 1847. R. Kner, 'Verstein. Kreidemerg. von Lemberg,' Haidinger's Naturwiss. Abhandl. vol. iii. pt. ii. p. 25, pl. v. f. 3; 1850. H. B. Geinitz, 'Das Quadersandsteingeb. in Deutschl.' p. 150; 1850. A. d'Orbigny, 'Prodr. de Pal.' vol. ii. p. 238; 1850? var., A. Alth, 'Geogn.-pal. Beschreib. der nächst. Umgeb. v. Lemberg,' Haidinger's Naturwiss. Abhandl. vol. iii. p. 237, pl. xii. f. 22; 1863. A. v. Strombeck, Zeitschr. Deutsch. geol. Gesellsch. vol. xv. p. 147; 1873. H. B. Geinitz, 'Das Elbthalgeb. in Sachsen,' Palæontographica, vol. xx. pt. ii. p. 67, pl. xxiii. f. 19; 1877? A. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. II. Die Weissenberger u. Malnitzer Schichten,' p. 125, f. 107; 1882. H. Schröder, Zeitschr. Deutsch. geol. Gesellsch. vol. xxiv. p. 275; 1889. Fritsch, 'Stud. im Gebiete der böhm. Kreideformat. IV. Die Teplitzer Schichten,' p. 81; 1893. Fritsch, *ibid.* 'V. Die Priesener Schichten,' p. 96.

1839–63. *Neara caudata*, G. P. Deshayes, 'Traité Élément. de Conchyliol.' vol. i. p. 192; 1864. F. J. Pictet & G. Campiche, 'Foss. du Terr. Crét. des Envir. de Ste. Croix' (Pal. Suisse, ser. ix.), p. 42; 1869. E. Favre, 'Moll. Foss. de la Craie des Envir. de Lemberg,' p. 102, pl. xi. f. 8; 1885. F. Nütling, 'Die Fauna der baltischen Cenoman-Geschiebe,' Paläont. Abhandl. vol. ii. p. 35, pl. vi. f. 7; 1889. O. Griepenkerl, 'Die Verstein. d. Senon. Kreide v. Königslutter,' Paläont. Abhandl. vol. iv. p. 69.

1850. *Leda pulchra*, J. de C. Sowerby, in F. Dixon's 'Geol. Sussex,' p. 346 (p. 382, 2nd ed.), pl. xxviii. f. 10; 1854. *Leda*? *pulchra*, J. Morris, 'Cat. Brit. Foss.' 2nd ed. p. 205.

Remarks.—I have seen only one example of this from the Chalk Rock, which is in the Montagu Smith Collection; it shows the concentric ribs, although the shell is not preserved. This specimen agrees perfectly with Sowerby's figure of *Leda pulchra*, but I have not succeeded in tracing the type of that species; it is stated to have come from the 'Chalk of Kent.' The English specimens, and also the figures given by Goldfuss and Reuss, differ from the type in having the posterior part of the shell much shorter; this, however, is probably due to the preservation of the shell in Nilsson's original specimen.

Affinities.—Stoliczka¹ states that this species is closely allied to his *Neera detecta* (from the Ootatoor Group), 'but it has the posterior end still narrower and longer, and the beaks incurved in a direction perpendicular to the longitudinal axis of the shell.'

Distribution.—Chalk of Kent (horizon unknown). Chalk Rock of Cuckhamsley. *Westphalia*: zone of *Ammonites cœsfeldensis* (Upper Senonian) of Cœsfeld. *Saxony*: Pläner-Kalk of Strehlen. *Bohemia*: in the Weissenberg, Malnitz, and Teplitz Beds (*vide* Fritsch). *Bavaria*: Grossberg Beds of Martenberg near Passau. *Galicia*: Nagorzany, near Lemberg (*vide* Favre).

IV. DISTRIBUTION AND RELATIONS OF THE FAUNA.

I have already pointed out that the fauna of the *Reussianum*-zone has a wide range in Europe; it can be recognized, although showing differences in passing from one region to another, in Northern France, North-western Germany (Westphalia, Brunswick), Saxony, Upper Silesia, Bohemia, and Bavaria. But, though traceable in countries so distant as England and Bohemia, it is, I believe, absent from the Belgian area; this is probably to be accounted for by the very different conditions under which the Cretaceous Series was deposited in Belgium. I hope, however, to recur to this point after I have had further opportunities of studying the rocks of that country.

The area over which the *Reussianum*-zone can be traced undoubtedly formed part of one life-province in the Cretaceous seas; this province seems to have remained fairly constant throughout the Chalk period; it included what Munier-Chalmas² has termed the second or temperate zone, which he considers to have been especially characterized, in Senonian and Upper Turonian times, by the great development of the echinoids *Micraster* and *Echinocorys*.

Just as is the case in so many formations, the cephalopoda of the *Reussianum*-zone have a much wider geographical range than the gasteropoda and lamellibranchia; this is no doubt accounted for by their more active mode of life. Of the 10 species of cephalopods present in the *Reussianum*-zone in this country, 7 occur in Saxony and 6 in Bohemia; but of the 16 gasteropods only 2 (or perhaps 3) are found in Saxony and 2 in Bohemia; of the 29 species of lamellibranchs about half have been recognized in Saxony and 11

¹ 'Cret. Fauna S. India,' Pal. Indica, vol. iii. (1870) p. 46, pl. iii. f. 7 & pl. xvi. f. 15.

² Comptes Rendus, vol. cxiv. (1892) p. 851.

III. TABLE SHOWING THE DISTRIBUTION OF THE LAMELLIBRANCHIA FOUND IN THE CHALK ROCK OR *Reussianum*-zone.

LAMELLIBRANCHIA.			England.										North of Ireland.	Northern France.	Aachen.	North-western Germany (Westphalia & Brunswick).		Saxony.	Silesia.	Bohemia.	Bavaria.																	
Genus and Species.	Author.		Lower Chalk.	Zone of <i>Rhynchonella Cuvieri</i> .	Zone of <i>Terebratulina gracilis</i> .	Zone of <i>Holaster planus</i> .	Winchester.	Cuckhamsley.	Aston Rowant.	Luton cutting.	Cambridgeshire.	Upper Chalk.	Hibernian Greensand.	White Limestone.	Cenomanian.	Zone of <i>Inoceramus labiatus</i> .	Zone of <i>Terebratulina gracilis</i> .	Zone of <i>Micraster breviporus</i> .	Higher Beds.	<i>Quadrata</i> -beds.	<i>Mucronata</i> -beds.	Zone of <i>Inoceramus Brongniarti</i> .	Zone of <i>Heteroceras Reussianum</i> .	Senonian.	Cenomanian.	Beds with <i>Inoceramus labiatus</i> .	Beds with <i>Inoceramus Brongniarti</i> .	Beds with <i>Scaphites Geinitzi</i> .	<i>Scaphites</i> -Beds.	Weissenberg Beds.	Mahnitz Beds.	Teplitz Beds.	Priesen Beds.	Kagerhüh Beds.	Grossberg Beds.			
<i>Nuculana</i> cf. <i>siliqua</i>	(Goldfuss)						*	*												*																		
<i>Nucula</i> sp.							*	*																														
<i>Arca</i> sp., cf. <i>Galliennei</i>	d'Orbigny						*	*							*																							
„ (<i>Barbatia</i>) sp., cf. <i>Geinitzi</i> ..	Reuss						*	*																														
„ sp.							*	*																														
<i>Limopsis</i> sp.							*	*																														
<i>Modiola Cottæ</i>	Römer					*	*	*		*		*															*		*									
<i>Inoceramus</i> ¹ <i>Brongniarti</i>	Sowerby				?	*	*	*		*		*		*																								
„ <i>striatus</i>	Mantell		*				*	*		*		?	*																									
„ sp.							*	*		*		*																										
<i>Ostrea semiplana</i> ?	Sowerby						*	*		*		*									*																	
<i>Chlamys ternata</i>	(Goldfuss)						*	*		*		?									*																	
<i>Lima granosa</i>	Sowerby					*	*	?		*		*																										
„ (<i>Plagiostoma</i>) <i>Hoperi</i>	Mantell						*	*		*		*		*						*																		
„ (<i>Acesta</i> ?) <i>subabrupta</i>	d'Orbigny						*	*		*		*		*						*																		
<i>Spondylus spinosus</i>	(Sowerby)			*	*	*	*	*		*		*		*					*	*	*																	
„ <i>latus</i>	(Sowerby)		*		*	*	*	*		*		*		*				*	*	*	*																	
<i>Plicatula Barroisi</i>	Peron						*	*		*		*		*				*	*	*	*																	
<i>Cardium turoniense</i>	Woods						*	*		*		*						*	*	*	*																	
„ sp., cf. <i>cenomanense</i>	d'Orbigny						*	*		*		*		?				*	*	*	*																	
„ sp., cf. <i>Mailleanum</i>	d'Orbigny						*	*		*		*		*				*	*	*	*																	
<i>Cardita cancellata</i>	Woods						*	*		*		*		*				*	*	*	*																	
<i>Arctica quadrata</i>	(d'Orbigny)		*				*	*		*		*		*				*	*	*	*																	
„ <i>?equisulcata</i>	Woods						*	*		*		*		*				*	*	*	*						*		*									
<i>Trapezium trapezoidale</i>	(Römer)						*	*		*		*		*				*	*	*	*																	
„ <i>rectangulare</i>	Woods						*	*		*		*		*				*	*	*	*																	
<i>Corbis</i> ? <i>Morisoni</i>	Woods						*	*		*		*		*				*	*	*	*																	
<i>Martesia</i> ? <i>rotunda</i>	(Sowerby)						*	*		*		*		*				*	*	*	*																	
<i>Cuspidaria caudata</i>	(Nilsson)						*	*		*		*		*				*	*	*	*					*											*	

¹ The foreign distribution of the species of *Inoceramus* is not shown here.

or 12 in Bohemia. So far as I know, no species of cephalopod, with the exception of *Nautilus sublaevigatus*, d'Orb., is common to the Chalk Rock and the Belgian Cretaceous beds.

The palæontological characters of the *Reussianum*-zone as seen in England are well maintained in the 'Zone of *Heteroceras Reussianum* and *Spondylus spinosus*' (Schlüter) of North-western Germany. This is especially true as regards the cephalopoda, which have been so carefully described by Prof. Schlüter; the gasteropoda and lamellibranchia, however, are not so abundant nor so well preserved, and have not yet been studied in detail.

In Saxony, the Pläner-Kalk of Strehlen (near Dresden) contains the fauna we are now considering, with, perhaps, that of part of a lower zone also. That rock can no longer be studied at Strehlen, the site of the old exposure having been built over. The fossils, however, have been fully described and figured in Geinitz's great work, 'Das Elbthalgebirge in Sachsen,' and the originals are preserved in the Dresden Museum. Even allowing for the possibility that the Pläner-Kalk includes a little more than the *Reussianum*-zone, the number of species in that part of it is still considerably greater than in the same zone in England. This is indeed what we should expect from the fact that the Upper Cretaceous rocks of Saxony were deposited in shallower water and much nearer the shore-line than were those of the same age in England. The greater richness of the fauna is seen particularly in the Lamellibranchia, Gasteropoda, and Fishes; of these three groups Geinitz describes about 50, 30, and 28 species respectively. There is no important difference in the number of forms of Cephalopoda, Brachiopoda, Echinoidea, and Actinozoa in the two countries; but in the Pläner-Kalk the Asteroidea, Crinoidea, and Reptilia, which, so far as I know (with the exception of a single specimen of *Pentacrinus*), are not found in the Chalk Rock at all, are each represented by one or two species.

The genera of gasteropods and lamellibranchs which are present in the Pläner-Kalk, but unknown in the Chalk Rock, are:—

<i>Patella.</i>	<i>Anomia.</i>	<i>Crassatella.</i>
<i>Rissoa.</i>	<i>Glycimeris.</i>	<i>Venus.</i>
<i>Turritella.</i>	<i>Pinna.</i>	<i>Isocardia.</i>
<i>Actæon.</i>	<i>Gervillia.</i>	<i>Eriphyla.</i>

The species which are found in the Chalk Rock, but not in the Pläner-Kalk of Strehlen, are:—

<i>Ptychoceras Smithi</i> , Woods.	<i>Dentalium turoniense</i> , Woods.
<i>Heteroceras</i> sp.	<i>Arca</i> cf. <i>Galliennæ</i> , d'Orb.
<i>Emarginula Sanctæ-Catharinæ</i> , Passy.	<i>Limopsis</i> , sp.
" aff. <i>divisiensis</i> , Gard.	<i>Lima granosa</i> , Sow.
<i>Trochus Schbüteri</i> , Woods.	" (<i>Acesta</i> ?) <i>subabrupta</i> , d'Orb.
" <i>berocscirensis</i> , Woods.	<i>Cardium turoniense</i> , Woods.
<i>Turbo gemmatus</i> , Sow.	" cf. <i>cenomanense</i> , d'Orb.
" <i>Geinitzi</i> , Woods.	" cf. <i>Mailleanum</i> , d'Orb.
<i>Cerithium cuckhamiense</i> , Woods.	<i>Cardita cancellata</i> , Woods.
" <i>Saundersi</i> , Woods.	<i>Arctica</i> ? <i>equisulcata</i> , Woods.
<i>Aporrhais (Lispodesthes) Mantelli</i> , Gard.	<i>Trapezium rectangulare</i> , Woods.
<i>Lampusia</i> ? sp.	<i>Corbis</i> ? <i>Morisoni</i> , Woods.
<i>Avellana</i> cf. <i>Humboldti</i> , Müll.	<i>Martesia</i> ? <i>rotunda</i> (Sow.).

The fauna of the *Reussianum*-zone in Bohemia is apparently also richer than in our own country, but at present it is not possible in all cases to say definitely which species come from that zone. In the Tables showing the range of the mollusca (facing p. 394, and Part I. pp. 92, 93), it will be noticed that some species, which in other areas have a very limited range, pass through all or nearly all the divisions in Bohemia. I believe that these divisions ('Weissenberg Beds' etc.) are, to a large extent, geographical, rather than zonal, in character.¹

It would be interesting to compare the English fauna with the Bavarian; but in this case too we meet with a difficulty, since, from the available sources of information, it is not possible to separate all the species found in the Pulverthurm Beds from those of the other divisions of the Kagerhöh Beds.

As might be expected, there is no important difference between the fauna of the *Reussianum*-zone in England and in Northern France.

I believe that few, if any, of the species which occur in the *Reussianum*-zone have been identified, without doubt, as occurring in extra-European areas, although some have certainly 'representative forms' elsewhere.

Turning now to our own country, we find that the feature which has struck everyone who has studied this zone is the general resemblance of its fauna to that of the Chalk Marl.—First: ammonoids, gasteropods, and certain groups of lamellibranchs are abundant at both horizons, whereas they are rare or absent in the intervening beds. Secondly: some species are common to the *Reussianum*-zone and the Cenomanian, namely:—

Nautilus sublaevigatus, d'Orb.
Criocerat ellipticum (Mant.).
Emarginula Sanctæ-Catharinæ, Passy.
Pleurotomaria perspectiva (Mant.).
Turbo gemmatus, Sow.

Aporrhais (Lispodesthes) Mantelli,
 Gard.
 (?) *Inoceramus striatus*, Mant.
Spondylus latus (Sow.).
Arctica quadrata (d'Orb.).

Thirdly: allied forms occur at the two horizons, e.g. *Baculites bohemicus*, Fritsch, *Scaphites Geinitzi*, d'Orb., and *Holaster planus* (Mant.) of the higher zone, are closely related to *B. baculoides*, Mant., *S. obliquus*, Sow., and *H. trecensis*, Leym., of the lower zone.

In England, the following species of mollusca are, so far as is known at present, confined to the *Reussianum*-zone:—

Ptychoceras Smithi, Woods.
Heteroceras Reussianum, d'Orb.
 sp.
Baculites bohemicus, Fritsch.
Prionocyclus Neptuni (Gein.).
Turbo Geinitzi, Woods.
Trochus Schlüterii, Woods.
 " *berocsiensis*, Woods.
Natica (Naticina) vulgaris, Reuss.
Cerithium cuckhamiense, Woods.
 " *Sandersi*, Woods.
Avellana cf. *Humboldti*, Müll.
Dentalium turoniense, Woods.
Nuculana cf. *siliqua* (Goldf.).

Arca cf. *Galliennei*, d'Orb.
 " (*Barbatia*) cf. *Geinitzi*, Reuss.
Lima (Acesta?) subabrupta, d'Orb.
Plicatula Barroisi, Peron.
Cardium turoniense, Woods.
 " cf. *cenomanense*, d'Orb.
 " cf. *Mailleanum*, d'Orb.
Cardita cancellata, Woods.
Arctica? equisulcata, Woods.
Trapezium trapezoidale (Röm.).
 " *rectangulare*, Woods.
Corbis? Morisoni, Woods.
Martesia? rotunda (Sow.).
Cuspidaria caudata (Nilss.).

¹ On this subject see J. J. Jahn, 'Einige Beiträge zur Kenntniss der böhm. Kreideformat.' Jahrb. d. k.-k. geol. Reichsanst. vol. xlv. (1895) p. 125.

One of the most noteworthy points in the mollusca of the *Reussianum*-zone, as compared with those of the Cenomanian, is the rarity in the former, of the three families Ostreidæ, Pectinidæ, and Limidæ. All three are very important in the Lower Chalk.

Whether the *Reussianum*-zone should be regarded as the lowest zone of the Senonian or the highest of the Turonian appears to me to be a point of no great importance. The forms which seem to show that its relations are with the lower rather than the higher division are *Pachydiscus peramplus*, *Crioceras ellipticum*, *Turbo gemmatus*, *Arctica quadrata*, and *Holaster planus*. Others, however—such as *Spondylus spinosus*, *Lima* (*Plagiostoma*) *Hoperi*, and the species of *Micraster*, *Cardiaster*, and *Echinocorys*.—link it to the Senonian. Probably the species of *Inoceramus*, when fully worked out, may furnish some evidence of importance on this point. On the whole, I am inclined to think that the affinities of the fauna are closer to the Turonian than to the Senonian.

The absence of crustacea in the Chalk Rock, with the exception of a few specimens of *Pollicipes*, is somewhat remarkable, but the rarity of this class of animals in deposits now forming was noticed by the *Challenger* Expedition,¹ and is attributed to the areolar structure of the exoskeleton, 'which admits of relatively rapid solution after the death of the animal.'

It may be convenient for reference to give here a list of the fossils, other than the mollusca, which are found in the Chalk Rock:—

PISCES.

- Oxyrhina* Mantelli, Ag.²
Corax falcatus, Ag.
Ptychodus latissimus, Ag.
 „ *mammillaris*, Ag.

CIRRIPEDIA.

- Pollicipes* sp.

CHÆTOPODA.

- Serpula ampullacea*, Sow.
 „ *plexus*, Sow.
 „ sp.

BRACHIOPODA.

- Rhynchonella* *Cuvieri*, d'Orb.³
 „ *plicatilis* (Sow.).
 „ „ var. *Woodwardi*,
 Dav.
 „ „ var. *octoplicata*
 (Sow.).
 „ *reedensis*, Eth.

BRACHIOPODA (cont.).

- Terebratula carnea*, Sow.
 „ *semiglobosa*, Sow.
Terebratulina striata (Wahl.).
Trigonosemus incerta, ? Dav. (? young specimen).³

CRINOIDEA.

- Pentacrinus Agassizi*, v. Hagen.

ECHINOIDEA.

- Cardiaster ananchytis* (Leske); elevated variety.
Cidaris sp.
Cyphosoma radiatum, Sorig.
 „ *spatuliferum*?, Forbes.
Echinoconus conicus, Breyn.
Echinocorys vulgaris, Breyn., var. *gibbus* (Lam.).
Holaster planus (Mant.).
Micraster breviporus, Ag.
 „ *cor-bovis*, Forbes.

¹ Murray & Renard, *Challenger* Rep. 'Deep-Sea Deposits' (1891), p. 264.

² For the determination of this species I am indebted to Mr. A. Smith Woodward, F.G.S.

³ I am indebted to Mr. J. F. Walker for the determination of these species.

ACTINOZOA.

Parasmilia centralis (Mant.).

PORIFERA.

Camerospongia campanulata (Smith)." *subrotunda* (Mant.).*Coscinopora infundibuliformis*, Goldf.*Cystispongia subglobosa*, Römer.*Guettardia stellata*, Mich.*Leptophragma Murchisoni* (Goldf.).¹

PORIFERA (cont.).

Placotrema cretaceum, Hinde.*Plinthosella squamosa*, Zitt.¹*Plocoscyphia convoluta* (Smith)." *flexuosa* (Mant.).*Ventriculites aleyonoides*, Mant." *angustatus*, Röm." *decurrens*, Smith." *impressus*, Smith." *mammillaris*, Smith.*Verrucocælia tubulata*? (Smith).

V. CONDITIONS UNDER WHICH THE CHALK ROCK WAS DEPOSITED.

To endeavour to determine the depth at which a fauna, composed (with the exception of some of the foraminifera) of extinct species, lived, may at first sight appear to be quite hopeless, since we know that at the present day different species of a genus have often very diverse ranges. I believe, however, that by a study of the predominating forms in a fauna, and their association, together with the relative numbers of individuals and species, some conclusions of a trustworthy nature may be arrived at.

That the fauna of the *Reussianum*-zone lived in water of less depth than the faunas of the other Turonian and Senonian zones will, I think, scarcely be disputed. The Chalk Rock is very thin generally, yet fossils are more numerous specifically and far more abundant individually than in the other zones. It is well known that at the present day we find a similar difference in passing from comparatively shallow water to greater depths: the number of species, as well as the number of individuals, living on the sea-bottom, diminishes considerably. In water of no great depth, the nature of the materials forming the sea-bottom has a greater influence on the character of the fauna than has the actual depth of the water.² The relative richness of the fauna of the *Reussianum*-zone certainly cannot be accounted for by any difference in the nature of the sea-bottom, since in its original soft state the Chalk-ooze must have been, so far as animal life was concerned, uniform in character throughout the Chalk period. We can, therefore, only conclude that the change in the fauna was caused by a decrease in depth; and, since the change is so marked, the decrease was probably considerable.

The presence of glauconite-grains, which is one of the distinguishing features of this zone, also lends support to the view just stated. The *Challenger* Expedition³ found that glauconite was 'almost exclusively limited to terrigenous deposits in more or less close proximity to the continental masses of land, while it was relatively

¹ These species are here recorded from information supplied by Mr. Jukes-Browne, whose specimens were determined by Dr. G. J. Hinde, F.R.S.

² See especially remarks by W. A. Herdman, Proc. Liverpool Geol. Soc. vol. vii. pt. ii. (1894) p. 171; also Address, Rep. Brit. Assoc. (Ipswich) 1895, p. 698.

³ Murray & Renard, *Challenger* Rep. 'Deep-Sea Deposits' (1891), p. 382.

rare or wholly absent from pelagic deposits situated towards the centres of great ocean basins. . . . It is also present in samples of *Globigerina*-ooze situated at no great distance from the continents.' 'Glaucinite may therefore be regarded as having been formed in deep water not far from the coasts, or in shallow water where no large quantity of continental débris was deposited.' Further, at the present day glauconite is generally associated with phosphate of lime; this is what we find too in the Chalk Rock—it is a nodular phosphatic deposit, containing glauconite.

The rarity or absence of aragonite-organisms, even in the form of casts, in the Upper Chalk, is considered by Mr. P. F. Kendall¹ to be due to the fact that they were, like the shells of pteropods, which form the main part of the modern Pteropod-ooze, dissolved at a particular depth—not less than 1500 fathoms; for if these organisms had remained for a short time on the floor of the Chalk sea, some of them would have left traces of their existence in the form of casts, since the soft Chalk-ooze would easily have filled up the interiors of the shells. If this explanation be correct, then I think we may safely take the abundance of casts of aragonite-organisms (ammonoids, *Nautilus*, etc.) in the *Reussianum*-zone as an indication that it was formed in water of less depth than the Upper Chalk, since the aragonite shells must have become covered up with sediment and were not dissolved until some time afterwards.

We can scarcely doubt that the Chalk Rock was formed beyond the limits of terrigenous deposits, and therefore presumably at a depth of greater than about 100 fathoms. Both palæontological and lithological evidence are entirely in favour of this. The Benthos within the 100-fathom line would have been much richer in species than is our *Reussianum*-zone; just as the fauna of the Pläner-Kalk of Strehlen—particularly the gasteropoda and lamelli-branchia—is more varied than that of the Chalk Rock. If we remember the extremely minute quantity of detrital material which is present in the Chalk Rock, and if we compare a section of that rock with sections of some samples of hardened *Globigerina*-ooze, we can hardly doubt that the two deposits have been formed in the same way.

That the *Reussianum*-zone was not laid down in very deep water is shown by the character of its fauna; not only does it contain a considerable variety of forms, but the number of individuals of any species is, even in the same block of stone, often very large. This is contrary to what is met with in abyssal regions at the present day; thus in the deep-sea Benthos the number of specimens of a species, as well as the number of species, decreases with increasing depth, and, apart from depth, a similar diminution in numbers is noticed in tropical and subtropical regions as the distance from the shore becomes greater. Another point is the large number of gasteropods with thick shells, often of large size (such as *Turbo*, *Pleurotomaria*), in the *Reussianum*-zone; at the present day most

¹ Rep. Brit. Assoc. (Liverpool) 1896, p. 791.

deep-sea animals are characterized by the possession of thin shells, usually of rather small size. It might indeed be urged that the occurrence of thick shells in the Chalk Rock can be explained by the existence of a higher temperature than is found in the deep sea at the present time, since Murray and Irvine¹ have shown that the secretion of carbonate of lime by organisms is directly related to the temperature of the water; but I know of no evidence in favour of the Cretaceous temperature having been high enough to cause any great change at abyssal depths.

In discussing the question of depth from the evidence supplied by the genera of Mollusca which have living representatives we must consider three main points:—(1) the genera which have a limited bathymetrical range; (2) the depths at which the other genera are most numerous; (3) the relative abundance of the genera in the *Reussianum*-zone itself.

So far as their range in depth is concerned, we may conveniently divide the genera into five groups:—

1. The first includes *Crepidula*, *Emarginula*, *Martesia*, *Ostrea*, *Placatula*, and *Trapezium*, all of which are shallow-water forms and, so far as I know, do not live at a greater depth than 50 fathoms. These genera are all rare, and some of them very rare, in the *Reussianum*-zone, and we cannot therefore take them as a proof that the deposit was formed in such shallow water.²
2. *Pleurotomaria*, *Cardita*, and *Arctica* do not live below a depth of 200 fathoms.

Pleurotomaria is one of the commonest gasteropods in the *Reussianum*-zone, and its evidence should therefore be of considerable importance. Only four living species are known; they were dredged at various depths between 73 and 200 fathoms. Two species—*P. Adansonia* and *P. Beyrichi*, both of large size—have been found at the greater depth. It is, of course, possible that the range of the genus may have been more extended in Mesozoic times when the number of species reached its maximum; we know, at any rate, that it is very common in several Jurassic formations which are undoubtedly of shallow-water origin.

Cardita and *Arctica* are not common in the Chalk Rock; the former extends from the Littoral zone to 150 fathoms, and is found mainly in shallow water; the latter ranges from the Laminarian zone down to about 180 fathoms.

¹ Proc. Roy. Soc. Edin. vol. xvii. (1891) p. 79: J. Murray, 'Summary of Scientific Results (*Challenger* Exped.),' pt. ii. (1895) p. 1456.

² With regard to genera which appear to be limited to shallow water, we shall do well to bear in mind the warning given by Starkie Gardner:—'When we reflect that, for one cast of the dredge in abyssal depths, a thousand have perhaps been made in the littoral zone, we must hesitate to pronounce definitely that any genus is without deep-sea species' (Geol. Mag. 1884, p. 497).

3. *Turbo*, *Chlamys*, *Spondylus*, and *Cardium* are not found below the 600-fathom line.

Turbo is very common in the *Reussianum*-zone, and one of the species is of considerable size. At the present day the genus extends from the Littoral zone down to 565 fathoms, but, being phytophagous, it is of course most abundant in shallow water.

Chlamys is very rare, and *Cardium* not common, in the *Reussianum*-zone; both are abundant in fairly shallow water.

Spondylus is rather common, particularly *Sp. spinosus*. The existing species live in warm seas, mainly in the Littoral zone, or at no great depth, but one form, which is, however, quite small, has been found at a depth of 520 fathoms.

4. *Natica* is found down to about 1000 fathoms, but is abundant only at less than 100 fathoms; it is moderately common in the *Reussianum*-zone.

Modiola extends down to 800 fathoms, but is not common below 100 fathoms; it is moderately rare in the *Reussianum*-zone.

5. Ten genera—namely, *Trochus*, *Aporrhais*, *Cerithium*, *Dentalium*, *Limopsis*, *Nucula*, *Arca*, *Cuspidaria*, *Nuculana* (= *Leda*), and *Lima*—have species which live at 1000 fathoms or greater depths, but in every case these genera have a great bathymetric range; all occur in shallow water, and nearly all are found in depths of only a few (1 to 5) fathoms.

The living forms of *Trochus*¹ are abundant in the Littoral and Laminarian zones, but the genus is not uncommon in fairly deep water; indeed, Agassiz² speaks of the Trochidæ as being well represented in deep water. *Trochus* is, I believe, the commonest gasteropod in the *Reussianum*-zone, nevertheless it is represented by only two species; in water of less than 100 fathoms there would almost certainly have been a larger number of species.

Aporrhais is also very common. Existing species are most numerous within the 100-fathom line, and are not common beyond it.

Cerithium: there are two species in the Chalk Rock, one being very common. The genus is abundant in the Littoral zone or at no great depth, and rare beyond 100 fathoms.

Dentalium: the Dentaliidæ are characteristic of deep water, but also occur in shallow regions. The genus is somewhat rare in the *Reussianum*-zone.

Nucula and *Arca* are common in the Chalk Rock; they

¹ Dr. W. F. Hume, 'Nat. Sci.' vol. vii. (1895) p. 391, has stated that the 'presence of *Trochus*, *Turbo*, and *Solarium* in the Chalk Rock is paralleled at the present day by the same association found at Culebra Island at a depth of 390 fathoms.' *Solarium* does not occur in the Chalk Rock, and the association of *Trochus* and *Turbo* proves nothing, since they both occur in the Littoral zone as well as at various greater depths.

² 'Three Cruises of the *Blake*,' vol. ii. (1888) p. 67.

are widely distributed in rather shallow water, and have also some abyssal species.

Cuspidaria is found in all seas and at all depths, but the species are most abundant in deep water and abyssal regions; since, however, only one specimen has been seen in the Chalk Rock, we cannot take it as evidence of very deep water.

Nuculana (= *Leda*) also occurs at all depths, but is rather a characteristic deep-water form.¹ Only two specimens have been found in the Chalk Rock.

To sum up the preceding evidence furnished by the Mollusca, we see that we have in the *Reussianum*-zone some genera (*Cuspidaria*, *Nuculana*, *Dentalium*) which are characteristic of deep water, but are not confined to it; others which are limited to shallow water (0 to 50 fathoms). But neither group forms the predominating element in the *Reussianum*-fauna; we may therefore consider that this zone was not laid down either in shallow or in very deep water. The commonest genera, although at the present day most abundant in shallow or rather shallow water, do occur fairly often in water of moderate depth (say from 100 to 500 fathoms), but these genera, numerous in the *Reussianum*-zone as the individuals may be, are there represented by only one or two species in each case, whereas in shallow water they would almost certainly have been represented by a larger number. I think, therefore, that it is unlikely that the *Reussianum*-zone was formed at a depth greater than about 500 fathoms; this is further supported by the fact that in dredging beyond this depth a marked decrease is noticed in the number of individuals as well as species of both lamellibranchia² and brachiopoda.³

I consider, then, that the Chalk Rock was laid down between the depths of about 100 and 500 fathoms. From the number of species found in it, several of which belong to genera common in fairly shallow water, I think it was probably deposited somewhat nearer the former than the latter limit, although the depth must necessarily have varied in different places. The absence of the Chalk Rock in Lincolnshire is most likely due to the greater depth of water which existed in that region.

I have not studied in detail the other groups of fossils found in the *Reussianum*-zone. I may, however, mention that the Hexactinellid sponges are well represented, and therefore strongly favour the view that the lower limit was not less than about 100 fathoms,

¹ The occurrence of the genera *Cuspidaria* (= *Næra*), *Nuculana* (= *Leda*), and *Dentalium* is noteworthy, since Dr. Gwyn Jeffreys and many later writers have regarded the absence of these forms in the Upper Chalk as evidence in favour of its shallow-water origin. On this subject see J. G. Jeffreys, Rep. Brit. Assoc. for 1877 (1878), p. 86; J. S. Gardner, Geol. Mag. 1884, pp. 496-506; A. R. Wallace, 'Island Life,' 2nd ed. (1892) p. 89.

² E. A. Smith, 'Report on the Lamellibranchiata,' *Challenger* Exped. (1885) p. 6.

³ T. Davidson, 'Report on the Brachiopoda,' *Challenger* Exped. (1880) pp. 3, 4.

since they do not live in water of less than 95 fathoms in depth; they are abundant between 95 and 200 fathoms, and also from 301 to 700 fathoms.¹

EXPLANATION OF PLATES XXVII. & XXVIII.

All the specimens figured come from the Chalk Rock, and, unless otherwise stated, are preserved in the Woodwardian Museum (Montagu Smith Collection).

The figures are of the natural size, except where otherwise stated.

PLATE XXVII.

- Figs. 1 & 2. *Nucula* sp. Internal moulds.
 Fig. 3. *Arca* sp., cf. *Galliennei*, d'Orbigny. Internal mould.
 4. *Arca* sp. Internal mould.
 Figs. 5 & 6. *Arca* (*Barbatia*) sp., cf. *Geinitzi*, Reuss. 5. Wax mould of exterior showing ornamentation. 5a. Portion of same, $\times 5$. 6. Internal mould.
 Figs. 7 & 8. *Limopsis* sp. Internal moulds. $\times 1\frac{1}{2}$.
 Figs. 9–12. *Modiola Cottæ*, Römer. 9, 10. From Winchester (coll. R. M. Brydone). 11. Part of a larger specimen from Luton (collected by the Author). 11a. Portion of shell of the same enlarged, showing the character of the ornamentation, $\times 6$. 12. Outline of section of valve of the same specimen.
 Fig. 13. *Inoceramus striatus*, Mantell.
 Figs. 14–17. *Inoceramus* sp. Internal moulds. 15. Posterior view of 14.
 Figs. 18 & 19. *Plicatula Barroisi*, Peron, from Winchester (coll. R. M. Brydone). $\times 2$.
 Figs. 20–22. *Cardium turoniense*, sp. nov. 20. Wax mould, $\times 1\frac{1}{2}$. 20a. Portion of same further enlarged, showing the character of the ornamentation, $\times 5$. 21. Natural mould, $\times 1\frac{1}{2}$. 22. Anterior view of the same, $\times 1\frac{1}{2}$.
 Figs. 23 & 24. *Cardium*, cf. *cenomanense*, d'Orbigny. Internal mould. 24. Anterior view.
 Fig. 25. *Arctica quadrata* (d'Orbigny). Anterior view of natural mould. Morgan's Hill, near Devizes (coll. A. J. Jukes-Browne).

PLATE XXVIII.

- Fig. 1. *Arctica quadrata* (d'Orbigny). Right valve.
 Figs. 2–5. *Cardita cancellata*, sp. nov. 2. Wax mould. 3. Portion of same, $\times 5$. 4, 5. Natural mould. 4. Anterior view. 5. Left valve.
 Figs. 6–8. *Arctica*? *equisulcata*, sp. nov. 6. Dorsal view of natural mould. 7. Right valve of same. 8. Left valve, with part of shell preserved. 8a. Portion of same enlarged, $\times 3$.
 Figs. 9 & 10. *Trapezium trapezoidale* (Römer). 9. Left valve. 10. Dorsal surface of the two valves.
 Figs. 11 & 12. *Trapezium rectangulare*, sp. nov. Internal moulds. 11. Left valve. 12. Dorsal surface of the two valves.
 Figs. 13 & 14. *Corbis*? *Morisoni*, sp. nov. 13. Right valve. 14. Anterior end.
 Figs. 15–18. *Martesia*? *rotunda* (Sowerby). 15–17. Internal casts, $\times 2$. 15. Dorsal view. 16. Right valve. 17. Anterior end. 18. Wax mould of exterior of right valve, $\times 2\frac{1}{2}$.
 Figs. 19 & 20. *Cuspidaria caudata* (Nilsson). Internal cast. 19. Left valve. 20. Dorsal surface.

¹ F. E. Schultze, 'Report on Hexactinellida,' *Challenger Exped.* (1887) pp. 453–467.

DISCUSSION.

Dr. W. F. HUME congratulated the Author on the completion of this detailed contribution to our knowledge of the Chalk Rock fauna, and referred to the interest of the records of *Chlamys* and *Arctica* at this horizon. That the nodular condition characteristic of this lithological feature had been formed at some depth was an hypothesis now being generally accepted; but the Author, in discussing the question of the depth at which the deposit had been formed, scarcely seemed to lay sufficient stress on the action of currents, which to the speaker appeared of essential value in the formation of the nodular rock. Analyses carried out recently show that the glauconitic material is generally present only in small quantity, the carbonate of lime in most cases exceeding 90 per cent.; so that the higher bathymetric limit assigned by the Author appears to be the more probable. The repetition of a lower or Cenomanian fauna in the Chalk Rock, to which the Author has again called attention, is one of great interest, and the beds containing these forms should be considered as the true upper limit of the Middle Chalk, all the more arbitrary boundaries adopted having completely broken down.

Mr. W. WHITAKER also spoke.

Edwin Wilson, Cambridge

CHALK ROCK MOLLUSCA.

Edwin Wilson, Cambridge.