A CATALOGUE OF

THE AMMONITES OF THE LIASSIC FAMILY LIPAROCERATIDAE

IN THE
BRITISH MUSEUM (NATURAL HISTORY)

BY

L. F. SPATH, D.Sc., F.G.S.

WITH TWENTY-SIX PLATES AND SEVENTEEN TEXT-FIGURES

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PREFACE

It is noteworthy that most palaeontologists who have made ammonites their special study have largely failed to win the interest, or even enlist the sympathy, of those who study other fossils. Doubtless this is because, however strongly individual ammonites may appeal to workers in other groups through their intrinsic beauty or interest, the group as a whole displays such a spate of differing forms and such a wealth of variation in, albeit, but few characters, that it defies any clear-cut classification, and has reduced ammonite systematics to tedious descriptions couched in a necessarily cumbrous terminology. Moreover, the ammonite specialists themselves have seldom agreed either in the classifications they have made, in the phylogenies they have drawn up, or even in their views of how the evolution of ammonites has come about; their results, therefore, have been looked upon with but little confidence by other workers.

In spite of the drawbacks inherent in the subject, the group here monographed should prove profoundly interesting to palaeontologists generally. The Liparoceratidae—the "green ammonites" of the Dorset coast—are a well-defined family, limited to a comparatively short range in time, abundant in species, and superabundant in individuals that occur at frequent horizons throughout that range and display almost continuous gradation from form to form:—

. . . . . Facies non omnibus una,
Nec diversa tamen, qualem decet esse sororum.

If the classification appears arbitrary and far from clear-cut, it is because the abundant material presents an evolutionary flux. Yet in this seeming chaos, one guiding principle throws a flood of light upon the evolution of the group.

The stratigraphical order of the specimens is largely known, and much of the material, of which the British Museum possesses an unequalled collection, has actually been gathered foot by foot throughout a large part of the stratigraphical series. The result has been most unexpected. The phenomena of recapitulation and earlier inheritance (tachygenesis) have been unhesitatingly accepted for ammonites by most authors since first Hyatt, and then Buckman, applied them to the group; and this very family, the Liparoceratidae, has been monographed and its evolution worked out on orthodox lines by Professor Trueman, but with far less abundant and far less carefully collected material than is now available. It was then taken for granted that the more evolute (loosely-coiled) forms were the more primitive; that is, that the capricorns at different horizons evolved into different sphaerocones (closely-coiled forms). But Dr. Spath here shows, on unequivocal stratigraphical evidence, that the sphaerocones *preceded* the capricorns, persisted throughout "green-ammonite" time, and continually gave rise to different capricorn stocks; in other words, that the Liparoceratids have evolved in a direction exactly opposite to that in which they have hitherto been supposed to have evolved. He also shows that new characters have often arisen caenogenetically; and that, therefore, recapitulation is a very fallible guide to evolution.

Such are the points of general interest expounded in the following pages. Dr. Spath has thrown down the gage; it is for other palaeontologists to take it up.

W. D. LANG,
Keeper of Geology.

July, 1938.

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INTRODUCTION

A. GENERAL

During a recent detailed investigation of the ammonites from the so-called "Green Ammonite Beds" of the Dorset coast (Spath, 1936*a*) special attention was paid to the members of one family, namely, the Liparoceratidae. There were several reasons for this preferential treatment. First of all, the ammonites belonging to the Liparoceratidae were found to be the most abundantly represented: and then they proved of considerable importance from a stratigraphical point of view, allowing of very detailed subdivision of that uppermost part of the Lower Lias of Dorset (*davoei* zone, or Liparoceratan age) which constitutes the local "Green Ammonite Beds." Again, the Liparoceratidae had long been a favourite with all interested in the evolution of ammonites, and on several occasions (Spath, 1933*a*, p. 705; 1935, p. 396) I had briefly referred to my views of their phylogeny, without being able to substantiate them with chapter and verse.

In the course of the investigation other important points emerged. It could be announced that the distribution in time of various species was rather different from what it had been taken to be by previous authors, and that consequently different inter-connexions of the various members had to be found. Moreover, some of the species had not been figured at all, others had been mis-interpreted owing to imperfect descriptions or bad figures, and there were many new and un-named forms; so that while their adequate illustration was necessary, it could only be attempted in a monographic account of the whole family.

The investigation furthermore revealed not only that the members of the family Liparoceratidae were more fully and abundantly represented in the English Lias than anywhere else in the world, but also that by far the largest and most varied collection of these ammonites was housed in the British Museum (Natural History). I had already studied this collection before the War, and twenty-five years ago I attached MS. names to most of the new species. The work was interrupted, but since 1919 I have had the privilege of examining year by year new collections of ammonites from the Dorset coast, made by Dr. W. D. Lang. And it is largely due to his continual encouragement and to his affording me special facilities for this research that the present work has materialised.

When the stratigraphical results of the investigation were published in the *Quarterly Journal of the Geological Society* (Spath, 1936*a*, p. 438) I hoped to include a discussion of the phylogeny of the family Liparoceratidae in a separate paper, and to deal with the more important new species and other systematic details merely in an appendix. But I underestimated the size of my task. A mere discussion proved unsuitable for publication by a scientific society; for, in its necessarily condensed form, it assumed that the reader was as familiar with the group as the writer, or was willing to make continual reference to figures scattered in a great variety of publications, to be found as a whole in extremely few libraries. In the extended form in which the discussion, and especially the systematic part, are now published in this Catalogue, they include all the necessary illustrations, and will, it is hoped, prove easier to read and understand. My thanks are due to the Trustees of the British Museum for enabling me to present the results in this far more attractive manner.

The phylogenetic views here put forward differ *in toto* from those of previous workers. Most biologists know how the Biogenetic Law has been applied by Hyatt to the study of ammonites. In his opinion, it was sufficient merely to dissect a given form in order to find its phylogeny reflected in the development of its inner whorls. Buckman, in 1892 (p. 288), stated that it was not altogether true that the inner whorls revealed the genealogy of an ammonite, and he stressed the " modifying action of the law of earlier inheritance." Many workers still assume that, except in so far as the evidence is masked by tachygenesis, the phylogeny of an ammonite may be seen in its ontogeny.

The value of such evolutionary evidence, in so far as the Cephalopoda in general are concerned, has recently been discussed by the writer, first in a paper entitled " The Evolution of the Cephalopoda," which appeared in *Biological Reviews* (1933*b*), and then in a sequel, " The Phylogeny of the Cephalopoda " (*Palaeontologische Zeitschrift*, 1936*b*), which was also a reply to various critics of the first paper. The family Liparoceratidae seemed ideal for showing how the principles which I advocated in these papers were applied in practice, when dealing with a single stock of ammonites, and it was very agreeable to be able to illustrate the various members of this stock in this Catalogue. Clearly this could not have been done so satisfactorily in any other form.

Thanks to the careful collecting of Dr. W. D. Lang in the Belemnite Marls and Green Ammonite Beds of the Dorset coast, there is an unequivocal stratigraphical foundation for at least a large portion of the phylogenetic work. Furthermore, the evolution of the family Liparoceratidae was considered to be by no means unknown. There are the views first put forward by Hyatt himself in 1871 (p. 41); the views of Buckman, who discussed the Liparoceratidae repeatedly between 1892 and 1919; and those of Prof. A. E. Trueman, who fully elucidated the phylogeny of the family in a valuable paper (1919). Inasmuch as the Hyattian principles used by these authors differ fundamentally from mine, our results necessarily differ in many points. Indeed the evolutionary order is entirely reversed in my account; *for in my opinion the more-or-less involute, often sphaerocone, Liparoceratids are ancestral to the more evolute (dimorph) forms; and these, in turn, gave rise to the capricorns, which are the most evolute Liparoceratids.* Hitherto it has been considered by most authors that the capricorn Liparoceratids were ancestral, and gave rise, through the dimorphs, to the involute sphaerocones; but others did not even take the capricorns to be related to *Liparoceras*. My view is grounded on the fact that among the early

Liparoceratids there are no capricorns. It is for the reader to judge between these conflicting views.

Although I may have had the advantage of a more refined stratigraphy and far more abundant material than my predecessors, I hasten to point out that the Liassic sequence is as yet tantalisingly incomplete ; and I am not deluding myself that I have carried the problem of Liparoceratid evolution to finality. Perhaps the elasticity or fluidity of phylogenetic implications for which I always plead, in view of the enormous gaps in our knowledge, may be held to be more objectionable than a principle like recapitulation which at least allows of elucidation of relationship with some show of reason. If it can be shown, however, that the results obtained by Hyattian principles must be artificial because they are not in agreement with the stratigraphical evidence, an alternative explanation of how change came about in this family may be acceptable.

The reader will ask why everything to do with the classification of ammonites is in a state of flux. (1) Are they too uniform to be satisfactorily classified ? (2) Was hybridisation so common among them that nobody can hope to unravel their relationships ? (3) Or are they as yet too incompletely known to attempt this ?

(1) This is largely so ; and I have on several occasions expressed the opinion that Suess's division of all post-Triassic ammonites into only two main groups, namely, the thin-shelled (? pelagic) *Phylloceras* and *Lytoceras*, on the one hand, and the trachyostracous, or highly ornamented (? benthonic) remainder—*Ammonites*—on the other, was a master-stroke, as showing the essential uniformity of the order. Even the apparent distinctness of the tachyostracous ammonite families of the Lower Lias of north-western Europe is largely deceptive, owing to the absence of those intermediate types between the radical, smooth Phylloceratids and Lytoceratids and their modified, often highly ornamented offshoots, to which I have previously alluded (1924*b*, p. 194) ; and Buckman's claim must not be forgotten that of all the ammonites which are presumed to have existed, perhaps only a quarter are as yet known to science. Speculation on these critical forms is almost limitless ; *Lytoceras* itself, with a shell as clear as glass and as thin as paper, has been taken to be a secondary end-form by some, and a primary radical by others.

(2) I do not believe that Ammonite relationships can be explained by hybridisation from without, as claimed by Monestier (1928, p. 21), who thought he recognised four " subphyla " mingled in one genus, *Amaltheus*, and derived from widely distinct roots. *Amaltheus* may be an extremely plastic genus, including smooth, discoidal, as well as coronate, tuberculated shells, and countless transitions between them ; but, for an ammonite genus, I consider it unusually coherent, and easily and unmistakably recognisable as *Amaltheus* in spite of all its variations. Moreover, the Amaltheidae are among the few stocks whose rise, decline, and extinction can be actually observed, and clearly form a single stock, even if their origin (either from the Liparoceratidae, through *Oistoceras*, or from the Phylloceratidae, through "*Amphiceras*") is still disputed. It is different with the forms, included in the family Liparoceratidae, which are grouped round *Androgynoceras heterogenes* and throughout

this discussion referred to as " dimorphs." If my views are correct, there is no need to fall back either on hybridisation from without or on hypothetical Liparoceratid capricorn ancestors to demonstrate the relationships of that family ; in any case, my explanation brings out the essential uniformity of the Liparoceratidae, and confirms what I previously (1923*c*, p. 14) called the " logical result for the paracmic period of the order Ammonoidea, namely wide-spread simplification, instead of elaboration, of characters."

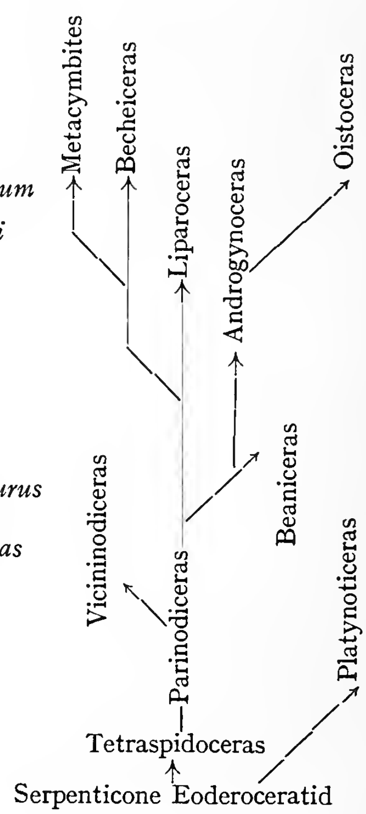
(3) Although our knowledge of ammonites must still be far from complete in view of the large number of forms that remain to be discovered, yet the number already known is so great, and has been gathered from so many horizons and from such widely separated localities, that it is unlikely for new discoveries radically to affect the problems of classification. If we cannot convincingly express the phylogeny of ammonites in a classification of the forms already known, it is improbable that we shall have more success, even if much new material is forthcoming.

A chronological guide and genealogical tree of the Liparoceratidae (Table I) is inserted at this early stage because frequent reference to it will be found necessary throughout this Introduction : diagrams of the most important types of shell are also given here (Text-fig. 1) for the same reason.

TABLE I

		Oppel's zones	Sub-divisions
MIDDLE LIAS DOMERIAN	(Amaltheian Age)	Zone of *Amaltheus margaritatus*	Upper Middle Lower
LOWER LIAS CARIXIAN	(Liparoceratan Age)	Zone of *Prodactylioceras davoei*	Sub-zone of *Oistoceras figulinum* Sub-zone of *Becheiceras bechei* Sub-zone of *Androgynoceras lataecosta* Sub-zone of *Androgynoceras maculatum*
	(Polymorphitan Age)	Zone of *Tragophylloceras ibex*	Sub-zone of *Beaniceras centaurus* Sub-zone of *Acanthopleuroceras maugenesti*
		Zone of *Uptonia jamesoni*	Upper Lower
SINEMURIAN			

Liparoceratid genera



It should be noted that specimens of Liparoceratids gathered from Dorsetshire, especially in old collections, are often labelled simply "Lyme Regis" or "Charmouth." It may be assumed that these were found within $\frac{1}{2}$ mile east of, and $\frac{1}{4}$ mile west of, St. Gabriel's Mouth, west of Golden Cap. In the lists of specimens given in the systematic part of this work "St. Gabriel's Mouth" is shortened to St. Gabriel's." The Green Ammonite Beds extend east of Golden Cap as far as Seatown, and occur in the higher parts of Stonebarrow Cliff east of, and Black

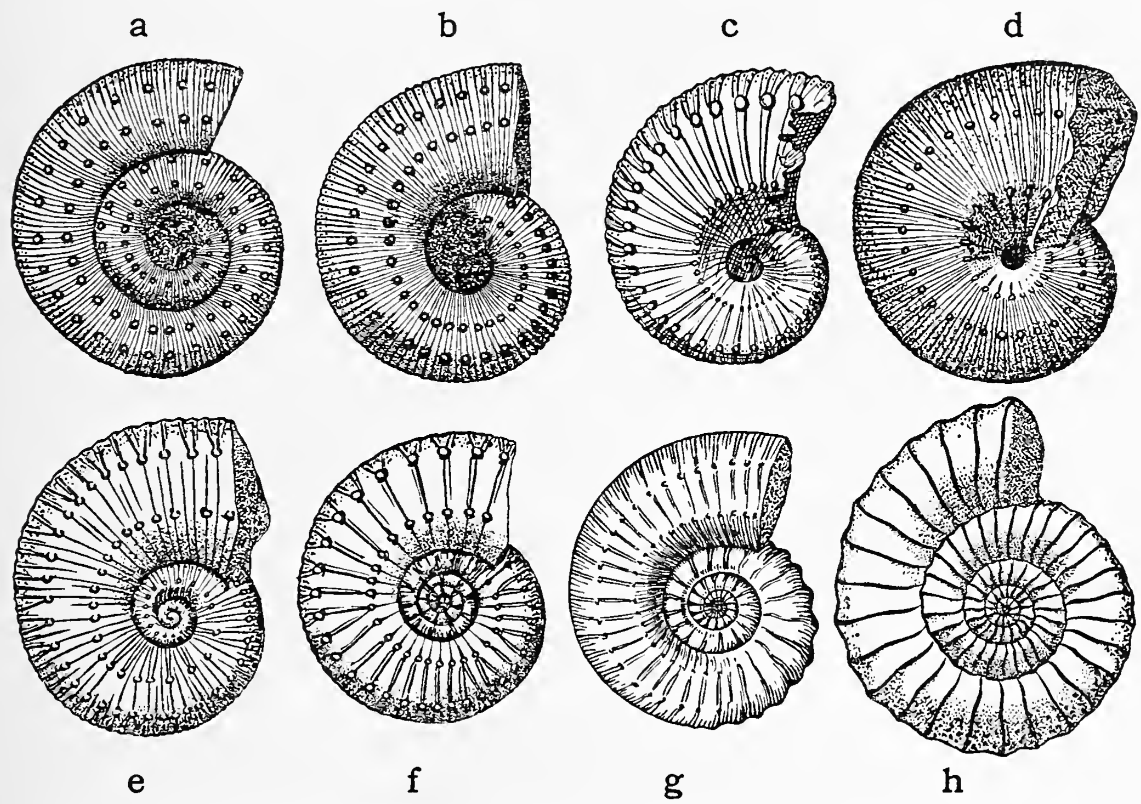


FIG. 1.—Diagrammatic representation of the more important types of shell in the Liparoceratidae.

(*a*) One of the evolute ancestral forms (*Tetraspidoceras latispina* Reynès sp. of the base of the *jamesoni* zone). (*b*) A more involute transition to *Liparoceras* (*Tetraspidoceras reynesi*, n. (p. 17), of the same horizon). (*c*) An early sphaerocone (*Liparoceras* (*Parinodiceras*) *parinodus* Quenstedt sp. of the *jamesoni* zone). (*d*) A late sphaerocone (*L.* (*Becheiceras*) *bechei* J. Sowerby sp. of the *bechei* sub-zone). (*e*) An intermediate sphaerocone with comparatively open umbilicus (*Liparoceras cheltiense* Murchison sp. of the *maugenesti* sub-zone). (*f*) A similar dimorph sphaerocone, with capricorn ribbing on the inner whorls (*Androgynoceras sparsicosta* Trueman sp. of the *centaurus* sub-zone). (*g*) A more evolute dimorph, with prolonged capricorn stage (*Androgynoceras henleyi* J. Sowerby sp. of the *lataecosta* sub-zone). (*h*) An evolute capricorn (*Androgynoceras lataecosta* J. Sowerby sp. of the same horizon).

Ven west of, Charmouth ; but, except that some local collectors used to work the Red Band on Stonebarrow and Westhay, it is unlikely that many old specimens were collected from exposures other than near St. Gabriel's.

Again, it may be useful to mention here the named horizons of the Green Ammonite Beds and the top of the ibex-zone of the Dorset coast, as recorded and numbered from below, upwards by Lang (1936, pp. 430–5).

Lowest Tier (Middle Lias)

Upper Limestone	(129)	*figulinum* sub-zone
Red Band	(126)	*bechei* sub-zone
Lower Limestone	(123)	*lataecosta* sub-zone
Belemnite Stone	(121)	*centaurus* sub-zone
Crumbly Bed	(120*d*)	

With regard to the forms represented in Text-fig. 1, photographs of actual specimens are reproduced in the plates, except in the case of *Tetraspidoceras*; and they are not arranged in a sequential order, as can be seen from Table I. I have always sympathised with Waehner's (1894, pp. 18, 19) criticism of Hyatt's well-known diagrammatic representations of lineages in his *Genesis of the Arietidae* (1889), and I emphasise that the figures are merely meant to illustrate such terms as "sphaerocone" and "capricorn" to those readers who are not familiar with them, just as the stratigraphical subdivisions in Table I may be of use to the geologists who are not conversant with the units of Jurassic Time.

My best thanks are due to Dr. W. D. Lang, not only for the way, already referred to, in which he has facilitated the publication of these results, but for much useful criticism. I also gratefully acknowledge the assistance received, chiefly in the way of loans of type and other material, from Prof. H. H. Swinnerton, Nottingham, Prof. A. E. Trueman, Glasgow, Dr. J. Wilfrid Jackson, Manchester, Dr. W. E. Collinge, York, Mr. J. W. Tutcher, Bristol, and especially from the officers of the palaeontological department of the Geological Survey, Dr. J. Pringle and Mr. C. P. Chatwin; from Prof. Jacob and Dr. E. Roch of the Sorbonne, Paris; from Prof. Arambourg, M. J. Cottreau and Mlle. Basse (Madame de Menorval) of the Musée National d'Histoire Naturelle in Paris; from M. L. Morrelet of Paris and M. H. Contaut of Saint-Max-Les-Nancy; from Prof. L. W. Collet and Dr. E. Bovier of Geneva; from Prof. W. O. Dietrich of the Geological-Palaeontological Institute of Berlin University; from Prof. Dr. O. H. Schindewolf of the Geologische Landesanstalt in Berlin; from Prof. Hennig and Dr. Schertz of the University of Tübingen; and from Dr. H. Aldinger of Cannstatt, Wurtemberg.

B. ON THE EVOLUTIONARY VALUE OF CERTAIN CHARACTERS

Before considering the Liparoceratidae in particular, certain characters are dealt with, which have hitherto been relied upon as affording definite evidence for phylogeny, and certain other general considerations are reviewed.

(*a*) The Suture-line

Prominent among the characters which have been used to prove or disprove affinity is the suture-line, which usually forms an elaborate and distinctive pattern where the puckered edges of a septum meet the outer shell wall.

Hyatt (1867, p. 81) originally stated that throughout the three genera of the family Liparoceratidae there was "positive agreement in the septa." The number of genera in this family may have increased since Hyatt wrote, but the similarity of the suture-line remains (Text-fig. 2). Since, however, much has been made by subsequent investigators of sutural evidence and of slight differences in the various suture-lines, I may say at once that in my opinion the value of these for phylogenetic and systematic purposes has always been greatly over-rated, in the Liparoceratidae as much as in other families. The following illustration may be of interest in this connection.

It is often difficult enough categorically to decide whether a given lobe of the suture-line is branching in a symmetrical or an unsymmetrical manner (fig. 2); but definition becomes altogether impossible when the lobe has two prongs on one side of the ammonite and three on the other, as sometimes happens (fig. 3 *a*); or when the respective prongs of each side differ in size, as is often the case in capricorns (fig. 4 *b*) and other ammonites (fig. 3 *b*, *c*). The relative depths of the external and

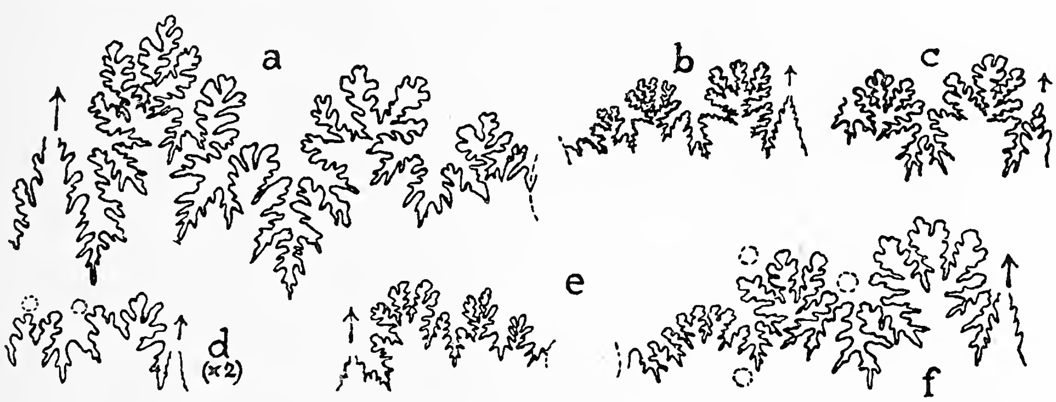


FIG. 2.—Suture-lines of various Liparoceratids (natural size, except *d*).

(*a*) *Liparoceras divaricosta* (Trueman) at 85 mm. diameter. Bracebridge, Lincs (No. C. 36962). (*b*) *Liparoceras* aff. *naptonense*, sp. nov., at about 55 mm.; Napton, Warwickshire (No. C. 38421). (*c*) *Androgynoceras* aff. *lataecosta*, J. Sowerby sp., transitional to *A. subhybrida*, sp. nov. (see p. 139). Last suture-line at 75 mm.; Kilsby, Northants (No. 20130 *gb*). (*d*) *Liparoceras geyeri*, sp. nov., figured in Plate X, fig. 3; last suture-line at 17 mm. (enlarged × 2); Cheltenham, Gloucester (No. C. 38416). (*e*) *Oistoceras orbignyi*, sp. nov., figured in Plate XXII, fig. 3, at about 62 mm.; Vieux Pont, Calvados (No. 37188 *a*). (*f*) *Liparoceras* aff. *lytoceroides*, sp. nov., inflated variety, at 60 mm. (from a part omitted in Plate IX, fig. 5); Stroud, Gloucestershire (No. C. 9873).

first lateral lobes vary, even in the same individual (fig. 3 *d*), as do the relative widths of the external saddle and of the first lateral lobe. For example, if this lobe happens to lie on the crest of a rib of one of the capricorns, it may be narrow, because there the external saddle is unduly widened; but, if it lies in the hollow between two ribs, where the external saddle is normal, the lobe may be wide. Tuberculation effects still more far-reaching changes, though perhaps not so strikingly in the Liparoceratids as in a form of *Knemiceras* which is reproduced in Text-fig. 3 *e*.

In these circumstances I consider it useless to express the length of a given element of the suture-line, such as the first lateral lobe, in percentages of the whorl-breadth; or to indicate the position of such an element with regard to the radius or the tuberculation in highly ornamented stocks. Such spurious "accuracy" leads to an entirely erroneous conception of the importance of the suture-line in the Liparoceratidae, as in other families; and even for specific identification of ammonites in general, the proportions of the suture-line are of no practical value to the initiated, while they prove merely a snare to the beginner. Comparison of the suture-lines of six species of *Oistoceras* represented in Text-figs. 4 *d–i* will show this variability.

(*b*) The Unstable Siphuncle

The Siphuncle is shown, by examples drawn from several genera inside and outside the Liparoceratidae, to exhibit no stability in its position at a given immature stage of growth.

The position of the siphuncle at a given size in the young of different ammonite

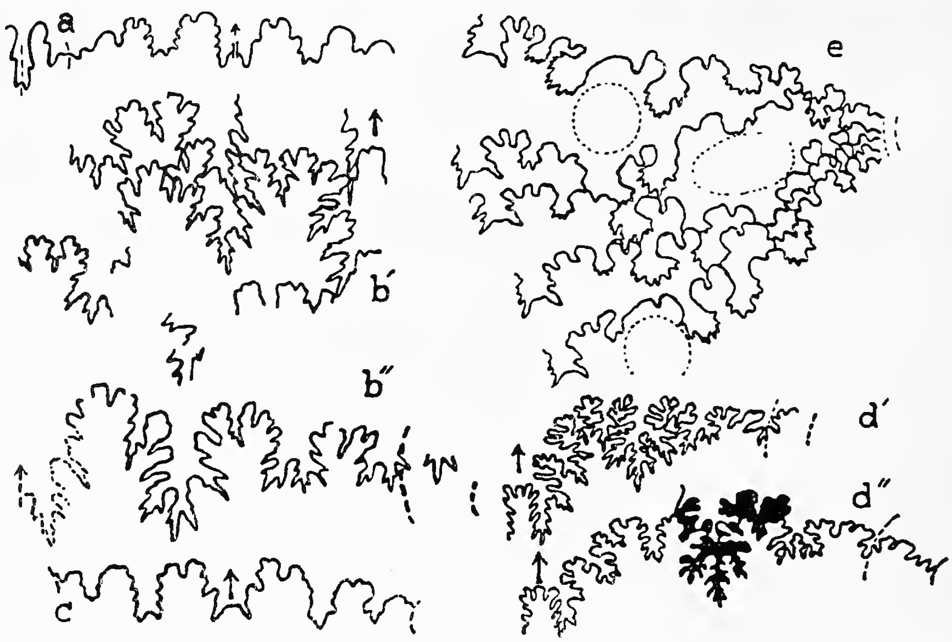


Fig. 3.—Suture-lines of various normal ammonites, showing irregularities of different kinds.

(*a*) *Echioceras aureolum* (Simpson) S. S. Buckman; Lower Lias, Yorkshire (Hull Museum) at 19 mm.; showing differences in the elements on the two sides. (*b′*, *b″*) *Kamptokephalites herveyi* (J. Sowerby); Cornbrash, Lincs (B.M., no. 46485); two opposite sides. (*c*) *Hysteroceras* sp. (*varicosum* Collignon *non* Sowerby); Upper Albian, Madagascar (× 2⅔) (after Collignon); note lobes of two sides. (*d′*, *d″*) *Sigaloceras calloviense* (J. Sowerby); Kellaways Rock, Wilts (B.M., no. 43924 *a*); two suture-lines at 52 and 82 mm. (*e*) *Knemiceras* sp.; Middle Albian, Hamiran, S. Iran (E. D. S. Richardson Coll.); showing interference by three tubercles (dotted). All except *c* after Spath.

stocks is known to vary, and, like the variability in the number of whorls, or of septa, seemed to offer a possible means of checking the phylogenetic conclusions arrived at from the examination of the ordinary shell-characters. Unfortunately, the difficulties encountered in preparing the slides, in which I had the constant help of Mr. A. Reeley of the British Museum (Natural History), has proved out of all proportion to the results obtained. It is not only essential to have well-identified material for sectioning, but it is often necessary to sacrifice many examples before obtaining one in which the preservation is sufficiently favourable, and the orientation sufficiently exact, to show the siphuncle continuously. Obviously it is impossible to do this with the less common forms, and the observations up to the present are thus based on only about two dozen sections out of many attempted. For what

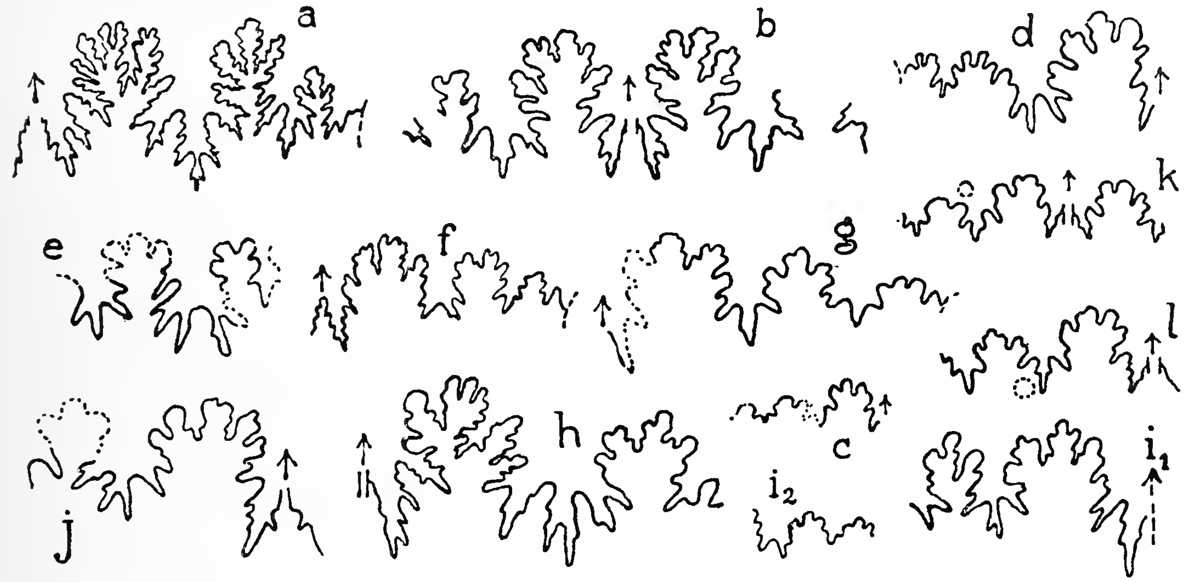


FIG. 4.—Suture-lines of various Liparoceratidae, all enlarged and slightly diagrammatic.

(*a*) *Liparoceras* (*Parinodiceras*) *ovale*, sp. nov., figured in Plate I, fig. 5; Bettlingen, Wurtemberg (B.M. No. 22118). (*b*) *Beaniceras* aff. *luridum* (Simpson), at about 25 mm. diameter; Tranzault, Indre (B.M. No. C. 28079). (*c*) *B. centaurus* (d'Orbigny) figured in Plate X, fig. 7 (inner whorls). St. Amand, Cher. (B.M. No. C. 28072). (*d*) *Oistoceras* aff. *figulinum* (Simpson) at about 20 mm.; Les Cottards, nr. St. Amand, Cher (B.M., No. C. 28065). (*e*) *O. figulinum* (Simpson); two lateral lobes, at about 35 mm.; Bettant, Ain (B.M., No. C. 28066). (*f*) *O.* cf. *omissum* (Simpson); at 30 mm.; Yorkshire (B.M., No. C. 19231). (*g*) *O.* sp. juv. aff. *figulinum* (Simpson); at 20 mm.; Venarey, Côte d'Or (B.M., No. C. 28134). (*h*) *O. wrighti* Spath; at about 40 mm.; Les Cottards, nr. St. Amand, Cher (B.M., No. C. 28058). (i_1, i_2) *O.* sp. juv. (i_1) At about 25 mm. and (i_2) on inner whorls. Same locality (B.M., No. C. 28064). (*j*) *Oistoceras* aff. *sinuosiforme*, sp. nov. (see also Plate XXVI, fig. 8). At about 28 mm.; Tranzault, Indre (B.M., No. C. 28067). (*k*) *Liparoceras* sp. juv. (*cheltiense* group), at about 6 mm.; St. Amand, Cher (B.M., No. C. 28127). (*l*) *Liparoceras* sp. juv. (*cheltiense* group), at about 8 mm.; same locality (B.M., No. C. 28128).

they are worth, I am listing in tabular form the results given by sixteen examples whose diameter in all cases is 2 mm.

	Whorls	Septa	Siphuncle external at
Microderoceras birchi	$2\frac{1}{2}$	39	2 whorls
Promicroceras planicosta (i)	$2\frac{3}{4}$	42	$2\frac{1}{2}$
,, ,, (ii)	$2\frac{1}{2}$	37	2
,, ,, (iii)	$2\frac{5}{8}$	40	$2\frac{1}{4}$
Liparoceras cheltiense	2	25	$1\frac{1}{4}$?
,, (*Becheiceras*) *bechei*	$1\frac{7}{8}$	22	$1\frac{1}{4}$
,, ,, *gallicum*	$2\frac{2}{5}$	27	$1\frac{1}{2}$
Beaniceras sp.	$2\frac{2}{5}$	27	?
,,	$2\frac{2}{5}$	28	2
,, (transitional to *Androgynoceras*)	$2\frac{2}{5}$	20 ?	?
,, ,, ,,	$2\frac{3}{5}$	20 ?	?
Androgynoceras aff. *lataecosta* (from Charmouth)	$2\frac{1}{8}$	18	$1\frac{1}{2}$
,, *lataecosta* (from Bracebridge)	?	?	2
,, aff. *brevilobatum*	$2\frac{1}{5}$	20	2
Oistoceras sp. i (from Bracebridge)	2	18	$1\frac{1}{2}$?
,, sp. ii (,,)	$2\frac{1}{8}$	21	$1\frac{1}{2}$
,, sp. (from Whitby)	2	26	$1\frac{1}{2}$

These observations seem to show that there is no regularity whatever in the rate of growth (dependent on food supply) or in the position of the siphuncle, although the sphaerocone *Liparoceras* (*Becheiceras*) with only $1\frac{7}{8}$ whorls might be expected to be more closely coiled than a serpenticone even at this small diameter. On the other hand, the capricorns of the Liparoceratidae (*Androgynoceras*, *Oistoceras*) have fewer septa than their Sinemurian homoeomorphs (*Promicroceras*), but the siphuncle becomes external at about the same size.

Unsatisfactory as this evidence is, it is of interest when comparing the Liparoceratids with the fundamental stocks *Phylloceras* and *Lytoceras*, and with a family like the Amaltheidae, which is here believed to have been derived from the capricorns. In *Phylloceras heterophyllum* the siphuncle does not become external until a considerable size, there being only $1\frac{3}{4}$ whorls (with 26 septa) at 2 mm. diameter *Tragophylloceras loscombi*, very similar in general to *Phylloceras heterophyllum*, moved its siphuncle to the venter at a slightly larger size than any of the Liparoceratids. *Lytoceras* looks altogether different ; it shows a more rapid increase in whorl-height, close and long septa, and a siphuncle that seems to be external from the start ; but I have only examined two Upper Liassic species. *Amaltheus*, with 40 septa and $2\frac{1}{4}$ whorls at 2 mm. diameter, somewhat resembles *Lytoceras*, but its siphuncle becomes external at $1\frac{1}{4}$ whorls. In *Pleuroceras* (another Amaltheid) there are fewer septa (22 and 23) at 2 mm. ($1\frac{3}{4}$ whorls) and the siphuncle is external at $1\frac{1}{2}$ whorls ; but Branco figured a *P. spinatum* in which the siphuncle had moved to the venter within the first whorl.

It is not impossible that in the future, continued (and, it should be added, very desirable) research on these lines will yield more telling results. But the data so far published, while showing that distant relationship is reflected in the position of the siphuncle, yet indicate that there is too much variability within the same species or genus to be of immediate use to the systematist. As there is great variability in the young in all the other characters, external or internal, it is not surprising that the features shown in median sections have not yielded more decisive evidence of relationship, except, perhaps, in the case of *Lytoceras*.

(*c*) Other Characters

The stress laid on so-called developmental evidence, especially that afforded by the configuration of the earliest whorls in the Liparoceratidae, seems to me no less misplaced than the importance attached to the suture-line. Since the protoconch, or initial chamber, is barrel-shaped in all ammonites, the innermost whorl must be more or less globose. The prolongation of the globose stage and the duration of the smooth stage, also common to all ammonites, are subject to great variation ; as also are the proportions of the whorls, the number of septa, the position of the siphuncle before it becomes external, and other features, which like these are influenced by the rate of growth, food supply, and so on. This can easily be seen in the young of an ammonite so much like the capricorns of the Liparoceratidae as is the common species *Promicroceras planicosta* (J. de C. Sowerby) no two individuals of which are identical at small diameters.

(*d*) Other Considerations

(1) *Plasticity of Ammonite Stocks*

But this diversity is far more pronounced in certain plastic stocks ; and ammonite stocks may have widely different natures ; for instance, it took me a long time to realise that some were short-lived and that others, quite contrary to expectations, persisted for an unusual length of time. While some ammonite stocks are extremely stable (*Phylloceras*, *Lytoceras*), the Liparoceratid genus *Beaniceras* seems to be extraordinarily plastic. Every gradation is known in this genus, connecting the typical forms (*luridus-centaurus* groups) not only with the involute, globose, *Liparoceras* on the one hand, and the evolute, serpenticone capricorns on the other, but apparently also with the coronate *Coeloceras* of an entirely distinct family. It is not surprising that *Beaniceras* has been the subject of much theorising ; but if such an interpretation of *Beaniceras* be contested and an example from outside the Liparoceratidae be preferred, there is the universally accepted genus *Amaltheus*. We now know that the earliest species to appear (*stokesi* group) are compressed and discoidal. Clearly, then, the tuberculate cadicone or barrel-shaped inner whorls of some later, coronate species, whether caenogenetic or not, can have no reference to the shape of the ancestor. Moreover, it is impossible to derive the Liparoceratidae and other Liassic families from *Cymbites*, as suggested by Buckman, merely because this has the supposed ancestral globose shape, or *Cymbites* itself from a similar Triassic forerunner (*Nannites*). For there is a general consensus of opinion that these smooth stocks are degenerate, because they all have the familiar catagenetic features of ammonoid end-forms, reduced suture-lines, constricted mouth-borders, scaphitoid coiling, and dwarfed size.

(2) *Variability of Characters*

It is easy enough to construct supposed evolutionary series in the ammonites, but on comparing the diverse results obtained by the different investigators working on Hyattian principles, it is obvious that all cannot be well with " merely following out the law of earlier inheritance." To give a few examples, when Prof. Trueman (1919, p. 292) considered not only *Beaniceras*, but even the Amaltheidae, as perhaps related to the Dactylioceratidae (Dactyloids), rather than, as Buckman had suggested, to the Liparoceratidae, the divergence of opinion was startling ; but later, Frebold (1922) derived part of the Amaltheidae from the Phylloceratids, and part from the Liparoceratids (*Oïstoceras*). On the other hand, I (1923*c*) suggested that *Amaltheus* was evolved from the Phylloceratidae (Rhacophyllitinae) through " *Amphiceras* " Gemmellaro,[1] although the suture-line may not be held to support this derivation. Now I am able to figure actual passage-forms between the Liparoceratidae and Amaltheidae.

[1] *Amphiceras*, Gemmellaro, 1884, is preoccupied (by *Amphiceras* [Gronovius] Gray, 1847, a gastropod) and the new name *Galaticeras*, gen. nov. is now proposed for this group (genotype :—*A. harpoceroides* Gemmellaro, 1884, p. 32, pl. I, figs. 8–9).

(3) *The Stratigraphical Criterion*

But while I rely more on resemblance in the adolescent and adult stages and on the existence of passage-forms than on the ontogenetic evidence of the earliest whorls, I insist in the first place on correspondence in appearance in time of the successive members of a series. That is to say, I have no faith in lineages whose members appear in the wrong order. The sequence from "*Aegoceras*" ("*Microceras*" at first), through *Androgynoceras* to *Liparoceras*, forming Hyatt's original Liparoceratidae, looks perfectly convincing; and I myself accepted it at one time as implicitly as did Buckman and Trueman. But now that it is known that the different types did not successively appear in the order mentioned, a diagram like that of the latter author (1919, p. 255), illustrating five stages in a Liparoceratid lineage, fails to impress. Since *Androgynoceras hybrida* and *A. henleyi* appear later than *Liparoceras*, and since the capricorns again are later than the earliest "dimorphs," the order in the sequence should have been exactly the reverse of that postulated by Hyatt and his followers.

It might be objected that in the present state of our knowledge, and with so many potential passage-forms to the two fundamental ammonite stocks (*Phylloceras* and *Lytoceras*) existing in the home of all our ammonite immigrants, i.e. the ancient Mediterranean sea, or the Tethys, it is unsafe to rely on this order of appearance. Yet Hyatt was not reluctant in his time to adduce stratigraphical support for what he thought might possibly be called an "artificial arrangement." If he was unsuccessful, owing to lack of exact stratigraphical information, it should only make us feel more grateful to those patient workers on the details of some local succession who after all have the last say in the matter.

(4) *Caenogenesis*

If the order of succession in the Liparoceratids is, as I hold, from the sphaerocone, through the dimorph, to the capricorn (as is also borne out by the stratigraphical evidence) it is necessary to allow that certain new characters appeared first in the younger stages, and as evolution proceeded, spread on to the later whorls. There are now so many other stocks in which I have shown the caenogenetic appearance of new characters, that there is every likelihood of its also holding for the Liparoceratidae. For instance, some notable examples outside the Liparoceratidae are illustrated in Text-fig. 5. The genus *Waehneroceras* (*a*) with a grooved periphery only in the young is the undoubted ancestor of *Schlotheimia* (*b*) in which the groove persists to the adult. *Kepplerites* (*c*) is the ancestor of *Kosmoceras* (*d*) and acquires the truncate periphery first in the young. The early *Cadoceras* (*e*) foreshadows the later sharpened Cardioceratids (*f*) on its inner whorls. They are all connected by an uninterrupted succession of intermediate forms, but, of course, as demonstrated by Rowe (1899) for the Chalk Echinoid genus *Micraster*, the individuals of one horizon are not necessarily advanced or reduced to an equal extent in all their characters.

(5) *Conservative Stocks*

Again, new characters may appear not only caenogenetically, but also far from gradually. In *Lytoceras* we have a stock which persisted almost unchanged throughout the whole of the Jurassic and Cretaceous; yet I have been able to show (1933*b*, p. 427; 1937, p. 498) how this extremely conservative stock probably evolved by a

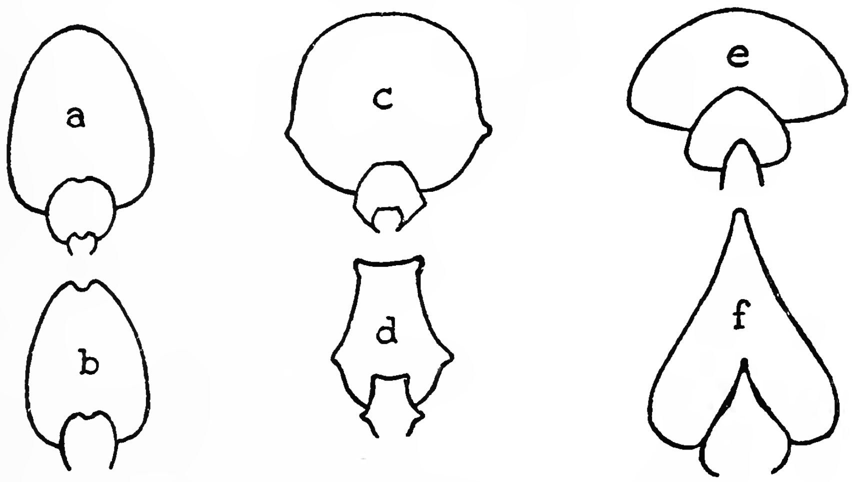


FIG. 5.—Caenogenetic appearance of new characters (grooving *a*, *b*, flattening *c*, *d*, and sharpening *e*, *f*, of the periphery) in some ammonites.

(*a*) *Waehneroceras*, Lower Lias, Middle Hettangian. (*b*) *Schlotheimia*, Upper Hettangian. (*c*) *Keppler-ites*, Kellaways Rock. (*d*) *Kosmoceras*, Oxford Clay. (*e*) *Cadoceras*, Kellaways Rock. (*f*) A Cardioceratid, Oxfordian. (All diagrammatic.)

leap into the most plastic *Scaphites*. Here it is the coiling which was affected. The critical Upper Gault species, *Amm.* ? *circularis* J. de C. Sowerby (represented in Text-figs. 6 *a–g*), in its suture-line still a *Lytoceras*, is extremely unstable, especially on its earlier volutions; and it may be loosely or more closely coiled, circular or depressed in whorl-section, and with the body-chamber in contact or loose. Together with it

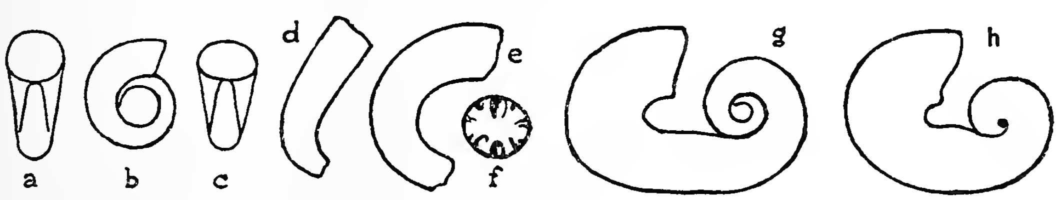


FIG. 6.

(*a–g*) *Scaphites circularis* (J. de C. Sowerby) showing unstable inner whorls and (*h*) *Scaphites hugardianus* d'Orbigny (with occlusal inner whorls), Upper Albian.

occur more globose and more involute forms (*S. subcircularis* Spath) which cannot readily be distinguished in shape from the later occlusal *Scaphites* (fig. 6 *h*), although the suture-line is different. There can be no doubt that *S. circularis* is the direct ancestor of the tuberculated *Scaphites* of the Cenomanian, since they agree in all the other characters; but the transition from the Lytoceratid to the *Scaphites* suture-line, consequent upon an undoubted change in the mode of life, and significant only from the point of view of the systematist, again must have been sudden. There is no question of degeneration in the vitality of the stock; judging by its abundance and variety of form, *Scaphites* proved to be one of the most successful adaptations known, and persisted throughout the whole of the Upper Cretaceous.

(6) *Applications to the Liparoceratidae*

I hope to show in the following pages how in my opinion variation came about; how new stocks first branched off the main stem; how, in the Liparoceratidae as in the Lytoceratidae, slow, progressive evolution is compatible with the appearance of sudden transformations; and above all how both important and new characters first appear on the inner whorls, though not necessarily at the very earliest stages. The instability of one branch in the Liparoceratidae led to the dwarfed *Beaniceras*, which was short-lived and left no descendants; other branches of the same plastic stock more-or-less gradually ceased to reproduce the ancestral features, even on the outer whorls, until they developed into forms (*Oistoceras*) entirely different from the persisting *Liparoceras* but intimately linked with the Amaltheidae. The curious resemblance between this Liparoceratid genus *Oistoceras* and the Amaltheid genus *Pleuroceras*, of course, might be fortuitous, and it should be a warning to us not to be over-confident in the present state of our knowledge; for the frequent occurrence of such homoeomorphs remains one of the greatest of ammonite problems. But if I have been right in suggesting on several previous occasions that all our ammonite families may be polyphylectic, because there had been frequent replenishment from the two persisting fundamental stocks, Phylloceratidae and Lytoceratidae, then—alas for our systematics!

C. THE RISE OF THE LIPAROCERATIDAE

(*a*) THE UNCHANGING *LIPAROCERAS*

The involute (sphaerocone) genus Liparoceras—sensu lato—*appeared first in the jamesoni zone, and persisted almost unchanged through the davoei zone and into the margaritatus zone, where the whole family came to an end.*

On comparing an average example of a parinodate [1] *Liparoceras* (*Parinodiceras*) from the earlier *jamesoni* zone, with *L.* (*Becheiceras*) *gallicum* from the later *davoei* zone, surprisingly little change is noticed (see Plate XXV, figs. 1 and 2). The whorl-shape in *B. gallicum* has become more rounded, that is, it has not the lateral flattening so characteristic of *Parinodiceras*; the rows of tubercles are often closer together in *Becheiceras*; and the disposition of the ribs is slightly different. But these are characters of not more than specific value, while the modification of the suture-line is so slight as to be almost negligible. But if, instead of merely comparing the two types mentioned, we take into consideration the numerous forms of *Liparoceras* which connect the early *Parinodiceras* with the late *Becheiceras* (including the extreme end-form of the series, *Liparoceras*—" *Anisoloboceras* "—*nautiliforme* J.

[1] i.e. having tubercles in symmetrical pairs.

Buckman sp.), it becomes clear that they are inseparable, and represent but a single development—almost a single species, with only slight modification of every feature, from the ornamentation to the suture-line. The former becomes less regular, while there is a gradual decrease in the depth of the external lobe (see Text-fig. 7); but the size increases considerably, one specimen of *L.* (*Becheiceras*) *bechei* from the Red Band (upper *davoei* zone), being nearly 400 mm. in diameter.

The fact that this *bechei* type of shell persisted almost unchanged for so long, i.e. from the *jamesoni* through the *ibex* and *davoei* zones up into the *margaritatus* zone, shows that it must have been successful, that is to say, well adapted to the conditions under which it lived; the specific name of the latest *Liparoceras* known (*L. nautiliforme*) suggests the probable reason for this success and long persistence. It probably led a *Nautilus*-like mode of life, that is, it existed chiefly crawling at the bottom but was also able to swim well and quickly. It is probably for the same reason that the more or less globose *Aspidoceras*, of similar shape to *Liparoceras*, had such an extended range in the Upper Jurassic; but unlike the surviving *Nautilus*, both *Liparoceras* and *Aspidoceras* had many competitors, and were eventually displaced.

(*b*) The Early Parinodate Liparoceratidae

(1) *Sphaerocones preceded by Serpenticones*

In looking for the ancestor of the more-or-less globose and involute *Liparoceras*, it may be advisable to bear in mind the evolution of other globose and highly ornamented stocks, such as the genus *Aspidoceras*, just mentioned. There is general agreement that *Aspidoceras* developed from the earlier, evolute *Euaspidoceras*, and ultimately from the serpenticone Perisphinctids. Even if Loczy's (1915, p. 428) extraordinary statements were correct about the connexion between Aspidoceratids and the Lower Liassic Eoderoceratidae on the one hand, and the Albian Lytoceratid *Kossmatella* (*Amm. ventrocinctus* Quenstedt) on the other, the ancestor of the globose species would still have been a serpenticone. This, of course, applies to many other globose end-forms, from the Triassic *Trachysagenites* to the uppermost Cretaceous *Menuites*. Consequently, in looking for an ancestor of the involute Liparoceratids, we shall expect to find it in an evolute (serpenticone) form.

(2) *The Earliest Liparoceratids*

Now in England, unfortunately, the evolute forerunners of the Liparoceratidae do not seem to occur. The few early Liparoceratids known from the Dorset coast are already sphaerocones and have been briefly mentioned in previous papers. Thus in the (Dorset) Belemnite Marls there occur some crushed fragments that may possibly belong to the early *Parinodiceras* Trueman; but *Vicininodiceras*, of the same author, and *Platynoticeras*, known from Radstock, Somerset, are so far unknown from Dorset. All these genera have been assigned to the "*valdani*" (=*ibex*) zone, but since only *Liparoceras cheltiense* and allies have been found where the *ibex* zone is well developed, it seems that both *Parinodiceras* and *Vicininodiceras* (here grouped as sub-genera of *Liparoceras*) are of *jamesoni* age. Oppel (1853, p. 47) also already recorded *Platynoticeras* (" *Amm. hybrida* ") from below the *ibex* zone ; and although some wrong identifications in Bovier (1932, p. 29) make his more recent succession seem contradictory (see p. 36), Futterer in 1891 (p. 316) had been explicit enough about the abundance of " *Liparoceras* " *alterum* (Oppel) in his *jamesoni* limestones. At Robin Hood's Bay, Mr. Bairstow found *Parinodiceras* in the equivalent of my *brevispina* sub-zone, i.e. even below *jamesoni* proper.

(3) *The Genus* Phricodoceras

The still earlier and more evolute genus *Phricodoceras*, Hyatt (group of *Amm. taylori* J. de C. Sowerby), which has also been included in the Liparoceratidae, is probably an end-form of a distinct branch of the Eoderoceratids ; and it should be grouped in a separate sub-family (PHRICODOCERATINAE nov.) which may include the incompletely known *Amm. ferstli* Hauer (see p. 19). Judging by analogy with certain forms of *Spinikosmokeras* or the Albian *Euhoplites proboscideus* (J. de C. Sowerby), with which *Phricodoceras* had actually been confused, it is incapable of producing an involute and flattened nautilicone like *Parinodiceras*. The inflation of the final whorl in some species (*Phricodoceras lamellosum* d'Orbigny sp., *P. bicornis* Quenstedt sp., *P. subtaylori* Krumbeck sp.) is comparable to the modification of the body-chamber in similarly tuberculate and large forms of *Douvilleiceras* of the Cretaceous, and is without phyletic significance.

(4) *Certain Sinemurian Capricorns*

There are, however, certain capricorns in the *oxynotus* and *raricostatus* zones that have been claimed by Buckman and Trueman to be ancestors of the Liparoceratidae. Apart from the enormous time gap that separates these early forms from the first capricorns in the Green Ammonite Beds—the *maculatum* group, resemblance is not close, not nearly so great, for example, as that between the (unrelated) Sinemurian *Promicroceras* or *Aegasteroceras* and the later Carixian capricorns, which has misled many observers from d'Orbigny and Dumortier down to recent times. Moreover, two of these supposed ancestors, namely *Amm. integricostatus* Simpson and *Amm. vesta* Reynès, are clearly species of *Gagaticeras*, while *Amm. sirius* Reynès apparently is a *Promicroceras*, and *Amm. siphuncularis* Simpson is altogether doubtful, biologically and stratigraphically. It is necessary, then, to look for a different ancestry from these *oxynotus-raricostatus* time capricorns, especially since nothing intermediate between a capricorn and the involute *Liparoceras* (s.l.) is known from below the *ibex* zone, long after *Platynoticeras* and *Parinodiceras* had been abundant.

(5) *The densinodus-natrix group*

What little resemblance there is between the *densinodus-natrix* group, envisaged by Frebold (1922, pl. I) as an ancestor of *Androgynoceras capricornus*, and the other Liparoceratids is due to a similar origin in the same family, namely the Eoderoceratidae. As I mentioned previously, the *natrices* tended towards the formation of a keel, and they are related to members of the family Polymorphitidae, e.g.

Uptonia. Moreover, the resemblance is not at all close, and, but for the mistaken identifications of authors like Futterer (1891), the *natrices* probably would never have been linked very closely with the Liparoceratids, least of all with *Becheiceras* (Trueman, 1919, p. 263). But it may be noted that here again a branch of the Eoderoceratidae produced certain forms that had at least enough resemblance to the later true capricorns to be compared to them. This is another instance of the essential uniformity of ammonites which still defies attempts at simple classification, though it facilitated the " splitting-up " of the groups.

(c) The Supposed Eoderoceratid Ancestors

(1) *The Genus* Platynoticeras

The early parinodate forms of Liparoceras are connected in the *jamesoni* zone by innumerable transitions with more evolute, but by no means capricorn, types which bear close resemblance to another Eoderoceratid off-shoot, namely, the family Polymorphitidae. These transitional forms are now grouped under Platynoticeras gen. nov., described on p. 86. There is no reason to assume that these forms of *Platynoticeras* and the numerous transitions to *Parinodiceras* were earlier than *P. parinodus* itself ; quite the contrary is perhaps the case, since Quenstedt (1884, p. 229) speaks of his *Amm. striatus parinodus* as occurring together with *Phricodoceras bicornis*, i.e. in the lower part of the *jamesoni* zone, although elsewhere (p. 225) he calls it one of the commonest fossils of the middle part of Lias gamma. In any case, the very complex suture-lines of all these Liparoceratids, many of them here figured, are against derivation from *Polymorphites* which is probably a parallel development. The similarity between Quenstedt's *Amm.* cf. *henleyi*, a Liparoceratid, and *Amm. polymorphus mixtus*, a Polymorphitid—which seemed so remarkable to him (p. 249)—is, in my opinion, due just to this common derivation from the Eoderoceratidae. In default of any more likely forms, it is in the Eoderoceratidae that the Liparoceratid ancestor should be sought, and it is the Sinemurian serpenticones (but not capricorns) of that family that are the ultimate ancestors of the Liparoceratidae as well as of the Polymorphitidae.

(2) *The Genus* Tetraspidoceras

Another group of forms that could be held to lead directly to such parinodate Liparoceratids as those here referred to the genera *Platynoticeras* and *Parinodiceras* is represented by *Amm. latispina* Reynès (1879, pl. xliv, fig. 33, lectotype), and especially *Tetraspidoceras* **reynesi,** nom. nov. (=*Amm. latispina* Reynès, *ibid.*, figs. 35–36 only) of the base of the *jamesoni* zone (Text-figs. 1 *a*, *b*). This is one of the ancestral stocks I had in mind on previous occasions (see e.g. Spath, 1933*a*, p. 705) when deriving the Liparoceratidae from the Eoderoceratids. *Tetraspidoceras quadrarmatum* Dumortier sp. (1869, pl. ix, fig. 1 ; pl. x, figs. 1–3) of the same approximate age as *T. reynesi*, returns to an Eoderoceratid whorl-shape in the adult, and shows, too, a tendency to closer coiling in the earlier stages ; and it is this trend to involution, in my opinion, that produced forms like *T. reynesi*. It has already been shown that the resulting globose and involute nautiliform type of shell was environmentally successful, and was tried in many stocks; but it is necessary to visualise the full stream of development of the Eoderoceratids, for there is far too much variability within the various groups of this stock to fix upon a single species, like *Tetraspidoceras reynesi* or *Platynoticeras alterum*, as the one and only ancestor of the Liparoceratidae.

There is a single fragment from the *Beaniceras* beds (top of *ibex* zone) of Napton (No. C. 38421) which looks remarkably like a bi-spinous *Eoderoceras*, but which has capricorn inner whorls. But this is one of many examples of Liparoceratids in which earlier Eoderoceratid features recur. At one time during this investigation I was inclined to think that this form from the *Beaniceras* zone might represent a second wave of the persisting Eoderoceratidae, changing into a Liparoceratid, this time without the inflation and involution that characterised the earlier *Parinodiceras* and *Vicininodiceras*. But the resemblance to earlier bi-tuberculate types is only superficial.

In a syntype of *Liparoceras* (*Vicininodiceras*) *simplicicosta* Trueman, here figured (Plate III, figs. 6 *a*, *b*), which is specifically distinct and represents a new, unnamed form, there is the comparatively wide umbilicus of the ancestral types; but the tubercles are elongated radially, while in the Napton fragment they are distinctly elongated in a spiral direction, especially those of the outer row. This Napton form, therefore, is merely one of the dimorphs of the *naptonense* group (p. 64, compare Plate X, fig. 7). Its resemblance to early forms like *Tetraspidoceras latispina* (Reynès) or *Eoderoceras* (?) *bimacula* (Quenstedt) is due largely to its fragmentary condition, whereas the new species, above mentioned, is a true passage-form between the typical *Vicininodiceras* and its *Tetraspidoceras* ancestor (Text-figs. 1 *a*, *b*). Here, obviously there is yet a third link between the Eoderoceratidae and the Liparoceratidae. The *jamesoni* age of this un-named form is not definitely established, but it is certainly earlier than any of the typical forms of *Liparoceras* here described.

(3) *Return to Hyatt's Views*

In going back to Eoderoceratidae for the ancestry of the Liparoceratidae I am merely returning to Hyatt's original views. Even in 1900 (p. 578) he still included the Middle Sinemurian *Microderoceras* in the Liparoceratidae, and to this genus both Hyatt and Buckman would probably have referred *Tetraspidoceras reynesi* and *T. latispina*, although Schröder (1927, p. 226) included them in *Liparoceras*.

It is equally significant that Hyatt, after first (1867) creating a separate family "Deroceratidae," later (1871) included "*Deroceras*" and *Microderoceras* in the Liparoceratidae, which he thus considered to be undoubted descendants of these Sinemurian forerunners (Eoderoceratidae). Buckman accepted this derivation in 1898 (Table II, p. 451) when including *Liparoceras* in the "Deroceratidae." Haug (1887, p. 103), contrary to Hyatt, thought that *Liparoceras* could not have been derived from a capricorn ancestor, and considered that the *striati* (i.e. *Liparoceras*) probably were genetically related to the *globosi* (i.e. *Agassiceras* Haug *non* Hyatt = *Cymbites* Neumayr). This last view was endorsed by Trueman (1919, p. 293), who, however, accepted *Cymbites* only as the "pre-capricorn" ancestor of the Liparoceratids.[1] But he was unable to point to any transitional forms in the *jamesoni* zone that could have led to *Liparoceras*, and the suture-line of the latter is entirely against any connection with an "Arietitid" stock.

The changes necessary to transform an Eoderoceratid, like *Tetraspidoceras reynesi*, into a *Liparoceras* (*Vicininodiceras*) on the one hand, or a *Platynoticeras* into a *Liparoceras* (*Parinodiceras*) on the other, after all are very slight. Judging by Dumortier's *Tetraspidoceras quadrarmatum*, such transformation was not gradual, first affecting the outer whorl, and then younger and younger stages by tachygenesis; quite the contrary, the transformation must have appeared on the unstable inner whorls which, in a plastic species, are not alike in two individuals. The tendency of the early forms, here discussed, to become more involute, I take to be due merely to adaptation to a more nautiliform mode of life, but the resulting Liparoceratidae soon threw off branches (*Beaniceras* and *Androgynoceras*) that reverted to the capricorn shape (and therefore different mode of life) of some of the ancestral Eoderoceratidae (*Promicroceras*).

In short, this review leads to the conclusion that Hyatt was right when he thought that the stock now called the Eoderoceratidae, had given rise to the Liparoceratidae.

It is also significant that in 1900 (p. 578) he included the Tropidoceratidae in a super-family Liparoceratidae, and although he did not recognise the close affinity of the "*natrices*" with *Uptonia* and *Polymorphites*, he evidently looked upon at least the genus *Platypleuroceras* as being derived from the same stock as the Liparoceratidae. The century-old confusion of *Amm. brevispina* and *Amm. lataecosta* was not due only to the wrong numbering of the two figures in Sowerby's plate 556.

D. THE ACME OF THE LIPAROCERATIDAE

(*a*) THE SPHAEROCONES (*LIPAROCERAS*)

The maximum development of the family Liparoceratidae in England occurred in the *ibex* zone and the lower part of the *davoei* zone. In the typical forms of *Liparoceras* from the earlier zone there is a tendency to exaggerate the tuberculation or to lose the regularity of the ornament, compared with the ancestral stock; but this was foreshadowed already on the inner whorls of *Parinodiceras* and *Vicininodiceras*, e.g. in *L.* (*V.*) *gollingense* Rosenberg, or in forms of *Platynoticeras*. Moreover, while there are great changes in ribbing on the body-chambers of the very variable *Liparoceras cheltiense* Murchison sp. from the *ibex* zone, the greater regularity

[1] Trueman also referred to two other species as capricorn ancestors of the Liparoceratidae. He cited the inner whorls of the Sinemurian *Amm. adnethicus* Hauer (1854, p. 101, pl. i, figs. 1–3); but according to Geyer (1886, p. 261) they have indistinct inner, and still feebler outer, tubercles, which show the species to be probably an Ectocentritid. It is generically distinct from *Eoderoceras*, e.g. the associated *E. bispinatum* (Geyer) and allies, described by Fucini (1903, pl. xxv) from the Monte di Cetona. *Amm. ferstli* Hauer (1854, p. 104, pl. ii, figs. 1–3) also quoted by Trueman (1919, p. 263), and doubtfully referred to "*Anisoloboceras*," is incompletely known, but probably represents still another new genus which cannot be the direct ancestor of the Liparoceratidae. I have suggested above (p. 16) that *Amm. ferstli* may be a Phricodoceratid forerunner, but in any case, it is of much too early an age to have anything to do with the Liparoceratids. Bonarelli (1899, p. 70) put both *Amm. adnethicus* and *Amm. ferstli* in the genus *Lytoceras*, and there seems to be no doubt that, like *Aegolytoceras*, *Peltolytoceras*, and other Ectocentritids, they belong to that group of trachyostracous *Lytoceras*-developments which gave rise to families like Eoderoceratidae.

of the ribbing appeared again in the late *Becheiceras*, which Haug (1887, p. 107) had no hesitation in deriving from the irregularly tuberculate (imparinode) "*striatum*" group. The importance of the regularity of the tuberculation must not, therefore, be exaggerated. Prof. Trueman (1919, p. 264) was right when he stated that the parinode forms represented a more primitive stage in evolution; but this applies only to the early forms which, being, in turn, descendants of (often bituberculate) Eoderoceratids, are necessarily at first parinode, like the early *Aspidoceras*.

When *Liparoceras* was abundant, it produced some very variable species, but even this variability, on the whole, was confined to definite limits. Thus, the sharply ornamented *cheltiense* group, already mentioned, includes the first ten species described below, but they are all extremely closely allied. Yet there are over seventy examples of *L. cheltiense* alone, and among these are compressed and inflated varieties, coarsely and finely ribbed forms, and others in which decline and rejuvenation of the ornament alternate; but there is not one which is perfectly identical with the holotype. What is more significant, however, is that there is scarcely one example that is not mal-formed, many in a striking way; and only a considerable number of plates, with side- and peripheral-views of these examples of *L. cheltiense*, could convey to those unfamiliar with this species some idea of the instability of their ornamentation. Whatever the cause of this instability, it prepares us for that exhibited by the inner whorls of the immediate descendants of this *cheltiense* group, expressing, perhaps, an endeavour to modify a mode of life that resulted in much injury to those shells that were over-ornamented.

The slightly later descendants of *L. cheltiense* and allies include species like *L. heptangulare* (Young & Bird) and *L. kilsbiense*, sp. nov. described below, which lead directly to such transitions to *Androgynoceras*, as *L. obtusinodus* Trueman, and *L. naptonense*, sp. nov. In these forms the inner whorls tend to become more evolute, but they are connected by so many, and such perfect, transitions with *L. cheltiense*, that it is often impossible specifically to identify fragments of outer whorls. The spiral elongation of the tubercles, however, tends to persist even on the body-chambers of this later group, and the size increases. *L. cheltiense* does not exceed 150 mm. in diameter; *L. kilsbiense* reaches 200 mm. (No. 20417) and more; but even this is a dwarf compared with the giants of *L.* (*Becheiceras*) *bechei*, *L.* (*B.*) *gallicum*, etc., of higher beds.

With forms like the large original of Wright's plate xliii (*Liparoceras wrighti*, nom. nov., see p. 67), differing little from *L. kilsbiense* except in the still more open umbilicus, this group of *Liparoceras* persisted into the *davoei* zone, but appears to have become very rare, at least in England.

(*b*) The Sub-Genus *BECHEICERAS*

The more conservative *Becheiceras* branch increased to its acme at the top of the Lower Lias (upper *davoei* zone) or even in the *margaritatus* zone, according to Haug (1887), Quenstedt (1884), and many more recent authors. These Middle Liassic forms, which include an ammonite figured by Zieten as early as 1830, have been separated generically from *Becheiceras*, as "*Anisoloboceras*" (Trueman, 1919), but they differ merely in having a high external lobe. It can be seen that in *Liparoceras* (*Becheiceras*) *bechei* already at a diameter of 20 mm. the external lobe is as high as in *L.* (" *Anisoloboceras* ") *nautiliforme*, and though the external lobe is slightly less undercut, this is scarcely a specific difference. In all the other characters there is the closest agreement. Stratigraphically, also, their separation cannot be maintained; as has already been shown in the stratigraphical paper (1936*a*), the occurrence of *L.* (*B.*) *bechei* in the Red Band, of *L.* (*B.*) *gallicum* in the Upper Limestone, and the restriction of *L.* (" *Anisoloboceras* ") *nautiliforme* to the *margaritatus* zone are purely local accidents, as was the supposed rarity of the last form in England, up to 1936. In the circumstances it is entirely unnecessary to stipulate some unknown capricorn ancestor for the late sphaerocones, least of all the Sinemurian *Ectocentrites* (?) *adnethicus* (Hauer), as has been suggested by Trueman (1919, p. 286), for they are inseparable from their immediate forerunners.

Incidentally, the gradual modification of the *bechei* into the *nautiliforme* suture-line, illustrated in Text-fig. 7, is one of the few instances among ammonites that illustrate the working of " palingenesis." Others are the slow change of the suture-line in *Ptychophylloceras* (Spath, 1933*a*, p. 701) or in certain Devonian Clymenids, recently described by Schindewolf (1937, p. 116). Such slow quantitative modification in successive mutations of a single series, however, does not explain anything that is not inherent in normal growth and the principle of evolution in general; and if all qualitative changes were caenogenetic as Schindewolf now seems prepared to accept (even if he does not use the term) the value of " palingenetic " evidence for phylogenetic work is nil.

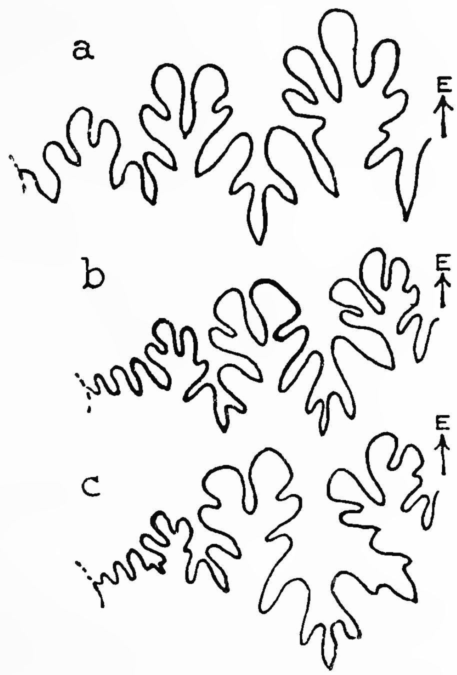


FIG. 7.—Part of suture-lines (diagrammatic) of *Liparoceras* (*a*), *Becheiceras* (*b*), and " *Anisoloboceras* " (*c*) to show decreasing depth of external lobe (marked E).

" *Anisoloboceras* " and *Becheiceras* are not only inseparable, but they are connected directly with early *Liparoceras* of the *cheltiense* type. Trueman (1919, p. 263) has already pointed out that the suture-line of *Becheiceras* differed only slightly from that of *Liparoceras*, mainly in having a deeper first lateral lobe (a tendency that continued in " *Anisoloboceras* "); he also agreed that *Becheiceras* was very similar to the finely ornamented, involute *Liparoceras* with which all previous authors had connected it. Unfortunately, there are only a few involute sphaerocone examples from the Dorset Coast that bridge the gap between the *cheltiense* group (or even *Parinodiceras*) and *Becheiceras*, and they are from uncertain levels about the horizon of the Lower Limestone (*lataecosta* sub-zone); but they are undoubtedly already typical *Becheiceras*. Quenstedt (1884, pl. xxix, fig. 8) also figured a true *Becheiceras* from his Lias gamma, and this must be still earlier, judging by the occurrence of *Androgynoceras intracapricornus* (Quenstedt) in the next higher beds (gamma-delta) and the resemblance of that form to the early *A. heterogenes* (Young & Bird) rather than to any later species.

(*c*) Other Imparinode Sphaerocones

Although intermediate in age and finely ornamented, the commoner sphaerocones of the type of *L. divaricosta* are not in the direct line of evolution from the early *Liparoceras* to *Becheiceras*. For *L. subhenleyi*, a member of the same group, is close to *L. lytoceroides*, nov. with faint tuberculation, on the one hand, and to *L. contractum*, sp. nov. with more pronounced tuberculation, on the other, and there are many passage-forms among all these, with evolute early whorls. No two of these are strictly alike, and there are differences in the suture-lines; but on account of the appearance of ribbing on the inner whorls of some individuals in this group, and especially in *L. mickletonense*, sp. nov., they are already transitional from *Liparoceras* to the "dimorphs" discussed below under *Androgynoceras*.

Now, before *Becheiceras* branched off from *Liparoceras* s.s., the young whorls had already been affected by a remarkable instability, resulting in a wide range of forms with scarcely two individuals identical, except in the adult stages. From *Liparoceras kilsbiense*, nov. (p. 60) and the similar, but still more evolute, *L. obtusinodus* Trueman, through *L. naptonense* and *L. geyeri*, sp. nov., to *Androgynoceras heterogenes* and its varieties, there is a continuous series of transitions; but they are all contemporaneous, and if the inner whorls were unknown, the outer whorls of these species would scarcely be distinguished as varieties.

There are then two closely similar and parallel sets of passage-forms from *Liparoceras* to *Androgynoceras*. There is the early, distantly-costate *obtusinodus-geyeri* group, tending towards *Androgynoceras heterogenes*; and a rather distinct, later assemblage, with more finely ribbed inner whorls, which includes *Liparoceras subhenleyi*, *L. lytoceroides*, and *L. divaricosta*, and which leads to *Androgynoceras hybridiforme* and *A. henleyi*. It will be interesting to examine whether these two groups of intermediaries to the dimorphs represent separate genera.

(*d*) The Dimorphs (*ANDROGYNOCERAS*)

(1) *The Tangle of Related Dimorphs*

Now it is impossible to consider the relations of the sphaerocone forms, just mentioned, to their dimorph descendants (*Androgynoceras*) without bearing in mind the fact that there are also, in turn, passage-forms from these dimorphs to their respective capricorns, i.e. to *A. maculatum* in the earlier, and to *A. lataecosta* in the later, members of the "lineages" just considered; and that the two dimorph and the two capricorn types themselves are connected by transitions. Thus, if (for simplicity's sake) only two lineages are visualised, and it be assumed (as former authors have supposed) that evolution proceeded from the capricorns to the sphaerocones, as, for example, from *A. maculatum* through *A. heterogenes* to a sphaerocone (*Liparoceras heptangulare*), and from *A. lataecosta*, through *A. henleyi*, to some other sphaerocone (*Liparoceras mickletonense*), it is difficult to account for the existence of all these transitions between the supposed two lineages. To put it in the form of a diagram, the connections are not only vertical, but also diagonal and horizontal. Or if, as I hold, the evolution proceeded from the sphaerocone to the capricorn, and the forms be connected downwards as well as upwards, the same difficulty arises, thus :—

$$\begin{tikzcd}
\text{Sphaerocone} \arrow[r, leftrightarrow] \arrow[d, leftrightarrow] \arrow[dr, leftrightarrow] & \text{Transitions} \arrow[r, leftrightarrow] \arrow[d, leftrightarrow] \arrow[dl, leftrightarrow] \arrow[dr, leftrightarrow] & \text{Sphaerocone} \arrow[d, leftrightarrow] \arrow[dl, leftrightarrow] \\
A.\ heterogenes \arrow[r, leftrightarrow] \arrow[d, leftrightarrow] \arrow[dr, leftrightarrow] & \text{Transitions} \arrow[r, leftrightarrow] \arrow[d, leftrightarrow] \arrow[dl, leftrightarrow] \arrow[dr, leftrightarrow] & A.\ henleyi \arrow[d, leftrightarrow] \arrow[dl, leftrightarrow] \\
A.\ maculatum \arrow[r, leftrightarrow] & \text{Transitions} \arrow[r, leftrightarrow] & A.\ lataecosta
\end{tikzcd}$$

—a diagram which shows mere lineage-confusion. Clearly, whichever way evolution went, the forms must be closely interrelated, and in my opinion they are a uniform, plastic stock that defies classification except on a purely morphological basis. But it should be noted the order of appearance in time is more-or-less the reverse of that expected, if the capricorns gave rise to the sphaerocones, for it is only the sphaerocones that persisted throughout. They were flourishing long before the first capricorns appeared, and their involute, finely ribbed end-forms (*Becheiceras*) lingered on into the Middle Lias ; while even the more variable *Liparoceras* itself still occurred in beds (the *Oistoceras figulinum* sub-zone) in which the abundant capricorns of the *maculatum* and *lataecosta* sub-zones had already modified their original form. The dimorphs, it may be added, in the two sub-zones just mentioned, are always, unlike the capricorns, a comparative rarity, but their relative abundance was reversed in the *centaurus* sub-zone below.

(2) *The Elongation of the Tubercles*

It is the study of the early dimorphs of the *Beaniceras* beds (*centaurus* sub-zone) that suggests their derivation from *Liparoceras*, with caenogenetic modification of the young. One of the most significant features in this group is the elongation of the tubercles in a longitudinal direction. Now in earlier genera, such as the Eoderoceratid *Microderoceras* or the Liparoceratid *Parinodiceras*, when tuberculation was developed on a rib, it was always elongated radially. The tubercles are thus elongated also in the adult *Liparoceras cheltiense*, but in the young of this species and its allies (e.g. Plate II, fig. 6) the tubercles are elongated longitudinally. In species like *Liparoceras pseudostriatum* and *L. obtusinodus* of the next higher *Beaniceras* beds, the elongation persists to a much larger diameter ; and it is noticeable especially in dimorphs like *L. naptonense* and *Androgynoceras sparsicosta* (the latter almost a capricorn), while it is also seen in *Beaniceras*, a genus whose inclusion in Liparoceratidae had at one time been questioned. Even in such comparatively late forms as *A. artigyrus*, var. *similis* (Plate XVIII, fig. 1), when incipient tuberculation appears on the body-chamber of some individuals, it is in the form of two or three longitudinal ridges; and in examples of *Androgynoceras hybridiforme* or *A. henleyi*, the bituberculation may be altogether replaced by short, parallel, raised longitudinal lines, although in some of the later forms, e.g. *A. subhybrida*, nov. (Plate IX, fig. 1), the tubercles may be elongated radially.

It is probable, then, that this spiral ornamentation and the longitudinal elongation of the tubercles in the Liparoceratids, and especially the dimorphs here discussed, indicate relationship, and were a family feature, inherited from the ancestral, specialised *Liparoceras*, as was the tendency to inflation of the outer whorl, shown in forms of *Androgynoceras*. But it must be emphasised that the spiral striation

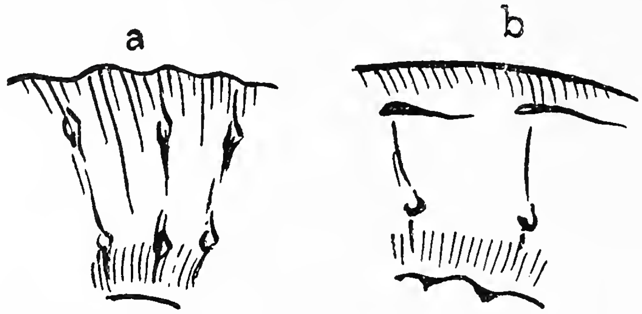


Fig. 8.—Showing elongation of the tubercles in some Liparoceratid genera.

(*a*) Radial or transverse (*Liparoceras*, Plate I, fig. 1). (*b*) Longitudinal or spiral (*Androgynoceras*, Plate IX, fig. 4).

or tuberculation, again, was a feature which first appeared at an early stage, and only gradually encroached on the later whorls, like the imparinode ribbing in *Parinodiceras*, or the high external lobe in *Becheiceras*.

(3) *The Dwarf Offshoot BEANICERAS*

Associated with the dimorphs of the *centaurus* sub-zone above discussed, are numerous dwarfed and reduced ammonites, for which Buckman created the genus *Beaniceras*. Again, no two individuals are alike, and yet they are undoubtedly descendants of the same plastic stock, and perhaps in the nature of an "unsuccessful experiment." Many cannot be distinguished at diameters below 20 mm. from certain forms of *Androgynoceras* here discussed; others retain the capricorn shape for longer, and lead to the *maculatum* group discussed below. Both these types of *Beaniceras*, however, at diameters up to 40–50 mm. (maximum) show degenerate ornamentation, and the periphery especially may be extremely variable. The suture-line does not differ in any essential from that of *Androgynoceras* of the *sparsicosta* group.

In another group of *Beaniceras* (the *centaurus* group), connected with the first by many transitions, the ribs tended to develop the outer tubercle at the expense of the inner, and the periphery consequently became very flat. The suture-line also changed (Text-figs. 9 *a–f*), and there were produced series of extraordinary forms, converging towards *Coeloceras pettos* (Quenstedt) on the one hand, and *Reynesoceras* *ragazzonii* (Hauer) on the other. What seems to me particularly significant is that the dwarf offshoot *Beaniceras* was short-lived and disappeared, without leaving any progeny, during the period of rise of the dimorphs (*Androgynoceras*). A species like *Beaniceras crassum* Buckman (1919, pl. cxlvii), remaining still much like *Androgynoceras sparsicosta*, also has the spiral ridges connecting the outer tubercles. This confirms the common ancestry of the two genera in *Liparoceras*; but like the spiral striation, the retention on the body-chamber of such a family characteristic is of no palingenetic significance. That supposed tuberculate, cadicone ancestor of *Beaniceras*, which prompted Trueman (1919, p. 292) at first to refer this genus to a different family (Dactylioceratidae), is hypothetical; and although there are apparent transitions to *Coeloceras*, the examination of numbers of individuals of *Beaniceras* leads

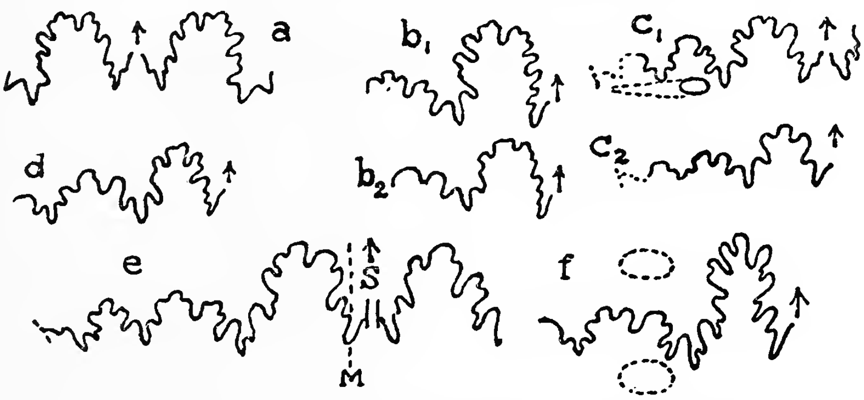


FIG. 9.—*Beaniceras centaurus* (d'Orbigny), Lower Lias, upper *ibex* zone, St. Amand, Cher. Enlarged suture-lines of six slightly differing examples between 12 and 19 mm. diameter. (B.M., Nos. C. 28118–28123).

to the conviction that, with the numerous passage-forms to *Androgynoceras* and *Liparoceras*, all the species of *Beaniceras* formed one interbreeding population.

(*e*) THE CAPRICORNS

(1) *The Encroaching Capricorn Stage*

The early *Androgynoceras*, found with *Beaniceras* in the *centaurus* sub-zone, had a short capricorn stage and soon reverted to the ancestral, swollen *Liparoceras* shape; but at higher levels the capricorn stage tended to be more and more prolonged, until finally there was no more inflation, even of the body-chambers. But these forms of *Androgynoceras* found at different horizons do not constitute a genetic sequence; for at every horizon they are accompanied by corresponding forms which do not develop the final inflated stage, but remain capricorn throughout life, and consequently retain a simple suture-line. It is these typical capricorns, appearing with small forms in the *centaurus* sub-zone, and with an abundance of larger forms in the *maculatum* beds, that constitute the new, and apparently successful, line of evolution. Compared with them, the more variable, and therefore more spectacular, dimorphs are rare, and represent individuals that, after a rather shortened existence as capricorns, reverted to the ancestral mode of life. In a fully grown *Androgynoceras hybridiforme* of 285 mm. diameter (No. 46514), the inner whorls of which agree with the "*A. henleyi*" figured by Wright (pl. xxxiii, the capricorn stage persists long enough to make the ammonite indistinguishable from *A. lataecosta* to a diameter of 80 mm.; but the subsequent swelling of the outer whorl resulted in a "sphaerocone," in which the width of the umbilicus was reduced from 50 to 32 per cent. Probably the mode of life in the adult was benthonic and similar to that of the large *Becheiceras*, rather than to that of the far more abundant individuals that remained capricorns throughout life, and probably were more active swimmers. But it must be remembered that the tendency to inflation, with or without tuberculation, persisted in occasional (pathological ?) individuals even of the late *Oistoceras*, and that it was at first a question of size; and the abundance of small capricorns is no proof that they were fully grown. It is only the gradual encroachment on to the outer whorls of the *Oistoceras* stage, with the modification of the ribbing on the venter (Plate XXI, fig. 8 *b*) that makes it possible to separate from *Androgynoceras* certain capricorns.

(2) *The Capricorns of the* CENTAURUS *Sub-zone*

The earliest forms (Plate X, fig. 5), small forerunners of the *maculatum* group, are distinguished from the associated *Beaniceras* chiefly by having the ribs more distinctly developed on the periphery, and showing less tendency to degeneration, although there is still ventral flattening of the costae. Comparison of *Beaniceras costatum* (Buckman) (Plate XIII, figs. 5 *a*, *b*) with *Androgynoceras maculatum* (Plate IX, figs. 2 *a*, *b*) will show the close similarity of the two stocks. The differences in the suture-lines are negligible, except perhaps in the coronate forms, in which whorl-shape alone determines a modification. The more typically capricorn species, from the *maculatum* to the *capricornus* groups especially, may have a short first lateral lobe, compared with the deep external lobe, a feature found again in the late *Oistoceras*.

(3) *The Capricorns of the* MACULATUM *and* LATAECOSTA *Sub-zones*

The forms of the *maculatum* group being poorly represented on the Dorset coast, their succession in time at Robin Hood's Bay has to be relied on. I may repeat that unlike many ammonite stocks that immigrated from more southern regions and never became abundant, the Liparoceratidae are more fully developed, and can be traced more continuously in Britain than anywhere else, so far as is known at present. Thanks to the careful collecting of Mr. L. Bairstow in the Yorkshire Lower Lias, and his kindness in submitting to me the ammonites, I am able to state that *A. maculatum* first appeared about 65 feet below the Oyster Bed, where it is associated with *A. heterogenes*. There are some doubtful fragments of *Liparoceras* (*kilsbiense* and *naptonense* group) from intervening beds, and a *L. heptangulare* is from at least 50 feet below the first *A. maculatum*; but *Liparoceras* of the *cheltiense* type occur about 30 feet lower still, while *Parinodiceras* occurs even below the maximum development of *Uptonia jamesoni* and *U. bronni*, i.e. a very long way down in the sequence. On the other hand, the larger and more typical examples of *A. maculatum*, associated with its var. *leckenbyi* nov. only seem abundant in a bed about 5 feet below the Oyster Bed. There is as yet only a single ammonite (*Androgynoceras lataecosta*) collected *in situ* from the Oyster Bed showing that this is already in the *lataecosta* zone, but it probably marks a gap in the succession, for *Oistoceras sinuosiforme*, nov., comes in in numbers only a few feet higher.

The crushed forms of *Androgynoceras* and their innumerable body-chambers found above the Belemnite Stone on the Dorset coast allow of upward continuation of the *Androgynoceras* sequence, but it is to be noted that there about 90 feet of deposits intervene between the top of the *maculatum* sub-zone and the first *Amaltheus*, as against not more than half (and possibly less) in Yorkshire. Conversely, as shown in the stratigraphical paper already cited (Lang, 1936, p. 434 ; Spath, 1936*a*, p. 449), capricorns with distantly and coarsely ribbed inner whorls, i.e. *A. maculatum* and its varieties, only occured in the lowest 9½ feet of the *davoei* zone ; so that in Dorset the stratigraphical gap is between the upper *maculatum* and the *centaurus* sub-zones. *Androgynoceras lataecosta*, so dominant in the next higher division, marks the acme of the true capricorns, for in the sub-zones above they gradually became modified until they were entirely unlike their forerunners. The last *Androgynoceras* disappeared about the same time, but the sphaerocones persisted. There was no decline of these, except in numbers ; they may have finally disappeared because they were a highly specialised group compared with the contemporary nautilid sphaerocones, which were unaffected by all the vicissitudes that changed the ammonite populations.

E. THE DECLINE OF THE LIPAROCERATIDAE

It has been seen that the incontrovertible evidence of stratigraphy does not favour the view that there was a persistent unspecialised, ancestral, capricorn stock, giving rise to a number of progressive branches that, after a meteoric career, disappeared one by one as a result of over-specialisation. On the contrary ; the tendency to close coiling which resulted in the early, suturally specialised, sphaerocones initiated a stream of evolution, which at its acme showed rapid differentiation and great plasticity, resulting in at least one unsuccessful experiment (*Beaniceras*) ; but the specialised, ancestral stock persisted, and even the simplified capricorn branches, in spite of their far greater abundance in individuals, were doomed to extinction before the rarer sphaerocones (*Liparoceras*) disappeared. I have previously directed attention to the frequency of cases of simplification in post-Triassic stocks, and it may even be styled the normal sequence, for *Liparoceras* itself is believed to have produced the degenerate *Metacymbites*.

(*a*) The Dwarf Offshoot *METACYMBITES*

This dwarf, smooth, globose stock appeared during the final burst of the (often gigantic) sphaerocones at the top of the Lower Lias, and in the lower part of the Middle Lias ; but on the strength of the greatly reduced suture-line alone, it is, of course, impossible to prove that *Metacymbites* must be a simplified Liparoceratid. The presence of spiral striation, however, a family feature of the Liparoceratidae, is an indication that *Metacymbites* is related to such globose forms as *Liparoceras*

(*Becheiceras* ?) *spinellii* Hauer sp., and the more doubtful *L.* (?) *woodwardi* Reynès sp. The latter may be ribbed, but cannot, as Schröder (1927, p. 224) thinks, be compared to young *Liparoceras* of the *zieteni* type, rather than to *Becheiceras* except by its suture-line ; such broad ribs, separated by pseudo-constrictions, are found in at least one immature *Becheiceras* before me (No. C. 38626), but the young *Liparoceras* s.s. is tuberculate at that stage. Since the earliest forms of *Amaltheus* are discoidal, it is clearly impossible to connect these with the globose *Metacymbites*, and there was no other known stock in existence at the time that could have produced *Metacymbites*.

The earlier true *Cymbites*, discussed in 1923 (p. 76), ranges up into the *oxynotus* zone (with *C. globosus*, Schübler sp., in Geyer, 1886, p. 257, pl. iii, fig. 26, which was included in Hyatt, 1889, p. 195, in the synonymy of *C. laevigatus* J. de C. Sowerby), and possibly much higher (see p. 93). But it comprises derivatives of the " Arietids," both keeled and unkeeled, and is believed to be distinct from the genus *Metacymbites*, which appeared in the *davoei* zone. There is nothing to connect the ribbed and longitudinally striate *Metacymbites* with the true *Cymbites*, except a reduced suture-line ; and since similar degenerate and globose developments occur in many formations up to the Upper Cretaceous, the value of a reduced suture-line for indicating affinity, is nil.

(*b*) The Last Capricorns

Apart, however, from the small sphaerocone group just described, it is the " decline " of the capricorns that is of most interest to the general palaeontologist. It is not often that such a complete record of the evolutionary history of a stock is available. Whatever our views as to how the capricorns became differentiated, the progress of their development, from the *maculatum* sub-zone up, is not a phylogenetic speculation, but an incontrovertible fact of observation in the field. The early forms with fairly complex suture-lines and, what is even more significant, spiral striation, e.g. *A. sparsicosta*, have comparatively coarsely ribbed inner whorls ; but their descendants, while gradually losing the spiral striation, develop finer and closer costation, as we go higher in the sequence, and the ribs become more prominent on the peripheries of the adult. Then the ventral ribs develop a sinus with the apex pointing forwards, *first on the inner whorls, and gradually spreading to the outer*, until in the later forms (*Oistoceras*), in which, it should be noted, the suture-line has become simple, the median area of the periphery is either at a lower level than the edges, or else raised into a keel.

(1) *The Simple Suture*

It seems to me that the mere simplification of the capricorns is evidence that they are neither the ancestors of the specialised sphaerocones, nor immigrants from the Mediterranean Province. For the supposed capricorns of that Province, like *Amm. adnethicus* (whose Sinemurian age, in any case, is entirely against association with the Liparoceratids), had a highly developed suture-line, while *Androgynoceras*, in that region, is always a rarity. But, on the contrary, I consider that the main development of the Liparoceratidae was in north-west Europe, as Meister (1914, p. 537) contended, and not in more southern areas. In that case those unknown elements of which I spoke on p. 4 are not likely to affect the present conclusions, except perhaps with regard to the polyphyletic origin, in Lytoceratidae, of the diverse groups of Eoderoceratidae, above discussed.

(2) *The Variable OISTOCERAS*

The later capricorns with differentiated venter (*Oistoceras*) were almost as common and as widely distributed in north-western Europe as the earlier capricorns, but unlike the long-lived *Liparoceras*, they had a comparatively short vertical range. *Oistoceras* is more-or-less confined to the *figulinum* sub-zone in England, if we exclude certain passage-forms from *Androgynoceras* which appear already in the *lataecosta* sub-zone. These passage-forms are very variable, no two individuals of such species as *Androgynoceras brevilobatum* Trueman and *O. crescens* (Hyatt) being identical; and they appear rather too late to be considered as a persisting development of the early *Beaniceras*, which occasionally produced a peripheral rib-curve.

(3) *The ANDROGYNOCERAS-OISTOCERAS Stream of Development*

The transformation of *Androgynoceras* into *Oistoceras* took place in the broad stream of development, not in a single lineage, so that *Oistoceras* is a morphological, not a genetic, unit; since various forms of *Androgynoceras*, perhaps, at different times, developed the *Oistoceras* characters. There arose, for example, the typical tuberculate and highly specialised *curvicorne* group, which disappeared before *Amaltheus* arrived in Dorset; but in Normandy the equally large *Oistoceras orbignyi*, sp. nov., persisted into the *margaritatus* zone, and is probably derived from quite a different species of *Androgynoceras*. Other forms developed a concave periphery, without being tuberculate, and the whorls may have been compressed or depressed, slender or inflated. Logically, each one of these end-forms could be claimed to need its own generic name.

(4) *Inflated OISTOCERAS*

It should be added that those rare forms of *Oistoceras* in which inflation of the final whorls has been observed, do not develop true sphaerocones; and far from producing progressively more advanced forms, the capricorn Liparoceratids show in time a marked decline in the body-chambers of large individuals. The outer whorls of *Liparoceras kilsbiense* already show much degeneration; and in *L. lytoceroides*, as the name implies, ornamentation is reduced almost to striation. Large *Androgynoceras heterogenes* and *A. henleyi* may scarcely produce bi-tuberculation, and are often very irregular; and the degenerate body-chamber of the largest *Oistoceras* known (B.M., No. C. 36914), of about 150–160 mm. diameter, fails even to retain the bi-tuberculation of its earlier stages, except in the most enfeebled condition. I can see in this no suspicion of orthogenesis, and no sign of a trend in the Liparoceratidae to develop tuberculate sphaerocones, time after time.[1] What change there

[1] See Buckman, 1919*a*, p. 296.

is, is on the inner whorls, and the outer merely become more degenerate in the later members. If we ignore *Metacymbites*, the two resulting end-forms, namely, *Becheiceras* (including " *Anisoloboceras* ") and *Oistoceras*, are almost as widely distinct as any two ammonites can be, except the oxycone. But, while the former differs little from the very earliest Liparoceratids (*Parinodiceras*), no one could have foretold the production of *Oistoceras*.

F. CONNEXION OF THE LIPAROCERATIDAE WITH AMALTHEUS

Opinions on the origin of the Amaltheidae have long been divided, but the family was generally assumed to be either " cryptogenous," i.e. of unknown origin, or else it was taken to be derived from some simple, sub-goniatitic ancestor (*Nannites* ? in Buckman, 1889, p. 655 or *Cymbites* in 1898, Table II, p. 451). Hyatt (1900, p. 577) did not express a definite opinion, but in recent German editions of Zittel's Grundzüge, the view is still held that the Amaltheidae are derived from the Aegoceratidae (*sensu lato*) and more particularly from the sub-family " Arietitinae." These views have all been contested during the last few years. Thus it was suggested by Frebold (1922) that one of the Liparoceratids here discussed, namely, *Oistoceras angulatum* Quenstedt sp. (see p. 172), was already an *Amaltheus*, and a forerunner of *Amaltheus margaritatus*, though not of all forms of *Amaltheus* ; and there is such close resemblance between *Oistoceras* of the *curvicorne* group, i.e. a Liparoceratid, and *Pleuroceras* (=" *Paltopleuroceras* "), a genus of the family Amaltheidae, that it might well be doubted whether the capricorns really died out with the last *Oistoceras*, as has been assumed. It is thus necessary to enquire into the possible connection between the Liparoceratidae and the Amaltheidae, a connection refuted altogether by Trueman (1919, p. 293). I (Spath, 1936*a*, p. 440) have already briefly referred to Frebold's views of the origin of *Amaltheus* itself, but new evidence is available and it is chiefly the suggested affinity with the genus *Oistoceras* that has now to be considered.

The resemblance between *Oistoceras* and *Pleuroceras*, of course, could be superficial ; and I may say at once that it seems unlikely that the many authors who derived *Pleuroceras* from *Amaltheus* were wrong. The existence of so many, and apparently perfect, transitions between *Amaltheus* and *Pleuroceras* ; the similar suture-line, which generally does not show the low external lobe of the late capricorns ; and the tardy appearance, in post-*Amaltheus* times, of *Pleuroceras* ; all, indeed, make it appear that these two Amaltheids are a homogeneous development and independent of the Liparoceratidae. Yet it must be remembered that Frebold was not alone in suggesting affinity between the Liparoceratidae and Amaltheidae ; for Monestier (1928, p. 22) also traced one of the " subphyla " of his polymorph and polyphyletic genus *Amaltheus* back to *Oistoceras omissum*. There is no need to discuss in detail the origin of the other branches of *Amaltheus*, envisaged by Monestier. Hyatt (1900, p. 577) already considered the connection with *Oxynoticeras* improbable ; and *Eoderoceras armatum* (Sowerby) will, no doubt, be ruled out at once by most palaeontologists as an Amaltheid ancestor ; while the derivation of *Amaltheus* from

"*Amphiceras*" Gemmellaro (now *Galaticeras*, see *supra*, p. 11) was suggested by myself as long ago as 1923 (*c*, p. 14) and, chiefly for want of a more likely ancestor, seemed probable not only for *Amaltheus* itself (and thence *Pleuroceras*), but also for what had been separated as "*Pseudoamaltheus*" Frebold 1922 (="*Proamaltheus*" Lange, 1932), i.e. for the whole family Amaltheidae.

Unfortunately there is nothing known so far from the *davoei* zone to bridge the gap between *Amaltheus* and "*Amphiceras*," though this is perhaps no greater than the time gap between *Oistoceras* and *Pleuroceras*; but there is even less likelihood of connecting *Amaltheus* or *Pseudoamaltheus* (after Frebold) with *Tragophylloceras*, than (after Buckman) with *Cymbites* or *Metacymbites*, both of which existed in *davoei* times. The interesting fact, however, may be here recalled, that so experienced a student of ammonites as Quenstedt considered the possibility of *Amaltheus laevis* being a hybrid between an Amaltheid and a Phylloceratid.

Both the Liparoceratidae and the Amaltheidae have end-forms of two types. The Liparoceratid end-forms are the complex sphaerocone *Becheiceras* ("*Anisoloboceras*") *nautiliforme*, which has been described as "the most flourishing" of all the sphaerocones, on the one hand; and the tri-tuberculate serpenticone of the most advanced *Oistoceras* on the other. The Amaltheid end-forms are (1) the very flat, oxynote *Amauroceras*, with very complex suture-line, which is the normal final stage in the development of the genus *Amaltheus*, as of many other discoidal genera; and (2) the tri-tuberculate serpenticone *Pleuroceras*. While the sphaerocone and oxycone end-forms (i.e. *Becheiceras* and *Amauroceras*, respectively) are entirely different in the two stocks, those with elaborate tri-tuberculate ornamentation and highly modified periphery, namely *Oistoceras* in the Liparoceratidae, and *Pleuroceras* in the Amaltheidae are curiously similar. The most notable apparent differences are in the siphuncular characters referred to on p. 10, in the short body-chamber of *Pleuroceras*, as compared with the very long body-chamber of *Oistoceras* (nearly a whole whorl in *O. figulinum* at 100 mm. diameter), and perhaps in the presence of a final rostrum in *Pleuroceras*, although *Oistoceras* may similarly have a ventral lappet. None of these features is in reality of great significance.

In the evolute types the suture-lines are reduced, compared with the involute second groups, but this is only a mechanical result of the modified shell. In my opinion the three final types above discussed—the nautiliform sphaerocone, the oxycone, and the tri-tuberculate serpenticone (with sulcate, carinate, or carinati-sulcate periphery)—were all successful adaptations to particular surroundings. But they were only three out of many possible adaptations, and since there is no apparent reason why the discoidal *Amaltheus* should have changed into a tri-tuberculate serpenticone, a globose *Liparoceras* could well have developed an oxycone Amaltheid end-form. The genus *Oistoceras*, in fact, is now believed to be the connecting link between the Liparoceratids and the whole family Amaltheidae, that is, not only the genus *Pleuroceras*, but also *Amaltheus*, as mentioned below. There is apparently no significance in the fact that while one of the supposed end-forms (*Oistoceras*) persisted and became modified as *Amaltheus*, another and a very similar type (*Pleuroceras*) disappeared entirely. Monestier (1928, p. 31) thought that "this disappearance, so general and so sudden, and found to be identical in all Liassic areas and in the most diverse facies," could only be considered to be the result of changes in the environment. At the same time, however, he took this disappearance to be in favour of Brocchi's theory, according to which " a phylum, after having retained for a more or less prolonged period of geological time the faculty to reproduce itself, ended in feebleness, sterility, and extinction, leaving its place henceforth to other types whose series of transformations was not yet accomplished."

Unfortunately, the latest attempt to trace the phylogeny of the Amaltheidae, by K. Frentzen (1937), is of slight value for the present enquiry, *Oistoceras* not even being mentioned. Apart from the regrettable ignorance or disregard of the works of previous authors, old and recent, and of the laws of palaeontological nomenclature, Frentzen's work is painstaking enough ; but, pinning his faith to Haeckel's biogenetic law, the author arrives at entirely inconclusive results, and has to be content with an unknown Amaltheid ancestor, less definite than that envisaged by Buckman (1892, p. 291). Moreover, even Frentzen's stratigraphical data may be questioned ; for the oldest horizons that yielded him populations sufficiently numerous for his purposes, are probably not as early as Monestier's " passage-beds " (with *Amaltheus stokesi* J. Sowerby sp.). Also the exclusion of *Pseudoamaltheus* and *Proamaltheus* from the Amaltheidae (genera which had been correctly appraised already by Quenstedt) is inadmissible, as is their identification with the totally unrelated Toarcian Grammoceratid genus *Onychoceras*, Wunstorf, 1907.

The phylogeny of the Amaltheidae thus was far from being agreed upon ; but there seems to be now more definite evidence for a connection between *Oistoceras* and not only the late *Pleuroceras*, but even *Amaltheus* itself. For, associated with the young *Oistoceras* referred to under *O. figulinum* (e.g. Plate XXII, fig. 6) there occurred an inflated young ammonite that is almost coronate, but has only indistinct, and not very acute, chevrons lying across the perfectly rounded periphery (Plate XXIV, figs. 2 *a*, *b*) ; there was also a more compressed young individual, similarly rounded ventrally, but with faint and irregular, sigmoidal ribs on the sides (Plate XXVI, figs. 16 *a*, *b*) ; furthermore, with these were two or three examples, apparently having an *Oistoceras*-costation (though the ribs are rather sigmoidal), yet with a sharpened venter, along which the apexes of the chevrons form a distinct, if blunt keel (Plate XXV, figs. 10 *a*–*c*). The suture-line of the first example is too immature for useful comparison, but like that figured in Plate XXIII, fig. 17, it does not differ in any essential from the suture-lines of either *Oistoceras* (Plate XXIII, fig. 10) or of *Amaltheus* (Text-fig. 14 *j*, p. 94).

Now, on morphological grounds as well as by their suture-lines, the sub-coronate as well as the keeled types could be taken to lead directly to *Amaltheus*, if they are not already referable to that genus ; but the first lateral lobe of the example figured in Plate XXVI, fig. 16 (and Plate XXIII, fig. 16) is so unusual that it is not certain whether this form can also be considered a transition between the Liparoceratids and Amaltheids. At any rate, it shows the existence, in *Oistoceras* times, of yet another group that apparently is not yet described ; and it suggests the desirability of re-examining those numerous but small individuals of *Amaltheus* that Dumortier

(1869, p. 91) found in the *davoei* zone or of the forms that are said to be so common in the *capricornus* beds of Portugal (Choffat, 1880, p. 14; Meister, 1914, p. 543).

According to Frebold (1922, p. 12) there are no transitions between *O. angulatum* and *Amaltheus margaritatus*; but this may be questioned as much as the same author's denial of the existence of passage-forms between *Amaltheus* and *Pleuroceras*. Moreover, from Frebold's own description of the young of his *Amaltheus angulatus*, it appears that he examined transitional types like that figured in Plate XXVI, fig. 16; for, while branching of the ribs at the ventro-lateral edge may occur, for example, in *O. orbignyi*, the costation in Quenstedt's *O. angulatum* is still of the common *capricornus* type. Until the adult of the transitional types here described are known, it matters little whether they are named or not; what is important is the fact that, while extreme forms like *O. curvicorne* died out, the undifferentiated and very variable young became modified and gave rise to the new stock. In fact, the caenogenetic appearance of both coronate whorl-shape with lateral tubercles, and a keel, is demonstrated in the forms figured in Plate XXIV, fig. 2, and Plate XXV, fig. 10.

G. CHRONOLOGICAL SUMMARY OF LIPAROCERATIDAE

The following table (pp. 34, 35) shows the ranges, in time, of the different species of Liparoceratidae. They are only approximate, in view of the lack of zonally collected material, except from the Dorset and Yorkshire coasts; and this may account for the apparent irregularity of the distribution in the different subzones. But taking the four larger divisions, the totals of species are as follows:—

margaritatus zone	8 species
davoei zone	47 ,,
ibex zone	25 ,,
jamesoni zone	14 ,,

Compared with the gradual increase in numbers during the lower three zones, the decline of the Liparoceratidae in the highest zone may seem very rapid, yet it does not imply sudden extinction of the three remaining genera. The sphaerocones were still in the "period of anagenesis," and their disappearance, no doubt, was gradual. This is the only branch of the Liparoceratidae that can be held to have "come to a dead end at the height of its career" (Buckman, 1919*a*, p. 296). But I can see no justification for Buckman's claims that, "by analogy with other ammonite stocks, there should have been a long period of catagenesis in front of them (i.e. the sphaerocones) passing to serpenticone stages again, with loss of ornament, and even with possibilities of renewed anagenesis." Except in so far as it applies to the origin of the dimorphs here advocated, this is a mere assumption, to conform to Buckman's views of cyclical development, and is not borne out by such a comparable bi-tuberculate and extremely long-lived sphaerocone as the Upper Jurassic *Aspidoceras*, or perhaps the suturally reduced, but globose, *Metacymbites*. In the third group that persisted into the highest zone, namely, the capricorns, "catagenesis" begins already in the *ibex* zone, but the serpenticone coiling and reduced suture-line are correlated with the different whorl-shape, and are probably necessitated by mechanical considerations. The uncertainty of some authors as to whether there was transformation of *Oistoceras* into an Amaltheid, as is here suggested, or merely a gradual disappearance of the capricorns, indicate how little the history of a stock can be foretold.

VERTICAL DISTRIBUTION OF THE SPECIES OF LIPAROCERATIDAE

	Species	Page	jamesoni		ibex		davoei				margaritatus		
			Lower	Upper	maugenesti-actaeon	centaurus	maculatum	lataecosta	bechei	figulinum	Lower	Middle	Upper
			1	2	3	4	5	6	7	8	9	10	
1	*Liparoceras bronni*, sp. nov.	43			3								
2	,, *zieteni* (Quenstedt)	44			3								
3	,, *cheltiense* (Murchison)	46			3								
4	,, *tiara* Trueman	49			3								
5	,, *tutcheri*, sp. nov.	50			3								
6	,, *rusticum*, sp. nov.	51			3								
7	,, *elegans*, sp. nov.	52				4							
8	,, *densistriatum*, sp. nov.	54			3								
9	,, sp. nov. aff. *densistriatum*, sp. nov. . .	54				4							
10	,, *substriatum*, sp. nov.	56				4							
11	,, *pseudostriatum* Trueman	57				4							
12	,, *heptangulare* (Young & Bird)	59				4							
13	,, *kilsbiense*, sp. nov.	60				4							
14	,, *obtusinodus* Trueman	62				4							
15	,, *naptonense*, sp. nov.	63				4	(?)						
16	,, *geyeri*, sp. nov.	65				4	(?)						
17	,, (?) *indecisum* (Hyatt)	64				(?)	(?)						
18	,, *wrighti*, sp. nov.	67						6					
19	,, *divaricosta* (Trueman)	68						6					
20	,, *contractum*, sp. nov.	69						6					
21	,, *lytoceroides*, sp. nov.	70						6					
22	,, *subhenleyi*, sp. nov.	72							7				
23	,, *mickletonense*, sp. nov.	73					(?)	6					
24	,, (?) *woodwardi* (Reynès)				(?)								
25	,, (*Becheiceras*) *bechei* (J. Sowerby) . .	74							7	(?)			
26	,, ,, *gallicum* Spath . . .	77							(?)	8			
27	,, ,, *nautiliforme* (J. Buckman) .	79									9	10	
28	,, ,, (?) *rotticum*, Krumbeck . .								(?)				
29	,, ,, (?) *spinellii* (Hauer) . .										(?)	(?)	
30	,, (*Parinodiceras*) *reineckii* (Quenstedt) . .	81	(?)	2									
31	,, ,, *parinodus* (Quenstedt) .	82	(?)	2									
32	,, ,, *ovale*, sp. nov. . . .	84		2									
33	,, ,, *laeve* (Quenstedt) . .			2									
34	,, ,, *radstockense*, sp. nov. . .			2									
35	,, (*Vicininodiceras*) *simplicicosta* (Trueman) .	85		2									
36	,, ,, (?) *gollingense*, Rosenberg .			2									

VERTICAL DISTRIBUTION OF THE SPECIES OF LIPAROCERATIDAE—*continued*

	Species	Page	jamesoni		ibex		davoei				margaratitus		
			Lower	Upper	maugenesti-actaeon	centaurus	maculatum	lataecosta	bechei	figulinum	Lower	Middle	Upper
			1	2	3	4	5	6	7	8	9	10	
37	*Platynoticeras alterum* (Oppel)	88	(?)	2									
38	,, *haugi*, sp. nov.	89	(?)	2									
39	,, *transitorium*, sp. nov.	90	(?)	2									
40	,, (?) *appressum* (Hyatt)			(?)									
41	*Metacymbites centriglobus* (Oppel)	95									9	10	
42	,, *primus*, sp. nov.	97								8			
43	*Beaniceras luridum* (Simpson)	100				4							
44	,, *subluridum*, sp. nov.	102				4							
45	,, *rotundum* Buckman	103				4							
46	,, *costatum* Buckman	104				4							
47	,, *crassum* Buckman	106				4							
48	,, *centaurus* (d'Orbigny)	107				4							
49	,, *senile* Buckman	109				4							
50	*Androgynoceras heterogenes* (Young & Bird)	113					5						
51	,, *sparsicosta* (Trueman)	115					5						
52	,, *intracapricornus* (Quenstedt)	117					5						
53	,, *hybrida* (d'Orbigny)	133					(?)	6					
54	,, *henleyi* (J. Sowerby)	119						6					
55	,, *hybridiforme*, sp. nov.	120						6					
56	,, *subhybrida*, sp. nov.	122						6					
57	,, *subcontractum*, sp. nov.	125						6					
58	,, *maculatum* (Young & Bird)	126					5						
59	,, *lataecosta* (J. Sowerby)	135						6					
60	,, *capricornus* (Schlotheim)	149						6	7				
61	,, *brevilobatum* (Trueman)	154						6	(?)				
62	,, *artigyrus* (Brown)	158						6	(?)				
63	*Oistoceras figulinum* (Simpson)	162								8			
64	,, *curvicorne* (Schloenbach)	164								8			
65	,, *wrighti* Spath	166								8			
66	,, *sinuosiforme*, sp. nov.	167							(?)	8			
67	,, *omissum* (Simpson)	170								8			
68	,, *angulatum* (Quenstedt)	171								8			
69	,, *langi*, sp. nov.	172								8			
70	,, *lincolnense*, sp. nov.	174								8			
71	,, *colubrinum*, sp. nov.	174								8			
72	,, *orbignyi*, sp. nov.	176									(?)		
73	,, *allaeotypus* (Trueman)	177								8	(?)		
74	,, *crescens* (Hyatt) Trueman sp.	178							(?)	8			
75	,, *nortonense*, sp. nov.	180								8			
76	,, (?) *sinuosum* (Hyatt) Lapparent and Fritel sp.								(?)	8			
77	,, (?) *anguliferum* (Phillips)									(?)			

It is tempting to list the species here described from the different English localities in geographical order, so as to bring out the incompleteness of the several horizons, for example, those of the *davoei* zone, at different points along their outcrops from Dorset to Yorkshire. Even the two coastal sections, where the record is most complete, reveal stratigraphical gaps (see p. 27), and it is fair to assume that the intervening sequences are even more fragmentary. This is indicated by the stratigraphical evidence so far available in the Survey Memoirs, and by the thickness of the beds at various localities known from other sources. But, without a great deal of additional fieldwork, it would be too speculative to attempt an interpretation of the faunal evidence supplied by the Museum specimens mentioned in the present Catalogue. Wide tracts of the outcrop also are without natural sections, or else the beds are rather unfossiliferous, except in certain condensed bands; so that it will be many years before the sub-zones within the *davoei* zone can be mapped across the country. Conversely, it is hoped that the detailed description of the most abundant constituents of the various faunas, namely the Liparoceratid ammonites, will, in turn, facilitate the stratigrapher's task.

Since careful zonal collecting of Liparoceratids outside England has been attempted, so far as I know, only at Champfromier in the French Jura, it seemed important to check the somewhat contradictory results obtained by E. Bovier (1932). By the kindness of Prof. L. W. Collet, in whose department at Geneva the Bovier collection is preserved, I have been able to examine most of the Liparoceratids listed by Bovier, and find that the apparent anomalies in the succession are easily explained by misidentification. For the state of preservation of the ammonites is generally very poor, especially those from the higher beds C. 23 to C. 32. M. Bovier was probably correct in drawing the line between the *ibex* zone and the *davoei* zone above his bed C. 22, because there are typical fragments of *Liparoceras* from beds C. 8, C. 18, and C. 20 and a characteristic form of *Beaniceras* from bed C. 19, while the specimen from C. 22, labelled *Beaniceras* cf. *centaurum* (d'Orbigny) seems to me to be a small *Androgynoceras* of the group of *A. heterogenes*.

The forms of the *jamesoni* zone listed from beds C. 8 to C. 19, such as *Uptonia*, *Polymorphites*, and even *Parinodiceras*, I take to be all misidentified, owing to extremely poor preservation. If *Acanthopleuroceras valdani* really appears at the base of the succession, as Bovier states, then there is nothing earlier than the *ibex* zone in these 10 feet or so of deposits, while the upper (and still more attenuated) part of the succession, chiefly containing crushed capricorns, is almost certainly only a very incomplete representation of the *davoei* zone. Mr. Bovier's lists suggest that the succession is complete from *maculatum* below to *figulinum* on top. In reality *A. maculatum* (labelled *A. obtusicosta*) still occurs in C. 31 but not in C. 35; and since Bovier's "*Oistoceras figulinum*" may be the crushed inner whorls of a form like *A. brevilobatum*, it will be seen that the succession at Champfromier may not reach up to the *bechei* sub-zone, and even so may contain non-sequences.

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PART II. SYSTEMATIC

Family LIPAROCERATIDAE, Hyatt

Genus LIPAROCERAS Hyatt, 1867, p. 83

GENOLECTOTYPE.—*Ammonites striatus*, Bronn, 1836, *non* Reinecke, in Buckman, 1911, p. *iii* (here taken to be identical with *Liparoceras bronni*, sp. nov.). *A. striatus* Reinecke, is a *Parinodiceras* (see p. 81).

DIAGNOSIS.—More-or-less involute platycones to sphaerocones, with rapid increase of whorl-height, deep umbilicus, and strong ornamentation consisting of two lateral rows of tubercles connected by fine or coarse, regular or irregular ribbing, often crossed by longitudinal lineation. Ribbing continuous across broadly arched venter. Suture-line complex, with large first lateral lobe and prominent external saddle.

DISTRIBUTION.—Lower Lias, Lower and Upper Pliensbachian (=Carixian and Domerian), *jamesoni* to *margaritatus* zones. Europe, Dutch East Indies.

Sub-genus LIPAROCERAS

SUB-GENOTYPE.—As for genus.

DIAGNOSIS.—Ornamentation generally strong. First lateral lobe about the same length as the external lobe.

DISTRIBUTION.—Lower Lias, Lower Pliensbachian (Carixian), *ibex* and *davoei* zones. Europe, Atlas Mts., Dutch East Indies.

Liparoceras bronni, sp. nov.

Plate II, figs. 1 *a*, *b*

Ammonites striatus, *non* Reinecke : Zieten, 1830, p. 7, pl. v, fig. 6.
,, ,, ,, Bronn, 1836, p. 449, pl. xxiii, figs. 7 *a*, *b*.
,, ,, ,, Buckland, 1837, p. 59, pl. xxxvii, fig. 10.

TYPE.—The Bettlingen (Wurtemberg) example, No. 22118 *a* (figured in Plate II, fig. 1).

DIAGNOSIS.—*Liparoceras* with sub-hexagonal whorl-section, slightly convergent sides, and broadly arched venter, about 13–15 inner, and 21–24 outer, tubercles. Connecting ribs strong, peripheral ribs closer, finer, and more numerous (about 3 to each outer tubercle). Umbilicus very narrow.

MEASUREMENTS.	Diameter	Whorl-height	Whorl-thickness	Umbilicus [1]
Holotype (Plate II, fig. 1)	49	·50	·66	·15
Bronn's figure	53	·50	·65	·16
No. 38770	76	·50	·65	·22

[1] The measurements throughout the systematic portion of this Catalogue are always given in the same order, the last three figures being percentages of the diameter.

REMARKS.—The only difference between the holotype (Plate II, fig. 1) and the figures given by Zieten and Bronn seems to be in the strength of the tubercles; but the whorl-section, and the elevation of the venter are identical. The difference mentioned appears too trivial to separate these forms specifically; yet it is still uncertain whether the genotype is actually represented by the present species. For the specimen here figured is still entirely septate, and it is possible that the (missing) outer whorls of the holotype and of Zieten's example differed specifically, considering the variability of the body-chamber in *Liparoceras*, for instance, in *L. cheltiense*.

The regular increase in the strength of the tubercles in the present form suggests comparison with *L. zieteni* (Quenstedt), another involute species of *Liparoceras*. This was taken by Trueman (1919, p. 272) to be characterised by its highly arched periphery; but Quenstedt's figs. 1 and 2 (1884, pl. xxviii) represent two different individuals,and it is thus necessary to restrict *L. zieteni* to fig. 2, as mentioned below. Fig. 1 is much like the present form, except for the strong tubercles near the end, and its umbilicus at a larger diameter also has increased to 22 per cent. It may be added that the difference in the tuberculation, so conspicuous on comparison of Bronn's with Quenstedt's figures, is more apparent than real, for it depends on the mode of preservation and on size, and at a small diameter they may have an equal number of tubercles.

The only English example in the Collection (No. C. 38591), comparable to the holotype, from the *ibex* zone of Charmouth (Pyritic Marls ?) at 45 mm. diameter has proportions :—·50 ; ·68 ; ·17, and therefore is also rather immature. Other more or less doubtful, young specimens, however, are in the Survey Collection (e.g. No. 23930, apparently from the Belemnite Stone). The Wurtemberg examples listed below also include some immature inner whorls (e.g. the two Pliensbach examples) or poorly preserved specimens (e.g. No. C. 38771) which cannot be definitely identified with *L. bronni*. Another doubtful individual, belonging to the Sorbonne (Petitclerc Coll.) is from the Rivière (Aveyron) and the species is probably also represented by some of the many limonitic young examples from Les Cottards, near St. Amand (Cher) and the Lozère and Aveyron in the same collection.

HORIZON AND LOCALITIES.—*Ibex* zone. Wurtemberg, England, France.

SPECIMENS.

22118*a* (Holotype)	Bettlingen, Wurtemberg	P. Mohr Coll., 1848.
C. 38350	Randen, Switzerland	History unrecorded.
C. 38591	Charmouth (Pyritic Marls)	L. F. Spath Coll., 1937.
C. 38770–74	Nürtingen, Wurtemberg	C. Allmendinger, 1937.
C. 38775–76	Pliensbach, Wurtemberg	,, ,,

Liparoceras zieteni (Quenstedt)

Plate II, figs. 2 *a*, *b*

Ammonites striatus zieteni Quenstedt, 1884, p. 222, pl. xxviii, figs. 1–2.
Liparoceras zieteni (Quenstedt) Trueman, 1919, p. 272.
non Ammonites zieteni Oppel, 1856, p. 285.

TYPE.—The original of Quenstedt's pl. xxviii, fig. 2 (Geol. Institute, University of Tübingen).

DIAGNOSIS.—Like *L. bronni*, but with more convergent, less parallel, sides and with highly arched venter; 13–14 inner, and 22 outer, tubercles (at 65 mm. diameter).

MEASUREMENTS.

Holotype (approximate)	65	·54	·64	·16
,, (Trueman)	64	·50	·64	·22
B.M., No. C. 17009	57	·52	·61	·16

REMARKS.—The separation of this species from the last seems justified on comparison of the whorl-section of Quenstedt's fig. 2 (here taken as the lectotype) with Zieten's (1830) fig. 6 *c*, and of examples corresponding with these two extremes; but there are many intermediate forms. The constantly narrow umbilicus (15 per cent. at 13·5 mm., 16 per cent. at 36 mm. and still in the adult) is perhaps the most characteristic feature of *L. zieteni*, as of *L. bronni* and the numerous passage-forms between them; but when the umbilicus begins to open out, there are produced transitions to *L. cheltiense*, such as the original of Plate II, fig. 7, though this, like the original of Quenstedt's fig. 1 (pl. xxviii), has the flatter periphery of *L. bronni*. I may add that, according to information by Dr. Schertz who, together with Prof. Hennig of Tübingen, had the kindness to examine Quenstedt's two syntypes at my request, the more involute lectotype (fig. 2) has 13–14 inner, and 22 outer, tubercles as against 12–13 inner, and 22 outer, in the more evolute original of fig. 1. The fact that this syntype of *L. zieteni* (in Trueman) could thus equally well be considered a passage-form from *L. bronni* to *L. cheltiense* shows how intimately the three species are related.

The example figured in Plate II, figs. 2 *a*, *b* has only two (exceptionally even one) peripheral ribs to each outer tubercle on the last half-whorl, but it is more closely ribbed (peripherally) on the inner volutions, as are two other small examples here listed (Nos. C. 28194 and C. 36927). Conversely, the larger figured specimen has 28 outer, to about 17 inner, tubercles, but it is probable that it merely retained the comparatively finely tuberculate early (*Becheiceras*) stage to a larger diameter than the typical examples. In any case, its small umbilicus indicates that it cannot be attached to any of the species described below. The young specimens figured in Plate I, figs. 8 *a*, *b*, and Plate VI, fig. 9, which well display the suture-lines, have a flatter periphery and are thus transitional to *L. bronni*, but the umbilicus is slightly wider. The large Yorkshire example listed below and previously referred by Crick (1922, p. 279) and the writer (1923*a*, p. 10) to *L. striatum*, like two examples labelled by Buckman " *L. zieteni* " (M.P.G., Nos. 23928, 23936), is transitional between this species and *L. cheltiense*, having a slightly larger umbilicus.

Another transitional example (No. C. 38779) is figured in Plate XII, fig. 3. It may even represent a new species, combining the small umbilicus and whorl-shape of the present species with the distant and radially elongated tubercles of the form figured in Plate IX, fig. 8 (*L. kilsbiense*, nov.), but it is rather too small to be named. It is quite different from the other involute species here described, except possibly the more compressed *L. tutcheri*, sp. nov.

The Alpine form attributed by Schröder (1927, p. 223, pl. xii, fig. 5) to a var.

zieteni of " *L. striatum* " is not closely allied to the present species. It appears to be a compressed example of *L. rusticum*, but its peripheral ribbing is rather close, so that it is probably more nearly allied to the (typically more inflated) *L. bronni*.

HORIZON AND LOCALITIES.—*Ibex* zone. Wurtemberg, England, France.

SPECIMENS.

C. 17009	(Plate II, fig. 2)	Labelled " Lias moyen " (France) .	M.P.G. (ex Chas. Stokes) Coll., 1880.
C. 18117	. . . .	Robin Hood's Bay, Yorkshire . .	J. F. Blake Coll., 1907.
C. 28194	. . . .	Battledown Brick Works, Cheltenham, Glos.	L. Richardson Coll., 1925.
C. 36927	(Plate I, fig. 8) .	Charmouth, Belemnite Stone . .	W. Wingrave Coll., 1935.
? **C. 38460**	(Plate VI, fig. 9)	Charmouth, Belemnite Stone or below	L. F. Spath Coll., 1937.
? **C. 38601**	. . . .	[St. Amand, Cher] France . .	,, ,,
C. 38777–78	. . .	Nürtingen, Wurtemberg . . .	C. Allmendinger, 1937.
? **C. 38779**	(Plate XII, fig. 3)	,, ,,	,, ,,
? **C. 39185**	. . . .	Tranzault, Indre, France . . .	N. Boubée, 1938.

Liparoceras cheltiense (Murchison)

Plate I, fig. 3 ; Plate II, figs. 4–9

Ammonites cheltiensis Murchison, 1834, p. 20, fig. 1.
,, ,, ,, 1839, The Silurian System, p. 19, text-fig. 2 *a*.
,, *cheltensis* ,, Bronn, 1848, Index, p. 45.
,, *henleyi* (*non* Sowerby) Morris, 1854, p. 292 (*partim*).
Liparoceras cheltiense (Murchison): Buckman, 1905 *b*, Pal. Universalis, 67 and 67 *a*.
,, ,, ,, Trueman, 1919, p. 271, pl. xxi, figs. 4 *a–d*.

TYPE.—Murchison's presumed original (B.M., No. 74955*a*), Plate I, fig. 3.

DIAGNOSIS.—Like *L. bronni*, but with umbilicus opening out already at diameters of 30–40 mm., with 20 outer, and 12 inner, tubercles at 66 mm., 21 outer and 15 inner at 93 mm. (holotype), but generally more on the earlier volutions.

MEASUREMENTS.

Holotype	93	·45	·67	·24
Plate II, fig. 7	73	·46	·69	·24
Plate II, fig. 3	96	·46	·68	·25
var. **compressa**, nov. (Plate II, fig. 8) .	80	·45	·54	·28

REMARKS.—As already mentioned, the examples of *L. cheltiense* show great variation, and as there is scarcely one that is not malformed, no two individuals are alike. In the circumstances this highly ornate species cannot be interpreted very narrowly, and it seems especially advisable also to include in it examples (C. 38192, Plate II, fig. 8), in which the whorl-thickness amounts to only 54–60 per cent. of the diameter. The degeneration of the tubercles on the body-chamber (over three-quarters of the last whorl) and the closeness of the peripheral ribbing near the aperture are the same in most typical examples as well as in the var. *compressa*, but transitions to *L. rusticum* are formed when the ventral ribs, generally for a short distance only, are widely spaced. In other individuals, again, the close peripheral ribbing of the final phase may already appear on the earlier half of the outer whorl, and one inflated example (No. C. 7314), with a thickness of about 85 per cent. at 73 mm. diameter, shows no decline of ribbing at all at the (slightly crushed) end of its outer whorl (all body-chamber).

The example figured in Plate II, figs. 4 *a*, *b*, represents an inflated variety, in which the degeneration of the ribbing towards the end of the body-chamber is particularly conspicuous. Conversely, the smaller specimen (Plate II, figs. 7 *a*, *b*), somewhat transitional to *L. bronni*, also with nearly a whole whorl of body-chamber, retains the typical tuberculation. A similar Nürtingen example (No. 38780) is still septate at 90 mm. diameter. In very young specimens, the ornamentation may be much the same as in the adult (Plate II, fig. 6), or the ribbing may be rather close (Plate II, fig. 5), or the tubercles may be rather fine, with scarcely perceptible connecting ribs, foreshadowing the *Becheiceras*-ornamentation (Plate I, fig. 3). The inner whorls figured by Quenstedt in 1849 (pl. ix, fig. 24) and (less definitely so) his finely nodate *Amm. striatus zieteni* of 1884 (pl. xxviii, fig. 4) may represent similar young examples of *L. cheltiense*, but the umbilicus is generally narrow in the English specimens.

There are transitions to the more evolute *L. tiara* Trueman, and the more involute *L. pseudostriatum* Trueman, as mentioned below. Some specimens (e.g. No. C. 36958) with a more highly arched periphery than the typical forms and a narrower umbilicus may also be considered to be passage-forms to *L. zieteni*, but the other species of *Liparoceras* here described are rather distinct, except, perhaps, the finely ornamented *L. substriatum* and the more megalomorph *L. kilsbiense*. The former at 50 mm. diameter still retains the aspect of the young *L. cheltiense* (e.g. Plate II, fig. 5), when the present species is already very coarsely tuberculate. *L. kilsbiense* is similar in whorl-shape and involution, but has more numerous tubercles, is less imparinode, and the tubercles increase in strength still at a large diameter.

HORIZON AND LOCALITIES.—*Ibex* zone. England (Dorset, Gloucestershire, Warwickshire, Northants.), France, Germany. The *L.* cf. *pseudostriatum* (No. C. 23620) previously (Spath, 1923*a*, p. 7) recorded from the Pyritic Marls may be an impression of the present species, while the *L. cheltiense* (No. C. 23601) from the Crumbly Bed, listed on the same page, may be a badly crushed *L. kilsbiense*.

SPECIMENS.

50443	(Plate II, fig. 4).	Gloucestershire	J. Morris Coll., 1867.
74955*a*	. . .	Leckhampton, Gloucestershire (Holotype) .	W. Jenkins, 1877.
74955*b*	(Plate I, fig. 3).	Leckhampton, Gloucestershire	,, ,,
C. 3162	. . .	Mickleton Tunnel, Gloucestershire . .	G. E. Gavey Coll., 1890.
C. 4177	. . .	[Unrecorded.] Gloucestershire ? . .	W. F. Jennings Coll., 1892.
C. 6618	. . .	Northwick, Gloucestershire . . .	T. J. Slatter Coll., 1896.
C. 7314	. . .	Witcombe, Gloucestershire (inflated var.) .	,, ,,
C. 10004	. . .	Stroud, Gloucestershire	E. Witchell Coll., 1905.
C. 11639	. . .	(Transition to *L. pseudostriatum.*) "Lyme Regis", Dorset.	Caroline Birley bequest, 1907.
C. 16752	. . .	Stow Hill Cutting, G.W. Rly., Gloucestershire	R. F. Tomes Coll., 1905.
C. 16755	. . .	,, ,, ,,	,, ,,
C. 17633	. . .	[Unrecorded.] Gloucestershire ? . .	Sowerby Coll., 1861.
C. 18120	. . .	Cheltenham, Gloucestershire (transitional to *L. kilsbiense*, sp. nov.).	J. F. Blake Coll., 1907.

(?) **C. 23602**	Foreshore S.E. of Golden Cap, Crumbly Bed	W. D. Lang Coll., 1923.
(?) **C. 23620**	Cliff Base, S.W. of Golden Cap, Dorset	,, ,,
(?) **C. 28127–28**	St. Amand, Cher, France	J. R. Gregory & Co., 1925.
C. 28195 (Plate II, fig. 6).	Battledown Brick Works, Cheltenham, Glos.	L. Richardson Coll., 1925.
C. 28196 (Plate II, fig. 5).	,, ,, ,,	,, ,,
C. 28197	,, ,, ,,	,, ,,
C. 28199 (Plate II, fig. 7).	,, ,, ,,	,, ,,
(?) **C. 29355**	E. of Charmouth. Pyritic Marls (bed 120*b*).	W. D. Lang Coll., 1927.
C. 36701	Well near Council Houses, opposite Church, Cherington, Warwickshire.	A. Reeley Coll., 1935.
C. 36950	Webb's Pit, Cheltenham, Glos.	W. E. Cutler Coll., 1936.
C. 36958	(Transitional to *L. zieteni.*) Battledown Brick Works, Cheltenham, Glos.	S. S. Buckman Coll., 1929.
C. 38459 (Plate II, fig. 9).	Cheltenham, Glos.	L. F. Spath Coll., 1937.
C. 38603	,, ,,	,, ,,
C. 38606–9	Gloucestershire	,, ,,
(?) **C. 38610**	Dundry, Somerset (transition to *L. pseudostriatum* ?).	J. W. Tutcher Coll., 1937.
C. 38613	Hellern, Hanover, Germany	Dr. F. Krantz, 1937.
C. 38614	Nr. Herford, Westphalia	,, ,,
(?) **C. 38615**	"Charmouth", Dorset [Belemnite Stone]	,, ,,
C. 38781–83	Nürtingen, Wurtemberg	C. Allmendinger, 1937.
C. 38856	Webb's Pit, Cheltenham, Glos.	J. W. Tutcher Coll., 1937.
(?) **C. 38857**	West of Murphy's Pool, Dundry, Somerset	,, ,,
(?) **C. 39138–39**	Robin Hood's Bay, Yorkshire (bed 562)	L. Bairstow Coll., 1937.
(?) **C. 39344–45**	Essey, near Nancy, Meurthe & Moselle, France.	Exchange H. Contaut, 1938.

The following eight specimens are transitional to *L. rusticum*, sp. nov.

39831	Stow-on-the-Wold, Gloucestershire	J. Gregory, ? 1862.
74955*c*	Leckhampton, Glos.	W. Jenkins, 1877.
75124	[" Queensland "] ?	History unrecorded.
C. 6617	Little Wolford, Warwickshire	T. J. Slatter Coll., 1896.
C. 23497	Yelvertoft, E. of Rugby, Northamptonshire.	Sir H. Butlin Coll., 1921
C. 28198	Battledown Brick Works, Cheltenham, Glos.	L. Richardson Coll., 1925.
C. 38274	[Unrecorded.] Cheltenham, Glos. ?	J. F. Blake Coll., 1907.
C. 38314	Dursley, Glos.	Dr. W. A. Cunnington Coll., 1930.

The following twenty-eight specimens are referred to the var. *compressa*, nov., but some are transitional.

20130*c*	Kilsby Tunnel, Northamptonshire (transitional to *L. pseudostriatum*).	G. Baker Coll., 1843.
20130*d*	,, ,, ,,	,, ,,
20918	,, ,, ,,	,, ,,
50131	Gloucestershire	J. Morris Coll., 1867.
C. 6616	Witcombe Reservoir, nr. Gloucester	T. J. Slatter Coll., 1896.
C. 9993	Stroud, Glos.	E. Witchell Coll., 1905.
(?) **C. 16753**	Stow Hill Cutting, G.W. Rly., Glos.	R. F. Tomes Coll., 1905.
C. 16784	Witcombe Reservoir, nr. Gloucester	,, ,,
C. 17632	,, ,, ,,	,, ,,
C. 23093	Cheltenham, Glos.	M. S. Johnston Coll., 1922.

C. 28192 . . .		Battledown Brick Works, Cheltenham, Glos.	L. Richardson Coll., 1925.
C. 28193 . . .		,, ,, ,,	,, ,,
C. 28200 . . .		Didcot Farm, Dumbleton, Glos. . .	,, ,,
C. 36703 . . .		Well near Council Houses, opposite Church, Cherington, Warwickshire.	A. Reeley Coll., 1935.
C. 36951 . . .		Battledown Brick Works, Cheltenham, Glos.	W. E. Cutler Coll., 1936.
C. 36952 . . .		Shackel's Pike, Cheltenham, Glos. . .	S. S. Buckman Coll., 1929.
C. 36954 . . .		Arlebrook, Standish, Glos.	,, ,,
C. 36956 . . .		,, ,,	,, ,,
C. 36957 . . .		Battledown Brick Works, Cheltenham, Glos.	,, ,,
C. 38192	(Plate II, fig. 8)	[Unrecorded.] Gloucestershire ? . .	Sowerby Coll., 1935.
C. 38198 . . .		[Unrecorded.] Cheltenham, Glos. ? . .	,, ,,
C. 38411 . . .		Webb's Pit, Cheltenham, Glos. . . .	J. W. Tutcher Coll., 1937.
(?) 38602 . . .		Golden Cap, Charmouth (Pyritic Marls) .	L. F. Spath Coll., 1937.
(?) C. 38652 . .		,, ,, ,,	Mrs. Gollancz Coll., 1937.
C. 38604–5 . .		Cheltenham, Glos.	L. F. Spath Coll., 1937.
C. 38612 . . .		France [Sarthe ?].	Dr. F. Krantz, 1937.
C. 38730 . . .		Nürtingen, Wurtemberg	C. Allmendinger, 1937.

Liparoceras tiara Trueman

Plate IV, figs. 3 *a*, *b*

Liparoceras tiara, Trueman, 1919, p. 272, pl. xxi, figs. 1 *a*, *b* ; text-fig. 4 *d*, p. 270.
non ,, ,, ,, Bovier, 1932, p. 31.

TYPE.—Trueman's original (B.M., No. C. 28280) here refigured (Plate IV, fig. 3).

DIAGNOSIS.—Like *L. cheltiense*, but more evolute and less inflated ; 20 outer, and 14 inner, tubercles (at 66 mm. diameter.)

MEASUREMENTS.

Holotype (Plate IV, fig. 3)	63 (66)	·41	·57	·29
C. 38410	80	·44	·65	·30

REMARKS.—The holotype appears to be unique, but there are individuals of the var. *compressa* of *L. cheltiense* (e.g. No. C. 36703) which are so close to *L. tiara* that the latter can be safely characterised as merely an extreme of the same group. In *L. cheltiense* and its varieties, the early whorls are finely tuberculate to a stage at which *L. tiara* has already prominent spines connected by strong ribs, and decline of ornamentation sets in much earlier than in *L. cheltiense*, without, apparently, being so pronounced. Since, however, the holotype of *L. tiara* is entirely septate it is possible that some imperfect large examples (e.g. No. C. 6618) here referred to *L. cheltiense* on account of the characteristic body-chamber, should really be included in the present species, even if the peripheral ribbing is less close.

The second example listed in the above measurements, identified by Prof. Trueman himself with *L. tiara*, has far coarser ornamentation than the holotype of that species and might, in fact, be considered to be merely an evolute variety of *L. rusticum* ; but two other examples from Mr. Tutcher's collection, labelled *L.* aff. *tiara*, while having the characteristic ornamentation of the present species, have the smaller umbilicus of *L. cheltiense*. The Radstock example (No. C. 38412) labelled by Prof. Trueman " *Liparoceras* sp." is doubtful because of its imperfect preservation.

The forms of *Liparoceras* with an open umbilicus comparable to that of *L. tiara*, are described below as *L. kilsbiense* and *L. heptangulare*, and have finer ornamentation of rather a different style ; but there is a Curcy (Calvados) specimen in the Tesson Collection, listed below as doubtful, which combines the coarse *tiara*-tuberculation with the distant peripheral ribbing of *L. rusticum*. The number of tubercles has increased to 26 outer, and 16 inner, at 130 mm. diameter. Unfortunately it is too poorly preserved to be certain that it is a passage-form between the two species, or that the apparent differences between it and the holotypes of *L. tiara* on the one hand, and of *L. rusticum* on the other, are not due to its defective preservation.

Another doubtful example from the Crumbly Bed is crushed, so that the width of the umbilicus cannot be determined. It may represent a form intermediate to *L. bronni*, which it also resembles in its present condition.

Horizon and Localities.—*Ibex* zone, *centaurus* sub-zone. England, France (?).

Specimens.

(?) **37044**	Curcy, Calvados	Tesson Coll., 1857.
C. 28280 (Holotype)	Excavation for bridge, near Manor Farm, Gotherington, nr. Cheltenham, Glos.	L. Richardson Coll., 1925.
(?) **C. 29245**	E. of Charmouth (Crumbly Bed)	W. D. Lang Coll., 1922.
C. 38410	Churchdown, Glos.	J. W. Tutcher Coll., 1937.
(?) **C. 38412**	Tyning Colliery, Radstock, Som.	,, ,,
C. 38859	Webb's Pit, Cheltenham, Glos.	,, ,,
C. 38860	,, ,, ,,	,, ,,

Liparoceras tutcheri, sp. nov.

Plate XII, figs. 5 *a, b*

Liparoceras cheltiense (Murchison) : Tutcher & Trueman, 1925, p. 652 (*partim*).

Type.—The Radstock example (No. C. 38413) figured in Plate XII, fig. 5.

Diagnosis.—Sub-platygyral, pachygyral, sub-angustumbilicate *Liparoceras*, like *L. cheltiense*, but more compressed and more involute, with higher whorls, narrower venter and flattened whorl-sides. Tubercles very distant at first, imparinode (11 inner and 17 outer, on last whorl) ; longitudinal striation present. About two secondary ribs to each outer tubercle, remainder intercalated. Body-chamber over three-quarters of outer whorl ; mouth-border plain, slightly constricted. Suture-line very complex.

Measurements.

Holotype (Plate XII, fig. 5)	108	·48	·50	·22

Remarks.—Although represented by only a single example, this form is given a distinct name because it is an interesting passage-form to *Parinodiceras*. It is more compressed than the slenderest example of the evolute *L. cheltiense* (Murchison), var. *compressa*, nov., but there is at least one example of a slender variety of the involute *L. pseudostriatum* (No. C. 38611) which is equally close to the present form. Both the species just cited, however, have different inner whorls.

L. zieteni (Quenstedt), with a similarly small umbilicus at the same size as the earlier whorls of the present species, is less compressed and has far more numerous tubercles, but the transitional form (figured in Plate XII, fig. 3) may be closer. It has the distant tubercles of *L. tutcheri* on the last half whorl, but, unlike this species, has a curious longitudinal elongation of the outer tubercles, fused almost into a continuous ridge.

HORIZON AND LOCALITY.—*Ibex* zone. England (Radstock, *Valdani* Limestone).

SPECIMENS.

C. 38413 (Holotype) . Tyning Colliery, Radstock, Somerset . . J. W. Tutcher Coll., 1937.

Liparoceras rusticum, sp. nov.

Plate I, figs. 1 *a*, *b*

Compare: *Ammonites henleyi* (*non* Sowerby) Dumortier, 1869, p. 76, pl. xviii, figs. 1, 2.

TYPE.—No. C. 36926 (Plate I, fig. 1).

DIAGNOSIS.—Like *L. cheltiense*, but less inflated, and with few, and very coarse, peripheral ribs; 16 outer, and 13 inner, tubercles at 66 mm. (holotype), 20 outer, and 14 inner, at 95 mm. (paratype).

MEASUREMENTS.

Holotype	72	·44	·65	·25
Paratype (C. 9917)	95	·45	·60	·26
No. C. 36953	115	·45	·60	·26

REMARKS.—This species is merely a coarse extreme of *L. cheltiense*, and is taken to be identical with the "variété à gros tubercules," figured and described by Dumortier, although the inner whorls of the British types are generally more depressed than those of the French example. This applies especially to the holotype here figured, but a specimen from Curcy, Calvados, in the Tesson Collection (No. 37186) like English examples other than the holotype, has a more arched periphery. The dimensions of the type seem to differ from those given by Dumortier (63; ·41; ·60; ·15) chiefly in the width of the umbilicus, but since the whorl-height and Dumortier's illustration suggest that the umbilicus was probably 25 per cent. also in the French specimen, the differences are not of specific importance. In view of the great variability of the species of *Liparoceras* of the *cheltiense* group, it does not seem advisable to regard the more-or-less pronounced arching of the periphery as even of varietal significance.

As already mentioned, this species is very close to *L. cheltiense*, Murchison sp., but has coarser tuberculation, and far fewer ventral ribs. There are passage-forms, however, between these two very variable species, and at larger diameters their ornamentation similarly degenerates. *L. tiara* Trueman, also more finely ribbed, has a wider umbilicus. The involute *L. zieteni* (Quenstedt), with an arched periphery like Dumortier's example, also is much less coarsely ornamented.

There are forms, e.g. No. 17159, previously referred to (Spath, 1923*a*, p. 10) as *L. heptangulare* (Young & Bird), as well as an example from Banbury (No. C. 38647) which are somewhat intermediate between *L. rusticum* and the Yorkshire species described below. In these transitional examples the interspaces between the ventral ribs may be even wider than in the typical *L. rusticum*; but if the tubercles are damaged or worn, definite identification may be difficult.

The largest of the examples listed below (No. 20130 *b*), consisting of the body-chamber of a shell at least 140 mm. in diameter, is slightly larger than the most complete *L. cheltiense* before me, but in the absence of the inner whorls it cannot be definitely referred to the present species. Another large and complete example (No. 74955 *d*), of 125 mm. diameter, still has a whorl-thickness of at least 66 per cent. near the (damaged) aperture, the body-chamber occupying almost the whole of the outer whorl. This represents an inflated variety such as occurs also in *L. cheltiense*.

The transitions to *L. cheltiense* include specimens (Nos. C. 16754, C. 38648) in which the earlier volutions (up to about 35–40 mm. diameter) are more closely costate than in the type, but which become very coarse afterwards; also examples (Nos. C. 36702, C. 38279) in which the inner whorls are typical, but the outer whorls, if found isolated, would not have been distinguished from *L. cheltiense*. One specimen (No. 89023), with an open umbilicus, might be considered transitional to *L. tiara*. It is, in fact, closely comparable to the French example (No. 37044) already referred to under that species, but less megalomorph.

Horizon and Localities.—*Ibex* zone. England, France.

Specimens.

17159	Robin Hood's Bay [" Whitby "], Yorkshire	Ripley Coll. (? Date).
(?) 20130*b*	Kilsby Tunnel, Northants	G. Baker Coll., 1843.
37186	Curcy, Calvados, France	Tesson Coll., 1857.
74955*d*	Leckhampton, Glos.	W. Jenkins, 1877.
89023	Near Dursley, Glos.	J. S. Bowerbank Coll., 1865.
C. 6615	" N.W. Rly.", Banbury, Oxfordshire	T. J. Slatter Coll., 1896.
C. 9917 (Paratype)	Stroud, Glos.	E. Witchell Coll., 1905.
C. 16754	Stow Hill Cutting, G.W. Rly., Glos.	R. F. Tomes Coll., 1905.
C. 36702	Well near Council Houses, opposite Church, Cherington, Warwickshire.	A. Reeley Coll., 1935.
C. 36926 (Holotype)	Gretton Hill, Glos.	S. S. Buckman Coll., 1929.
C. 36930	[Unrecorded.] Gloucestershire ?	Sowerby Coll., 1935.
C. 36953	Robins Wood Hill, Glos.	S. S. Buckman Coll., 1929.
C. 36955	Arlsbrook, Standish, Glos.	" "
C. 38279	[Unrecorded.] Gloucestershire ?	History unrecorded.
C. 38647	Banbury, Oxfordshire	L. F. Spath Coll., 1937.
C. 38648	[Unrecorded.] Gloucestershire ?	" "
C. 39184	Tranzault, Indre, France	N. Boubée, 1938.
C. 39490	Cheltenham, Glos.	L. Norris Coll., 1908.

Liparoceras elegans, sp. nov.

Plate I, figs. 7 *a*, *b*

Type. No. C. 1910 (Plate I, fig. 7).

Diagnosis. — Platygyral, per-pachygyral, sub-angustumbilicate *Liparoceras*. Whorl-section depressed, heptangular, with widely arched periphery, convergent sides and very high, slightly convex umbilical slope. Ornamentation imparinode

(33 outer, and 24 inner, tubercles) with irregular, duplicating costae between, faintly produced to umbilical suture, but distinct across venter which tends to be concave near the two outer rows of tubercles. Suture-line very complex, apparently as in *L. pseudostriatum*.

MEASUREMENTS.

Holotype (Plate I, fig. 7) . . .	93	·50	·70	·25
var. **platynotus** (Text-fig. 10 *b*) . .	85 (70)	·48	·84	·22

REMARKS.—The above description applies to the holotype which is entirely septate. Since the body-chamber was presumably between half and three-quarters of a whorl in length, the specimen originally must have been of about 160–170 mm. diameter. A slightly smaller specimen, provisionally included here as a var. *platynotus*, nov., has part of the body-chamber, and forms a transition to *L. pseudostriatum* Trueman. In side-view, this var. *platynotus* may be compared to the ammonite figured by Schröder (1927, p. 223, pl. xiii, fig. 1) as "*Liparoceras striatum* (Reinecke) Typus" (but not to the true *L.* (*Parinodiceras*) *striatum*), and it has fewer tubercles than the holotype of *P. elegans* (24 outer to 15 inner). The peripheral ribbing is also much coarser, while the whorl-section (Text-fig. 10 *b*) is more depressed than that of the type. The section figured by Schröder (fig. 1 *b*) is still slenderer. The var. *platynotus* thus has a wider and flatter periphery than *L. pseudostriatum*, which differs from the Bavarian example figured by Schröder chiefly in its enormous inflation, but which also has a rounded shape and blunt tubercles. The French (Curcy) example listed below is intermediate between the type of *P. elegans* and its var. *platynotus*, both as regards whorl-section and numbers of tubercles.

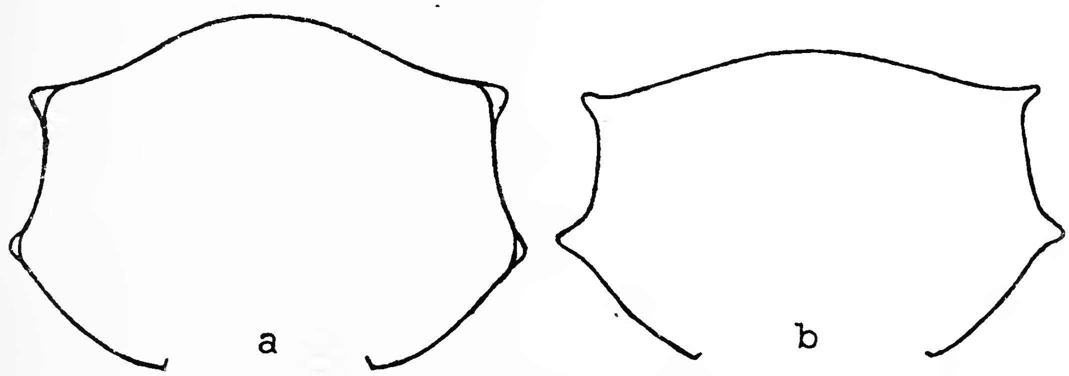

FIG. 10.—Outline whorl-sections of (*a*) *Liparoceras elegans*, sp. nov. holotype (No. C. 1910), and (*b*) var. *platynotus*, nov. (No. C. 311). *Ibex* zone (Belemnite Stone), Charmouth.

L. kilsbiense, sp. nov. (see p. 60), has much coarser costation than *L. elegans*, a lower umbilical wall, more parallel sides, and a narrower venter; but d'Orbigny's side-view of the former species (1844, pl. **lxxxiii**, fig. 1) somewhat resembles the var. *platynotus*, except in its wider umbilicus. The ventral aspect, however, owing to the great width of the periphery and the more divergent sides, is rather different in this variety.

The form described on this page as *L. densistriatum*, nov. shows fine ribbing on the venter, almost as close as in *L. elegans*, but the blunt and distant tubercles give it quite a different aspect in side-view. In those varieties of *L. cheltiense* that develop fine costation on the venter, the earlier whorls are always coarse.

The holotype of the present species had been labelled by Wright " *Aegoceras striatum*=*Amm. cheltiense*, pl. xlii, fig. 2." The resemblance to *L. subhenleyi*, however, of which species Wright's figured example is the type, is superficial, the different style of ornamentation alone being sufficient to distinguish *L. subhenleyi* from the present form.

Horizon and Localities.—*Ibex* zone, Belemnite Stone. England (Dorset), France.

Specimens.

37186	Curcy, Calvados, France . . .	Tesson Coll., 1857.
C. 311 (var. *platynotus*) .	" Lyme Regis "	Mrs. Dollan, 1882.
C. 1910 (Holotype) . .	,, ,, ...	T. Wright Coll., 1887.

Liparoceras densistriatum, sp. nov.

Plate III, figs. 1 *a*, *b*; Plate IX, fig. 9

Type.—No. C. 6217 (Plate III, fig. 1).

Diagnosis.—Sub-platygyral, per-pachygyral, sub-angustumbilicate *Liparoceras*. Whorl-section greatly depressed, sub-trapezoidal, with a comparatively flat periphery and strongly convergent sides, also high and convex umbilical wall, perpendicular near the umbilical suture. About 18 outer, to 12 inner, tubercles (at 80 mm. diameter), very blunt (on cast) and not directly connected by ribs, but each row producing its own radial riblets, at least on the body-chamber. Peripheral ribs comparatively fine and close, first five, and then four, to each outer node. Suture-line very complex, with external lobe considerably higher than first lateral.

Measurements.

Holotype (Plate III, fig. 1) . .	(at) 82	·44	·73	·28
,, ,, . .	(at) 50	·44	·80	·26 ?

Remarks.—Apart from the slightly closer peripheral costation of the present species and its less convergent whorl-sides, there is close resemblance between the holotype and a Belemnite Stone (Dorset) example (W. D. Lang Coll., 1493) which was included by Trueman (1919, p. 269) in *L. obtusinodus*. But the proportions, especially the whorl-thickness, and width and ornamentation of the venter are entirely different from those of the holotype of *L. obtusinodus*, which is somewhat intermediate between *L. kilsbiense* and *L. naptonense*. I may add that judging by another Belemnite Stone example (No. C. 38649) with closely approximating rows of tubercles, this form (also wrongly recorded as *L. obtusinodus* in Spath, 1923*a*, p. 7) probably belongs to an entirely new species which, however, cannot yet be described separately for lack of good material.

The inner whorls figured in Plate XII, fig. 4, are somewhat doubtful, because the peripheral costation is as yet very feeble and may have developed differently at a larger size. The identification of inner whorls of *Liparoceras* is not easy, even when they are well preserved. The forms from the Belemnite Stone and immediately below are generally in a very poor condition, but two, in an unusually good state of preservation, are now figured. One (Plate I, fig. 4) is inflated and the peripheral ribbing becomes increasingly coarser as in *L. rusticum*; the other (Plate I, fig. 8) is slender-whorled and the ventral ribs are very fine and close. But the reference of the first to *L. pseudostriatum*, because of its high umbilical wall, and of the second to the *bronni-zieteni* group is provisional, pending the discovery of better material. Both are as distinct from the present form as they are from the Belemnite Stone example (No. 1493) above referred to; yet the comparison of their outer whorls, when these are found, may lead to quite a different reading of their affinities.

The holotype of the present species includes part of the body-chamber, the last suture-line being at 68 mm. It is thus large enough to show not only that it is specifically distinct, but that it is closer to the early *L. bronni* and *L. cheltiense* than to the later forms, with more evolute inner whorls. Another Belemnite Stone form, *L. elegans*, nov., var. *platynotus* (p. 53) also differs from the present species chiefly in having smaller, closer, and sharper tubercles. The peripheral view of its earlier whorls is much like fig. 9 of Plate IX, but at a larger size the ventral area becomes relatively wider in the var. *platynotus*.

A doubtful and crushed specimen (No. C. 17631), presumably from the Pyritic Marls, has the ornamentation of the present species, but the peripheral ribs form forwardly directed chevrons, and are especially projected along the siphonal line. This ventral ornamentation is quite different from that of any species of *Liparoceras* figured in geological literature.

The un-figured Wurtemberg example listed below (No. C. 37809) is somewhat doubtful, being poorly preserved. It is still septate at about 100 mm. diameter, but while it has the whorl-shape of the present species, it seems to have the coarser ventral ribbing of the new Belemnite Stone form, although this is almost completely effaced without the pyritic cast being at all worn.

HORIZON AND LOCALITIES.—*Ibex* zone. England, France, Germany.

SPECIMENS.

C. 6217 (Holotype) .	Little Welford, Warwickshire . .	T. J. Slatter Coll., 1896.
(?) **C. 17631** . . .	Golden Cap, Dorset	,, ,,
(?) **C. 20245** (sp. nov. ?) .	Dorset Coast (Belemnite Stone) .	W. D. Lang Coll., 1919. [No. 1493.]
(?) **C. 38649** (sp. nov.) .	Charmouth, Dorset	L. F. Spath, Coll. 1937.
(?) **C. 38809**	Nürtingen, Wurtemberg . . .	C. Allmendinger, 1937.
(?) **C. 38810** (Plate XII, fig. 4)	,, ,, ...	,, ,,
C. 39186	Malzeville, nr. Nancy, Meurthe & Moselle, France.	N. Boubée, 1938.
C. 39343	Laitre-en-Amance, nr. Nancy, Meurthe & Moselle, France.	Exch. H. Contaut, 1938.

Liparoceras substriatum, sp. nov.

Plate I, figs. 6 *a, b*; Plate III, figs. 5 *a, b*

Type.—No. C. 23279 (Plate I, fig. 6).

Diagnosis.—Platygyral, pachygyral, sub-angustumbilicate *Liparoceras*. Whorl-section depressed, with convergent sides and evenly arched venter. Outer row of tubercles fine and close, twice as numerous as inner (17). Ribbing very irregular, extremely fine on periphery. Suture-line probably as in *L. cheltiense*. Body-chamber three-quarters of last whorl.

Measurements.

Holotype (Plate I, fig. 6) . . .	51	·52	·58	·20
var. **inflata**, nov. (Plate III, fig. 5) .	38	·47	·68	·21

Remarks.—There is only a single typical example of this species, and this is a malformation, but it can be seen that the injury has not changed the unusually fine style of ornamentation that characterises this form. In *L. cheltiense* (Murchison) the outer tubercles, as a rule, are distantly spaced in the young (Plate I, fig. 3) and they already become prominent at about 20 mm. diameter, but in some immature examples doubtfully attached to that species (Nos. C. 28196–7) there is an approximation to the closely-spaced tuberculation of the present form. At diameters of over 20 mm., however, these may be presumed to have developed much more inflated whorls than the present form, together with a wider and more arched periphery, and with much more prominent tuberculation. In the var. *inflata*, which is represented by a small example (No. 20130 *l*) with a complete body-chamber, the whorl-shape is that of a young *L. cheltiense*, but the fine ornamentation agrees with that of the type.

L. elegans, nov., differs greatly in whorl-section, and all the other species of *Liparoceras* are less finely ribbed; but there is a small example (No. 20130 *o*) of an evolute and rather finely ornamented variety of *L. kilsbiense* which may perhaps be considered somewhat transitional to the present form. These two species and *L. obtusinodus* are the only forms of *Liparoceras* before me from Hillmorton.

Horizon and Localities.—*Ibex* zone, *centaurus* sub-zone. England (Warwickshire, Northamptonshire). A Dorset example comparable to the var. *inflata*, but with a more rapid increase in thickness (M.P.G., No. 23589) is apparently from the Belemnite Stone.

Specimens.

20130*l* (Plate III, fig. 5)	Kilsby Tunnel, Northants . . .	G. Baker Coll., 1843.
C. 23279 (Holotype) .	Hillmorton, nr. Rugby, Warwickshire .	G. E. Dibley, 1922.

Liparoceras pseudostriatum Trueman

Plate III, figs. 3 *a*, *b*; Plate VI, figs. 4 *a*, *b*

Liparoceras pseudostriatum Trueman, 1919, p. 272.
,, ,, ,, Spath, 1923*a*, p. 7.
(?) ,, ,, ,, Bovier, 1932, p. 30.

TYPE.—Trueman's original, here figured for the first time (No. C. 21992).

DIAGNOSIS.—Like *L. bronni*, with small umbilicus, and with about 20–22 outer and 12–13 inner tubercles (at a diameter of 100 mm.), but with more rapid increase in width. High and strongly ribbed umbilical slope; costae between the two rows of tubercles very irregular. Suture-line very finely divided.

MEASUREMENTS.

Trueman (p. 272)	100	·47	·65	·16
var. **obtusa**, nov. (Plate VI, figs. 4 *a*, *b*) .	110	·46	·66	·23
No. C. 38611	96	·52	·58	·18

REMARKS.—Trueman, who did not figure this form, characterised it as "differing from other species of *Liparoceras* in having stout whorls and involute form, accompanied by unpaired fine tubercles." *L. bronni* and *L. zieteni* are equally involute; and the inflated varieties of *L. cheltiense* and *L. rusticum* are equally globose. Yet the present species has a different aspect from the other forms here described, and may well be retained. I may add that the holotype is worn on one side of the last half whorl, which is body-chamber, but that at 90 mm. diameter, the whorl-thickness is already 65 per cent. The subsequent increase in thickness is regular, so that the complete shell must have been extremely globose, far more inflated than the original of Wright's (1881) pl. xlii, figs. 1 and 3 (now *L. kilsbiense*, sp. nov.), to which Trueman had compared the present form. The intermediate nature of *L. pseudostriatum* between the early *bronni-cheltiense* group on the one hand, and the later *L. kilsbiense* on the other, especially in regard to ornamentation, is perhaps its most striking feature. It should be added that the tubercles are sharp only where the test is preserved, and they may present very blunt bosses on internal casts.

The inner whorls of the holotype are not preserved, but the young example figured in Plate I, figs. 4 *a*, *b*, probably belonged to a form of the same group. It differs from the immature *L. cheltiense*, figured in Plate I, fig. 3, in its stronger tuberculation, but there are many intermediate forms, and it would be unsafe definitely to attach such young examples to the present, rather than to other, species.

Again, there are more compressed individuals of the present species, either with small umbilicus (e.g. No. C. 38611) or with the umbilicus tending to open out (e.g. No. C. 38638), and the peripheral ribbing may be more forwardly inclined. They resemble the ammonite figured by Schröder (1927, pl. xiii, fig. 1) as *Liparoceras striatum* typus, but have many fine and irregular ribs between the two rows of tubercles, and they lead directly to *L. cheltiense* by way of such transitions as those listed above from Northamptonshire (No. 20130*c*, *d*). Other such passage-forms

(Nos. C. 38319, C. 38414) differ from the type merely in their wider umbilicus, while the compressed variety already mentioned (No. C. 38611) is directly transitional to *L. tutcheri*, nov.

The poorly preserved *Liparoceras* previously recorded from the Crumbly Bed probably includes the present species, but nine more forms (W. D. Lang Coll., Nos. C. 23583–85, C. 23602, 04, 06, 08–9 ; J. W. Tutcher Coll., No. C. 38449) are indeterminable specifically.

The example figured in Plate VI, fig. 4, represents an evolute variety in which the two rows of tubercles are more approximate than in the type, and the peripheral ribbing is coarser (var. *obtusa*, nov.). A larger example of the same variety (No. C. 3292), also with 22 outer, and 16 inner, tubercles at nearly 150 mm. diameter, has inner whorls like those of that new Belemnite Stone species referred to under *L. densistriatum* ; but like the figured example, it is also comparable to certain passage-forms between *L. rusticum* and *L. heptangulare*, already discussed (p. 51), and to a Westphalian example (No. C. 38616) listed under *L. kilsbiense*, nov.

Horizon and Localities.—*Ibex* zone, England (Belemnite Stone—bed 121, and Crumbly Bed—120*d*, Dorset Coast ; Northants), France.

Specimens.

C. 3292	(var. *obtusa*)	"Lyme Regis"	R. Damon, 1890.
(?) **C. 11639**	(Plate I, fig. 4)	,, ...	Caroline Birley Bequest, 1907.
C. 21992	(Holotype) .	,, ...	A. E. Trueman Coll., 1920.
(?) **C. 23601**	. . .	Cliff base, S.W. of Golden Cap, Dorset	W. D. Lang Coll., 1923.
(?) **C. 23605**	. . .	,, ,, ,,	,, ,,
C. 36704	(var. *obtusa*)	Kilsby Tunnel, Northants . . .	Presd. Kent Education Committee, 1935.
C. 38319	. . .	[" Plaister Quarries, Derbyshire "]. .	History Unrecorded.
C. 38414	. . .	Webb's Pit, Cheltenham (transitional to *L. cheltiense*)	J. W. Tutcher Coll., 1937.
C. 38611	. . .	Cheltenham, Glos.	Dr. F. Krantz, 1937.
C. 38638	. . .	[Kilsby Tunnel, Northants] . . .	L. F. Spath Coll., 1937.
C. 39341	. . .	Essey, nr. Nancy, Meurthe & Moselle, France.	Exch. H. Contaut, 1938.
C. 39342	(var. *obtusa* ?)	,, ,, ,,	,, ,,
C. 39454	. . .	Charmouth, Dorset (in same slab with *L.* cf. *cheltiense*, No. C. 38615).	Dr. F. Krantz, 1937.
(?) **C. 39498**	. . .	East of St. Gabriel's, Dorset (bed 121) .	L. Bairstow Coll., 1938.

The nine doubtful examples referred to above are :

C. 23583 . . .	Stonebarrow, Charmouth, Dorset (bed 121)	W. D. Lang Coll., 1923.
C. 23584 . . .	West of Ridge Fault, Dorset (bed 121) .	,, ,,
C. 23585 . . .	Black Ven, Charmouth (bed 121) . .	,, ,,
C. 23602 and 604 .	Foreshore S.E. of Golden Cap, Dorset .	,, ,,
C. 23606 . . .	,, ,, ,,	,, ,,
C. 23608–09 . .	,, ,, ,,	,, ,,
C. 38449 . . .	Charmouth, Dorset (bed 120*b*, by preservation).	J. W. Tutcher Coll., 1937.

Liparoceras heptangulare (Young & Bird)

Plate VII, fig. 1

Ammonites heptangularis Young & Bird, 1828, pp. 263, 359, pl. xiv, fig. 1.
,, ,, ,, Bronn, 1848, Index, p. 45.
,, *henleyi* (*non* Sowerby) Morris, 1854, p. 292 (*partim*).
,, *heptangularis* Young & Bird : Simpson, 1855, p. 71.
Aegoceras striatum (Reinecke) Blake, in Tate and Blake, 1876, p. 281 (*partim*).
,, ,, ,, Wright, 1881, p. 378 (*partim*).
Ammonites henleyi (*non* Sowerby) : Simpson, 1884, p. 105.
Liparoceras heptangulare (Young & Bird) : Buckman, 1914, pl. cviii, A–C, p. 108*b*.
,, ,, ,, Spath, 1923*a*, p. 10.

TYPE.—Young and Bird's original (Whitby Museum, No. 170).

DIAGNOSIS.—Like *L. kilsbiense*, sp. nov., with numerous tubercles and with the two rows connected by irregular ribs, with equally conspicuous umbilical slope, but with slenderer whorls and with very broad and flat ribs on the periphery. Umbilicus comparatively wide ; increase in whorl-thickness slight.

MEASUREMENTS.

Holotype (Buckman)	98	·47	·53	·20
,, ,, ...	162	·47	·46	·27
Plate VII, fig. 1	165	·49	(?)	·25

REMARKS.—According to Buckman, the holotype shows various displacements due to crushing. This accounts, at least partly, for the almost ventral position of the outer tubercles (on one side of the specimen). Apart from the irregularity of the ornamentation, which is common to *L. kilsbiense* and the present species, there remain, as distinctions from the former, the compression and the unusually wide peripheral ribs of *L. heptangulare*. Unfortunately there is a dearth of material, and the only Yorkshire specimen in the collection that appears to belong to the present species is also crushed, so that its dimensions are without diagnostic value. But the number of tubercles (30 outer to 20 inner) is distinctive, showing the intermediate position of *L. heptangulare* between the *cheltiense* group on the one hand, and *L. kilsbiense* on the other. I may add that, at the diameter of the Yorkshire examples referred to under *L. zieteni* (52, 72, and 84 mm. diameter), the large example of *L. heptangulare* here discussed is not only more evolute, but also has closer and finer tubercles.

Three specimens (Nos. 20417, C. 9686, and C. 38288) listed below, are transitional between *L. kilsbiense* and *L. heptangulare*, and have either the distant and broad peripheral ribs of the latter or its general appearance in side-view, but they show the more numerous tubercles of *L. kilsbiense*. It is probable that there are various transitions between the two species, and not impossible that the discovery of more Yorkshire material will show *L. kilsbiense* to be not more than a variety of the older species.

HORIZON AND LOCALITY.—*Ibex* zone, *centaurus* sub-zone ?, England (Yorkshire).

SPECIMENS.

C. 2685 (Plate VII, fig. 1)	Robin Hood's Bay [" Whitby "], Yorkshire	Baber Coll., 1889.
(?) C. 39137 . .	Robin Hood's Bay, Yorkshire (bed 571).	L. Bairstow Coll., 1937.
(?) C. 39495 . .	Orchard S.W. of Wootton Cross, Dorset (Belemnite Stone).	W. D. Lang Coll., 1938.

Liparoceras kilsbiense, sp. nov.

Plate IV, figs. 1, 2 ; Plate VII, figs. 2 *a*, *b* ; Plate VIII, fig. 5 ; Plate IX, figs. 8 *a–c*

Ammonites henleyi (*non* Sowerby) : d'Orbigny, 1844, p. 280, pl. lxxxiii, figs. 1–3.
,, ,, ,, d'Orbigny, 1850, Prodrome I, p. 224.
Aegoceras striatum (*non* Reinecke) : Wright, 1881, *partim*, p. 378, pl. xlii, figs. 1 and 3 only.

TYPE.—No. C. 23493 (Plate IV, fig. 2).

DIAGNOSIS.—Sub-platygyral, pachygyral, sub-angustumbilicate *Liparoceras*. Whorl-section depressed, heptangular, with widely arched periphery, slightly convergent sides, and very high, but rounded, umbilical slope. About 28 outer, to 20 inner, tubercles (34–40 outer and 24–27 inner in very large examples), with irregular, often duplicating, costae in between. Tubercles produced on umbilical slope, with some intermediate striae ; two or three ventral ribs to each outer tubercle. Spiral ornament distinct. Suture-line with elements very finely divided and with high, triangular, pointed saddle in siphonal line. Internal lobe bifid, flanked by two pairs of dorsal saddles (Plate XVI, fig. 7).

MEASUREMENTS.

Holotype (Plate IV, fig. 2) . . .	115	·46	·59	·24
d'Orbigny (pl. lxxxiii and text) . .	[150]	·44	·58	·24
Wright (pl. xlii, figs. 1 and 3) . .	133	·48	·60	·24
var. **aperta**, nov. (Plate IV, fig. 1) .	138	·45	·56	·30

REMARKS.—The holotype is slightly and obliquely crushed, especially near the apertural end, where the costation degenerates, as in *L. cheltiense*. In other examples this degeneration does not set in till a much larger size, and there is then excellent agreement with d'Orbigny's figure, which is said to be of natural size.

Trueman (1919, p. 272) compared d'Orbigny's ammonite to his *L. tiara*, but in my opinion the latter species is closer to *L. cheltiense* than to the present form. For, in this, and in the closely allied *L. heptangulare*, the ornamentation gradually increases in strength, whereas in *L. tiara* and the more inflated and more rounded *L. cheltiense* the inner whorls are comparatively coarser than the outer. Some examples of the present form (e.g. Plate VIII, fig. 5) remain almost smooth until a fairly late stage.

One of the examples of "*Aegoceras striatum*" figured by Wright and cited in the synonymy (presumably also from Kilsby Tunnel although Wright does not mention this locality) belongs to the present species, but has more finely tuberculate inner whorls and slightly less involution. Its dimensions given above are very similar to those of the typical example, but there is a more evolute variety of the present form (var. *aperta*, nov., e.g. Plate IV, fig. 1, or Plate VII, fig. 2) in which the umbilicus increases to 30%. There is also some variation in the tuberculation of the inner whorls, and since the preservation so much influences the appearance of these tubercles, no two individuals are identical; but at least one example (No. C. 23490) with coarsely tuberculate early whorls, suggests a transition to *L. cheltiense*, except in its much larger size.

L. pseudostriatum to which Trueman (1919, p. 272) had compared the ammonite figured by Wright, has a more inflated shape, with wider periphery, and its tuberculation is coarser and more distantly spaced, there being only 13 inner tubercles in *L. pseudostriatum* compared with at least 20 in the present form. *L. obtusinodus* Trueman (1919, p. 269) is closer, but less inflated and more evolute; it also has less parallel whorl-sides and the two rows of tubercles are more approximate. The ammonite from Rotti (Dutch East Indies) figured by Krumbeck (1922, p. 197, pl. xviii, fig. 3) as "*Liparoceras* cfr. *striatum amalthei* Quenstedt sp.," is probably also close to *L. kilsbiense*, and differs chiefly in having its line of involution almost at the outer row of tubercles. It has nothing to do with *L.* (*Becheiceras*) *nautiliforme* (J. Buckman), to a Wurtemberg example of which (figured in Quenstedt) the Rotti ammonite had been compared.

The evolute variety (var. *aperta*) already referred to, like *L. obtusinodus*, is connected by numerous passage-forms directly with *Androgynoceras sparsicosta* (Trueman) and *Liparoceras naptonense*, nov. (p. 63).

The example figured in Plate IX, fig. 8, with proportions: 48; ·48; ·70; ·26, but changing to 67; ·45; ·63; ·29 at a later stage, is remarkable on account of its greatly elongated nodes. The outer row especially is almost fused into a continuous spiral line on the first half of the outer whorl, so that it is impossible to count the individual tubercles. Later, this example, or rather, its un-figured outer whorls, do not seem to differ much from the typical *L. kilsbiense*. It is not advisable to separate it, at present, although it may be somewhat transitional to a species like *L. densistriatum*, especially since there are only about 10 inner tubercles, as compared with at least twice as many on the inner whorls (probably of the var. *aperta*) figured in Plate VIII, fig. 5.

It is probable that at least one of the badly preserved examples of *Liparoceras* from immediately below the Belemnite Stone (No. C. 23607) belongs to the present species, but another (No. C. 23601), previously recorded as *L. cheltiense* (Spath, 1923*a*, p. 7), has fewer inner tubercles, and is now doubtfully listed with *L. pseudostriatum* Trueman. Some examples (Nos. 20417 and C. 38288) with very coarse peripheral ribbing or with slightly more distant tuberculation (No. C. 9686) are transitional to *L. heptangulare*, discussed above.

HORIZON AND LOCALITIES.—Upper *ibex* (and lowest *davoei*?) zone. England, France, Germany, Dutch East Indies? A French specimen in the Sorbonne (Coll. Schlumberger) is from Seichamps.

SPECIMENS.

20130*e*	(Plate VII, fig. 2).	Kilsby Tunnel, Northants . .	G. Baker Coll., 1843.
20130*f*	(var. *aperta*, Plate IV, fig. 1).	„ „ . .	„ „
20130*g*	(var. *aperta*) .	„ „ . .	„ „
20417	. . . .	„ „ . .	„ „

20918*a*	(Plate IX, fig. 8) .	Kilsby Tunnel, Northants . .	G. Baker Coll., 1843.
C. 1899	. . . .	[Kilsby Tunnel, Northants] . .	W. Wright Coll., 1886.
C. 9686	. . . .	Near Winchcombe, Glos. . . .	Presd. Rev. R. N. Jackson, 1905.
C. 23490	. . . .	Napton, Warwickshire . . .	Sir. H. Butlin Coll., 1921.
C. 23491	. . . .	,, ,, . . .	,, ,,
C. 23493	(Holotype, Plate IV, fig. 2) .	,, ,, . . .	,, ,,
(?) **C. 23605**	. . .	Cliff base, W. of Golden Cap, Dorset (immediately beneath Belemnite Stone).	W. D. Lang Coll., 1923.
C. 36925	(Plate VIII, fig. 5)	Napton, Warwickshire . . .	W. Wingrave Coll., 1935.
(?) **C. 38288**	. . .	Bracebridge, Lincs.	W. E. Cutler Coll., 1936.
C. 38289	. . . .	Napton, Warwickshire . . .	W. Wingrave Coll., 1935.
C. 38317	. . . .	Unrecorded [Kilsby Tunnel, Northants ?].	G. W. Young Coll., 1930.
C. 38320	. . . .	[" Plaister Quarries, Derbyshire "] .	History unrecorded.
C. 38328	. . . .	Germany, Franconia ? [labelled " Nürnberg "].	,, ,,
(?) **C. 38448**	. . .	Bracebridge, Lincs. [malformed]. .	W. E. Cutler Coll., 1936.
C. 38480	. . . .	Kilsby, Northants	L. F. Spath Coll., 1937.
C. 38616	. . . .	Near Herford, Westphalia, Germany .	Dr. F. Krantz, 1937.
C. 38636	. . . .	Broadway Lane, nr. Welton, Somerset	J. W. Tutcher Coll., 1937.

Liparoceras obtusinodus Trueman

Plate VII, figs. 3 *a–d*

Liparoceras obtusinodum Trueman, 1919, p. 269.

TYPE.—Trueman's original (now B.M., No. C. 38323, figured in Plate VII, fig. 3).

DIAGNOSIS.—Sub-platygyral, pachygyral, sub-angust- to sub-latumbilicate *Liparoceras*. Whorl-section depressed, with gently arched venter and convergent whorl-sides. Ornamentation as in *L. kilsbiense*, with about 22 outer, to 18 inner, tubercles, but on evolute inner whorls like that of *Liparoceras naptonense*, without, apparently, being so definitely capricorn. Suture-line complex, with slender external saddle.

MEASUREMENTS.

Trueman, p. 269 (holotype)	45	·44	·52	·33
No. C. 23278	109	·46	·50	·30

REMARKS.—The holotype consists of a body-chamber fragment, with the last suture-line (and muscle impressions), but the concave dorsal area shows impressions of broad folds such as could only have been caused by sub-capricorn inner whorls. According to Trueman, the present species had no capricorn stage at all, and I am leaving it in *Liparoceras* because, as in *L. mickletonense*, the early costate stage was presumably less distinct than in the forms here included in *Androgynoceras*. But, as Trueman has already pointed out, a complete series of specimens may be arranged, transitional between *Androgynoceras heterogenes* and *L. obtusinodus*, and the example figured in Plate VI, fig. 1, transitional to *Liparoceras naptonense*, shows that the outer whorl cannot be distinguished from that of the type of *L. obtusinodus*.

The present species is connected by transitions with *L. kilsbiense*, especially the var. *aperta*, and it is interesting to note how readily a sub-capricorn early stage is formed when the ventral ribs unite in bundles, passing from one outer tubercle across the periphery to its opposite number. This is indicated in the small example of a finely ribbed variety of *L. kilsbiense*, figured in Plate VII, fig. 2, and in a similar example from the Belemnite Stone (M.P.G., No. 23929), labelled by Buckman "*Liparoceras* sp. nov. ? aff. *heptangulare*," forms that lead directly to such transitions to *Androgynoceras* as that figured in Plate X, fig. 4. Those examples listed below and under *L. naptonense* in which the inner whorls are not clearly shown, may, in fact, equally well be referred to the genus *Androgynoceras*.

The involute, un-named, Belemnite Stone form attached by Trueman to *L. obtusinodus* and already referred to under *L. densistriatum* (p. 54) has nothing to do with the species here described.

HORIZON AND LOCALITIES.—*Ibex* zone, *centaurus* sub-zone. England (Warwickshire, Northamptonshire).

SPECIMENS.

19531 . . .	Kilsby Tunnel, Northants . . .	G. Baker Coll., 1843.
C. 23278 . . .	Hillmorton, nr. Rugby, Warwickshire	G. E. Dibley Coll., 1922.
C. 38323 (Holotype) .	Napton, Warwickshire	Presd. Univ. College Nottingham, 1936.

Liparoceras naptonense, sp. nov.

Plate VI, figs. 1 *a*, *b*; Plate IX, fig. 7; Plate X, figs. 6 *a*, *b*; Plate XIV, fig. 6; Plate XVI, fig. 10

Androgynoceras sp., Spath, 1935, p. 396, pl. xviii.

TYPE.—The Napton example (No. C. 12638) figured in Plate X, fig. 6.

DIAGNOSIS.—Inner whorls like *Androgynoceras heterogenes* (Young & Bird), but with shorter *maculatum*- (or *Beaniceras*-) stage and with outer whorls resembling *Liparoceras kilsbiense*. Suture-line complex, with slender saddles and external lobe less deep than first lateral. Body-chamber three-quarters of outer whorl.

MEASUREMENTS.

Holotype (Plate X, fig. 6) . .		103	·40	·47	·34
Paratype (No. C. 23494) . .	(140 ?)	100	·42	·45	·31
Plate VI, fig. 1 (transition to *Liparoceras obtusinodus*) .		90	·43	·50	·31

REMARKS.—This species is closely allied to *Androgynoceras sparsicosta* (Trueman) and they are connected by many transitions; both forms are also related to *A. heterogenes*, yet the present species has leanings rather towards *Liparoceras obtusinodus* Trueman, as the intermediate examples figured in Plate VI, figs. 1 *a*, *b*, and Plate XIII, fig. 3, will show. The species also is often so much like *L. kilsbiense* that portions of outer whorls, in the absence of the early *maculatum* or *Beaniceras* stage, could not be distinguished from that form, especially in the more involute or more inflated varieties (e.g. Nos. C. 12637, C. 23492), in which the ornamentation tends to be coarser than in the holotype. *L. obtusinodus* may be said to differ from *L. naptonensis* in its blunt tubercles, more divergent whorl-sides, and distant ventral ribbing; but it probably had a similar, if shorter, early *Beaniceras* stage, and there are many passage-forms as already mentioned.

The paratype, previously figured (in peripheral view) because it showed colour-bands, has more distantly spaced ribbing in the umbilicus, like the smaller example figured in Plate IX, fig. 7; and the still more transitional example represented in Plate X, fig. 6, is already very close to *A. sparsicosta*, especially the coarse variety figured in Plate IX, fig. 4. The specimen from which was taken the suture-line represented in Text-fig. 2 *b* (p. 7) and which has already been referred to (p. 18) on account of its resemblance to Eoderoceratids, probably belongs to a similar passage-form between *L. naptonense* and *A. sparsicosta*. There are also transitions to *Liparoceras geyeri*, nov., e.g. the example figured in Plate X, fig. 4, with the inner whorls bi-tuberculate after a very short and closely-costate *Beaniceras* stage.

L. indecisum, Hyatt sp. (1867, p. 84; 1871, p. 24), which has been described as "exhibiting the planicostan abdomen not later than the fourth whorl," may be close to the present species or to one of the passage-forms above discussed, but none of these has been found at "Lyme Regis," whence Hyatt recorded his *L. indecisum*.

There is a finely ribbed variety (var. **gracilis**, nov.), a peripheral view of the typical example of which is given in Plate XVI, fig. 10, for comparison with Plate X, fig. 6 *b*. The number of tubercles is about the same as in the holotype, but there are three or four peripheral ribs to each instead of two (or rarely three), and the inner whorls show a short capricorn stage, as in the original of Plate VI, fig. 1. Another example listed below (No. C. 16567) was previously mistaken for a *Liparoceras* of the *divaricosta* group when its umbilicus was covered and when its early costate stage was hidden (Spath, 1936*a*, p. 442). Although it belongs to one of the more inflated varieties already referred to, its resemblance to some examples here included in *L. divaricosta* (e.g. No. C. 36967) is so close that, if the inner whorls could not have been developed, its true affinities would never have been discovered. Still another example (No. C. 20901*s*) is almost indistinguishable from the var. *aperta* of *Liparoceras kilsbiense*, but it shows the early costate, and the subsequent coarsely ornamented, stages to a larger diameter even than the holotype of the present species.

HORIZON AND LOCALITY.—*Ibex* zone (*centaurus* sub-zone) and ? *davoei* zone (*maculatum* sub-zone). England (Somerset, Gloucestershire, Warwickshire, Northants, Leicestershire, ? Yorkshire).

SPECIMENS.

20901*r*	(var. *gracilis*)	Kilsby Tunnel, Northants	G. Baker Coll., 1843.
20901*s*		,, ,,	,, ,,
(?) **20918*b***	(very large fragment).	,, ,,	,, ,,
C. 12637		Napton Hill, nr. Southam, Warwickshire	C. H. Watson Coll., 1909.
C. 12638	(Holotype)	,, ,, ,,	,, ,,
C. 12639		,, ,, ,,	,, ,,
C. 12640	(Plate XIV, fig. 6)	,, ,, ,,	,, ,,
C. 16567		Mickleton Tunnel (G.W.R.), Glos.	R. F. Tomes Coll., 1905.
C. 22589	(Plate IX, fig. 7)	Napton, Warwickshire	Sir H. Butlin Coll., 1921.
C. 23492		,, ,,	,, ,,
C. 23494		,, ,,	,, ,,
C. 38327	(Plate VI, fig. 1)	Husbands Bosworth, Leicestershire	History unrecorded.

C. 30420	Napton, Warwickshire	L. F. Spath Coll., 1937.
C. 38421	,, ,, ...	W. E. Cutler Coll., 1925.
C. 38422	Broadway Lane, bed 6, near Welton, Somerset.	J. W. Tutcher Coll., 1937.
C. 38447	Napton, Warwickshire	L. F. Spath Coll., 1937.
C. 38468 (Plate XIII, fig. 3)	,, ,, ...	W. E. Cutler Coll., 1937.
(?) C. 39140 . . .	Robin Hood's Bay, Yorkshire (bed 582)	L. Bairstow Coll., 1937.
(?) C. 39141 . . .	,, ,, ,, (bed 580)	,, ,,

Liparoceras geyeri, sp. nov.

Plate IV, figs. 4–6 ; Plate VI, figs. 2 *a*, *b* ; Plate X, figs. 3 *a*, *b*, 4 *a*, *b* ; Plate XVIII, fig. 11

Compare *Aegoceras striatum* (*non* Reinecke) : Geyer, 1893, *partim*, p. 32, pl. iii, figs. 14 *a*, *b*.
Compare *Aegoceras* cf. *heterogenum* (*non* Young & Bird) : Geyer, 1893, p. 31, pl. iii, figs. 16 *a–c*.

TYPE.—The example (No. C. 38416) figured in Plate X, fig. 3, from the Yellow Lias of Hewlitt's Road, Cheltenham.

DIAGNOSIS.—Sub-platygyral, pachygyral, sub-latumbilicate *Liparoceras*, generally dwarfed. Costate *Beaniceras* stage with broad and flat periphery to about 10 or 12 mm. diameter, then bi-tuberculation. Periphery remaining almost smooth, with only striae of growth, very slightly arched (forwards) in the middle of the venter. Suture-line simple, with wide and broad-stemmed external saddle (Text-fig. 2 *d*, p. 7).

MEASUREMENTS.

Holotype	25	·40	·54	·36
Plate XVIII, fig. 11	26	·40	·56	·36

REMARKS.—This species, being small, has not received much attention, and has either generally been included in *Beaniceras*, with which it occurs in the Belemnite Stone of Dorset, or has been confused with young *Liparoceras* of the type of *L. kilsbiense* (Plate VIII, fig. 5) with which it is associated, e.g. in the Alpine Lias (Geyer, 1893, pl. iii, fig. 13). But it is important on account of its forming a connecting link with *Beaniceras centaurus* (d'Orbigny) and allies, and showing, not only the Liparoceratid nature of these forms, but also the appearance of capricorn ribbing on the inner whorls. It may also be added that Geyer already considered these middle Liassic " *armati* " to be derived from the Sinemurian *Eoderoceras* of the *praecursor* group, which he described from the Hierlatz Mts. Compared with *L. geyeri*, *L. mickletonense* is somewhat farther advanced in the direction of *Androgynoceras henleyi*, and *L. obtusinodus* in the direction of *L. naptonense* ; that is to say, they have a slightly more prolonged costate stage, closely and distantly spaced respectively, but they are neither dwarfed nor do they show such decided leanings towards *Beaniceras*.

The example figured in Plate IV, fig. 5, is probably the centre of a form half-way between the present species and *L. mickletonense*, but like the specimen figured in Plate IV, fig. 4, it is septate to the end. The holotype example figured in Plate X, fig. 3, has half a whorl of body-chamber, and well displays the last few (simplified ?) suture-lines (Text-fig. 2 *d*, p. 7). The fourth specimen (Plate XVIII, fig. 11), half of the body-chamber of which was omitted in the illustration, has a slightly coarser early stage and a less broad periphery, but, as in all the variable species of the genus *Beaniceras*, there are scarcely two individuals identical. This second example had been labelled by Buckman "*Androgynoceras* cf. *parinodus* Quenstedt sp., something between figs. 17 and 26 of pl. 28," but the affinity with *Beaniceras* rather than with *Parinodiceras* or *Platynoticeras* is obvious. In fact, by the incomplete development or absence of the inner tubercle there are produced passage-forms to *B. centaurus* (d'Orbigny), such as the St. Amand (Cher) example figured in Plate X, figs. 7 *a–c*; but this is rather too small and the species is too variable in the young for useful comparison.

The inner whorls figured in Plate IV, fig. 6, agreeing with those of the example represented in Plate X, fig. 4, belong to an evolute variety transitional to *Liparoceras naptonense*, and are characterised by remaining comparatively slender, while already bi-tuberculate. In the typical examples even the costate stage is combined with a strongly depressed whorl-shape, but the typical *L. naptonense* has early capricorn ribbing of the *maculatum* type, i.e. the ribs are distantly spaced.

The example figured in Plate VI, fig. 2, is an interesting passage-form to *Beaniceras crassum* S. S. Buckman. It seems to resemble the specimen figured in Plate X, fig. 4, except in its coarser ornamentation and much more depressed whorls (at a corresponding size); but it retains the flat, comparatively smooth, *Beaniceras* periphery and the ribs, strong and irregular, are placed more-or-less alternately at the ventro-lateral edges, as in some forms of *Beaniceras*. The last half-whorl of the specimen represents the body-chamber.

The present form and *L. mickletonense* are referred to *Liparoceras* rather than to *Androgynoceras*, although they are connected by passage-forms with *A. sparsicosta* and hence *A. heterogenes*, on the one hand, and *A. henleyi* on the other. But, like certain forms with a more-or-less prolonged sub-costate or striate stage, figured in Plate VIII, fig. 3, and Plate IX, fig. 5, reference to *Liparoceras* seems preferable.

In its outer whorl, however, the present form is perhaps less like a *Liparoceras* than the more megalomorph *L. naptonense*, nov., and the original identification of this dwarf species with *A. heterogenes* was very apt.

HORIZON AND LOCALITIES.—*Ibex* zone, *centaurus* sub-zone. England, France, Alps. The inner whorls of a form like *L. geyeri* or *L. mickletonense* from Les Mottes, Vendée (Coll. Sorbonne) are associated with two species of *Beaniceras* of the *centaurus* sub-zone.

SPECIMENS.

C. 16757	(Plate VI, fig. 2)	Stow Hill Cutting (G.W.R.), Glos. .	R. F. Tomes Coll., 1905.
C. 18029	(Plate X, fig. 4)	Cheltenham, Glos. . . .	Old Coll.
C. 22324	(Plate XVIII, fig. 11).	Charmouth, Dorset (Belemnite Stone)	W. D. Lang Coll., 1921.
C. 38416	(Holotype) .	Hewlitt's Road, Cheltenham, Glos. .	L. F. Spath Coll., 1937.
C. 38417	(Plate IV, fig. 4)	Charmouth, Dorset (Belemnite Stone)	,, ,,
C. 38418	(Plate IV, fig. 5)	,, ,, ,,	,, ,,
C. 38419	(Plate IV, fig. 6)	,, ,, ,,	,, ,,
(?) C. 38596–8	. . .	Napton, Warwickshire . . .	W. Wingrave Coll., 1935.

Liparoceras wrighti, nom. nov.

Aegoceras striatum (*non* Reinecke) : Wright, 1881, *partim*, p. 378, pl. xliii only (holotype).

TYPE.—Wright's original, from near Lyme Regis, now in the Survey Collection (No. 25024).

DIAGNOSIS.—Like *L. divaricosta*, but with much coarser ornamentation, i.e. with prominent tubercles and conspicuous ribs between them.

MEASUREMENTS (approximate).

Holotype	230	·47	(?)	·23

REMARKS.—This unique form, although apparently quite different, seems to have its closest ally in *L. divaricosta*, Trueman sp., but it is much more coarsely ornamented. The inner whorls in Wright's figure are restored (probably quite incorrectly) and the forward projection of the peripheral ribs, especially on the first half of the outer whorl, is likewise the artist's invention, and is not shown on the holotype. Besides, the ribs between the two rows of tubercles are normal and not inclined, as shown in the figure. Attached to the specimen (but omitted in the figure) are two examples of *Androgynoceras* and a *Tragophylloceras loscombi* (Sowerby), so that its horizon cannot be below the *lataecosta* sub-zone, but fragments doubtfully referred to this form, or perhaps transitions to *L. divaricosta*, var. *crassa* seem to occur as high as the Red Band (*bechei* sub-zone).

The present species seems to be connected by transitions with the earlier *L. kilsbiense* and *L. heptangulare* (e.g. B.M., No. 20417), but its inner whorls are probably more evolute and of a different type, judging by the other forms from higher horizons, here described as *L. contractum* and *L. subhenleyi*. These, however, are much more finely ornamented.

Buckman in 1905 (Pal. Universalis, pl. 67*a*) considered Wright's pl. xliii to represent *L. cheltiense*; but apart from the difference in size, the present form gradually increases the strength of its ornamentation, whereas in *L. cheltiense* decline sets in at a comparatively early stage. The earlier whorls are also different, and the inner tubercles are proportionately more numerous.

One of the doubtful examples listed below (No. C. 36436) has inconspicuous ribs between the two rows of tubercles, and is therefore transitional to *L. divaricosta*. It is more finely ornamented than the type, especially near the aperture. Another (C. 38322) has more distant tubercles, and a less rapid increase in thickness than the type, but since only part of the body-chamber is preserved, it is uncertain whether the inner whorls may not have been quite different, especially since the dorsal area is narrow, as in *Androgynoceras*. It also shows some resemblance to the largest example of *L. contractum* (No. C. 3714) here listed, but in this the tubercles also are less distantly spaced. One of the remaining fragments seems to have had evolute inner whorls, and may thus have belonged to a form like *Androgynoceras subcontractum*, but it is from a high horizon. It will be seen that none of the listed fragments possibly belonging to different species, helps in the elucidation of the true affinities of *L. wrighti*.

HORIZON AND LOCALITY.—*Davoei* zone, *lataecosta* sub-zone. England (Dorset).

SPECIMENS.

(?) **C. 36436**	St. Gabriel's, Dorset (bed 123*d*)	W. D. Lang Coll., 1935.
(?) **C. 38322**	E. of Ridge Fault, St. Gabriel's, Dorset	,, ,,
(?) **C. 38850**	E. of St. Gabriel's, Dorset (10 feet above Red Band).	,, ,,
(?) **C. 38864**	E. of St. Gabriel's, Dorset (bed 123*g*).	,, ,,

Liparoceras divaricosta (Trueman)

Plate V, figs. 1, 2

Androgynoceras divaricosta,Trueman, 1919, p. 278, pl. xxii, fig. 1.
Androgynoceras aff. *divaricosta* Trueman : Lang, 1936, pp. 434–5.

TYPE.—No. C. 38326 (Plate V, fig. 1).

DIAGNOSIS.—Sub-platygyral, pachygyral, sub-angustumbilicate *Liparoceras*. Whorl-section nearly round, sides slightly flattened, moderately involute (involution not reaching inner row of tubercles) ; flattened costae with two rows of tubercles (34 outer to 29 inner), sharp where test is preserved and appearing at diameter of 20 mm. From the umbilical margin the ribs slope back to the inner tubercles between the tubercles they often divide, usually uniting again at the outer tubercles, splitting into two or three ribs which pass directly across the periphery. Longitudinal striation present. Suture-line with larger external saddle than in most of the earlier species.

MEASUREMENTS.

Holotype (Trueman, p. 278)	142	·42	·57	·27
Trueman, p. 279	120	·48	·56	·30
,,	50	·48	·54	·27

REMARKS.—The holotype is still septate at the end, and the species thus grew to a large size, one fragment (No. C. 38287) belonging to an individual of at least 300 mm. diameter. The peripheral ribbing in the holotype is rather fine and close and fairly regular, and there are several such typical examples ; but a metatype (presented by Prof. Trueman in 1921) has much coarser ventral ribs, there being about 32 to the half whorl (at 120 mm. diameter), as against 50 in the type. The dimensions of this example (var. **crassa,** nov.) are 120 ; ·46 ; ·58 ; ·28, and therefore not strikingly different from those given above. This variety, of which there are several other examples, connects the present species with the still coarser *L. wrighti* on the one hand, and with the more involute *L. kilsbiense* on the other. Even in the var. *aperta* of the last species, however, the inner whorls still resemble those of *L. cheltiense,* whereas in the present species they are of the *lytoceroides* type, foreshadowing *L. subhenleyi* and *Becheiceras.* The example figured in Plate VIII, fig. 3, represents this type of inner whorl, but on the un-figured outer volution the tubercles become rather prominent, so that this specimen is somewhat transitional to the less parinode *L. kilsbiense.* The dimensions (83 ; ·46 ; ·59 ; ·27) again are typical.

L. contractum is more compressed, and the tubercles as well as the ribs between them are more prominent. There are, however, various transitions between the two species, and by reduction of the tuberculation and general equalisation of the ribbing, passage-forms to *L. lytoceroides* are produced (e.g. No. C. 1919).

HORIZON AND LOCALITIES.—*Davoei* zone, *lataecosta* to *bechei* sub-zones. England.

SPECIMENS

C. 1251	(Plate V, fig. 2)	" Lyme Regis." [Dorset Coast] . .	J. E. Lee Coll., 1885.
C. 20232	. . .	Foreshore, S.W. of Golden Cap (bed 122, a few feet above Belemnite Stone).	W. D. Lang Coll., 1919.
C. 23284	(var. *crassa*) .	Bracebridge, Lincs.	A. E. Trueman Coll., 1921.
C. 36423 .	. . .	St. Gabriel's, Dorset (bed 122*f*) . .	W. D. Lang Coll., 1935.
(?) C. 36705.	. . .	Kilsby Tunnel, Northants. . . .	Presd. Kent Education Committee, 1935.
C. 36904	(var *crassa*) .	Stream above Cliff, Westhay Water, E. of Charmouth, Dorset (Red Band, bed 126)	W. D. Lang Coll., 1935.
C. 36962	(var. *crassa*) .	Bracebridge, Lincs.	W. E. Cutler Coll., 1936.
C. 36963–36966	. . .	,, ,, ...	,, ,,
C. 36967–36968	(var. *crassa*) .	,, ,, ...	,, ,,
C. 38287 .	. . .	,, ,, ...	,, ,,
C. 38326	(Holotype, Plate V, fig. 1)	,, ,, ...	Presd. Univ. College, Nottingham, 1936.
C. 38813 .	. . .	Charmouth, Dorset (with *Androgynoceras lataecosta* attached).	L. F. Spath Coll., 1937.
C. 39455 .	. . .	Robin Hood's Bay, Yorkshire (bed 596)	L. Bairstow Coll., 1937.

Liparoceras contractum, sp. nov.

Plate VIII, figs. 1 *a*, *b*

TYPE.—No. 39888 (Plate VIII, fig. 1).

DIAGNOSIS.—Sub-platygyral, sub-pachygyral, sub-angustumbilicate *Liparoceras*. Whorl-section rounded, with slightly flattened sides, bordered by the two rows of tubercles (32 outer to 26 inner). Ribbing very irregular, fine and striate in young as in *L. lytoceroides* (Plate IX, fig. 5). Line of involution just inside outer row. Contraction of final part of body-chamber due partly to decline of tuberculation. Mouth-border plain. Body-chamber three-quarters of last whorl. Suture-line apparently similar to that of *L. lytoceroides*. In the var. **communis,** nov., there is no excentrumbilication, and no appreciable contraction, hence a smaller umbilicus.

MEASUREMENTS.

Holotype	120	·41	·42	·32
var. *communis* (C. 36931)	100	·44	·45	·27
var. *communis* (C. 36959)	144	·43	·46	·29

REMARKS.—The var. *communis* leads to some very inflated forms (with a thickness up to 55 per cent.) which are transitional to *L. divaricosta*, Trueman sp. The first of the two examples of the var. *communis* above listed (No. C. 36931) fortunately retains the impression of its innermost whorls, and these are a miniature representation of the young *L. mickletonense* (Plate XIV, fig. 7). But the capricorn stage persists to a diameter of only about 5 mm., i.e. much less than in the example of *L. lytoceroides* figured in Plate IX, fig. 5; and since such ribbing tends to be developed in many of the more evolute forms of *Liparoceras*, it is not of specific importance. The second example of the var. *communis* (No. C. 36959, labelled by Buckman *Androgynoceras parinodus* Quenstedt sp.) is a polished half, with over three-quarters of a whorl of body-chamber, and the decline of the ornamentation at the end causes so much resemblance to the earlier, and generally more involute, *L. cheltiense* (Murchison), that body-chambers alone could easily be misidentified. One example of *L. cheltiense* (No. C. 36952) in fact, owing to the absence of the coarse septate stage and the breaking down of the ornamentation to about 34 outer and 20 inner tubercles (on the body-chamber) is remarkably like the present species, and differs from examples of the var. *communis* almost only in size.

While *L. wrighti* is more coarsely ornamented, *L. subhenleyi* has much finer ribbing than the form here described. There are, however, transitions to these species, as to *L. divaricosta* and probably to *L. lytoceroides*, although the passage-forms to the last species are known only in fragments.

HORIZON AND LOCALITY.—*Davoei* zone, *lataecosta* sub-zone. England (Dorset).

SPECIMENS.

39888 (Holotype) (Plate VIII, fig. 1).	Charmouth, Dorset	J. Harrison Coll., 1861.
C. 1538	" Lyme Regis," Dorset . . .	Darrell Stephens, 1886.
C. 3714	Unrecorded. [Charmouth, Dorset] .	S. H. Beckles Coll., 1891.
C. 36426 (finely ribbed variety).	Stonebarrow, Charmouth, Dorset (10 feet above Belemnite Stone).	W. D. Lang Coll., 1935.
C. 36931 (var *communis*) .	Stonebarrow, Charmouth, Dorset .	W. Wingrave Coll., 1935.
C. 36959 (var. *communis*) .	Charmouth, Dorset	S. S. Buckman Coll., 1929.
C. 38324 . . .	Stonebarrow, Charmouth, Dorset .	W. D. Lang Coll., 1935.
C. 38325 . . .	E. of Charmouth, Dorset . . .	W. T. Calman Coll., 1937
C. 38633	Stonebarrow, Charmouth, Dorset .	J. W. Tutcher Coll., 1937.

Liparoceras lytoceroides, sp. nov.

Plate V, fig. 5; Plate IX, fig. 5; Plate X, figs. 1 *a*, *b*; Plate XVI, figs. 2 *a*, *b*

Liparoceras lytoceroides Spath MS: Lang, 1936, pp. 433–5.
,, ,, MS.; Spath, 1936, p. 445.

TYPE.—No. C. 36464 (Plate X, fig. 1).

DIAGNOSIS.—Sub-platygyral, pachygyral, sub-angustumbilicate *Liparoceras*. Whorl-section rounded, more-or-less depressed, with lateral area (between the two rows of very faint tubercles) scarcely marked. Ribbing fine and generally reclined, fairly regular; main ribs generally broad on the periphery, with much thinner intercalated or branch ribs reaching across the venter, but not as far as the line of outer tubercles. Innermost whorls more finely ribbed than those of *L. mickletonense*. Body-chamber not quite three-quarters of last whorl. Suture-line (fig. 2 *f*, p. 7) with rather broad external saddle.

MEASUREMENTS.

Holotype (Plate X, fig. 1)	118	·44	·53	·29
Paratype (No. C. 38812)	146	·50	·56	·27
No. C. 1919 (transition to *L. divaricosta*)	146	·46	·53	·23

REMARKS.—The largest specimen known, a body-chamber fragment (No. C. 36376), shows a thickness of 90 mm. to a height of 78 mm. at the apertural end. Unlike the holotype, it has the inner row of tubercles well developed, and the outer row has almost entirely disappeared, while the ribbing is reduced to mere lines of growth, thus enhancing the lytoceratid aspect. The small example figured in Plate IX, fig. 5, belongs to a more depressed and involute variety with less aegoceratid, i.e. finely ribbed, inner whorls, almost like *L. mickletonense*, sp. nov. (p. 73) ; so that a series from *L. lytoceroides* to *Androgynoceras hybrida* on the one hand, and to *L.* (*Becheiceras*) *bechei* on the other, could easily be established, the small example showing great resemblance also to *L. subhenleyi* in its ornamentation. The present form, however, is only indirectly connected with *Becheiceras* and the somewhat intermediate *L. subhenleyi*, though all are derived from the same root-stock. Fragments of body-chambers, however, of *A. henleyi* and the present species may easily be confused, as may also even complete examples, when the umbilicus is covered by matrix.

There are passage-forms to *L. divaricosta*. For instance, a Stroud example (No. C. 9995) might well be taken to represent the septate inner whorls which are lacking in the holotype body-chamber ; but at about 70 mm. diameter the tubercles become more conspicuous, showing that this specimen could not have developed the outer whorl of the typical *L. lytoceroides*, in which the rows of spines are scarcely perceptible. Other examples (Nos. C. 38465, C. 38466), with a less pronounced *lataecosta* stage, are transitional to *L. contractum*, or rather, to a finely ribbed variety (No. C. 36426) of it ; but, except for the more distant spacing of the ribs, they could also be considered passage-forms to *L. subhenleyi*.

HORIZON AND LOCALITIES.—*Davoei* zone, *lataecosta* sub-zone (beds 122*f* to 123*n*). England (Dorset, Gloucestershire).

SPECIMENS.

C. 1919	(transitional to *L. divaricosta*).	Unrecorded. [Charmouth, Dorset] .	T. Wright Coll., 1887.
C. 9873	(Plate IX, fig. 5)	Stroud, Glos.	E. Witchell Coll., 1905.
C. 9995	(transitional to *L. divaricosta*).	,, ...	,, ,,
C. 36376	. . .	St. Gabriel's, Dorset (bed 122*f*) . .	H. M. Muir-Wood Coll., 1935.
C. 36428	. . .	St. Gabriel's, Dorset (bed 122*g*, about middle).	W. D. Lang Coll., 1935.
C. 36433	. . .	St. Gabriel's, Dorset (bed 123*d*) . .	,, ,,
C. 36464	(Holotype) .	,, ,, (bed 123*n*) . .	,, ,,
C. 36743	. . .	E. of St. Gabriel's, Dorset (bed 122*a*), doubtful body-chamber, perhaps of *L. contractum*.	,, ,,
C. 36891	(transitional to *L. divaricosta*).	St. Gabriel's, Dorset (bed 123*n*) . .	,, ,,
C. 38321	,,	E. of St. Gabriel's, Dorset (bed 123) .	,, ,,
C. 38465–6	(Plate XVI, fig. 2)	,, ,, ,,	L. F. Spath Coll., 1937.
C. 38635	(transitional to *L. divaricosta*).	Golden Cap, Dorset	J. W. Tutcher Coll., 1937.
C. 38654	,,	,, ,, ...	Miss V. Gollancz Coll., 1937.
C. 38812	(Paratype) .	,, ,, ...	L. F. Spath Coll., 1937.

Liparoceras subhenleyi, nom. nov.

Plate IV, fig. 7 ; Plate V, figs. 3, 6 ; Plate IX, fig. 6

Aegoceras striatum (*non* Reinecke) : Wright, 1881, *partim*, p. 378, pl. xlii, figs. 2 and 4 only.

TYPE.—Wright's original (No. C. 2211), here re-figured (Plate IV, fig. 7 ; Plate V, fig. 3).

DIAGNOSIS.—Like *L. lytoceroides*, but with a more angular whorl-shape and less compression ; also less regular, coarser ribbing, with forward projection in the median line of the periphery and a general resemblance to the ornamentation of *Becheiceras*. Suture-line with slender external saddle, and external lobe almost as deep as first lateral.

MEASUREMENTS.

Holotype (Plate IV, fig. 4)	87	·44	·59	·26
No. 50132 (Plate V, fig. 6)	69	·52	·56	·22
No. C. 38624	105	·50	·62	·25

REMARKS.—The ammonites figured by Wright as *Aegoceras striatum* belong to three distinct forms, none of which has anything to do with Reinecke's *L.* (*Parinodiceras*) *striatum*. The present finely ornamented species has evolute inner whorls which may or may not be ribbed, and which resemble those of *L. contractum*, *L. lytoceroides*, and especially *L. divaricosta*. The most characteristic feature of the adult shell is the sub-hexagonal, inflated whorl-shape with flattened sides, a deep umbilicus with steep walls, and a broadly arched venter. The figure in Wright is fairly successful, at least in so far as the side-view is concerned, but the ribbing is largely restored and there is no abrupt change in the direction of the ribs. The ventral aspect is not incorrectly drawn, except in the abnormal lateral bulges at the apertural end. The earlier part of the outer whorl of the holotype, in ventral view, is like that of the mal-formation figured in Plate IX, fig. 6, and since the preservation is identical, it is almost certain that the type also came from the Upper Limestone.

This species is interesting on account of its resemblance to *Becheiceras*. The mal-formed example here figured had originally been labelled (by Prof. J. Morris) *Amm. bechei*, and I accepted this identification, until I happened to remove some matrix from the umbilicus (on the side not figured). At smaller diameters the present species is essentially like *L. lytoceroides* (Plate IX, fig. 5) or *L. divaricosta* (Plate VIII, fig. 3) and, since involute sphaerocones leading up to *Becheiceras bechei* persisted side by side with these evolute forms, it is clear that *L. subhenleyi* cannot be referred to that sub-genus. But this resemblance between the present form and *Becheiceras*, due, in my opinion, to their common derivation from forms of *Parinodiceras* or *Vicininodiceras*, shows that the sub-genera of *Liparoceras* are artificial divisions.

L. wrighti and *L. kilsbiense*, to which belong the other two forms of " *Aegoceras striatum* " figured by Wright, are far more coarsely ornamented than *L. subhenleyi*.

HORIZON AND LOCALITY.—*Davoei* zone, *bechei* sub-zone. England (Dorset).

SPECIMENS.

50132	(Plate V, fig. 6)	"Lyme Regis," Dorset	J. Morris Coll., 1867.
C. 2211	(Holotype)	Unrecorded. [Dorset Coast]	T. Wright Coll., 1886.
C. 38624		Charmouth, Dorset	J. W. Tutcher Coll., 1937.

Liparoceras mickletonense, sp. nov.

Plate XI, fig. 4; Plate XIV, figs. 7 *a–c*

TYPE.—No. C. 3161 (Plate XIV, fig. 7).

DIAGNOSIS.—Sub-platygyral, pachygyral, sub-angustumbilicate *Liparoceras*. Whorl-shape and ornamentation as in *L. divaricosta*, Trueman sp. (compare Plate VIII, fig. 3 *a*, and Plate XIV, fig. 7 *a*), but umbilicus tending to be wider, and line of involution nearer outer tubercle. The stage of closely-set ribs, following on the earliest, smooth stage, persists to a diameter of about 15–20 mm., when the ribs become blunt, irregular, and indistinctly bi-tuberculate. After 40 mm. typical reclined ornamentation is established, as in *L. divaricosta*. Suture-line similar to that of *L.* aff. *lytoceroides* (Text-fig. 2 *f*, p. 7) with external lobe as deep as the asymmetrically trifid first lateral lobe.

MEASUREMENTS.

Holotype (Plate XIV, fig. 7)	70 (60)	·44	·56	·32

REMARKS.—This species could have been regarded as a variety of *L. divaricosta*, since the outer whorls of the two are indistinguishable. But the regularly costate inner whorls (figured separately in Plate XIV, figs. 7 *b*, *c*) make it an important passage-form between *Liparoceras* and *Androgynoceras*, one, moreover, distinct from such other, and presumably earlier, transitions between the two genera as *L. obtusinodus* Trueman. The ribbing of the inner whorls is slightly flexuous and weakened on the periphery, thus resembling that of *Beaniceras* as much as the ventral costation of the true capricorns. As already mentioned, the bi-tuberculate *L. geyeri*, sp. nov., has somewhat similar early volutions, and is now included in the same genus as the present form; but there is a rather considerable gap between this and *Androgynoceras* of the *henleyi* group, whereas *Liparoceras geyeri* and *L. naptonense* are as intimately linked with the *heterogenes* group as with *L. obtusinodus*.

Nor can *L. mickletonense* well be generically separated from species like *L. contractum* and *L. lytoceroides* discussed above, which may have more-or-less distinct ribbing on the early whorls, or from the transitions between *L. contractum* and *L. subhenleyi* and *L. divaricosta*, recorded above. The evolute inner whorls of all these may, therefore, be indistinguishable in the absence of the outer volutions.

A larger specimen (C. 10207), labelled by Buckman "*Platypleuroceras*" and still septate at 120 mm. diameter, does not seem to differ from some of the less finely ribbed examples of *L. divaricosta* listed above. At the beginning of the outer whorl, however, the ribs show that peculiar bundling which characterises the *Androgynoceras* type of ornamentation at that transitional stage where the early capricorn ribbing gives place to the later *Liparoceras* sculpture. Since the inner whorls are unrecognisable, it is possible that the example in question is a true *Androgynoceras*; but it is now doubtfully listed here, because its proportions are approximately those of the present species, and differ from those of the species of *Androgynoceras* here described.

HORIZON AND LOCALITY.—*Davoei* zone, *lataecosta* sub-zone. England (Gloucestershire).

SPECIMENS.

C. 3161 (Holotype) . .	Mickleton Tunnel, Glos. . .	G. E. Gavey Coll., 1890.
(?) **C. 10207** . . .	Stroud, Glos.	E. Witchell Coll., 1905.

Sub-genus BECHEICERAS Trueman, 1918, emend.

SUB-GENOTYPE.—*Aegoceras bechei* (Sowerby) Wright, 1881, pl. xli, figs. 1–2.

DIAGNOSIS.—Involute *Liparoceras* with very delicate ornamentation, transverse and longitudinal, especially in the young, appearing before tuberculation. Ribs lying between the two rows of tubercles always less prominent than ventral ribs. External lobe much shorter than first lateral lobe which, especially in late species, undercuts the external saddle.

DISTRIBUTION.—Lower and Upper Pliensbachian (Carixian and Domerian), *davoei* to *margaritatus* zones. Europe, Atlas Mts., Dutch East Indies.

Liparoceras (*Becheiceras*) *bechei* (J. Sowerby)

Plate VIII, figs. 2 *a*, *b* ; Plate XI, figs. 1, 2 ; Plate XXIV, fig. 1

Ammonites bechei J. Sowerby, 1821, p. 143, pl. cclxxx.
,, ,, ,, Brown, 1837, pl. ix, fig. 12.
,, ,, ,, Quenstedt, 1846, p. 135.
,, ,, ,, Bronn, 1848, Index, p. 45 (*partim*).
,, ,, ,, Morris, 1854, p. 290.
non ,, *bechii* ,, Simpson, 1855, p. 70.
Ammonites henleyi (*non* J. Sowerby) : Brauns, 1871, p. 218 (*partim*).
Androgynoceras bechei (Sowerby) : Hyatt, 1874*a*, p. 24.
Liparoceras bechei (Sowerby) : Hyatt, 1874*a*, p. 27.
non Aegoceras bechei (Sowerby) : Blake, in Tate & Blake, 1876, p. 281.
Aegoceras bechei (J. Sowerby) : Wright, 1881, *partim*, p. 380, pl. xli, figs. 1–2 (3–4).
Ammonites bechei J. Sowerby : Quenstedt, 1884, p. 234, pl. xxix, fig. 8.
non Aegoceras bechei (J. Sowerby) : Gemmellaro, 1884, p. 19.
Aegoceras (*Liparoceras*) *bechei* (J. Sowerby) : Parona, 1897, p. 15, pl. xi, fig. 3.
Aegoceras daedalicosta Trueman, 1919, p. 276, pl. xxii, fig. 3.
Liparoceras (*Becheiceras*) *bechei* (Sowerby) : Dacqué, 1933, pl. iv, fig. 2 (copy of Wright, pl. xli, figs. 3–4) ; 1934, p. 292.
Liparoceras (*Becheiceras*) *bechei* (J. Sowerby) : Lang, 1936, p. 435.
,, ,, ,, ,, Spath, 1936, p. 445.
non Liparoceras bechel (Sowerby) : de Brun and Brousse, 1936, p. 37.

TYPE.—Sowerby's original (De la Beche Coll.) is neither in the British Museum nor the Survey Collections, and is presumably lost. It is undoubtedly conspecific with, and from the same bed as, the metatype in the Sowerby Collection, figured in Plate XI, fig. 1.

DIAGNOSIS.—Involute sphaerocones, with rounded whorl-section, generally slightly wider than high, and numerous close ribs, only very gradually becoming more distantly spaced on outer whorls. Suture-line with slender external saddle only slightly undercut by first lateral lobe.

MEASUREMENTS.

Holotype (figure and text) . .	80	·56	·56	·08
No. C. 28628	87 (80)	·58	·58	·08
C. 2210 (Wright, pl. xli, figs. 1, 2) .	120	·57	·61	·08
No. 36668	145	·57	·59	·08
No. C. 1 (Plate XXIV, fig. 1) . .	285	·53	(?)	·16
No. C. 38629 (var. **obesa,** nov., Plate XI, fig. 2)	77	·62	·67	·05

REMARKS.—The missing holotype, by its colour alone, can be definitely identified as having come from the Red Band; and since it can be perfectly matched by numerous well-preserved examples, there can be no doubt about the interpretation of this species. Trueman considered as a typical example of the present species an Upper Limestone form (here referred to *L. gallicum*), and he created a new species (*Aegoceras daedalicosta*) for the restricted *L.* (*B.*) *bechei*; but this was due largely to the imperfect preservation of his material. The large holotype of *Aegoceras daedalicosta* looks distinct enough from typical, small examples of *L.* (*B.*) *bechei*, of the size of that figured by Sowerby; but more complete and larger specimens (e.g. Nos. C. 36468 and C. 1) clearly show that the holotype of Trueman's *Aegoceras* "*daedalicosta*" is merely a fragment of a large individual of *L.* (*B.*) *bechei*. There are examples with the characteristic "*daedalicosta*" ornament fully developed at 150 mm. diameter (No. C. 36468), and others in which the finer "*bechei*"-ribbing persists to the end (e.g. No. C. 38346, W. D. Lang Coll.) at over 200 mm. But in the case of Sowerby's type-specimen, or of such immature examples of *L.* (*B.*) *bechei* as those figured in Plate VIII, fig. 2, and Plate XI, fig. 1 (and undoubtedly from the same bed), it is impossible to tell what the shell would have been like at a larger size. For the type-specimen of *L.* (*B.*) *daedalicosta* itself has still more finely ribbed inner whorls than the typical *L.* (*B.*) *bechei* as drawn by Sowerby, but so also has a second example of the closely ribbed form, while typical "*daedalicosta*" outer whorls may have inner whorls that are more coarsely ribbed than the typical *L.* (*B.*) *bechei*. To restrict the present species thus, to the comparatively rare forms in which the close ribbing persists to a large diameter, and to use the name *daedalicosta* for the examples with coarse ribbing on the outer whorls, is impracticable, and makes it impossible to name specifically such examples as those figured by Wright (1881, pl. xli, especially the original of figs. 3–4, which is not in the Wright Collection), Meister (1914, pl. xii, fig. 7), or Schröder (1927, pl. xii, fig. 6). The variability of *L.* (*B.*) *bechei*, in fact, is as great as that of *L.* (*B.*) *gallicum*, and there are many intermediate forms between the two extremes mentioned, including some very large and complete examples.

There is a single example (No. C. 138) from the Red Band in which the position of the rows of tubercles and especially the absence of inflation, suggest comparison with *L.* (*B.*) *gallicum*; but at about 45 mm. diameter this individual returned to very fine and close costation, so that it cannot be separated from *L.* (*B.*) *bechei*. Conversely the very inflated var. *obesa*, nov. (Plate XI, fig. 2) also can only be differentiated at smaller diameters.

L. rotticum Krumbeck (1922, p. 198, pl. xiv, fig. 8, pl. xviii, figs. 1, 2) shows resemblance to *Becheiceras* or, at least, the larger paratype (fig. 1) does, whereas the lectotype (fig. 2) may be a *Parinodiceras* judging by its whorl-section. In any case, it was compared to *L.* (*P.*) *laeve*, Quenstedt sp., and not to *L.* (*B.*) *bechei*; but the button-and-loop ornamentation of the area between the two rows of tubercles is suggestive of *Becheiceras*.

L. (*B.*) *nautiliforme* J. Buckman (see p. 79), which resembles certain transitions from *L.* (*B.*) *bechei* to *L.* (*B.*) *gallicum* in side-view, has a much broader venter, coarser tubercles, and strongly inclined umbilical ribbing, but inner whorls again are difficult to distinguish from those of *L.* (*B.*) *bechei*. On such inner whorls is probably based D. Del-Campana's *Lyparoceras navianii* (Boll. Soc. geol. ital., vol. xix, 1900, p. 58, pl. vii, figs 43-44).

Horizon and Localities.—*Davoei* zone (*bechei* and *figulinum* sub-zones). Europe.

Specimens.

36668	Charmouth, Dorset	R. Damon, 1857.
39731	" Lyme Regis ", Dorset	R. Etheridge Coll., 1860 ?
67965	,, ,,	R. Etheridge Coll., 1869.
C. 1 (Plate XXIV, fig. 1)	Charmouth, Dorset	R. Damon, 1881.
C. 3	,, ,,	,,
C. 138	Unrecorded. [Dorset Coast]	J. Tennant, 1881.
C. 2210	Charmouth, Dorset. (Figured Wright, 1881, pl. xli, figs. 1–2.)	T. Wright Coll., 1886.
C. 3647	Dorset	S. H. Beckles Coll., 1891.
C. 17634	Unrecorded. [Dorset Coast]	Sowerby Coll., 1861.
C. 17635 (Plate XI, fig. 1)	,, ,, ,,	,, ,,
C. 17976 (Plate VIII, fig. 2)	Charmouth [" Lyme Regis "], Dorset	J. F. Blake Coll., 1907.
C. 20231	Gully of St. Gabriel's Water, Dorset (Red Band, bed 126*c*). (Holotype of *Aegoceras daedalicosta* Trueman).	W. D. Lang Coll., 1919.
C. 36466	St. Gabriel's, Dorset (bed 125*b*, 4 inches from top).	W. D. Lang Coll., 1935.
C. 36468	St. Gabriel's, Dorset (bed 126*c*)	,, ,,
(?) **C. 36895**	Stonebarrow, Charmouth, Dorset (bed 129).	,, ,,
C. 38276	Unrecorded. [Dorset Coast]	Sowerby Coll., 1935.
C. 38277	Stonebarrow, Charmouth, Dorset	W. Wingrave Coll., 1935.
C. 38278	,, ,, ,,	,, ,,
C. 38315	Charmouth, Dorset	L. Bairstow Coll., 1932.
C. 38338	Westhay Water, E. of Charmouth, Dorset (Red Band, bed. 126).	W. D. Lang Coll., 1937.
C. 38339–41	,, ,, ,,	W. D. Lang Coll., 1935.
C. 38342–3	Stonebarrow, Charmouth, Dorset (Red Band, bed 126).	,, ,,
C. 38344	St. Gabriel's, Dorset (bed 126*e*).	,, ,,
C. 38345	Stonebarrow, Charmouth, Dorset (bed 126); 2 pieces.	,, ,,
C. 38346	E. of St. Gabriel's, Dorset (bed 125).	,, ,,
C. 38347	Charmouth, Dorset (bed 126)	,, ,,
C. 38363	,, ,,	,, ,,
C. 38628	,, ,, (Red Band, bed 126)	L. F. Spath Coll., 1937.

C. 38629 (Plate XI, fig. 2, var. *obesa*).	Charmouth, Dorset (Red Band, bed 126)	L. F. Spath Coll., 1937.
C. 38630–31 . . .	,, ,, ,, ,,	,, ,,
C. 38632	Chipping Norton, Oxfordshire . .	,, ,,
C. 38637	Charmouth, Dorset	J. W. Tutcher Coll., 1937.
C. 39182	Pouilly-en-Auxois, Côte d'Or, France .	N. Boubée, 1938.
C. 39340	Rivière, Aveyron, France . . .	Exch. H. Contaut, 1938.

Liparoceras (*Becheiceras*) *gallicum* Spath

Plate VIII, figs. 6 *a*, *b* ; Plate XI, fig. 3 ; Plate XXV, figs. 2 *a*, *b*

Ammonites bechei J. Sowerby : d'Orbigny, 1844, p. 278, pl. lxxxii.
,, ,, ,, ,, 1850 (Prodrome, I), p. 224.
(?) ,, ,, ,, Terquem, 1855, pp. 16–17.
Becheiceras bechei (J. Sowerby) : Trueman, 1919, *partim*, p. 288, (W. D. Lang Coll., No. 4073).
Liparoceras (*Becheiceras*) *gallicum* Spath : Lang, 1936, p. 435.
,, ,, ,, ,, Spath, 1936*a*, p. 445.

TYPE.—B. M. No. C. 36716 (Plate XI, fig. 3).

DIAGNOSIS.—Like *L.* (*B.*) *bechei*, but more compressed in young, and with ribbing becoming distantly spaced much more rapidly. Suture-line similar.

MEASUREMENTS.

Holotype (Plate XI, fig. 3)	145	·55	·50	·15
Plate VIII, fig. 6	71	·58	·55	·11
No. 39731	112	·57	·52	·12
No. C. 2271	145	·57	(?)	·14
No. 37043 (coarse variety)	225	·52	·45	·19

REMARKS.—This species, of which a small English example, a larger French specimen, and the medium-sized holotype (with a quarter of a whorl of body-chamber) are here figured, differs from *L.* (*B.*) *bechei*, J. Sowerby sp. (=" *Aegoceras* " *daedalicosta* Trueman) in its less inflated whorl-shape and especially in its ribbing. This becomes coarse and comparatively distantly spaced at a fairly early stage, and the outer row of tubercles is far more prominent than in *L.* (*B.*) *bechei*. In the typical specimen (Plate XI, fig. 3) of 145 mm. diameter there are about 68 peripheral ribs ; in two others of 112 and 145 mm. diameter respectively (B.M., Nos. 39731 and C. 2271) about 68 and 65, but in a particularly coarse variety (B.M., No. 37043 from Curcy, Calvados) there are only 60 at the comparatively gigantic size of 230 mm., where the last septal edge occurs. Conversely, there is a more finely ribbed variety, resembling the ammonite figured by Chapuis (1858, pl. v, fig. 2) as *Amm. henleyi*, in which the closely-spaced ribbing of the early stage persists to a larger diameter than in the typical specimens. An example of this variety (B.M., No. C. 2786) which may be considered transitional to the typically more inflated *L.* (*B.*) *bechei*, has 80 peripheral ribs at the size of d'Orbigny's figure ; but the largest example seen (B.M., No. C. 17870) still has only about 80 ribs on the venter at 390 mm. diameter, whereas the largest *L.* (*B.*) *bechei* before me has 110 ventral ribs at 400 mm. diameter, 65 of them on the first half alone.

Although *L.* (*B.*) *gallicum* is as common as the more globose *L.* (*B.*) *bechei*

(=*B. daedalicosta*), it is difficult to find two individuals (of either species) that are perfectly alike. Variability, of course, also affects the whorl-section, and passage-forms to *L.* (*B.*) *bechei* result when individuals of the finely-ribbed variety (e.g. B.M., No. 52108*b*) acquire a more rounded whorl-shape (height=thickness=67 mm.). The position of the two rows of tubercles also varies; in d'Orbigny's figure the distance between the two rows has increased from 38 to 46 per cent. of the whorl-height between the beginning and the end of the outer whorl. In the smaller English example here illustrated (Plate VIII, fig. 6 *a*) the distance is seen to remain constant, but the distances from the umbilical suture and from the periphery, respectively, have changed.

In a typical Subles (Calvados) example (Sorbonne Coll., No. 10)—of dimensions 111; ·57; ·51; ·13—the distance between the tubercles has decreased from 42 to 36 per cent. of the whorl-height. Its inner whorls are identical with the specimen from the same locality figured in Plate XXV, fig. 2.

FIG. 11.—*Liparoceras* (*Becheiceras*) *gallicum*, Spath. External suture-line, natural size, of an example transitional to *L. pseudostriatum* Trueman. Charmouth, *davoei* zone. No. C. 38600.

It might be added that the example (No. C. 38600) of which the suture-line is figured in Text-fig. 11, unfortunately from an unknown horizon in the *davoei* zone, has only 13 outer, and 9 inner, tubercles (to the half-whorl, at about 150 mm.), as against 18 and 13, respectively, in the holotype, and thus seems directly transitional to *L. pseudostriatum* Trueman. A similar, but smaller, example (No. C. 38849) also suggests that there is an un-named intermediate species. A large Wurtemberg example (No. C. 38811) is entirely septate at 200 mm. diameter, and has about 28 outer tubercles on the last whorl. Although labelled *Liparoceras striatum* from Lias gamma, it is probably from the *davoei* bed (preserved in limestone), and it is interesting because, when the umbilicus was largely covered by matrix and thus seemed comparatively large, the specimen did indeed greatly resemble a *Liparoceras*, the only comparable and large species being *L. wrighti*.

SPECIMENS.

34595	Milhaud, Aveyron, France. (See Oppel, 1856, p. 164).	M. Saemann, 1855.
37043	Curcy, Calvados, France . . .	Tesson Coll., 1857.
37185*a*, *b* . . .	Vieuxpont, Calvados, France . .	,, ,,
39731	" Lyme Regis ", Dorset . . .	R. Etheridge Coll., 1860.
52108*a* (Plate VIII, fig. 6)	,, ,, . . .	R. Damon, 1867.
52108*b*	,, ,, . . .	,, ,,
75119	" Lyme Regis ", Dorset. (2 halves)	Toulm. Smith Coll., 1869.
C. 1250	[Dorset Coast]	J. E. Lee Coll., 1885.
C. 1911	Unrecorded. [Dorset Coast] . .	T. Wright Coll., 1887.
C. 2271	" Lyme Regis ", Dorset . . .	F. Harford Coll., 1888.
C. 2786	" Cheltenham " [Dorset Coast] . .	J. Baber Coll., 1889.
C. 3715 (transition to *L.* (*B.*) *bechei*).	Unrecorded. [Dorset Coast] . .	S. H. Beckles Coll., 1891.
C. 6117	Charmouth, Dorset	T. J. Slatter Coll., 1896.
C. 17870	Stonebarrow (above Red Band), Charmouth, Dorset.	T. Hunter, 1912.
C. 18068	" Lyme Regis ", Dorset	J. F. Blake Coll., 1907.
C. 20244	Stonebarrow (Upper Limestone) Charmouth, Dorset.	W. D. Lang Coll., 1919.
C. 36716 (Holotype) . .	Unrecorded. [Dorset Coast] . .	J. F. Blake Coll., 1907.
(?) C. 36896	Stonebarrow (few feet above Upper Limestone), Charmouth, Dorset.	W. D. Lang Coll., 1935.
C. 36961	Charmouth, Dorset	T. F. Grimsdale Coll., 1929.
C. 38316	,, ,, ...	L. Bairstow Coll., 1932.
C. 38318	Golden Cap, Dorset	G. W. Butler Coll., 1928.
C. 38330–32	Charmouth, Dorset	P. Bidwell Coll., 1937.
C. 38333	Below Upcot Farm, N. of St. Gabriel's, Dorset (not in place).	W. D. Lang Coll., 1935.
C. 38334–36	Charmouth, Dorset	W. Wingrave Coll., 1935.
C. 38351	,, ,, (bed 129*a*) . .	W. D. Lang Coll., 1935.
C. 38600	Charmouth, Dorset	L. F. Spath Coll., 1937.
C. 38618-19 (Plate XXV, fig. 2).	Subles, Calvados, France . . .	Dr. F. Krantz, 1937.
C. 38623-24	Charmouth, Dorset	J. W. Tutcher Coll., 1937.
C. 38625	,, ,, ...	L. F. Spath Coll., 1937.
C. 38626	[France ?]	,, ,,
C. 38627	Charmouth, Dorset	,, ,,
C. 38811	Maitis, Hohenstaufen, Wurtemberg .	C. Allmendinger, 1937.
C. 38848	Stonebarrow Cliff, Charmouth, Dorset .	W. D. Lang Coll., 1935.
(?) C. 38849 (sp. nov. ?) .	,, ,, ,, .	,, ,,
C. 39133	St. Amand, Cher, France . . .	N. Boubée, 1938.

Liparoceras (*Becheiceras*) *nautiliforme* (J. Buckman)

Plate III, figs. 2 *a*, *b* ; Plate XII, figs 1 *a*, *b*

Ammonites bechei Sowerby : Zieten, 1831, pl. xxviii, figs. 4 *a*, *b* (5 *b*).
Ammonites nautiliforme J. Buckman, in Murchison, 1844, pp. 90, 105.
Ammonites striatus, non Reinecke : Quenstedt, 1884, pl. xxix, figs. 4–6 (and 1 ?).
Aegoceras nautiliforme (J. Buckman) : S. S. Buckman, 1911, p. 37*b*, pls. xxxvii, A–D.
Anisoloboceras nautiliforme (J. Buckman) : Trueman, 1919, p. 263.
,, ,, ,, Neaverson, 1928, p. 335.
Liparoceras (*Anisoloboceras*) *nautiliforme* (J. Buckman) : Spath, 1936*a*, p. 445.
Liparoceras nautiliforme (J. Buckman) : Dubar, 1938, C. R. Soc. géol. France, fasc. 6, p. 94.

TYPE.—J. Buckman's original from Dumbleton, Gloucestershire, figured by

S. S. Buckman (1911) and now in the Manchester Museum (*fide* A. E. Trueman, 1919, p. 259).

Diagnosis.—Stout, bi-tuberculate sphaerocones, like *L.* (*B.*) *bechei*, but with a broader venter, coarser tuberculation, appearing later, and especially a short external saddle, deeply undercut by the spreading, large, first lateral lobe (see Text-fig. 7 *c*, p. 21).

Measurements.

Holotype	156	·57	·72	·08
No. 48839	205	·60	(?) ·70	·10
No. C. 38784	156	·59	·69	·10

Remarks.—The holotype and a second example from South Petherton, Somerset, figured by Buckman, are far more favourably preserved than the two English specimens listed below, which, therefore, are not now illustrated. The larger specimen, whose dimensions are given above, is septate almost to the end and well shows the undercutting of the external saddle by the extremely wide and deep first lateral lobe. The smaller example, at 125 mm. diameter, also just includes the last suture-line which, however, is not quite so extreme. This second example is also slightly less inflated, although, compared with the similarly ornamented *L.* (*B.*) *gallicum*, its very broad and flattened periphery is most conspicuous. It may be added that the present species is not so rare as appeared (Spath, 1936*a*, table on p. 451) and that Dr. Welch has recently collected a considerable number of specimens for the Geological Survey from the Middle Lias of the Dorset Coast and neighbourhood.

The largest of the four pyritised Wurtemberg examples listed below, a magnificent specimen, has the longitudinal ornament as strikingly displayed in peripheral view as in the original of S. S. Buckman's pl. xxxvii D. A smaller example, slightly mal-formed and showing a peripheral groove, is figured in Plate XII, figs. 1 *a*, *b*. It illustrates the difference between the strong, crenulate ribs of the test and the blunt and low ribs of the cast, though not so well as a similar, but normal, third specimen in a better state of preservation. The smallest example, of 56 mm. diameter (Plate III, fig. 2), differs from *L.* (*B.*) *bechei* of similar size chiefly in its coarser ribs and in the late appearance of the tuberculation.

Ammonites spinellii Hauer (1861, p. 416, pl. i, figs. 13–15) is probably the young of the present species, since it is more inflated than the immature *L.* (*B.*) *bechei* which, however, has a similarly undercut external saddle. *Amm. woodwardi* Reynès (1868, p. 99, pl. v, figs. 4 *a–c*) by its smoothness and high horizon (*margaritatus* zone) would appear to be another immature *Becheiceras*; but its suture-line with a low external lobe is that of a true *Liparoceras s. str.* Some of the Aveyron specimens listed below, which appear to include transitions to *Metacymbites*, may belong to this incompletely known *L. woodwardi*; but they are all very small.

Horizon and Localities.—Domerian, *margaritatus* zone. England, France, Germany, Italy, Morocco.

Specimens.

48839	Yeovil, Somerset	R. Damon, 1864 ?
C. 17816	[Unrecorded.] Dorset ? . . .	Sowerby Coll., 1861.

C. 38784–6 . . .	Reutlingen, Wurtemberg . . .	C. Allmendinger, 1937.
C. 38787	Eislingen, Wurtemberg . . .	,, ,,
C. 39346–47 (*L. spinellii*) .	Tournadous, Aveyron, France. . .	Exch. H. Contaut, 1938.
C. 39348 ,, .	Rivière, Aveyron, France . . .	,, ,,
C. 39349–50 ,, .	Samartha, Aveyron, France . .	,, ,,
C. 39351–43 ,, .	Lebourg, Aveyron, France . . .	,, ,,
C. 39359–62 . . .	,, ,, ,, . . .	,, ,,

Sub-genus PARINODICERAS Trueman, 1918, p. 66, emend.

SUB-GENOTYPE.—*Ammonites striatus parinodus* Quenstedt, 1884, p. 225, pl. xxviii, fig. 16 (lectotype).

DIAGNOSIS.—Parinode *Liparoceras*, with more-or-less elevated whorls and flattened whorl-sides between the two rather distantly placed rows of tubercles. Ornamentation rather delicate, with ribs never prominent between the nodes. Suture-line complex, with external lobe less long than first lateral.

DISTRIBUTION.—*Jamesoni* zone. Europe, Dutch East Indies.

REMARKS.—Trueman in 1918 (p. 66) cited Quenstedt's fig. 6 as genoholotype, but this is a slip for 16. In 1919 (p. 264) the correct reference was given, but the parinode series 1 and 2 are not here considered to represent distinct genera.

Liparoceras (*Parinodiceras*) *reineckii* (Quenstedt)

Plate I, figs. 2 *a*, *b*

Ammonites striatus reineckii Quenstedt, 1884, p. 223, pl. xxviii, fig. 5.
Liparoceras striatum reineckii (Quenstedt) : Haug, 1887, p. 106.
Parinodiceras reineckii (Quenstedt) : Trueman, 1919, p. 288.
non Parinodiceras reineckii (Quenstedt) : Buckman, 1927, pl. 748 A, B.

TYPE.—Quenstedt's original (University of Tübingen) from the Lias γ of Hinterweiler, Wurtemberg.

DIAGNOSIS.—See sub-generic diagnosis. Thickness greater than whorl-height.

MEASUREMENTS.

Quenstedt's figure	69	·56	(?)	·12
Plate I, fig. 2 (No. C. 11606) . .	58	·57	·57	·12

REMARKS.—Quenstedt did not figure an apertural view of his *Amm. striatus reineckii* [*sic*], but he specially mentioned that the increase in thickness was rapid, and that the breadth of the mouth always exceeded the height. He thought that his Suabian examples were not perfectly identical with the Franconian [Coburg] type, but in the absence of material from the type locality and in view of the diagrammatic nature of Reinecke's drawing (1818, p. 85, pl. viii, fig. 65), I am not in a position to say whether the differences are specific. Quenstedt's reservation seems all the more surprising since he failed to recognise the real differences between his forms and the ammonites figured by Wright. *L. subhenleyi*, however (=*Aegoceras striatum* Wright, *partim*, pl. xlii, fig. 2), though with less stable ornamentation and with evolute, costate inner whorls, shows the essential uniformity of all the sub-genera of *Liparoceras*.

Buckman's *Parinodiceras reineckii* (1927, pl. 748), now in the Survey Collection, is neither identical with Quenstedt's type nor with the original *L.* (*P.*) *striatum* (Reinecke), being more coarsely and more irregularly ornamented at the same diameter, and having more compressed whorls. It is therefore now re-named *L.* (*P.*) **radstockense,** nom. nov. In the example of *L.* (*P.*) *reineckii* here figured (Plate I, figs. 2 *a*, *b*) the thickness is about the same as the whorl-height (33 mm.), but the outer tubercles are more closely spaced than in the type, so that in this respect it may be considered a transition to *L.* (*P.*) *laeve* Quenstedt sp. (1884, pl. xxviii, fig. 6). The lectotype of *L.* (*P.*) *parinodus* (Quenstedt's fig. 16), on the other hand, is still more compressed than *L.* (*P.*) *radstockense*, and more finely ornamented at a small diameter.

L. (*P.*) *radstockense* is not represented in the collection, the holotype being unique.

HORIZON AND LOCALITIES.—*Jamesoni* zone. Germany, France.

SPECIMEN.

C. 11606	Ofterdingen, Wurtemberg . .	Caroline Birley bequest, 1907.

Liparoceras (*Parinodiceras*) *parinodus* (Quenstedt)

Plate VI, figs. 5 *a*, *b*; Plate XXV, figs. 1 *a*, *b*, 4, 5 *a*, *b*

Ammonites striatus parinodus Quenstedt, 1884, p. 225, pl. xxviii, fig. 16.
Parinodiceras reineckii (Quenstedt): Trueman, 1919, p. 288.
,, ,, ,, Tutcher and Trueman, 1925, p. 652.

TYPE.—The original of Quenstedt's pl. xxviii, fig. 16 from Ofterdingen, Wurtemberg.

DIAGNOSIS.—Like the last, but with whorl-height greater than thickness instead of the reverse, and therefore with different proportions.

MEASUREMENTS.

Holotype (Quenstedt's fig. 16) . .	86	·56	·38	·14
No. C. 38370	88	·56	·40	·13
var. **stenonotus,** nov. (Plate VI, fig. 5) .	75	·52	·36	·19

REMARKS.—Quenstedt's type, represented diagrammatically in Text-fig. 1 *c*, p. 5 (reversed for convenience of comparison), can be well matched by some Radstock examples from Mr. Tutcher's collection, which, although somewhat deformed and flattened by pressure, cannot have belonged to the far more inflated *L.* (*P.*) *reineckii*. The two larger of the three Radstock examples differ slightly from each other in the number of peripheral ribs and, in both, the costae that connect the two rows of lateral tubercles are not very regular, but are even separated occasionally by fine intermediate ribs which form extensions of ventral costae that do not end at an outer tubercle. This irregularity is also found in *L.* (*P.*) *radstockense*, nom. nov., discussed above, which, however, has much coarser ornamentation and is less compressed.

It is possible that the two Radstock examples just mentioned belong to a late mutation of *L.* (*P.*) *parinodus*, especially if their reference to the *ibex* (=*valdani*) zone (in Trueman) is correct. But they were associated with the example figured in Plate VI, fig. 5, which shows the most typical regularity in ornamentation and the closest similarity to Quenstedt's figures and typical Wurtemberg specimens. In its narrow periphery, this variety (var. *stenonotus*, nov.) resembles the fragment figured by Quenstedt (1884, pl. xxviii, fig. 22) as the thinnest variation of his *Amm. striatus parinodus* (or *Amm. striatus compressus*); but the obviously very large umbilicus of this fragment makes it doubtful whether it did not belong to a species of *Platynoticeras* discussed below. It will be noticed, however, that even in the examples of the var. *stenonotus*, here figured, the umbilicus distinctly opens out in the adult, and only about half of the perfectly smooth inner whorl is covered by the overlapping outer whorl.

Of three typical Wurtemberg examples of the var. *stenonotus* in the Collection, one has dimensions 73; ·55; ·36; ·18 and is essentially like the Radstock example, but complete. Another, figured in Plate XXV, figs. 5 *a*, *b*, is still more compressed, or rather, it has a narrower periphery; while the example represented in fig. 4 has a wider venter, and is thus transitional between the typical *L.* (*P.*) *parinodus* and the var. *stenonotus*. The large specimen illustrated in the same plate (XXV, fig. 1) may be a passage-form to *L.* (*P.*) *laeve* Quenstedt sp., since it is fairly smooth and more rounded ventrally; it is placed beside a typical, and similarly pyritised, Subles example of *L.* (*Becheiceras*) *gallicum* Spath (Plate XXV, fig. 2) to show the very close resemblance between the two species, even the extremely intricate suture-lines being very similar.

It may be added that the specimens are not too well preserved, and only one shows traces of the test, yet it can be seen that the spiral striation of test and internal cast must have been almost as well developed as in any *Becheiceras*. The suture-line of one of the larger examples is even more complex than that shown in Plate I, fig. 2 *a* (at a smaller diameter) and has the large first lateral lobe reaching considerably below the base of the external lobe.

Horizon and Localities.—*Jamesoni* (and *ibex*?) zone. Germany, France, England (Somerset, Yorkshire).

Specimens.

C. 38788 (Plate XXV, fig. 1)	Nürtingen, Wurtemberg . . .	C. Allmendinger, 1937.
C. 38789–91 (Plate XXV, figs. 4, 5).	,, ,, . . .	,, ,,
(?) **C.** 38792 . . .	,, ,, . . .	,, ,,
(?) **C.** 38792 . . .	,, ,, . . .	,, ,,
(?) **C.** 38798 . . .	,, ,, . . .	,, ,,
C. 38851	Radstock (Tyning Colliery Quarry), Somerset	J. W. Tutcher Coll., 1937.
C. 38853–54 (Plate VI, fig. 5)	Radstock Grove, Somerset . .	,, ,,
(?) **C.** 39142–44 .	Robin Hood's Bay, Yorkshire (beds 546, 548, and 554)	L. Bairstow Coll., 1937.

Liparoceras (*Parinodiceras*) *ovale*, sp. nov.

Plate I, figs. 5 *a–d*; Plate VIII, figs. 4 *a*, *b*

Compare *Ammonites striatus parinodus* Quenstedt, 1884, pl. XXVIII, fig. 18 only.

TYPE.—The Bettlingen (Wurtemberg) example (No. 22118 *b*) figured in Plate I, fig. 5.

DIAGNOSIS.—Like *L.* (*P.*) *parinodus*, but with a different whorl-section and different proportions; with the two rows of tubercles, and especially the inner, feebly developed; and with very faint ribbing. Suture-line (Text-fig. 4 *a*, p. 9) with deeper external lobe than *L.* (*P.*) *parinodus* and rather broad-stemmed external saddle.

MEASUREMENTS.

Holotype (Plate I, fig. 5) . . .	29	·57	·39	·21
Quenstedt (pl. xxviii, fig. 18) . .	38	·50	·36	·22
No. C. 36724 (Plate VIII, fig. 4) (transition to *Platynoticeras alterum*) . .	38	·49	·40	·25

REMARKS.—The holotype already has smooth and compressed whorls at 12 mm. diameter (after the very early depressed, and then rounded, stages); and the inner tubercles are scarcely perceptible as more than a raised line, even at 30 mm. The most distinctive features, however, of the present form compared with *L.* (*P.*) *parinodus* Quenstedt sp., are the highly arched periphery and the absence of true ribs on the rounded, not flattened, lateral area. The suture-line (Text-fig. 4 *a*, p. 9) has the external lobe almost as deep as the first lateral, and is similar to that of the young *Liparoceras cheltiense* (Murchison).

P. ovale, being the most compressed species of *Parinodiceras*, resembles *Platynoticeras*, but has neither the flattened periphery of that sub-genus nor the bordering, strong tubercles. A Radstock example (Plate VIII, fig. 4) of the size of Quenstedt's form, but with a broader periphery, in fact, has curiously polymorphoid inner whorls. These are first lineate and then costate, as in Quenstedt's fig. 28 (pl. xxviii), but the latter half of the outer whorl is typical. Such examples are true passage-forms between *Parinodiceras* and *Platynoticeras alterum* (Oppel).

HORIZON AND LOCALITIES.—*Jamesoni* (and *ibex* ?) zone. Germany and England (Somerset).

SPECIMENS.

22118*b*	(Plate I, fig. 5) .	Bettlingen, Wurtemberg . . .	Paul Mohr Coll., 1848.
C. 36724	(Plate VIII, fig. 4)	Radstock, Somerset	W. E. Cutler Coll., 1936.

Sub-genus VICININODICERAS Trueman, 1919, p. 264

SUB-GENOTYPE.—*V. simplicicosta* Trueman, 1919, p. 289, pl. xxiv, figs. 4 *a*, *b*.

DIAGNOSIS.—Parinode sphaerocones, with rounded whorls and inner row of tubercles placed so high up the whorl that the two rows are unusually close together. Suture-line complex, with external lobe only slightly less deep than first lateral lobe.

DISTRIBUTION.—*Jamesoni* (or *ibex* ?) zone. England (Somerset), France ?

Liparoceras (*Vicininodiceras*) *simplicicosta* (Trueman)

Plate XI, figs. 5 *a*, *b*

Vicininodiceras simplicicosta Trueman, 1919, p. 289, pl. xxiv, figs. 4 *a*, *b*.
„ „ „ Dacqué, 1934, p. 292.

TYPE.—Trueman's original (Tutcher Coll.) now in the British Museum (No. C. 38329).

DIAGNOSIS.—As for sub-genus. The ribs are fine on the high, but rounded, umbilical wall and gradually become wider and blunter towards the periphery, which they traverse with a slight backwardly-directed sinus. The spirally-elongated tubercles cover two or three ribs and are themselves joined by button-and-loop riblets.

MEASUREMENTS.

Holotype (Trueman)	87	·51	·58	·20
No. C. 38275	145	·45	·62	·24
No. C. 38855	118	·51	·59	·20

REMARKS.—The holotype of this species, septate to the end, is here re-figured, although it is rather defective ; for it represents a type of *Liparoceras* quite different

FIG. 12.—*Vicininodiceras* sp. ind. aff. *simplicicosta* Trueman. No. C. 38275. Unlocalised. External suture-line, natural size.

from anything figured in Quenstedt, or, indeed, the whole of geological literature, except, perhaps, the small *L. gollingense* Rosenberg (1909, p. 273, pl. xiv, fig. 5) which, however, has an open umbilicus. Longitudinal striation apparently is developed in all the forms. The second specimen listed here, a magnificent, entirely septate, but unfortunately un-localised ammonite, may belong to another species, for it is slightly less inflated at the same size, and the peripheral sinus in the slightly coarser ribs is bent convexly forward instead of being concave. In this second example, moreover, the ribs in between the two tubercles begin to swell considerably near the end, and the outer row especially (eighteen to the last whorl) form large, blunt knobs (on the cast), corresponding to what must have been formidable spines on the test. The suture-line of this specimen, figured in Text-fig. 12, is essentially the same as that of the holotype, so far as can be seen.

The third specimen in the above table of measurements belongs to the same form as the large second example, but it is less well preserved. Although it was included by Trueman in the present species, it has slightly coarser and more distant ribbing, with the sinus on the periphery directed forwards rather than backwards.

Another of Trueman's syntypes of the present species, figured in Plate III, fig. 6, but not specifically named, almost certainly represents still another form, and one which seems to be a transition to the ancestral *Tetraspidoceras* of the *reynesi* group (see p. 18). It has a comparatively wide umbilicus, and the tubercles are elongated radially; and while they are very close together, they are farther away from the umbilical suture and the periphery respectively than they are in the more compressed *T. reynesi*. The ribs between the two tubercles are also far more prominent than they are either in the typical *Vicininodiceras* above discussed, or in *Tetraspidoceras*, so that the present form could well be described as a new species, if it were not represented merely by a body-chamber fragment.

HORIZON AND LOCALITIES.—*Jamesoni* (and *ibex* ?) zone. England (Somerset), France (?).

SPECIMENS.

C. 38275 . . .	[Unrecorded.] France ? . . .	Sowerby Coll., 1935.
C. 38329 (Holotype) .	Tyning Colliery Quarry, Radstock, Somerset.	J. W. Tutcher Coll., 1936.
C. 38415 (sp. nov. ind.) .	Westpeed, nr. Radstock, Somerset .	J. W. Tutcher Coll., 1937.
C. 38855 . . .	„ „ „ .	„ „

Genus PLATYNOTICERAS, nov.

Supra, p. 17.

GENOTYPE. *Ammonites alter*, Oppel, 1862, p. 133. This species is here interpreted by B. M., No. 62567, which agrees with Oppel's (1853) pl. iii, fig. 6, this author's originally cited form (in Quenstedt, 1856, pl. xvi, fig. 9) including only the inner whorls.

DIAGNOSIS.—Like *Liparoceras* (*Parinodiceras*), but more evolute, with ribbed, polymorphoid, inner whorls; and a narrow, flat, periphery, with irregular costae zigzagging across it. Suture-line complex, with external saddles rather plump (Quenstedt, 1884, pl. xxviii, fig. 26, and Oppel, 1853, pl. iii, fig. 6 *a*), considering their great complexity.

DISTRIBUTION.—*Jamesoni* zone. Germany, France, England.

REMARKS.—This genus is separated with a distinct name because it forms an important link between the families Liparoceratidae and Polymorphitidae, and it seems inadvisable to treat it merely as a sub-genus of *Parinodiceras*. Quenstedt, it may be noted, included typical examples of the present genus in his *Amm. striatus parinodus* but he was well aware of their curious resemblance to *Polymorphites*; and other members of the group that is now separated as *Platynoticeras* were described by him as "*Amm.* cf. *henleyi*, cf. *polymorphus*." This, however, reflects no more than the inadequacy of Quenstedt's nomenclature, for as his comparison (1885, p. 249) of the original of fig. 63 with the *Amm. polymorphus mixtus* of fig. 27 (pl. xxx) shows, he correctly appraised the affinities of these "hybrids" with *Parinodiceras* on the one hand and *Polymorphites* on the other.

Now Haug (1887, p. 103) suggested that *Liparoceras*, which according to him had nothing to do with "*Aegoceras*" (a presumed *Psiloceras* derivative) was, like *Polymorphites*, a descendant of *Cymbites*; and he included them both in the family Polymorphitidae. I agree that his generic separation of the two closely allied, but divergent, groups was justified; but it seems that derivation of both from the Eoderoceratidae is much more probable than connection with "*Agassiceras*" (or *Cymbites*), i.e. the "Arietidae." The un-named form figured by Quenstedt in his pl. xxx (fig. 65), as well as the equally bi-tuberculate *Tetraspidoceras reynesi*, nom. nov. (see p. 17), obviously have affinity with Eoderoceratidae, and it is unfortunate that the doubtful *Vicininodiceras* figured in Plate III, fig. 6, does not show the inner whorls, since it is probably yet another species that connects the Liparoceratidae directly with the Eoderoceratid root-stock.

Quenstedt did not stress the evidence of the inner whorls, as did Haug, who considered *Platynoticeras transitorium* (*Polymorphites hybrida*, Oppel sp. in Haug) the direct descendant of *P. polymorphus*. Holding, as I do, that the inner whorls foreshadow the successor rather than recapitulate the ancestor, I might reverse Haug's sequence; but in reality I do not look upon *P. transitorium* as the one and only ancestor of *Polymorphites*, because, for example, "*Aegoceras*" *sellae* Gemmellaro (1884, p. 15, pl. iii, figs. 1–5) is another link between the Eoderoceratidae and Polymorphitidae (Genus *Gemmellaroceras*). This Sicilian form, moreover, and the French example of *Platynoticeras*, figured in Plate II, fig. 3, which closely resembles one of the "hybrids" figured by Quenstedt (pl. xxx, fig. 64), indicate how the complex Eoderoceratid suture-line changed into the simplified Polymorphitid suture-line (with its wide lateral saddle) without altering its general plan. In both *Platynoticeras alterum* and *P. haugi* the suture-line (see Plate XXV, fig. 3) is very complex; but in *P. transitorium* it is much simpler, and already shows the sub-bifid lateral lobe of *Polymorphites polymorphus* (Plate XII, fig. 6 *c*); yet there is no affinity whatever of any of these with the suture-lines of either an Arietid, or an early capricorn, like *Gagaticeras*. The similarity of the suture-line of *Polymorphites* to that of *Cymbites*, stressed by Trueman (1917, p. 447), does not seem to me to be of much significance, seeing that both genera are not primitive, but secondarily simplified or reduced dwarf stocks. Moreover, there are many differences in the suture-lines, and especially in the internal elements of the true *Cymbites* as well as of *Metacymbites*, as compared with *Polymorphites*, so that they must be derived from different roots, and the resemblance consists only of somewhat similar reduction.

Platynoticeras, then, although here included in the family Liparoceratidae, is intimately related to the micromorph genus *Polymorphites*. But this degenerate stock, although connected by transitions (*Amm. caprarius* Quenstedt) with *Platypleuroceras* Hyatt (*brevispina* group) and with *Uptonia* Buckman (*jamesoni* group) by *Amm. confusus* Quenstedt, is not the radicle of the family Polymorphitidae, which is derived from the ancestral family Eoderoceratidae rather by way of genera like *Gemmellaroceras* Hyatt and *Peripleuroceras* Tutcher and Trueman, with complex suture-lines.

Platynoticeras alterum (Oppel)

Plate III, figs. 4 *a*, *b*; Plate VII, figs. 4 *a*, *b*; Plate XXV, figs. 6 *a*, *b*

Ammonites hybrida (*non* d'Orbigny): Oppel, 1853, p. 91, pl. iii, fig. 6 only.
Ammonites striatus evolutus Quenstedt, 1856, p. 135, pl. xvi, fig. 9.
Ammonites alter, Oppel, 1862, p. 133.
Aegoceras alterum (Oppel): Neumayr, 1875, p. 906.
Ammonites cf. *henleyi* (*non* Sowerby): Quenstedt, 1884–5, p. 249, pl. xxx, fig. 64.
Liparoceras alterum (Oppel): Haug, 1887, p. 104 (*partim*).

TYPE.—The original of Quenstedt's *Amm. striatus evolutus*, identified by Haug with Oppel's (1853) pl. iii, fig. 6, from Hinterweiler, Wurtemberg (Pal. Staatssammlung, Munich).

DIAGNOSIS.—Platygyral, sub-leptogyral, sub-angustumbilicate *Platynoticeras*. Whorl-section compressed, rectangular, with parallel sides, and with large outer tubercles at ventro-lateral edges. Venter very gently convex. Umbilical wall low and steep, but produced into a long slope up to the line of small inner tubercles. Costae between the two rows of tubercles blunt and irregular. Suture-line very complex, with first lateral lobe only slightly deeper than external lobe.

MEASUREMENTS.

No. 62567 (Plate VII, fig. 4) . .	65	·50	·34	·20
Oppel's (1853) holotype . . .	77	·48	·31	·23
No. C. 38852 (Radstock) . . .	90 (80)	·55	·33 (?)	·18
No. C. 38799	108	·52	·32	·20

REMARKS.—The large Radstock example, above listed, with a suture-line that has more slender-stemmed saddles than Oppel's original, is not well enough preserved to be figured, but it differs from the Pliensbach example figured in Plate VII, fig. 4, merely in having closer peripheral ribbing. In this respect the latter resembles Quenstedt's figs. 21 *r*–23 *r* (pl. xxviii), whereas the Radstock example is more like Oppel's badly drawn fig. 6 *b*.

There is in the Collection a very fine set of pyritised examples of this species from Nürtingen, Wurtemberg, including individuals of over 100 mm. in diameter and still septate. They show considerable variation, and most of them do not display the inner whorls as well as Oppel's (incorrect) large figure, but it seems that the more coarsely-ribbed variety (Plate VII, fig. 4) can well be kept distinct (var. **rotiformis,** nov.). There are, however, various transitions between this variety and the more typical form; and the example figured in Plate XXV, fig. 6, is one of them.

P. haugi, sp. nov., described below, differs from the commoner *P. alterum* in its wider umbilicus with correspondingly smaller height of both inner and outer whorls, and in its more conspicuous bi-tuberculation with shorter principal ribs but larger inner nodes. There are transitions, however, between these two species (e.g. Quenstedt's fig. 27), besides passage-forms to the var. *stenonota* of *L.* (*Parinodiceras*) *parinodus* Quenstedt (see p. 82), although the latter has a more arched periphery and quite different inner whorls. Haug even included the typical *L.* (*P.*) *parinodus* in the present species.

It is doubtful whether certain ammonites figured by Quenstedt (1884, pl. xxviii, fig. 28, and pl. xxx, fig. 64) and Oppel (1853) pl. iii, figs. 3 and 5) are still other transitions, or merely varieties of the present species and of *P. haugi*. The illustrations may be somewhat diagrammatic; for instance an example figured in Plate II, fig. 3, seems to agree with Quenstedt's fig. 64, but is more inflated, and still farther removed from the involute, young *P. alterum* figured in Plate III, fig. 4. This is interesting because it shows incipient imparinode ribbing, some of the costae (with outer tubercles) being shorter than the majority.

The example figured in Plate VIII, fig. 4, and already referred to as transitional between *L.* (*Parinodiceras*) *ovale*, sp. nov., and *Platynoticeras alterum*, has a comparatively wide and rather highly arched periphery. It may have developed the typical *Platynoticeras* ornament at larger diameters, but its polymorphoid inner whorls resemble those of the present form.

Horizon and Localities.—*Jamesoni* (and *ibex*?) zone. Germany, France, England (Somerset). Oppel (1856, p. 165) recorded *Amm. hybrida* also from Yorkshire, but probably referred to a *Polymorphites*.

Specimens.

62567	(Plate VII, fig. 4)	Pliensbach, Wurtemberg	Bruckmann (*ex* Zieten) Coll., 1868.
62593	(Plate III, fig. 4)	,, ,,	,, ,, ,,
C. 38797	(Plate XXV, fig. 6)	Nürtingen, Wurtemberg	C. Allmendinger, 1937.
C. 38799–38806		,, ,,	,, ,,
C. 38807	(var. *rotiformis*)	,, ,,	,, ,,
C. 38808		,, ,,	,, ,,
C. 38852		Tyning Colliery Quarry, Radstock, Somerset.	J. W. Tutcher Coll., 1937.

Platynoticeras haugi, sp. nov.

Plate XII, figs. 2 *a*, *b*; Plate XXV, figs. 3 *a*, *b*, *c*

Ammonites striatus parinodus Quenstedt, 1884–5, *partim*, p. 229, pl. xxviii, figs. 26–27.
Polymorphites hybrida (Oppel): Haug, 1887, p. 117 (*partim*).

Type.—The Nürtingen (Wurtemberg) example (No. C. 38793) figured in Plate XXV, fig. 3.

Diagnosis.—Sub-platygyral, sub-pachygyral, sub-angustumbilicate *Platynoticeras*. Like *P. alterum*, but with wider umbilicus, showing costate *Polymorphites* stage to about 20 or 30 mm., and more inflated outer whorl, with more prominent bi-tuberculation; 24–30 pairs of tubercles, inner feebler than outer and appearing later. Two or three peripheral ribs to each outer tubercle, as in Quenstedt's figs. 22 *r*, 23 *r* (pl. xxviii) on later whorl, but at first ribs continuous across the venter (as in fig. 27 *r*). Median line of venter raised; sides flattened; umbilical slope very conspicuous. Suture-lines highly complex and interlocking, with external and first lateral lobes of about the same depth.

MEASUREMENTS.

Holotype (Plate XXV, fig. 3) . . .	67	·46	·44	·28
Quenstedt's fig. 26 (pl. xxviii) . . .	72	·44	(?)	·30
Plate XII, fig. 2	35	·44	·40	·37

REMARKS.—This species is connected with the slenderer *P. alterum* by various transitions; e.g. an example (No. C. 38808) of 100 mm. diameter and an umbilical width of 21 per cent.; and in spite of its large umbilicus, the example figured by Quenstedt in his pl. xxviii, fig. 27, is one of these, showing an increased whorl-height and greater lateral compression. As in the more typical example, however, figured in Quenstedt's fig. 26, the peripheral costae seem to be more numerous than in the type here figured, at least on the last half whorl. The smaller example, represented in Plate XII, fig. 2, shows better agreement with Quenstedt's figures, but it shows also breaking up of the ventral ribs into bundles of secondaries at a slightly earlier stage. Another example (No. C. 38807) of 95 mm. diameter, but with coarse, peripheral ornament, and listed above as *P. alterum*, var. *rotiformis*, also differs from *P. haugi* merely in its greater compression and smaller umbilicus.

P. transitorium, sp. nov., has finely ribbed inner whorls of *polymorphus* aspect, but later becomes very similar to *P. haugi*. The French form figured in Plate II, fig. 3, as *P.* sp. nov. ind., and comparable to a (less inflated) ammonite represented in Quenstedt's pl. xxx, fig. 64, also has costate inner whorls, but these are more rounded than those of *P. haugi*, so that the outer tubercles do not form a conspicuous ventro-lateral edge. It is probable that this French form, the suture-line of which (Plate II, fig. 3 *c*) is only slightly less complex than that of the present species, represents still another species of *Platynoticeras*, which, however, cannot yet be named. The third specimen listed below, unfortunately in a poor state of preservation, also shows more rounded and more inflated inner whorls than the type at the same diameter, and may belong to that transitional form of which Quenstedt's figs. 66 and 67 (pl. xxx) seem to represent fragments.

HORIZON AND LOCALITIES.—*Jamesoni* zone (lower). Germany, France?

SPECIMENS.

C. 38793 (Holotype) . .	Nürtingen, Wurtemberg . .	C. Allmendinger, 1937.
C. 38794 (Plate XII, fig. 2) .	,, ,, . .	,, ,,
C. 38795	,, ,, . .	,, ,,

Platynoticeras transitorium, sp. nov.

Plate XII, figs. 6 *a–c*

Ammonites hybrida (*non* d'Orbigny): Oppel, 1853, p. 91, pl. iii, figs. 3 *a*, *b* (4–5 ?).
,, ,, ,, ,, Brauns, 1871, p. 216 (*partim*).
Ammonites cf. *henleyi* (*non* Sowerby): Quenstedt, 1885, *partim.*, p. 249, pl. xxx, fig. 63.
Polymorphites hybrida (Oppel): Haug, 1887, *partim*, p. 117.

TYPE.—The Nürtingen (Wurtemberg) example (No. C. 38795) figured in Plate XII, fig. 6.

Diagnosis.—Sub-platygyral, sub-pachygyral, sub-latumbilicate *Platynoticeras*, like *P. haugi*, but with inner whorls like *Polymorphites lineatus*. Outer tubercles appearing at about 20 mm. diameter and inner tubercles appearing very soon after, but remaining small. Lineate ornamentation of young strongly projected on the faintly keeled periphery, but the strong costae of a later stage break up on the venter into fine secondaries, which are almost radial. Whorl-section sub-quadrate at end, with flattened sides. Suture-line fairly complex, with wide external saddle and first lateral lobe (fig. 6 *c*).

Measurements.

Holotype (Plate XII, fig. 6) . . .	31	·40	·35	·42
Quenstedt, pl. xxx, fig. 63 . . .	37	·40	·36	·38
Oppel's pl. iii, fig. 3	49	·43	·41	·32

Remarks.—Haug not inaptly described this species as being a true evolute "*polymorphus*" in the young, but becoming involute in the adult, and thus greatly resembling *Liparoceras striatum* (Reinecke). He separated it generically, however, from *P. alterum* (Oppel), and although I agree that Oppel's (1853) rather badly drawn figures of his *Amm. hybrida* depict three different species, I cannot see any fundamental differences between the originals of his figs. 3 and 6, here referred to *P. transitorium* and *P. alterum* respectively. In Oppel's large figure (6) the inner whorls are shown as far too distinctly costate (compare Plate XXV, fig. 6 *a*) but, as mentioned already under *L.* (*Parinodiceras*) *ovale*, there are transitions between that species and *Platynoticeras alterum* (Plate VIII, fig. 4), in which the polymorphoid character of the inner whorls is distinctly shown. It is probable that the original of Quenstedt's pl. xxviii, fig. 28, described as *Amm. striatus parinodus* with inner whorls like *Polymorphites lineatus*, and very aptly compared to fig. 18 of the same plate, is a corresponding passage-form between *L.* (*Parinodiceras*) *ovale* and *P. transitorium*.

P. haugi, sp. nov., described above, differs from the present species in having costate inner whorls. The small example, however, figured in Plate XII, fig. 2, has exactly the same ornamentation on the outer whorl as Oppel's fig. 5 (pl. iii); and, if its finely ribbed earlier volutions are correctly drawn, it represents a transition between *P. haugi* and *P. transitorium*.

Horizon and Locality.—*Jamesoni* zone (lower). Germany.

Specimen.

C. 38795 (Holotype) . . Nürtingen, Wurtemberg . . C. Allmendinger, 1937.

Genus METACYMBITES Spath, 1923

See *supra*, p. 27; also Spath, 1936*a*, p. 446.

Genotype.—*Ammonites centriglobus* Oppel, 1862, p. 140 = *Amm. globosus* Oppel, 1853, p. 95, pl. iii, fig. 7.

Diagnosis.—Dwarf sphaerocones, smooth or with obscure folds, and with peripheral ribs in young which suddenly cease; shell often constricted at aperture (with projecting lappet). Suture-line reduced, sometimes almost goniatitic, i.e. with entire lobes and saddles in extremes, generally more ammonitic, with slight frilling of both lobes and saddles; with more-or-less regularly trifid first lateral lobe. Body-chamber half a whorl.

DISTRIBUTION.—*Ibex, davoei* and *margaritatus* zones. England, Germany, France.

REMARKS.—The reasons for separating *Metacymbites* from *Cymbites* have already been given (Spath, 1923*d*). In the true *Cymbites* (*laevigatus* group of the Sinemurian *obtusus* zone) the shape may be similarly globose, especially that of inner whorls, but the suture-line (Text-fig. 12 *a–e*) retains such arietoid characters as a large external saddle, a deep external lobe, shallow and wide first and second lateral lobes, and indistinct second lateral saddles. When traces of a keel are present, in *Cymbites*, on the one hand, or faint transverse ribbing across the periphery, in the young of *Metacymbites*, on the other, distinction is simple; *Cymbites*, moreover, never had spiral striation, and its body-chamber, at least in the typical forms, was nearly a whole whorl in length.

Pompeckj (1894, p. 238) considered *M. centriglobus* to be the final member of a single lineage of monophyletic origin which he thought could be traced continuously from the Hettangian to the Domerian, and which was therefore regarded as very appropriately grouped in one genus (*Cymbites*). But this " homogeneous series, sprung from a single root-form " was stated to develop, in the course of its evolution, one definite characteristic which gradually became more pronounced; and as by this characteristic can only be meant the modification of the body-chamber, it may be mentioned that excentrumbilication, combined with a constricted mouth-border and a ventral lappet, bent downwards, occurred as much in the Sinemurian *Cymbites laevigatus* as in the Domerian *Metacymbites*. In Pompeckj's list, the crucial connecting link between the two groups, here taken to be homoeomorphous end-forms of " Arietidae " and (presumably) Liparoceratidae, respectively, is *Amm. globosus* γ of Quenstedt; for his *Amm. globosus* β (1885, pl. xlii, fig. 39) is a true *Cymbites* of the *laevigatus* group, as Quenstedt himself recognised. Now, unfortunately for Pompeckj's contention, this dwarf-form of the Lias γ, namely, *Amm. globosus numismalis* is anything but a passage-form between *Cymbites* and *Metacymbites*. The ammonite figured by Quenstedt in 1856 (p. 135, pl. xvi, fig. 15) though described as smooth, yet shows ribbing; and while that author pointed out that it had to be carefully distinguished from earlier and later species, he was at pains to add that the young of *Amm. striatus*, *Amm. pettos* and others also had to be borne in mind. Pompeckj also cited one of Quenstedt's *Amm. globosus* of 1885 (pl. xlii, fig. 38, p. 336 [*not* 366]) as representing this crucial γ form; but not only is this form found in the Lias δ, but it shows also very distinctive ribbing, in addition to a strongly inverse suture-line. The original of Quenstedt's fig. 37, which is doubtfully ascribed to the Lias γ, is even less comparable to either *Cymbites* or *Metacymbites*; for it has distant and strong ribs, and the first lateral saddle is much higher than the external saddle.

Such degenerate dwarf-forms, in fact, occur sporadically in many groups of ammonites, from the Triassic *Nannites* to the Cretaceous *Flickia*; and it may be remembered that Buckman (1898, table ii to p. 451), who took *Cymbites* to be anagenetic and not catagenetic, derived from this supposedly persisting radical various ammonite stocks of the Lower, Middle, and Upper Lias; but these did not include *Liparoceras*. Yet he took the very similar "*Oxynoticeras*" *dennyi* (Simpson) to be a decadent form (1909, p. 7*c*).

Cymbites numismalis (Quenstedt), then, may not be a well defined species, and it is almost certainly not a direct connecting link between the Sinemurian true *Cymbites* and the genus *Metacymbites* of the *margaritatus* zone. But forms of *Cymbites globosus*

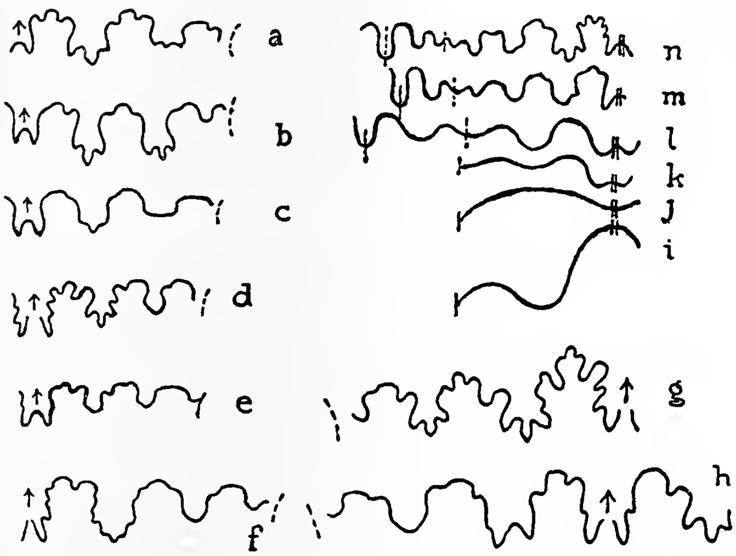

FIG. 13.

(*a*) *Metacymbites centriglobus* (Oppel). Suture-line of the topotype figured in Plate XI, figs. 7 *a–d*, at diameter of 9 mm. (*b*) Copy of Quenstedt, 1884, pl. xlii, fig. 29. (*c*) Suture-line of original of Plate X, fig. 8, at 5·5 mm. All from Middle Lias (*margaritatus* zone) of Heiningen. (*d, e*) *M. primus*, sp. nov. Suture-lines of the originals of Plate X, fig. 9 *d* (at 10 mm.) and 9 *b* (at 9 mm. diameter). Lower Lias, upper *davoei* zone (*figulinum* sub-zone) Charmouth. (*f*) Suture-line of the doubtful Liparoceratid figured in Plate XI, fig. 8. Middle Lias, Milhaud, Aveyron. (*g*) *Liparoceras* sp. juv., at 8 mm. (a less inflated form than original of Text-fig. 4 *k, l*, p. 9). Lower Lias, France (St. Amand, Cher ?), No. C. 38601. (*h*) *L.* (*Becheiceras*) *gallicum* Spath. Suture-line at 3·5 mm. diameter (No. C. 38351); *figulinum* sub-zone, Dorset. (*i–n*) *Metacymbites centriglobus* (Oppel). Suture-line development, after Branco (1879, pl. xii, fig. 5), *i–l* being the first, second, third, and seventh suture-lines respectively, *m* at 4 mm., and *n* at 7 mm. diameter. All the figures are enlarged, but not to the same scale.

have been recorded from the *jamesoni* zone, e.g. by Dubar (1925, p. 263); and I have before me the four somewhat differing examples recorded by Tutcher & Trueman (1925, p. 646) from the *Valdani* Limestone of Radstock, while still another species, indistinguishable externally from *Oxynoticeras dennyi*, just quoted (Buckman, 1909, pl. vii, figs. 1, 1 A) has been found in the Crumbly Bed (Upper *Ibex* zone) of Charmouth (No. C. 28808). I am figuring (Plate IV, figs. 8–9) the latter and one of the examples in Mr. Tutcher's collection, together with their suture-lines, and it will be seen that they are curiously like the suture-lines of *Metacymbites centriglobus* and of *M. primus*, represented in Text-figs. 13 *a* and 13 *e*, and therefore like the suture-lines of various young Liparoceratidae. Yet the less inflated shape of these *ibex*-zone forms is more reminiscent of *Cymbites laevigatus* than of *Metacymbites centriglobus*, and the peculiar, scaly ornamentation of the Radstock example resembles that of certain Lytoceratids as much as that of a young *Becheiceras*, so that their definite inclusion in either *Metacymbites* or even the family Liparoceratidae is impossible in the present state of our knowledge. It is not probable that a shell with the degenerate suture-line represented in Text-fig. 14 *e* produced descendants with the numerous elements in the suture-line shown in Text-fig. 13 *n*, but the few specimens so far known from intermediate horizons are obviously insufficient for correctly appraising their affinities.

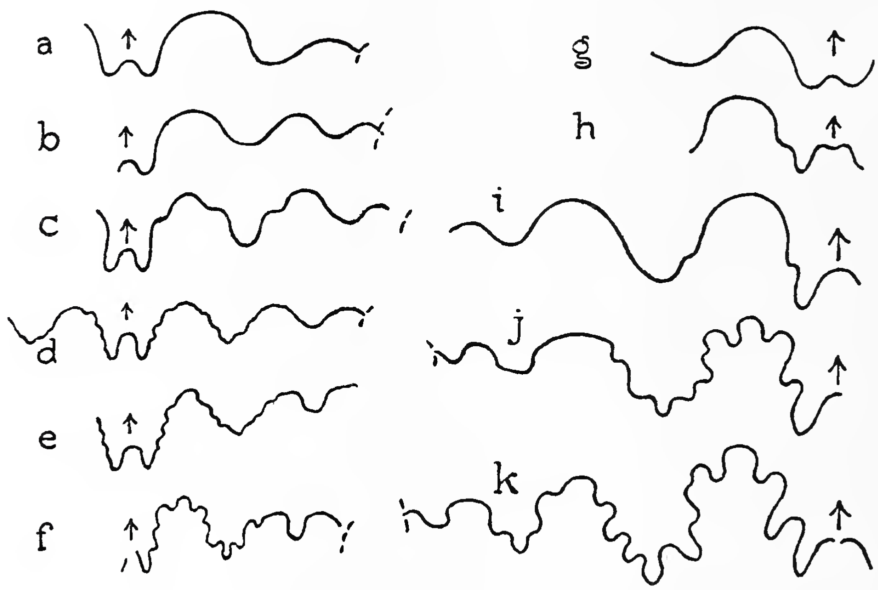

FIG. 14.—Suture-lines of *Cymbites* (*a–e*) and *Amaltheus* (*g–k*).

(*a–d*) *Cymbites laevigatus* (J. de C. Sowerby) at diameters of 1·5, 4, 8, and 10 mm. respectively, from examples out of a *birchi* nodule. Lower Lias. Lyme Regis. (*e*) From an adult Marston Magna example (No. C. 17960, upper *obtusum* zone) at 6 mm. diameter. (*f*) *Beaniceras*, sp. juv. (labelled *Amaltheus gibbosus* [Quenstedt]), at 5 mm. diameter; No. C. 38365 from Lower Lias, St. Amand, Cher (?). (*g–k*) *A. margaritatus* auct. at diameters of 1, 1·5, 2, 3, and 4 mm. respectively. Middle Lias, Milhaud, Aveyron (L.F.S., No. 1419). All the figures are greatly enlarged, but not to same scale.

The development of the suture-line of *M. centriglobus* (after Branco) is given in Text-figs. 13 *i–n*; also adult suture-lines of the same species after Quenstedt (Text-fig. 13 *b*) and from the two topotypes here figured (Text-fig. 13 *a*, *c*). The original of Plate XI, fig. 8, labelled "*Amm. globosus*, Zieten, Lias moyen, Milhaud, Aveyron" (L. Saemann Coll.) with a similar suture-line (Text-fig. 13 *f*), has obscure, broad folds; and since the septa are distantly spaced to the end, it may represent the inner whorls of some other Liparoceratid. Yet it does not compare well with young *Liparoceras*, *Becheiceras*, or *Beaniceras*, either in ornamentation or in suture-line (see Text-figs. 13 *g*, *h*, 14 *f*). It is very doubtful whether, in view of its globosity and narrow and deep umbilicus, it has any affinity with *Amaltheus*; the suture-line of the latter (see Text-figs. 14 *g–k*) is perhaps not so very different, but at the same diameter it is already flattened or strongly ornamented (costate or tuberculate, see *A. margaritatus* as figured by Buckman, 1889, pl. xxii, fig. 25, being a high-zonal form).

The development of the suture-line in *Cymbites laevigatus* (J. de C. Sowerby) is added (Text-figs. 14 *a–e*) for comparison with that of *Metacymbites* (Text-figs. 13 *i–n*); also that of a young *Amaltheus* of the *margaritatus* group (Text-figs. 14 *g–k*), the connection of which with *Oistoceras* and the Liparoceratidae is discussed on pp. 30–33. It will be noticed that the characteristic adventitious saddle between the external lobe and the external saddle is indicated already at a diameter of only 4 mm. (Text-fig. 14 *k*).

Metacymbites centriglobus (Oppel)

Plate X, figs. 8 *a–c*; Plate XI, figs. 6 *a–c*, 7 *a–c*

Ammonites globosus Zieten: Oppel, 1853, p. 95, pl. iii, fig. 7.
„ „ Quenstedt, 1856, pl. xxi, fig. 9.
„ „ Dumortier, 1869, p. 75, pl. xviii, figs. 3–4.
Ammonites henleyi (*non* Sowerby): Brauns, 1871, p. 218.
Cymbites globosus (Quenstedt): Branco, 1879, pl. xii, fig. 5.
Ammonites globosus Quenstedt, 1885, p. 336, pl. xlii, figs. 29–30 (31–36).
Agassiceras centriglobum (Oppel): Haug, 1887, p. 100.
Cymbites centriglobus (Oppel): Pompeckj, 1894, p. 238, pl. iv, fig. 3.
Agassiceras centriglobum (Oppel): Bonarelli, 1895, pl. iv, fig. 1.
Cymbites centriglobus (Oppel): Fucini, 1900, p. 163, pl. xxi, figs. 5–6.
Cymbites centriglobus (Oppel): Engel, 1908, p. 243.
Metacymbites centriglobus (Oppel): Spath, 1923*a*, p. 76.
Cymbites globosus (Zieten): Dubar, 1925, p. 263 (*partim*).
Metacymbites centriglobus (Oppel): Dacqué, 1934, p. 290.
„ „ „ Spath, 1936*a*, p. 446, text-fig. 1 *c*, p. 447.

TYPE.—The original of Oppel's (1853) pl. iii, fig. 7, from the *margaritatus* zone of Heiningen, Wurtemberg.

DIAGNOSIS.—*Metacymbites* with globose to cadicone septate whorls and narrowing body-chamber, showing strong excentrumbilication. Suture-line almost goniatitic (Text-fig. 13 *c*) or ammonitic (Text-fig. 13 *a*, *b*). Apertural lappet narrow and depressed (Plate XI, fig. 7 *d*).

MEASUREMENTS.

Holotype (Oppel's figure) . . .	15	·27	·47	·40
„ „ . . .	11	·45	·78	·23

REMARKS.—With dwarf-forms like the present, measurements are not very helpful, and there appears to be great variability in ornamentation, although most examples seem almost smooth. But the reduced suture-line, however variable in detail, is always built on the same plan, and it differs from the normal suture-lines of young *Liparoceras* (Text-figs. 4 *k–l*, p. 9, and 13 *g*) and *Beaniceras* (Text-figs. 9 *a–f*, p. 25) chiefly in the size of the external saddle, a feature correlated with the different whorl-shape. Quenstedt (1884, p. 337) has already stated that in the absence of the mouth-border, identification of these forms becomes very uncertain, and that confusion is possible with the young of *Liparoceras* (*Becheiceras*) which occurred in the same bed. Generally, however, a young *Becheiceras* already has a more complex suture-line at a very small diameter. Brauns (1871) even identified the present species with the immature *Amm. henleyi* (*sensu lato*), but no palaeontologist at the present day would accept such comprehensive interpretation.

Quenstedt thought that his *Amm. globosus* could be distinguished from the spirally striate *Liparoceras* by its thick shell; but, while the original of Plate X, fig. 8, is an internal cast, the examples of the species described below as *M. primus* do not seem to show any constancy in the thickness of the test, that of the originals of Plate X, figs. 9 *c* and *e* being thin, whereas that of example 9 *a* and others in the collection are thick. It may be added that the topotype figured in Plate X, fig. 8, shows spiral striation, like the original of fig. 9 *e*, but the latter retains its test, whilst the former is a cast. It will be seen that there are quite distinct primary folds on the earlier part of the outer whorl.

The two examples here figured were associated with a nucleus (No. C. 38361) of just under 6 mm. diameter, showing at the end a distinct constriction, which resembles the apertural constriction of a *Sphaeroceras*, and is preceded by a faint constriction about half a whorl earlier. Another example (No. C. 38360), figured in Plate XI, fig. 6, well shows the ribbing of the earlier whorls, with a pronounced, forwardly projecting sinus on the periphery; but a fifth specimen (No. C. 38359), with more complex suture-lines than the doubtful Liparoceratid figured in Plate XI, fig. 8, cannot be definitely identified.

The French specimens listed below, with few exceptions (Nos. C. 39375–7), lack the body-chamber, and therefore much resemble the associated *Liparoceras* (" *spinellii* " and " *woodwardi*," referred to on p. 80), especially since the septate portion may reach a diameter of 15 mm., and since they are then rather globose. But the suture-line is comparatively simple; and though there are considerable differences in the suture-lines, and even, as already mentioned, apparent transitions to *Liparoceras*, these small ammonites are now all provisionally listed under the present species. Like the doubtful Liparoceratid figured in Plate XI, fig. 8, some of the specimens also show bulges, or ribs, so that they are probably not so homogeneous an assemblage as the simplified suture-line suggests.

HORIZON AND LOCALITIES.—Domerian, *margaritatus* zone. Germany, France.

SPECIMENS.

22098	(Plate XI, fig. 7) .	Heiningen, Wurtemberg . .	P. Mohr Coll., 1848.
C. 38360	(Plate XI, fig. 6) .	,, ,, . .	,, ,,
C. 38361	. . .	,, ,, . .	,, ,,
C. 38362	(Plate X, fig. 8) .	,, ,, . .	,, ,,
(?) **C. 38364**	(Plate XI, fig. 8) .	Milhaud, Aveyron, France . .	L. Saemann, date ?
C. 39354–56	. . .	Rivière, Aveyron, France . .	Exch. H. Contaut, 1938.
C. 39357–58	. . . .	Samartha, Aveyron, France . .	,, ,,
C. 39363–74	. . . .	Lebourg, Aveyron, France . .	,, ,,
C. 39375–94	. . . .	Samartha, Aveyron, France . .	,, ,,

Metacymbites primus, sp. nov.

Plate X, figs. 9 *a–e*

Metacymbites sp. and sp. nov., Lang, 1936, p. 436.
Metacymbites sp. ind., Spath, 1936*a*, p. 446, text-fig. 1 *d*, *e*, p. 447.

TYPE.—No. C. 36902 (Plate X, figs. 9 *a*, *b*).

DIAGNOSIS.—*Metacymbites* with less globose or cadicone early stage than *M. centriglobus*, and with slightly less reduced suture-line, i.e. more frilling, especially on ventral sides of external and first lateral saddles. Constriction of aperture not observed. Blunt folds on sides of adult whorls.

MEASUREMENTS.

Holotype (Plate X, figs. 9 *a*, *b*) . .	11·5	·52	·53	·17
Paratype (No. C. 36901) . . .	14	·43	·43	·25
Plate X, figs. 9 *c*, *d*	11	·43	(?)	·23

REMARKS.—The paratype above listed, though not favourably enough preserved for photographic reproduction, and not showing the suture-line very clearly, yet seems to justify the creation of a distinct species on the fragmentary holotype. For it has about half a whorl of body-chamber, and, while there is no appreciable reduction in the thickness of the last whorl, it becomes narrower and the umbilicus opens out. The earlier whorls are clearly far less globose than those of *M. centriglobus*, but the test is thick. No spiral striation is visible on this paratype, comparable to that of the apparently very thin-shelled individual figured in Plate X, fig. 9 *e*, but there seem to be about nine very broad and obscure folds on the outer whorl.

Both the holotype and the example represented in Plate X, figs. 9 *c*, *d*, include only a small part of the body chamber, and the last suture-lines are approximate. One doubtful nucleus (No. C. 38354) has part of a body-chamber at a diameter of just over 4 mm., and another such specimen (No. C. 38355) shows fine Lytoceratid striation and several varices, drawn forwards on the periphery, as in *Ptychophylloceras ptychoicum* (Quenstedt). Both another example (No. C. 38336), of 7·5 mm. diameter, with the typical folds, and the two nuclei (Nos. C. 38357–8) well show the differences in thickness between the present species and *M. centriglobus*. The suture-line of the larger example (No. C. 38366) previously figured (Spath, 1936, Text-fig. 1 *e*, p. 447) has a high external saddle, and a rather unsymmetrical first lateral lobe. It should be added that the differences between the suture-lines of the original of Plate X, figs. 9 *c*, *d*, as figured in 1936*a* (fig. 1 *d*) and as now corrected (Text-fig. 13 *e*, p. 93) are due to the imperfect preservation of the ventral area (except at the beginning of the outer whorl).

The doubtful Liparoceratid figured in Plate XI, fig. 8 (labelled *Amm. globosus*) agrees with the present form in having obscure bulges, but its suture-line seems rather complex for a member of the genus *Metacymbites*; it is decidedly less subdivided, however, than that of either the restricted *Liparoceras* or, especially, a *Becheiceras*. The two doubtful specimens listed below from beds 123 and 124 could also be nuclei of *Liparoceras*.

HORIZON AND LOCALITY.—*Davoei* zone (*figulinum* sub-zone and below ?). England (Dorset).

SPECIMENS.

C. 36901	(Paratype) . .	Stonebarrow Cliff, Charmouth, Dorset (bed 129*c*).	W. D. Lang Coll., 1935
C. 36902	(Holotype) . .	Stonebarrow Cliff, Charmouth, Dorset (bed 129*a*).	,, ,,
C. 36903	(Plate X, figs. 9 *c*, *d*)	Stonebarrow Cliff, Charmouth, Dorset (bed 129*c*).	,, ,,
C. 36908	(Plate X, fig. 9 *e*) .	Stonebarrow Cliff, Charmouth, Dorset (bed 130).	,, ,,
C. 38352	. . . . .	Broom Cliff, St. Gabriel's, Dorset (bed 125*b*).	,, ,,
C. 38354–55	. . . .	Stonebarrow Cliff, Charmouth, Dorset (bed 129*c*).	,, ,,
C. 38356–58	. . . .	Stonebarrow Cliff, Charmouth, Dorset (beds 129–130).	,, ,,
C. 38366	. . . .	Black Ven, Charmouth, Dorset (Foreshore).	,, ,,
(?) C. 39135	. . . .	Broom Cliff, St. Gabriel's, Dorset (bed 124).	,, ,,
(?) C. 39456	. . . .	Black Ven, Charmouth, Dorset (7–12 feet above Belemnite Stone, about bed 123).	,, ,,

Genus BEANICERAS, S. S. Buckman, 1913

GENOTYPE.—*Ammonites luridus* Simpson : Buckman, 1913, p. iii, pl. lxxiii.

DIAGNOSIS.—Dwarf Liparoceratids ranging from forms with spinous or subcoronate early stage (and tendency to degeneration of ornamentation in this cadicone stage, and a tendency to capricorn costation, or even irregular striation, in the serpenticone later stages), on the one hand, to forms resembling *Androgynoceras maculatum*, with reduced ornamentation of the body-chamber, on the other. Whorl-section always depressed in the young and more elevated later, often with umbilicus opening out. Suture-line similar to that of *Liparoceras*, but with saddles tending to be less slender and with a pointed triangular median saddle in the external lobe (Text-fig. 9, p. 25).

DISTRIBUTION.—Lower Pliensbachian (Carixian) *ibex* zone (*centaurus* sub-zone) and ? *davoei* zone (? *maculatum* sub-zone).

REMARKS.—Buckman, when creating this genus, stressed its being a Liparoceratid which developed from (tuberculate ?) cadicone to serpenticone, i.e. a Liparoceratid with a catagenetic instead of an anagenetic capricorn stage ; yet he included in *Beaniceras* forms like Geyer's (1893) " *Aegoceras capricornum* " (pl. iii, figs. 7, 8) which do not seem to differ much from ordinary anagenetic capricorns. In reality it is impossible sharply to separate the two groups ; and in forms like the original of Geyer's fig. 10 or his " *Aegoceras centaurum* " (transition to " *Aegoceras capricornum* ", fig. 12) which were included by Buckman in *Beaniceras* but are here referred to *Androgynoceras sparsicosta* (Trueman), the uni-tuberculate (and presumably subsequent bi-tuberculate) stage is only beginning to be developed. Trueman (1919, p. 268) has already stated that it is difficult to separate "*Liparoceras*" *sparsicosta* from certain species of *Beaniceras*; and I have previously (1928*b*, p. 223; 1936*a*, p. 447) characterised this latter genus as a degenerate offshoot, including an extremely variable assemblage of forms, many dwarfed, which showed every transition to *Liparoceras* on the one hand, and to *Androgynoceras* on the other. But the differences in the suture-lines are of little significance. Thus Trueman (1919, p. 286), who erroneously regarded *L. sparsicosta* as of pre-*cheltiense* age and thus included it in the genus *Liparoceras*, inaccurately figured the suture-line of the holotype of *A. sparsicosta* at 23 mm. (Text-fig. 2 *g* on p. 266) and stated that the suture-line of *Beaniceras* at 5 mm. was quite as advanced as that of *A. sparsicosta* at 15 mm. In fact the two groups, occurring side by side in the same beds, are so close in the general configuration of the suture-lines (compare Plate V, fig. 9, and Text-fig. 9, p. 25) that a septate fragment could not be identified on the strength of the lobes and saddles alone.

Beaniceras is no more of a monophyletic unit within the Liparoceratidae than is *Androgynoceras*, but it is similarly retained here for systematic purposes as a conveniently collective genus for those uni-tuberculate to costate transitions between the persisting sphaerocones (*Liparoceras*) and the capricorns (*Androgynoceras*) which show more or less marked degeneration and, in all cases, dwarfing. Those intermediate types between *Liparoceras* and *Androgynoceras* that reverted to a bi-tuberculate Liparoceratid whorl-shape after a more-or-less prolonged capricorn stage, were scarcely ever dwarfed, and were often gigantic. Of course, it is known that small size alone may be due to unfavourable conditions, such as shortage of food; even among recent freshwater snails (*Limnaea*) dwarfed individuals had at one time been referred to a different genus. Thus, the development of the outer tubercle only in *Beaniceras*, the degeneration of the ornament, and the retention of the *Liparoceras* periphery, may be stressed for systematic purposes, rather than the size.

Again, it is customary to accept the approximation of the last few suture-lines (often erratic, see Quenstedt, 1885, pl. xxxiv, fig. 30 R) as evidence of complete growth, but it is obviously impossible to separate two otherwise identical forms specifically because it is presumed that, while the body-chamber of one was temporary, that of the other was permanent. Since also it is often difficult to tell whether a rib swells into a more-or-less distinct tubercle at the ventro-lateral edge; whether the capricorn ribbing is continuous or strong enough across the periphery for inclusion of a form in *Androgynoceras* rather than in *Beaniceras*; or whether there is enough degeneration; there will always be a number of small forms, even complete with the body-chamber like the original of Plate XIII, fig. 5, the identification of which is open to criticism, because it is based on individual opinion. The form in question is here included in *Beaniceras* and it has the suture-line of *Beaniceras luridum*; but it might be considered by some to be a dwarfed or degenerate example of *Androgynoceras maculatum*, except in the more complex suture-line and the characteristic periphery.

Beaniceras luridum (Simpson)

Plate XV, figs. 5–7 ; Plate XVI, figs. 3–5

Ammonites luridus Simpson, 1855, p. 46.
,, ,, ,, Blake, in Tate and Blake, 1876, p. 281.
Aegoceras pettos (Quenstedt) : Wright, 1880, pl. xxxvii, figs. 5–7 (1882, p. 363).
Ammonites luridus Simpson, 1884, p. 76.
Coeloceras wrighti Fucini, 1901, p. 74.
Coeloceras pettos Wright : Fucini, 1905, p. 138.
Coeloceras wrighti (Fucini) : Rosenberg, 1909, p. 312.
Beaniceras luridum (Simpson) : Buckman, 1913, p. 73*b*, pl. lxxiii.
Coeloceras-like Ammonite, Lang, 1914, p. 326.
Beaniceras sp., Buckman, 1918*a*, p. 264, table iii (bed 121).
Beaniceras luridum (Simpson) : Trueman, 1919, p. 268.
Beaniceras spp., Spath, 1923*a*, p. 7 (Belemnite Stone and Crumbly Bed).
Beaniceras aff. *luridum* (Simpson) : Lang, in Lang, Spath, Cox and Wood, 1928, p. 189.
Beaniceras cf. *luridum* (Simpson) : Richardson, 1929, p. 12.

TYPE.—Simpson's original in the Leckenby Collection (Sedgwick Museum, Cambridge), first figured by Buckman (1913).

DIAGNOSIS.—Sub-stenogyral, sub-pachygyral, sub-latumbilicate *Beaniceras*. Whorl-section greatly depressed in young, later more rounded. Strong capricorn ribs, almost nodate at ventro-lateral edges, but obsolescent (and projected forwards) across periphery, tending to break up into striae on the outer whorl or to become more closely spaced and degenerate. Body-chamber half a whorl. Suture-line with first lateral lobe comparatively simple, trifid, only slightly shallower than external lobe, and with short lateral saddles (Plate XVI, fig. 5 *c*, Text-fig. 4 *b*, p. 9).

MEASUREMENTS.

Holotype (Buckman) . . . (at)	50	·27	·34	·46
,, ,, ... ,,	27	·30	·48	·45
var. **submaculata**, nov. (Plate XV, fig. 7) .	35	·29	·37	·50
,, ,, (Plate XVI, fig. 5)	36	·29	·33	·50
var. **involuta**, nov. (Plate XV, fig. 6) .	44	·22	·39	·39
var. *wrighti* Fucini (Plate XV, figs. 5 *a*, *b*)	37	·30	·44	·52
,, ,, (Plate XV, fig. 5 *c*) .	30	·30	·53	·48
var. *wrighti* Fucini (Wright, 1880, pl. xxxvii, figs. 5–7)	33 (63)	·26	·45	·50

REMARKS.—Simpson's species does not appear to be common in Yorkshire, and since the examples from the Belemnite Stone of the Dorset Coast are generally poorly preserved, it is doubtful whether a single one of the specimens listed below is absolutely identical with the holotype. But since Buckman himself recorded an example from Stow-on-the-Wold (M.P.G., No. 47099, badly preserved) it is probable that the differences here noted are not more than varietal, and that the specimens from that Gloucestershire locality, at any rate, may well be included in *B. luridum*. It seems advisable, however, to separate, as a var. *submaculata*, nov. (Plate XV, fig. 7) those examples, transitional to *B. costatum*, in which the early capricorn ribbing is more distantly spaced and coarser than in the holotype, there being only 14 ribs to about 20 in the latter at the same size (about 20–25 mm. diameter). In another variety (var. *wrighti* [Fucini], Plate XV, figs. 5 *a–c*) the costation is irregular, even on the early whorls ; fine striae alternate with coarser ribs, and the peripheral costation is altogether closer than in the typical *B. luridum.*

The enlarged figure of the var. *wrighti* given in Wright (1880) was recognised by Fucini (1901) to represent a species distinct from *Coeloceras pettos* (Quenstedt), and he renamed it *C. wrighti*, a proceeding which was acclaimed by Rosenberg in 1909 ; but it is doubtful whether either of these authors was able to appreciate the real affinities of this form from the misleading figure. Since *B. luridum* was not figured till 1913, and since the species certainly could not have been recognised from Simpson's description, it might be argued that the name *wrighti* has priority of *luridum* ; but Buckman always objected to my ascribing Simpson's species to himself and dating them from the time of the first illustration and, judging by the accepted validity of the species in d'Orbigny's Prodrome, Buckman appears to have been right. The var. *wrighti* is not now accorded separate specific rank because, as the original of Plate XV, fig. 5 *a* shows, the differences from the typical *B. luridum* are not nearly so great as Wright's diagrammatic figure suggests. The original (from the collection of the Rev. Samuel Lucas) appears to be lost.

It is possible that the doubtful Dundry specimen listed below represents either an extreme in the same direction as the var. *wrighti* or an entirely new species, being very closely costate (about 34 ribs). It is unfortunately too badly preserved to be figured. A similar, but more slender example from Robin Hood's Bay collected by Mr. L. Bairstow, but unfortunately not *in situ*, may be transitional to the form figured in Plate XV, fig. 2, and referred to under *B. senile* Buckman.

The Belemnite Stone example figured in Plate XV, fig. 6, was marked by Buckman : " not quite the same about the umbilicus " [as the holotype]. It is more involute, and the increase in thickness is comparatively more rapid, so that the umbilicus is less shallow than in the typical *B. luridum.* This var. *involuta*, nov., to which probably also belongs the small example (with half a whorl of body-chamber) figured in Plate XVI, fig. 4, is apparently a more rapidly degenerating variety, in which the decline in the ornamentation sets in at an earlier stage than in the typical *B. luridum*, while the var. *wrighti* has no regular capricorn stage at all.

There are transitions to other species of *Beaniceras*, such as the more depressed *B. crassum* Buckman, described below ; also to *B. subluridum*, sp. nov., which latter typically shows a more rounded, not flattened, periphery and fewer ribs, and to *B. costatum*, to which one of the Stow Hill specimens listed below (No. C. 16763) might equally well have been referred, being a compressed extreme of the var. *submaculata* (Plate XVI, fig. 3).

HORIZON AND LOCALITIES.—Upper *ibex* zone, *centaurus* sub-zone. England, France.

SPECIMENS.

C. 6750	Stow Hill Cutting (G.W.R.) Glos.	T. J. Slatter Coll., 1896.
C. 16758–65 (incl. Plate XV, figs. 5, 7 and Plate XVI, fig. 3).	" " "	R. F. Tomes Coll., 1905.
C. 17528–29	" " "	" "

C. 22321	(Plate XV, fig. 6)	Black Ven, Charmouth (Belemnite Stone).	W. D. Lang Coll., 1921.
(?) **C. 23498**	. . . .	Husbands Bosworth, Leicestershire.	Sir H. Butlin Coll., 1921.
C. 23580–82	. . . .	Westhay Water, Dorset (Belemnite Stone).	W. D. Lang Coll., 1923.
C. 23594–600	. . .	Golden Cap, Dorset (Crumbly Bed)	,, ,,
C. 28079	(Plate XVI, fig. 5)	Tranzault, Indre, France . .	J. R. Gregory & Co., 1925.
C. 38402	. . . . .	St. Gabriels, Dorset (Crumbly Bed)	W. D. Lang Coll., 1936.
C. 38463	(Plate XV, fig. 5 *c*)	Hewlitt's Road, Cheltenham, Glos. (Yellow Lias).	L. F. Spath Coll., 1937.
C. 38467	(Plate XVI, fig. 4)	Charmouth, Dorset . . .	,, ,,
C. 38469	. . . . .	Murphy's Pool, Dundry, Somerset	J. W. Tutcher Coll., 1937.
C. 38470–77	. . . .	Charmouth, Dorset . . .	L. F. Spath Coll., 1937.
(?) **C. 38592**	. . . .	Napton, Warwickshire . .	W. Wingrave Coll., 1935.
C. 39159	. . . . .	Dorset Coast [bed 121]. . .	J. Francis Coll., 1927.
(?) **C. 39336**	. . . .	Orchard S.W. of Wootton Cross, N.E. of Charmouth, Dorset (Belemnite Stone). *See* Lang, 1932, p. 117, B. 43.	W. D. Lang Coll., 1935.
(?) **C. 39554**	. . . .	Smithfield Coppice, N. of Wootton Fitzpaine, Dorset (Bel. Stone). *See* Lang, 1932, p. 117, B. 39.	,, ,,
(?) **C. 39555**	. . . .	Fishpond Brook, Higher Coombe, N. of Wootton Fitzpaine, Dorset (Belemnite Stone). *See* Lang, 1932, p. 116, B. 38.	,, ,,

Beaniceras subluridum, sp. nov

Plate VI, figs. 6 *a*, *b*; Plate XV, figs. 8 *a*, *b*, 9

Beaniceras sp., Buckman, 1918*a*, p. 264, Table iii (bed 121).
,, sp., Spath, 1923*a*, p. 7 (Belemnite Stone).
,, sp., Lang, in Lang, Spath, Cox & Wood, 1928, p. 189.

TYPE.—The Belemnite Stone example (No. C. 22325) figured in Plate VI, fig. 6.

DIAGNOSIS.—Like *B. luridum*, but less inflated, with narrowly rounded, instead of wide and flattened, venter, and with more distantly spaced ribs on the inner whorls, the number of ribs being 8, 13, and 16 on the last three whorls respectively. Suture-line with bifid first lateral lobe and ascending auxiliaries (Plate XV, fig. 9).

MEASUREMENTS.

Holotype (Plate VI, fig. 6) . . .	29	·34	·41	·45
Plate XV, fig. 8	21	·33	·50	·40

REMARKS.—The holotype includes only a small part of the body-chamber which, however, in the smaller example figured in Plate XV, fig. 8, occupies at least three-quarters of the outer whorl. The latter example also retains more of the test than the holotype, and indistinct spiral lineation is visible on the venter and its edges. The ribs on the inner whorls of the smaller specimen are slightly closer than in the holotype, as they are in a somewhat doubtful third example (No. C. 38479); but another typical specimen (C. 38478) has again 8 and 13 ribs, respectively, on the second and third whorls, the first being smooth.

B. rotundum Buckman, described below, is more inflated and more involute; and *B. crassum* S. Buckman, which, unlike the two examples mentioned above, may have ribs decreasing rather than increasing in numbers on successive whorls, is more sharply ribbed, with the costae projecting laterally, more even than in *B. luridum*.

HORIZON AND LOCALITY.—Upper *ibex* zone (*centaurus* sub-zone). England (Dorset).

SPECIMENS.

C. 22322	(Plate XV, fig. 8) .	Black Ven, Charmouth, Dorset (Belemnite Stone).	W. D. Lang Coll., 1921.
C. 22325	(Holotype) . .	Charmouth, Dorset (Belemnite Stone).	,, ,,
C. 38478–9	. . . .	,, ,, ,,	L. F. Spath Coll., 1937.

Beaniceras rotundum S. Buckman

Plate XIII, figs. 9 *a*, *b*; Plate XVI, figs. 6 *a–d*

Ammonites centaurus d'Orbigny: J. Buckman, 1844, p. 89 (*partim*).
? *Ammonites centaurus* d'Orbigny: Quenstedt, 1885, p. 276 (*partim*), pl. xxxiv, fig. 37.
? *Coeloceras centaurum* (d'Orbigny): Rosenberg, 1909, p. 317, pl. xvi, figs. 12 *a–c*.
Beaniceras rotundum S. S. Buckman, 1918, pl. cxxix.

TYPE.—The Cheltenham example figured by Buckman, now in the Survey Collection (M.P.G., No. 47095).

DIAGNOSIS.—Like *B. subluridum*, sp. nov., but more inflated, with smaller umbilicus. Suture-line as in other species of *Beaniceras*, with sub-bifid first lateral lobe and low, lateral saddles.

MEASUREMENTS.

Holotype (Buckman)	11·5	·36	·55	·27
Plate XVI, fig. 6	14	·30	·54	·35
Plate XIII, fig. 9 . . .	(at) 20	·40	·60	·30
,, ,, . . .	,, 27	·33	(?)	·44

REMARKS.—Buckman's holotype is only a septate nucleus which could even be compared to the inner whorls of *Liparoceras* of the *naptonense* type (Plate XIII, fig. 3), except for its inflation and involution. It is almost certainly very close to, or identical with, the early stages of the larger topotype figured in Plate XIII, fig. 9. In this the body-chamber is almost a whole whorl in length, and degeneration of the very blunt and coarse ribbing of the earlier stages is clearly seen. The primary ribs are most prominent on the inner whorl-side, and break up into a number of fine secondaries which are projected forwards on the very broad and rounded venter; but there is little ornamentation in the siphonal line.

The smaller example figured in Plate XVI, fig. 6, is completely septate, and differs from the type in developing sub-tuberculate terminations of the ribs at the ventro-lateral edges, even at a very small diameter (10 mm.), so that it is transitional to forms like *B. crassum* Buckman. The inner whorls of *B. costatum* S. Buckman, or at least of some of the more doubtful specimens listed, also resemble larger examples of *B. rotundum*, but they similarly tend to thicken the ribs externally rather than on the inner whorl-side

A small specimen from the Dorset Coast (said to be from " bed 121 Lang," i.e. the Belemnite Stone, but perhaps from the Pyritic Marls) in the Survey Collection (M.P.G., No. 47104) was labelled by Buckman : " *B.* aff. *rotundum*, more numerous ribs." It is quite different from any of the species here described, except perhaps the doubtful Dundry example listed under *B. luridum*, and, like it, is probably new, but owing to its small size (13 mm.) it cannot be safely identified.

HORIZON AND LOCALITIES.—*Ibex* zone (*centaurus* sub-zone ; Yellow Lias). England, Germany.

SPECIMENS.

C. 38391 (Plate XVI, fig. 6)	Balingen, Germany	P. Mohr Coll., 1848.
C. 38462 (Plate XIII, fig. 9)	Hewlitt's Hill, Cheltenham, Glos.	L. F. Spath Coll., 1937.

Beaniceras costatum S. Buckman

Plate XIII, figs. 4–5 ; Plate XV, figs. 3–4

Ammonites centaurus d'Orbigny : J. Buckman, 1844, p. 89 (*partim*).
Beaniceras costatum S. Buckman, 1919, pl. cxxiii.
" " " Bovier, 1932, p. 30.

TYPE.—The Cheltenham specimen figured by Buckman, now in the Survey Collection (M.P.G., No. 47096).

DIAGNOSIS.—Sub-stenogyral, pachy- to sub-pachygyral, latumbilicate *Beaniceras*. Early whorls depressed, with very broad and flat venter, later more quadrate. Ribs strong, regularly spaced, and most prominent at ventro-lateral edge, forming a point only in the var. **transiens**, nov. Periphery smooth, except on contracting body-chamber ($\frac{3}{4}$ whorls), where secondary striae form distinct, forwardly directed chevrons, which end in a final rostrum. Suture-line (Plate XV, fig. 3 *c*) with low lateral saddles.

MEASUREMENTS.

Holotype (Buckman)	(at) 14	·35	·57	·42
" "	" 29	·29	·33	·52
Holotype (Spath, corrected)	28	·30	·35	·50
Plate XIII, fig. 5	23	·33	·44	·44
var. *transiens* (Plate XV, fig. 3)	(at) 12·5	·36	·60	·24
" " "	" 18	·33	·36	·39

REMARKS.—There are few typical examples of this species, but even a metatype from Buckman's collection (M.P.G., No. 47101) is not identical with the holotype and, in fact, is indistinguishable from some young specimens (e.g. No. 38450) here provisionally included in *Androgynoceras sparsicosta* (Trueman). For in the very young stages, when the costation only begins to develop after the smooth initial whorls, the peripheries which later become quite distinct, are essentially similar and faintly ribbed.

The specimen figured in Plate XIII, fig. 5, differs from the type in its dimensions, but this is believed to be due to its intermediate size. On the other hand, a second example (No. C. 38481) does not show definite degeneration of the ribbing on the half-whorl of body-chamber (at 26 mm. diameter), and is thus almost impossible to distinguish from the young of *Androgynoceras maculatum* (compare Plate IX, fig. 2), except by the prominence of the ribbing of the inner whorls compared with that of the outer.

In the var. *transiens* (Plate XV, figs. 3–4) the early whorls are as distinctly coronate as in *B. centaurus* (d'Orbigny), though with fewer ribs, and the degeneration of the contracting outer whorls is much more conspicuous than in the typical specimens. The measurements given of the larger example (fig. 3), at the end and half a whorl earlier, indicate a remarkable change in whorl-thickness and umbilication, and in some examples the transformation takes place at even a smaller diameter.

The present species is connected by transitions with *B. luridum* and *B. subluridum*. Thus an example (M.P.G., No. 47102) labelled by Buckman " *B.* cf. *costatum* ; outer whorl more inflated and more rounded on side," would be difficult to distinguish from the inner whorls of the var. *involuta* of *B. luridum* figured in Plate XV, fig. 6 ; while another specimen (M.P.G., No. 47103) also labelled *B.* cf. *costatum*, but with a different umbilicus and more widely spaced ribs, is directly transitional to *B. subluridum*. The closely costate *B. senile* Buckman, resembles the var. *transiens* in its contracted body-chamber and degeneration of the ornament, but it retains its outer tubercle.

The two un-localised specimens listed below (figured in Plate XIII, figs. 4 *a* and *c*), with an oolitic matrix, resemble some inner whorls figured by Quenstedt (1885, pl. xxxiv, figs. 38–40) as *Amm. centaurus*. They are less closely costate than the type of *B. costatum*, and could perhaps represent the inner whorls of *B. luridum* or its varieties ; but in view of the resemblance of these inner whorls to the immature *Androgynoceras sparsicosta*, already referred to, I hesitate to identify Quenstedt's examples from the figures.

One of the four Balingen examples (No. C. 38399), also provisionally listed with the present species, is again more closely costate, while another (C. 38400) could be a transition to *B. centaurus*, showing tuberculation of some of the ribs. The other two, with finer ribbing, are altogether doubtful.

Horizon and Localities.—Upper *ibex* zone, *centaurus* sub-zone. England, France ? Germany.

Specimens.

37226	. . . . .	May, Calvados, France . . .	Tesson Coll., 1857.
C. 10681–84	(incl. Plate XV, figs. 3, 4).	Marston, Glos.	F. H. Butler, 1905.
C. 28184–87	. . . .	Battledown Brickworks, Cheltenham, Glos.	L. Richardson Coll., 1925.
C. 38389	(Plate XIII, fig. 4 *a*)	Unlocalised (Germany ?) . .	Old Coll.
C. 38390	(Plate XIII, fig. 4 *c*)	,, ,, . .	P. Mohr Coll., 1848.
C. 38394–5	. . . .	Balingen, Wurtemberg . . .	,, ,,
C. 38399–400	. . . .	,, ,, ...	,, ,,
C. 38461	(Plate XIII, fig. 5)	Cheltenham, Glos. . . .	L. F. Spath Coll., 1937.
C. 38481	. . . . .	,, ,, ...	,, ,,
(?) C. 39173	. . . .	Les Cottards, nr. St. Amand, Cher, France.	N. Boubée, 1938.

Beaniceras crassum S. Buckman

Plate X, figs. 2 *a*, *b*

Ammonites planicostatus Sowerby: J. Buckman, *partim*, 1844, p. 90.
Coeloceras-like Ammonite, Lang, 1914, p. 326.
Beaniceras sp., Buckman, 1918*a*, p. 264.
Beaniceras crassum S. Buckman, 1919, pl. cxlvii.

TYPE.—The Cheltenham example figured by S. S. Buckman (1919) now in the Survey Collection (M.P.G., No. 32007).

DIAGNOSIS.—Like *B. luridum*, but more depressed, more involute, and with much coarser and more distantly spaced ribs (14 and 12 on last and penultimate whorls, respectively). Body-chamber just over half a whorl. Suture-line as in other forms of *Beaniceras*, with low external lobe, high external saddle, comparatively narrow, trifid first lateral lobe, and short and wide first lateral saddle, followed by a well individualised, trifid second lateral lobe, as deep as the first.

MEASUREMENTS.

Holotype (Buckman) . .	(at) 20·5	·36	·63 (·59)	·36
,, ,, . .	,, 28·5	·39	·42 (·40)	·41
Plate X, fig. 2	26	·32	·55	·42

REMARKS.—The example here figured was labelled by Buckman "*Beaniceras* stout species, like one from Yellow Lias, Cheltenham" and there is no doubt that this is the form for which he subsequently created the name *B. crassum*. The second specimen listed below is from the Belemnite Stone, and shows the suture-line, which cannot be seen in the holotype; but since this example is slightly less inflated and slightly less coarsely ribbed, it is somewhat transitional to the var. *involuta* of *B. luridum* figured in Plate XV, fig. 6.

The small *Amm. centaurus* figured by Oppel (1853, p. 94, pl. iii, fig. 8) seems to represent the inner whorls of a form like the present, but the dimensions 18; ·32; ·51; ·40 (after Buckman) are slightly different, i.e. the example is less inflated than the type, although the inner whorls of the example C. 38483, already referred to, are apparently very similar. These small forms are not easily identified, for some inner whorls here referred to the group of *Androgynoceras heterogenes* and *A. sparsicosta* are very similar. Thus the examples figured in Plate XIII, fig. 4, resemble Oppel's figure as much as they do the young *A. sparsicosta* illustrated in Plate X, fig. 5; and Quenstedt (1885, pl. xxxiv, figs. 38–40) figured as *Amm. centaurus* some inner whorls of the same type. I have already referred to these under *B. costatum* and it is probable that there are passage-forms between this species, *B. luridum*, and the present form, which yield such intermediate inner whorls.

The specimen figured in Plate VI, fig. 2, and discussed under *Liparoceras geyeri*, sp. nov. (p. 66), seems to be a passage-form to *B. crassum*, but it develops bi-tuberculation. It also already has part of the body-chamber, and it is perhaps chiefly the whorl-shape and irregular peripheral ribbing that suggest comparison with *Beaniceras*.

HORIZON AND LOCALITIES.—Upper *ibex* zone, *centaurus* sub-zone. England, France (?), Germany (?).

SPECIMENS.

C. 22323	(Plate X, fig. 2) .	Black Ven, Charmouth, Dorset (Belemnite Stone).	W. D. Lang Coll., 1921.
C. 38483	. . . .	,, ,, ,,	L. F. Spath Coll., 1937.
(?) C. 39552	. . . .	S.W. of Wootton Cross, N.E. of Charmouth, Dorset. See Lang, 1932, p. 117, B. 43.	W. D. Lang Coll., 1935.
(?) C. 39553	. . . .	S.E. of Lower Abbot's Wootton Farm, N.E. of Charmouth, Dorset. See Lang, 1932, p. 116, B. 27.	,, ,,

Beaniceras centaurus (d'Orbigny)

Plate VI, figs. 7, 8 ; Plate X, fig. 7 ; Plate XVI, figs. 8–9

Ammonites centaurus d'Orbigny, 1844, p. 266, pl. lxxvi, figs. 3–6.
,, ,, ,, Quenstedt, 1846, p. 179, pl. xiv, fig. 9.
,, ,, ,, Bronn, Index, 1848, p. 36.
,, ,, ,, Prodrome, II, 1850, p. 224.
,, ,, ,, Giebel, 1852, p. 665 (synonym of *A. pettos*).
,, ,, ,, Oppel, 1853, p. 94, pl. iii, fig. 8.
,, ,, ,, Pictet, 1854, p. 695.
non ,, ,, ,, Terquem, 1855, p. 14.
,, ,, ,, Oppel, 1856, p. 286.
,, ,, ,, Quenstedt, 1856, p. 135, pl. xvi, fig. 16.
,, ,, ,, Schloenbach, 1863, p. 528.
,, ,, ,, Seebach, 1864, pp. 81 and 136.
Coeloceras centaurus (d'Orbigny) : Hyatt, 1867, p. 87.
Ammonites centaurus d'Orbigny : Dumortier (iii), 1869, p. 97.
,, ,, ,, Emerson, 1870, p. 311.
,, ,, ,, Brauns, 1871, p. 222.
Coeloceras centaurus (d'Orbigny) : Hyatt, 1872, p. 13.
,, ,, ,, ,, 1874*b*, p. 32.
Ammonites centaurus d'Orbigny : Witchell, 1882, p. 20.
Coeloceras centaurus (d'Orbigny) : Zittel, 1884, p. 468.
Ammonites ,, ,, Quenstedt, 1885, p. 275, pl. xxxiv, figs. 30 (31 ?).
Ammonites (*Aegoceras, Coeloceras*) *centaurus* (d'Orbigny) : Lapparent & Fritel, 1888, pl. iii, figs. 21–22.
Aegoceras centaurus (d'Orbigny) : Haug, 1891, p. 33.
Coeloceras centaurus (d'Orbigny) : Futterer, 1891, p. 341.
Ammonites (*Coeloceras*) *centaurum* (d'Orbigny) : Ammon, in Gümbel, 1891, p. 693.
Aegoceras centaurum (d'Orbigny) : Geyer, 1893, p. 30 (*partim ?*), *non* pl. iii, figs. 11–12.
Coeloceras centaurus (d'Orbigny) : Engel, 1908, p. 243.
Beaniceras centaurus (d'Orbigny) : Buckman, 1913, pp. *iii*, 73*c*.
,, ,, ,, Buckman, 1919, pl. cxlvi.
Coeloceras centaurus (d'Orbigny) : Beurlen, 1924, p. 153.
,, ,, ,, Frebold, 1926, p. 527.
Beaniceras centaurum (d'Orbigny) : Richardson, 1929, p. 12.
non Beaniceras cf. *centaurum* (d'Orbigny) : Bovier, 1932, p. 31.
Beaniceras centaurus (d'Orbigny) : Dacqué, 1934, p. 291.
,, ,, ,, Spath, 1936*a*, p. 444.

TYPE.—The Cottards (St. Amand, Cher) example figured in d'Orbigny's pl. lxxvi, figs. 3–4, only.

Diagnosis.—Sub-platygyral, pachygyral, sub-latumbilicate *Beaniceras*. Whorl-section at first rounded and greatly depressed, then coronate, with divergent whorl-sides and wide, flattened periphery; median (siphonal) area and ventro-lateral edges slightly raised. Involution very slight. Inner whorls smooth to about 4 or 5 mm. diameter, then about 16–18 regular ribs in typical forms, 20–24 in the var. **elegans,** nov., and about 12 in var. **subcrassa,** nov. Ribs sharp and high, terminating at ventral edge in a more or less prominent spine. Three or four fine secondary ribs to each primary, continuous across the periphery, or with intermediate finer ribs and more general irregularity in var. **cherensis,** nov. Suture-line with two lateral lobes, of which the second is much narrower and smaller than the first which itself is as deep, or almost as deep, as the external lobe. External saddle high and comparatively slender. All the lobes and saddles subdivided unsymmetrically (Text-fig. 9, p. 25).

Measurements.

Holotype (d'Orbigny)	18	·35	·55	·35
,, (figure)	18	·39	·60	·40
No. C. 28120 (Plate XVI, figs. 9 *a*, *b*) .	12	·33	·66	·33
Quenstedt (1847, pl. xiv, fig. 9) . .	15	·35	·60	·35
,, (1856, pl. xvi, fig. 16) . .				
S. S. Buckman, 1919 (pl. cxlvi) . .	12·5	·39	·63	·29

Remarks.—Even as early as 1847 Quenstedt considered it a difficult task to separate all the modifications of this dwarf species. The three varieties mentioned above are based on the differences in ribbing, but in each variety individuals occur with a more than usually depressed whorl-section in at least one stage, such as the example (M.P.G., No. 32006) figured by Buckman (1919). This is indistinguishable from topotypes in side-view, yet its inner whorls are more depressed, while the outer increases less rapidly in width, so that its increase in thickness is slow compared with that of some more typical examples. The only British example listed below, with half a whorl of body-chamber at 11 mm. diameter, is of the same type, yet the two forms just mentioned differ so little, even in suture-line, from undoubted foreign individuals of *B. centaurus*, that they cannot be separated even as a variety or local race.

While these examples lead directly to the var. *transiens* of *B. costatum* Buckman, with loss of tuberculation on the outer whorls, the more distantly ribbed var. *subcrassa*, nov. (Plate XVI, fig. 8) is transitional to *B. crassum* Buckman, which latter, however, is un-tuberculate or at least has no projecting spines. The more closely ribbed var. *elegans* (Plate VI, fig. 8, corresponding with d'Orbigny's pl. lxxvi, fig. 5 only) leads to those indefinite forms with a less depressed and more quadrate, or even rounded, whorl-section of which Quenstedt's figs. 38 and 39 (pl. xxxiv) may represent two varieties. These have been already referred to under *B. costatum* and *B. luridum*.

In the var. *cherensis*, nov. (Plate X, figs. 7 *a–c*) the general shape is still that of the typical forms, but the irregularity of the costation, with appearance of fine, intermediate ribs, causes a certain resemblance to *Coeloceras* (*pettos* group). I have already mentioned (1936*a*, p. 444) that even in the d'Orbigny collection in Paris, examples of *Coeloceras* are mixed up with the types of *Beaniceras centaurus* and *vice versâ*, specimens of *Beaniceras* with the reputed types of *Coeloceras grenouillouxi*; and I thought that the superficial resemblance could be explained by their common origin in Eoderoceratidae, the similar suture-line being equally modified by a similar coronate whorl-shape. In reality the ornamentation is of a different type, in spite of the presence of intermediate ribs in *C. grenouillouxi* and the resemblance of the inner whorls of *C. subpettos* (see Gemmellaro, 1884, pl. vii, fig. 19) to the present species. But in the case of isolated individuals difficulties may often be encountered as Hyatt (1872) already discovered; and one mal-formed example of the var. *cherensis* (No. C. 28071) even shows some resemblance to the immature *Androgynoceras* figured by Geyer (1893, pl. iii, fig. 16) as *Aegoceras* cf. *heterogenum* (Young & Bird).

The inner whorls of *B. senile* Buckman differ from the same author's *B. centaurus* merely in whorl-thickness, and this suggests that the (unknown) final stage of the present species shows similar degeneration. Unfortunately complete specimens of *B. centaurus* do not seem to have been encountered.

HORIZON AND LOCALITIES.—Upper *ibex* zone, *centaurus* sub-zone. England, France, Germany.

SPECIMENS.

C. 28063	. . . . .	Hinterweiler, Wurtemberg . .	J. R. Gregory & Co., 1925.
C. 28071	. . . . .	Les Cottards, St. Amand, Cher, France.	,, ,,
C. 28072	(Plate X, fig. 7) .	,, ,, ,,	,, ,,
C. 28118	(Plate XVI, fig. 8) .	,, ,, ,,	,, ,,
C. 28119	(Plate VI, fig. 7) .	,, ,, ,,	,, ,,
C. 28120	(Plate VI, fig. 8) .	,, ,, ,,	,, ,,
C. 28121	. . . . .	,, ,, ,,	,, ,,
C. 28122–23	(Plate XVI, figs. 9 *a–d*)	,, ,, ,,	,, ,,
C. 28188	. . . . .	Battledown Brickworks, Cheltenham, Glos.	L. Richardson Coll., 1925.
C. 38310–11	. . . .	Unrecorded (" Lias γ, Germany ")	Transf. M.P.G., 1880.
(?) C. 38365	. . . .	France (St. Amand, Cher ?) .	History unrecorded.
C. 38392–3 .	. . . .	Balingen, Wurtemberg . .	P. Mohr Coll., 1848.
C. 38396–8 .	. . . .	,, ,, . .	,, ,,
C. 38163–72	. . . .	Les Cottards, St. Amand, Cher, France.	N. Boubée, 1938.
C. 38174–80 (varieties) .	. . .	,, ,, ,,	,, ,,

Beaniceras senile S. Buckman

Plate XV, figs. 2 *a*, *b*.

Ammonites centaurus d'Orbigny: J. Buckman, 1844, p. 89 (*partim*).
Beaniceras senile S. Buckman, 1918, pl. cxxvi.
,, ,, ,, 1924, pl. cxxvi A.
Beaniceras aff. *senile* S. Buckman: Tutcher & Trueman, 1925, p. 652.

TYPE.—The Cheltenham specimen figured by Buckman (1918) and now in the Survey Collection (M.P.G., No. 47092).

DIAGNOSIS.—Like *B. centaurus* (d'Orbigny), but only on early septate whorls; later with fine and close costation, tuberculate at ventro-lateral edges, and continuous across venter, with a forwardly directed sinus. Traces of spiral striation on test of venter, which is at first flattened, and later roundly arched. Suture-line simple, as in *B. centaurus* (Text-fig. 9, p. 25).

MEASUREMENTS.

Holotype (Buckman, 1918) . .	(at) 9	·42	·65	·22
,, ,, ,, . .	,, 18	·33	·39	·41
Idiotype (Buckman, 1924) . .	,, 9	·41	·77	·22
,, ,, ,, . .	,, 16	·375	·41	·425
Plate XV, fig. 2	30	·30	·45	·40

REMARKS.—The measurements of these dwarfed specimens are only approximate and of no practical value; for example, the whorl-thickness of the idiotype at 9 mm. (77 per cent. according to Buckman) is given on Mr. Tutcher's label as being only 64 per cent., while I make it slightly over 80 per cent. The species, however, is easily recognised, although there are transitions to *B. centaurus* (d'Orbigny), such as the original of Quenstedt (1884, pl. xxxiv, fig. 36). This is septate to the end yet it already shows the characteristic change to close ribbing, and it is probable that its body-chamber was contracted. Unfortunately, in these Suabian specimens preserved in limonite (after pyrite), as in the similar Cher specimens, the body-chamber is nearly always missing. In the example figured in Plate XV, fig. 2, the body-chamber is half a whorl in length, as it is in the holotype.

The larger example here figured (Plate XV, fig. 2) shows the typical degeneration of the costation on the outer whorl, where there is a small tubercle which is inconspicuous only because it is elongated radially. But the inner whorls are less coronate than in the typical examples, so that the form could be considered a transition to *B. luridum* Buckman, and especially the var. *submaculata*, nov. (Plate XV, fig. 7), or to *B. rotundum* S. Buckman (Plate XIII, fig. 9); in both these forms, however, the inner whorls are more coarsely ribbed. *B. costatum* Buckman, var. *transiens*, nov., had a somewhat similar, *centaurus*-like early stage, but it differs from *B. senile* in the ornamentation of the outer whorl.

HORIZON AND LOCALITIES.—Upper *ibex* zone, *centaurus* sub-zone. England, Germany, France (?).

SPECIMENS.

C. 38464 (Plate XV, fig. 2) .	Rugby, Warwickshire. . .	L. F. Spath Coll., 1937.
C. 38482 (Original of Buckman, 1924, Plate cxxvi A).	Tyning Colliery Quarry, Radstock (top beds, *valdani* limestone).	J. W. Tutcher Coll., 1937.
(?) C. 39557	Robin Hood's Bay, Yorkshire (not *in situ*)	L. Bairstow Coll., 1938.

Genus ANDROGYNOCERAS Hyatt, 1867, p. 83

GENOLECTOTYPE.—*Ammonites hybrida* d'Orbigny. See Buckman, 1911, p. *iii*.

DIAGNOSIS.—More-or-less evolute shells ("the envelopment may cover up only the abdomen of each internal whorl"), with narrow venter (compared with *Liparo-*

ceras) and more-or-less convergent sides, often carrying two lines of tubercles in the adult. Capricorn stage more-or-less prolonged ("the large pilae of the young are split into smaller pilae on the abdomen of the adult, but usually retain the characteristics of '*Microceras*' until a late period of growth"). Suture-line rather complex on the Liparoceratid outer whorls, but simpler at earlier stages and in the unmodified capricorns.

Distribution.—Lower Pliensbachian (Carixian), *ibex* zone (*centaurus* sub-zone), and *davoei* zone (*maculatum* to *bechei* sub-zones).

Remarks.—Buckman thought it "advisable" to take *Amm. hybrida* as the genotype, but the rules of nomenclature compel us to do so. D'Orbigny's (1844) description of *Amm. hybrida* seems to be based on the original of his figs. 1–2 (pl. lxxxv), which is the type of the species; and the size of fig. 4 alone indicates that d'Orbigny's small *Oistoceras* fragment (figs. 4–5) has nothing to do with his *Amm. hybrida*. Of the species included by Hyatt in *Androgynoceras*, the un-figured *A. appressum* (1867, p. 83; 1871, p. 24; 1874*a*, p. 27) was described as much flatter than *Liparoceras bechei* and as retaining a capricorn stage for at least four whorls. Since at the same time the envelopment was stated to extend to the inner line of tubercles, *A. appressum* can have nothing to do with *A. hybrida*; and according to Haug (1887, p. 110, footnote) it is identical with *Platynoticeras alterum* (Oppel). *Liparoceras indecisum* Hyatt (1867, p. 84; 1871, p. 24; 1874*a*, p. 27), described as showing the capricorn characteristics as late as the fourth whorl, but with an envelopment barely covering the prominent external line of tubercles, is equally doubtful. It may be a transitional form like *A. sparsicosta* or *Liparoceras naptonense*, but these are not found at Lyme Regis whence Hyatt recorded *L. indecisum*. Both *Androgynoceras appressum* and *Liparoceras indecisum*, in fact, were presumably put forward to illustrate certain stages of development more than as actual species.

It is important to remember that *Androgynoceras* was proposed for the members of a genetic series intermediate between the capricorns ("*Microceras*") on the one hand, and *Liparoceras* on the other, their actual occurrence in time being insufficiently known in Hyatt's day. *Androgynoceras* was accepted in this sense by Buckman and others, but unfortunately there is considerable uncertainty even now about the genotype species, namely *A. hybrida*. While Quenstedt in 1848 (pp. 352, 353) had already listed it as identical or almost identical with *A. henleyi* Sowerby (a view adopted by Hyatt in 1874, p. 27), Giebel in 1852 (p. 670) thought this contention "incomprehensible" (but no doubt misidentified *Amm. henleyi*). Wright (1882, p. 370) listed *A. hybrida* in the synonymy of *A. heterogenes* (Young & Bird); Oppel (1856, p. 284), Schloenbach (1863, p. 525), Dumortier (1869, p. 94), and Brauns (1871, p. 216) mistook it for a form now referred to *Platynoticeras*, while, again, Reynès (1868, p. 89) considered it to represent the inner whorls of *A. henleyi*, and Blake (in Tate and Blake, 1876, p. 281) put it in the synonymy of that species.

Through the kind help of Mlle. E. Basse (Madame de Ménorval), M. J. Cottreau, and Prof. Arambourg of Paris, I have received a cast of the specimen in the d'Orbigny collection (No. 1673 B) which is believed to have served as original to the figures 1 and 2. I am reproducing it in Plate XXVI, fig. 2, and it will be seen that it is entirely different from d'Orbigny's figure. It is in fact, comparable, among English forms, chiefly to *Androgynoceras heterogenes* (Young & Bird) and especially to its var. *gigas* Spath, which has similar inner whorls (compare *Aegoceras heterogenum* Wright, 1880, pl. xxxvi, figs. 1–3). It is true that the proportions (86 ; ·33 ; ·34 ; ·49) seem different, but that is due to difference in size ; and the number of ribs to the whorl (24 : 21 : 19, counting inwards) alone indicates that *A. hybrida* is a form occurring in the *maculatum* sub-zone. The var. *leckenbyi* of *A. maculatum* (Young & Bird) also is closely related to d'Orbigny's species, and it is even possible that some of the immature examples referred below to the two varieties just mentioned belong, in fact, to *A. hybrida*. A specimen from Charmouth, however, in the Musée d'Histoire Naturelle at Paris (Lady Hasting's Coll.) which has been identified by Mlle. Basse with d'Orbigny's species (and of which I have also received a cast) is a variety of *A. lataecosta*, transitional to *A. subhybrida*, sp. nov.

It is impossible to separate the two species *Amm. lataecosta* and *Amm. maculatus* from *Androgynoceras* of the *hybrida* group ; for not only are they connected by innumerable transitions among themselves and with *A. hybridiforme*, *A. subhybrida*, and *A. heterogenes* as shown below, but there is a return to bi-tuberculation in all fully grown individuals ; and the absence of more-or-less conspicuous inflation is alone insufficient for generic separation. As I mentioned previously (1936*a*, p. 448), however, *A. lataecosta*, in the young at least, is near enough to the figure published by d'Orbigny (as *Amm. planicosta*) to be looked upon as the genotype of *Aegoceras* Waagen, in Buckman's sense (1911, p. *iii*) ; and it has hitherto seemed to me that the latter author's selection of d'Orbigny's figured species as genotype was binding if the two genera were to be kept separate. In 1915, however, Buckman proposed to apply the name *Amblycoceras* Hyatt, 1900, to a series of capricorns having costae with a peripheral curve less pronounced than that of *Oistoceras*, and Trueman (1919, p. 262) accepted the emended genus *Amblycoceras* with *Amm. capricornus* (Zittel) Hyatt as the type. Now, as Haug (1900, p. 82) pointed out, *Amblycoceras* (first " *Microceras* ") is really a synonym of *Aegoceras* Waagen,[1] a name proposed to replace the former family of the " *Capricorni* ", the type of which is *Amm. capricornus* Schlotheim (see Hoernes, 1884, p. 322). Thus Buckman's selection of *A. planicosta* d'Orbigny as genotype of *Aegoceras*, and of *A. capricornus* as lectotype of *Amblycoceras*, whether technically correct or not, was as much against these various authors' intentions, as was Hyatt's restriction of *Aegoceras* to a Triassic group (previously named *Gymnites* by Mojsisovics). Moreover, in practice, it would be impossible generically to identify larger examples of forms of the *lataecosta* and *maculatum* groups which agree with Hyatt's diagnosis of *Androgynoceras*, but which, after Buckman, should now be referred to *Aegoceras*. The confusion caused by Hyatt's introduction of his genus *Amblycoceras* can also be gauged by the recent reference to it (Schröder, 1927, pp. 198–201) of four species belonging in reality to three genera of which two (*Promicroceras* and *Bifericeras*) do not even belong to the family Liparoceratidae.

[1] *Aegoceras* cannot be considered to be invalidated by *Aegocera*, *Aegoceros* or *Aegocerus* as Lydekker (1891, *Nature*, July 16th, p. 244) stated, since there is a difference of one letter.

Fortunately matters are now simplified by the fact that *A. capricornus* can be shown to be almost identical with *A. lataecosta* and that the latter species, or at least its close ally, *A. maculatum*, is much more like d'Orbigny's *A. hybrida*, the genotype of *Androgynoceras*, than the dimorph *A. henleyi*, previously identified with it. For, since *Androgynoceras* dates from 1867 and has priority over *Aegoceras* Waagen, 1869, this latter genus, as restricted by Buckman, as well as *Amblycoceras* in Trueman's sense, become synonyms of *Androgynoceras*, and therefore unnecessary, and the species here described are, accordingly, distributed between the two genera only, namely, *Androgynoceras* and *Oistoceras*.

Androgynoceras heterogenes (Young & Bird)

Plate XIII, figs. 6–7

Ammonites heterogenes Young & Bird, 1828, pp. 263, 264, 359, pl. xiv, fig. 7.
,, *heterogeneus* ,, Phillips, 1829, p. 163, pl. xii, fig. 19.
,, *heterogenus* ,, Brown, 1837, pl. xviii, fig. 12.
,, *heterogeneus* ,, Bronn, 1848, Index, p. 45.
,, ,, ,, Giebel, 1852, p. 740.
,, *heterogenus* ,, Morris, 1854, p. 292.
,, ,, ,, Simpson, 1855, p. 69.
Aegoceras heterogenum (Young & Bird): Wright, 1880–82, p. 370, pl. xxxv, figs. 4–6, pl. xxxvi, figs. 1–4.
Ammonites heterogenum Young & Bird: Quenstedt, 1884, p. 235.
Ammonites heterogenes Young & Bird: Simpson, 1884, p. 104.
Androgynoceras heterogenes (Young & Bird): Buckman, 1912, p. 46*b*, pl. xlvi.
,, ,, ,, Buckman, in Fox-Strangways and Barrow, 1915, p. 95.
Liparoceras heterogenes (Young & Bird): Trueman, 1919, p. 268 (*partim*).
Androgynoceras heterogenes (Young & Bird): Spath, 1936*a*, p. 446.

TYPE.—Young & Bird's original (Whitby Museum, No. 195) re-figured by Buckman (1912).

DIAGNOSIS.—Sub-platygyral, sub-pachygyral, sub-latumbilicate *Androgynoceras*. Capricorn (*maculatum*-) stage to about 50–60 mm. diameter, followed by a flattening of the ribs and their subdivision on the venter. Bi-tuberculation, which may appear slightly earlier (i.e. about 40 mm.), usually not distinct until change in ornamentation sets in, with fairly rapid approximation of ribs. One, two, or three secondaries to each primary rib, which may be parinode or imparinode. Whorl-section sub-hexagonal, with convergent, or almost parallel, sides. Suture-line very complex, with high, pointed median saddle in the external lobe, and wide lateral lobe, at first shallower, then slightly deeper than external lobe.

MEASUREMENTS.

Holotype (figure)	100	·39	·47	·40
No. C. 18118	100	·41	·47	·34
No. C. 38457	100	·40	·46	·34
Wright's pl. xxxv, figs. 4–6	111	·40	·44	·37
var. *gigas* Spath	125	·40	·46	·42
Plate XIII, fig. 7	59	·33	·43	·43

REMARKS.—This species is as variable as other forms of *Androgynoceras*, but the differences between the various individuals before me are far less than the diagrammatic figures in Young and Bird, Phillips, and Wright, suggest. The var. *gigas* Spath, 1936 (p. 447), was based on the original of Wright's pl. xxxvi, which is septate to the end, and therefore of far larger size than any typical example. As already mentioned (p. 112), this is one of the few English forms comparable to *A. hybrida* (d'Orbigny). Bi-tuberculation in this variety does not appear until about 75 mm. diameter (Wright's figures 1–3 of pl. xxxvi, although more successful than figs. 4–6 of pl. xxxv, are restored, and the peripheral part shown in his fig. 3 is entirely missing); inner whorls, thus, are difficult to distinguish from *Androgynoceras maculatum* or its var. *leckenbyi*, to the latter of which the var. *gigas* is a transition. The Dorset specimens listed below, from an unknown bed, are such doubtful inner whorls, and might represent the true *A. hybrida*.

The example figured by Wright in his pl. xxxv (figs. 4–6) represents another variety, also found at Napton, Warwickshire, and it shows a more prolonged, coarsely ribbed stage before the swelling of the outer whorl. There are many transitions, however, between the forms here discussed, *A. intracapricornus* (Quenstedt), and *A. sparsicosta* (Trueman), on the one hand (e.g. B.M., Nos. 20901 and C. 1900); and *A. maculatum*, var. *leckenbyi*, nov., on the other. In the last the *maculatum* stage is predominant, and there is even less attempt at inflation of the outer whorl than in *A. subhybrida*; while in the transitions to *A. intracapricornus* and *A. sparsicosta*, the outer whorls are more typically Liparoceratid. *A. appressum* Hyatt (1867, p. 83; 1871, p. 24), which I thought at one time might be one of these transitions, and which cannot be definitely recognised from the description, has already been referred to (p. 111) as possibly a *Platynoticeras*.

The septate inner whorls, figured in Plate XIII, fig. 7, represent a coarsely-ribbed variety, reminiscent of Phillips' sketchy figure, with fewer and stronger costae than the holotype at the same size. The venter is almost flat, and the thickness considerably exceeds the whorl-height, while the inner tubercle is only just appearing. Conversely, the example figured in Plate XIII, fig. 6, with half a whorl of body-chamber and a more convex periphery, is transitional to *A. sparsicosta*, and has not only bi-tuberculation, but more closely ribbed inner whorls than the first specimen. Trueman (1919, p. 268) stated that in *A. heterogenes* bi-tuberculation commenced earlier than in *A. sparsicosta*, certainly before a diameter of 20 mm. In reality the holotype of *A. sparsicosta* is bi-tuberculate at about 23 mm. diameter, whereas in the typical Yorkshire examples of *A. heterogenes* the inner whorls cannot be distinguished from *Androgynoceras maculatum*, even at about twice that size.

A. intracapricornus (Quenstedt), described below, is close to the present species and, judging by Quenstedt's fig. 9 *u*, has inner whorls like the small example here figured (Plate XIII, fig. 7); but the aspect of *A. intracapricornus* soon changes, and a resemblance to *Liparoceras* of the *obtusinodus* type results, which shows it to be a distinct species, as Quenstedt recognised, and not merely a Suabian variation of *A. heterogenes*.

Geyer's (1893) *Aegoceras* cf. *heterogenum* is referred to above (p. 65) under *Liparoceras geyeri*, sp. nov.

Horizon and Localities.—*Ibex* zone (*centaurus* sub-zone) and *davoei* zone (*maculatum* sub-zone). England, (Yorkshire, Warwickshire), France (?).

Specimens.

(?) 20918*c*	. . . .	Kilsby Tunnel, Northants. . .	G. Baker Coll., 1843.
37961	. . . . .	Robin Hood's Bay, Yorkshire .	W. Bean Coll., 1859.
37962	. . . . .	,, ,, ,, .	,, ,,
97432	. . . . .	[Robin Hood's Bay] "Whitby", Yorkshire.	J. Rofe Coll., 1878
C. 1870	(var. *gigas*) . .	[Robin Hood's Bay] "Yorkshire Coast" (Wright's pl. xxxvi, fig. 4).	T. Wright Coll., 1887.
C. 3742	. . . . .	,, ,, ,,	S. H. Beckles Coll., 1891.
C. 18118	. . . . .	Unrecorded. [Robin Hood's Bay]	J. F. Blake Coll., 1907.
C. 19225	(Plate XIII, fig. 7)	Robin Hood's Bay, Yorkshire .	,, ,,
C. 22588	(Plate XIII, fig. 6)	Napton, Warwickshire . .	Sir H. Butlin Coll., 1921.
C. 23488–89	. . . . .	,, ,, . .	,, ,,
C. 28179	. . . . .	W. end of Great Tunnel, near Winchcombe, Gloucestershire.	L. Richardson Coll., 1925.
C. 38423	. . . . .	Napton, Warwickshire . .	W. E. Cutler Coll., 1935.
C. 38496	(var. *gigas*) . .	Robin Hood's Bay, Yorkshire .	L. F. Spath Coll., 1937.
C. 38505	. . . . .	"Lyme Regis," Dorset . .	J. F. Blake Coll., 1907.
C. 38506	. . . . .	Stonebarrow, Charmouth, Dorset .	W. Wingrave Coll., 1935.
C. 38595	. . . . .	Napton, Warwicks. . . .	,, ,,
C. 38875	. . . . .	Robin Hood's Bay (bed 583) .	L. Bairstow Coll., 1937.
(?) C. 39136	. . . . .	Robin Hood's Bay (bed 588) (with *A. maculatum* attached).	,, ,,
C. 39156	. . . . .	[Robin Hood's Bay, Yorkshire] .	Sowerby Coll., 1935.
(?) C. 39312	. . . . .	Napton, Warwicks.	L. F. Spath Coll., 1937.

Androgynoceras sparsicosta (Trueman)

Plate V, figs. 7, 8; Plate IX, fig. 4; Plate X, fig. 5

Liparoceras sparsicosta Trueman, 1919, p. 265, pl. xxi, figs. 2–3.
,, ,, ,, Tutcher and Trueman, 1925, p. 652.
Androgynoceras sparsicosta (Trueman): Spath, 1935, p. 396.
,, ,, ,, Spath, 1936*a*, pp. 446, 448.

Type.—Trueman's original (No. C. 28281) from Cheltenham, here re-figured (Plate V, fig. 7).

Diagnosis.—Like young *A. heterogenes*, but remaining in the costate *Beaniceras* stage to the end of the septate portion. Bi-tuberculation developed on single, strong, and undivided ribs of the last half whorl. The swelling of the body-chamber is so slight that increase in thickness from beginning to end of outer whorl is almost negligible. Tubercles elongated radially, and outer tubercle with long backward extension. Suture-line as in *A. heterogenes* or *Beaniceras* (Plate XIII, figs. 6 and 8).

Measurements.

Holotype (Trueman)	35	·32	·35	·44
Napton (Trueman, p. 267)	20	·33	·45	·35
Plate IX, fig. 4 (transition to *L. naptonense*)	44	·43	·50	·33

Remarks.—I previously (1935) identified this species with the inner whorls of a transitional form, now included in *Liparoceras naptonense* (No. C. 12640, partly figured in Plate XIV, fig. 6) ; and it is still possible that the body-chamber of the holotype of *A. sparsicosta* was only temporary, and that at larger diameters it would have developed a *heterogenes*-like outer whorl. But among the additional material now before me, especially from the Cutler Collection, there are more passage-forms to species of *Beaniceras*, than to *Liparoceras naptonense*, and the forms are now, therefore, kept distinct. One topotype of *A. sparsicosta* in the Richardson Collection (Plate V, fig. 8), in fact, reduced its costation at the end (diameter=27 mm.) like a *Beaniceras*, and it is associated with a form of *Androgynoceras* (No. C. 28181, also labelled *Liparoceras* aff. *sparsicosta*) which belongs to a compressed and prematurely degenerate variety of *A. maculatum* (Young & Bird). Again, the example figured in Plate X, fig. 5, was at first intended to illustrate a slender variety of *Beaniceras crassum* S. S. Buckman ; but it is bi-tuberculate, and while it could have belonged to a form transitional to *Liparoceras naptonense*, like the example figured in Plate IX, fig. 4, and while it has slightly more depressed whorls than the holotype of *A. sparsicosta* at the same diameter, yet it is undoubtedly very closely allied to that species. Still other specimens (e.g. No. C. 38424) show no inner tubercle at about 30 mm. diameter, and, being entirely septate, they cannot perhaps be definitely identified ; for similar examples (e.g. C. 38425) not having even the outer tubercle, yet with the peculiar lateral projection of the sharp ribs of this group, lead directly to *Beaniceras* of the *costatum-luridum* group and to *Androgynoceras maculatum*, var. *intermedia*, nov.

Young examples (C. 38427–30) of the same type in Mr. Tutcher's collection were labelled *Liparoceras sparsicosta* and *L.* cf. *sparsicosta* [also *Androgynoceras*? C. 38431–2], and they were accompanied by a note in Buckman's handwriting which reads as follows : " One cannot do more with these than say ' young capricorn Amms.' They agree quite well with the inner whorls of *Amm. heterogenes* Y. & B. ; one or two look a trifle thicker than inner whorls of *Amm. maculatus*. It all depends on how soon they change, if they do change, to the bi-spinous inflated-whorl stage."

The specimen figured in Plate VI, fig. 3, differs from *Androgynoceras heterogenes* only in developing spirally elongated tubercles on the last half whorl, but it is more closely costate than the type of *A. sparsicosta*, to which species it is transitional.

Another young " *Liparoceras sparsicosta* " in the Tutcher collection (No. C. 38433) is distinguishable from inner whorls of *Beaniceras* of the *costatum* group chiefly by its quicker growth and greater thickness ; and so are some of the Napton examples in the Cutler Collection, listed below, while others could equally well have been listed under *A. heterogenes*. Again, of three more examples labelled *L.* aff. *sparsicosta* from Mr. Richardson's Collection (Nos. C. 28179, 28182–3), two are referable to the form described below as *Androgynoceras maculatum*, var. *intermedia*, nov., and one represents the inner whorls of *A. heterogenes*.

Horizon and Localities.—(?) *Ibex* zone ((?) *centaurus* sub-zone) and *davoei* zone (*maculatum* sub-zone). England, Germany (?).

Richardson in 1929 (p. 12) stated that Trueman had " defined a definite [*sparsicosta*] subzone " (below the *cheltiense* beds). In his Table A this is probably correctly placed above *centaurus*, but the *centaurus* sub-zone is merely the *Beaniceras* horizon duplicated, and *cheltiense* is the equivalent of the *actaeon* and *maugenesti* sub-zones, or the lower half of the *ibex* zone. In 1925, Trueman himself (in Tutcher & Trueman, p. 652) listed *Liparoceras cheltiense* from the *Valdani* Limestone, but the present species from the overlying " *Striatum* Clays."

SPECIMENS.

33579 (Plate IX, fig. 4) .	" Cheltenham, Gloucestershire." [Napton ?]	Purdue Coll. (? 1854).
C. 12627 (Plate X, fig. 5) .	Napton Hill, nr. Southam, Warwickshire.	C. H. Watson Coll., 1909.
C. 17304	Charingworth brickyard, Glos. .	R. F. Tomes Coll., 1905.
C. 28180	Well at Queen's Wood Cottages, Prestbury, nr. Cheltenham, Glos.	L. Richardson Coll., 1925.
C. 28281 (Holotype) . .	,, ,, ,,	,, ,,
(?) C. 38387	Unrecorded. [Germany.] . .	Old Coll.
C. 38424	Napton, Warwicks. . . .	W. E. Cutler Coll., 1935.
C. 38426	Broadway Lane, Welton, Somerset .	J. W. Tutcher Coll., 1937.
C. 38427–28	Blackberry Hill, nr. Clutton, ,, .	,, ,,
C. 38429–30	Oldfield Park, Bath, Somerset . .	,, ,,
C. 38431–32	Broadway Lane, Welton, Somerset .	,, ,,
C. 38433	Tinsbury Sleight, Somerset . .	,, ,,
C. 38434–45	Napton, Warwicks. . . .	W. E. Cutler Coll., 1935.
C. 38446	Dumbleton, Glos.	S. S. Buckman Coll., 1929.
C. 38450–55	Napton, Warwicks. . . .	L. F. Spath Coll., 1937.
C. 38456	Cheltenham, Glos.	,, ,,
C. 38515	Napton, Warwicks. . . .	,, ,,
C. 38593–4	,, ,, ...	W. Wingrave Coll., 1935.

Androgynoceras intracapricornus (Quenstedt)

Plate XVI, figs. 1 *a*, *b*

Ammonites intracapricornus Quenstedt, 1884, p. 235, pl. xxix, fig. 9.
Aegoceras infracapricornum (Quenstedt) : Engel, 1908, p. 243.
Androgynoceras intracapricornus (Quenstedt) : Spath, 1936*a*, p. 446.

TYPE.—The Thannhausen (Wurtemberg) example figured by Quenstedt, from the " Lias γ/δ border-bed."

DIAGNOSIS.—Like *A. heterogenes*, but with shorter *maculatum* stage and more distinctly Liparoceratid outer whorl, showing imparinode ornamentation (about 26–32 outer to 20–25 inner tubercles). Suture-line comparatively simple, especially in young, with wide first lateral lobe.

MEASUREMENTS.

Holotype	(at)	77	·35	(?)	·40
,, ...	,,	119	·40	(?)	·31
Plate XVI, fig. 1		92	·41	·50	·33

REMARKS.—The example here figured is entirely septate, like the larger holotype ; and the resemblance, at later stages, to *Liparoceras obtusinodus* Trueman, and the transitions to *L. naptonense*, make it impossible definitely to distinguish body-chamber fragments or impressions of such. In *L. naptonense* the capricorn stage is still further reduced, and the inner whorls are those of a costate *Beaniceras* rather than the peripherally ribbed aegoceratid young figured by Quenstedt. *A. sparsicosta* is distinguished by its spirally elongated tubercles, which appear at an earlier stage than in *A. intracapricornus*.

A. hybrida (d'Orbigny), with which Trueman (1919, p. 277) had compared Quenstedt's form, is not nearly so close to *A. intracapricornus* as is *A. heterogenes*. Apart from the difference in the suture-lines, which may be enhanced by the diagrammatic drawings, the ribs remain continuous across the periphery in *A. hybrida*, and its inner whorls are far more finely ribbed.

The three additional examples listed below are directly transitional to *A. heterogenes*, remaining in the *maculatum* stage to a slightly greater diameter. The last suture-line of one (C. 9918) is figured in Text-fig. 15 for comparison with that of

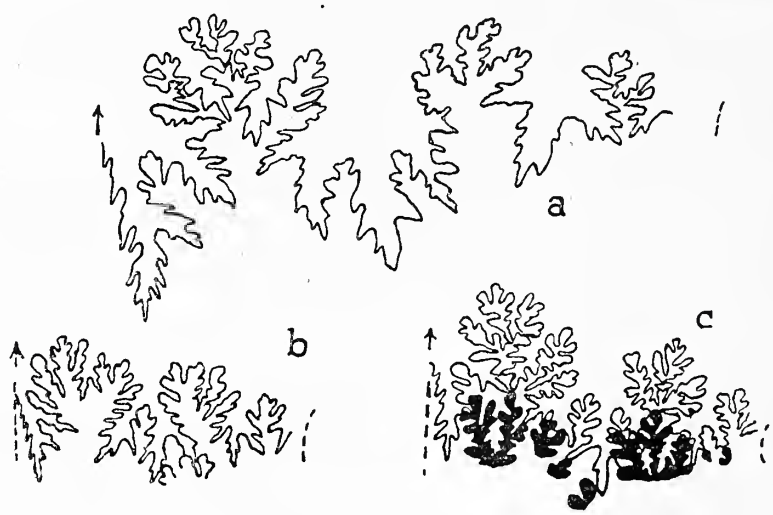

FIG. 15.—External suture-lines (natural size) of (*a*) *Androgynoceras* aff. *intracapricornus* (Quenstedt) transitional to *A. heterogenes* (Young & Bird): Stroud, No. C. 9918. (*b*) *A. hybridiforme*, sp. nov., var. *umbilicata*, nov.; original of Wright's (1880), pl. xxxiii, at 90 mm.; Charmouth, No. C. 1912. (*c*) *A. hybridiforme*, sp. nov.; original of Plate XIV, fig. 2; Charmouth, No. C. 36923.

A. heterogenes, var. *gigas*, figured by Wright (1884, pl. xxxvi, fig. 4), which also was taken at the last septal edge, near the end of the shell. But it should be mentioned that only the left-hand branch of the first lateral lobe really forms part of the lobe, and that the two leaflets to the right of it were erroneously added by Wright's artist, who failed to notice the interlocking of the lobe with the terminations of the preceding lateral saddle. The suture-line here figured shows the wide first lateral lobe seen in Quenstedt's holotype of *A. intracapricornus*; this lobe is slightly shorter than that of another transition to *A. heterogenes* from Yorkshire (Plate XIII, fig. 7 *b*) which also shows somewhat greater complication; but the wide trifid saddles will be seen to show a striking resemblance to those of *Beaniceras* (Plate XIII, fig. 8 *b*) and the young of *A. heterogenes* figured in Plate XIII, fig. 6 *c*.

HORIZON AND LOCALITIES.—*Davoei* zone (base (?) =*maculatum* sub-zone) ((?) and *ibex* zone, *centaurus* sub-zone). England, Germany.

SPECIMENS.

20901	(Plate XVI, fig. 1) .	Kilsby Tunnel, Northants. . .	G. Baker Coll., 1843.
C. 1900	. . . . .	(Labelled by T. Wright: *Aeg. heterogenes*, Y. & B. Marlstone, Yorks. Coast.)	T. Wright Coll., 1887.
C. 9918	(Text-fig. 15 *a*) .	Stroud, Glos.	E. Witchell Coll., 1907.
C. 38457	(Plate XIII, fig. 7 *b*)	Yorkshire Coast	L. F. Spath Coll., 1937.

Androgynoceras henleyi (J. Sowerby)

Plate XVII, figs. 1 *a*, *b*

Ammonites henleyi J. Sowerby, 1817, p. 161, pl. clxxii.
,, ,, ,, de Haan, 1825, p. 134.
(?) ,, ,, ,, Brown, 1837, pl. xix, fig. 11.
,, ,, ,, Quenstedt, 1848, p. 352.
,, ,, ,, Bronn, 1848, Index, p. 45 (*partim*).
Aegoceras henleyi (J. Sowerby): Wright, 1882, p. 366 (*partim ?*).

TYPE.—Sowerby's original (Buckland Coll.) from "Lyme Regis", is apparently lost [1], and the example figured in Plate XVII, fig. 1, apparently from the same bed, may be taken as the neotype.

DIAGNOSIS.—Sub-platygyral, sub-pachygyral, sub-angustumbilicate *Androgynoceras*. Closely ribbed capricorn stage (with about 27 ribs to the whorl) rather short, inflation beginning at under 50 mm. diameter, and change to fine striation, as in *Liparoceras lytoceroides*, at about 55 mm. Bi-tuberculation rather inconspicuous, absent in capricorn stage. Suture-line similar to that of *A. hybridiforme* (Text-fig. 15 *b*).

MEASUREMENTS.

Sowerby's figure		160	·42	(?)	·31
Neotype (Plate XVII, fig. 1) .	(at)	79	·42	·43	·34
,, ,, .	,,	116	·46 (?)	·40 (?)	·32

REMARKS.—This species has been mis-interpreted by everybody, including the writer, who only last year (1936) still followed Wright and Buckman in applying the name to the form now described as *A. hybridiforme*. In fact, the real nature of the present form was only discovered when I was clearing the umbilicus of the neotype here figured, which previously I had grouped with *Liparoceras lytoceroides*. Unlike the lost holotype (of the same colour and preserved in the same way, that is, as a body-chamber, broken off at the last septum), the example here figured shows the camerate inner whorls; but it is slightly crushed, so that the whorl-section is higher than wide, whereas Sowerby described it as round, except for the flattening of the sides. It may be assumed that in uncrushed individuals the thickness is about the same as the whorl-height. It is uncertain whether, on further growth, the neotype would have developed the comparatively coarse ornamentation of the final portion of Sowerby's original; judging by body-chamber fragments of the closely allied *A. hybridiforme*, there is no regularity in such slight, and often sudden, changes in ornamentation; and for the same reason no significance is attached to the greater or less prominence of the inner or outer row of tubercles, respectively.

[1] Prof. J. A. Douglas and his staff kindly searched for it at Oxford.

The inner whorls of the restricted *A. henleyi* resemble those of *Androgynoceras* of the *lataecosta* group to a diameter of only about 25 mm., and then assume a different aspect owing to the appearance of inflation and a high umbilical slope while there is still regular costation. In *A. hybridiforme*, and especially in the var. *umbilicata*, the resemblance to *A. lataecosta* and its varieties, persists throughout the ribbed, capricorn stage, while *A. hybrida* (d'Orbigny), with its distantly spaced ribs, is closer to *A. maculatum*, var. *leckenbyi*. In this variety in which the inflated stage is less marked than in *A. henleyi*, the ribs are prominent across the venter, even when they break up into secondaries, so that the shell has a more capricorn aspect, in spite of the more-or-less distinct notching of the ribs by longitudinal ridges.

HORIZON AND LOCALITY.—*Davoei* zone, *lataecosta* sub-zone. Dorset.

SPECIMEN.

C. 38486 (Plate XVII, fig. 1) .	Dorset Coast (bed 123*i*, to judge by its preservation).	L. F. Spath Coll., 1937

Androgynoceras hybridiforme, sp. nov.

Plate XIII, figs. 1 *a*, *b* ; Plate XIV, figs. 1 *a*, *b*, 2 *a*, *b*

Aegoceras henleyi (*non* Sowerby) : Wright, 1880, pl. xxxiii, figs. 1–3 ; 1882, p. 370.
Androgynoceras hybrida (d'Orbigny) : Lang, 1936, p. 436.
,, ,, ,, Spath, 1936*a*, p. 446.

TYPE.—The Dorset example (No. C. 36923) figured in Plate XIV, figs. 2 *a*, *b*.

DIAGNOSIS.—Sub-platygyral, sub-pachygyral, sub-latumbilicate *Androgynoceras*. Capricorn stage (with ribbing similar to that of equal-sized *A. lataecosta* and its varieties) persisting to about 50–70 mm. diameter, then gradually changing to irregular but parinode, feebly bi-tuberculate ornamentation. Swelling of body-chamber always distinct, but true *Liparoceras* stage only tardive. Suture-line with external lobe as deep as the first lateral lobe, and with broad-stemmed external saddle, but small and comparatively simple lateral saddles (Text-fig. 15 *b*).

MEASUREMENTS.

Holotype (Plate XIV, fig. 2) .	(at) 118	·44	·47 (?)	·32
Plate XIV, fig. 1 (var. **praecox**, nov.) .	65	·41	·41	·37
Plate XIII, fig. 1	109	·36	·39	·41
No. C. 38484	78	·40	(?)	·39
No. C. 1912 (Wright's pl. xxxiii, figs. 1–3 = var. **umbilicata,** nov.) . .	140	·41	·35	·41

REMARKS.—It has already been mentioned that there used to be considerable doubt about the real affinities of *A. hybrida* (d'Orbigny) to which I previously referred some of the specimens now included in the present form. The dimensions (85 ; ·42 ; ·36 ; ·37) of d'Orbigny's figure of this form are not unlike those of some compressed individuals of *A. hybridiforme* ; and in *A. hybrida* also the height of the outer whorl was shown as increasing over $2\frac{1}{2}$ times in the course of the last volution. As now defined, however, *A. hybrida* is very distinct from the present form. Likewise *A. henleyi* is now restricted, chiefly because the examples listed below are not preserved in the characteristic matrix of Sowerby's holotype (apparently from bed 123*i*), and *A. henleyi* thus is probably later in date than *A. hybridiforme*. Again, the dimensions are not dissimilar and the differences are confined to the earlier whorls, which in the present form resemble *A. lataecosta* and its varieties to a considerable diameter. But in the case of transitional specimens and of isolated body-chamber fragments without the inner whorls, distinction may become impossible. For it must be borne in mind that there is great variability in these closely related species, because no two individuals changed from the slender capricorn stage to the swollen *Liparoceras* stage at exactly the same diameter or after precisely the same number of undifferentiated ribs had been formed. The change may, or may not, coincide with the end of the septate stage, and it may be gradual or comparatively sudden. Of course, it is impossible to tell whether a given body-chamber was temporary or permanent ; and there is no reason for assuming that growth would have stopped when the animal had advanced sufficiently in its shell for its hind end to coincide exactly, rather than approximately, with that point where the change took place, as it did, for example, in *Scaphites*.

The example figured by Wright as *Aegoceras henleyi* has the early capricorn (*lataecosta*) stage more prolonged than in the type. It seems advisable to separate this variety (var. *umbilicata*, nov.) with a distinct name, but it is directly connected by way of intermediate examples, like the holotype itself, with the small and accelerated form represented in Plate XIV, fig. 1 (var. *praecox*, nov.). The ribs between the tubercles of the outer whorl are not very strong in all these forms but, judging by examples like that figured in Plate XIII, fig. 1, by various fragments of the var. *umbilicata* (e.g. Nos. C. 36450, C. 36890), and especially by the transitions to *A. subhybrida* (e.g. Nos. C. 38403 and C. 38405), there is great variability in this character, and the largest example of all (No. 48514 of 290 mm. diameter) has almost completely lost the tuberculation on the outer whorl. On the other hand, one coarsely tuberculate specimen, with the prolonged capricorn stage of the var. *umbilicata*, may represent yet another distinct variety ; but it is unfortunately the only example available and it is somewhat worn, so that it could equally well be attached to *A. subcontractum*, nov. In any case, that new species is connected by transitions with *A. hybridiforme*, as mentioned below.

There is some variation in the shape of the early capricorn whorls. In both the holotype and the accelerated variety (var. *praecox*) figured in Plate XIV, fig. 1, the inner whorls are quadrate with a flat and wide periphery, as in *A. lataecosta* and in *A. artigyrus*, var. *similis*, nov. In other examples (including the original of Plate XIII, figs. 1 *a*, *b*) they are compressed, as in *A. lataecosta*, var. *pyritosa*. Now if these varieties *similis* and *pyritosa* were separated specifically from *A. artigyrus* and *A. lataecosta*, respectively, their " hybrid " or dimorph developments would require distinct names, possibly also their " *subhybrida* " modifications, which is clearly impracticable. Actually there is a tendency in most forms of *Androgynoceras* to return to bi-tuberculation. Again, it is almost certain that *A. lataecosta* and the present form (or the corresponding *A. maculatum* and *A. heterogenes*) are not, as has been suggested, merely individuals of different sexes.

The *Amm. henleyi* figured by Reynès (1868, pl. i, figs. 2 *a*, *b*) is probably referable to the var. *umbilicata*, although the illustration is somewhat diagrammatic. Trueman (1919, p. 261) thought it belonged to a different series, but the fact that the outer tubercles (omitted by the artist) are feebler than the inner is of little significance considering that this is just what is shown also in the holotype, though not in all the specimens, of the present species. Moreover, a large example of Reynès's form in the collection of M. H. Contaut (from Samartha, Aveyron) shows that the apparent differences in the fine tuberculation are due to the preservation (in a hard, compact, crystalline limestone).

A. subhybrida, sp. nov., with very similar ornamentation, is connected with *A. hybridiforme* by various transitional forms. It is rather more serpenticone, and the outer whorl scarcely reaches what can be called a swollen *Liparoceras* stage. *A. subcontractum*, on the other hand, has coarser peripheral ribbing, and in the bi-tuberculate stage resembles typical *Liparoceras* more than do *A. hybridiforme* or *A. henleyi*. Some of the examples listed below are doubtful, chiefly because they are incomplete or too poorly preserved for accurate identification. Some of them were previously (Lang, 1936, pp. 434–6) listed as *A. hybrida* and *A. henleyi*, but the " evolute mutation " (of *A.* aff. *hybrida*) recorded from bed 123 *m* is not now included in the present species, while a fragment from bed 122 *b* (No. C. 36744) is far too incomplete to be identified specifically.

HORIZON AND LOCALITIES.—*Davoei* zone, *maculatum* and *lataecosta* sub-zones (beds 122*b*–*g*). Dorset, England (France ?).

SPECIMENS.

39863	Dorset Coast	Day Coll., ? 1864.
46514	,, ,,	,, ,,
C. 1912	,, ,, (Wright's pl. xxxiii, figs. 1–3.)	T. Wright Coll., 1887.
C. 10019 (Plate XIV, fig. 1	Stroud, Gloucestershire	E. Witchell Coll., 1905.
C. 36424–5	St. Gabriels, Dorset (bed 122*f*)	W. D. Lang & H. D. Thomas Coll., 1935.
C. 36437	,, ,, (bed 122*g*)	,, ,,
C. 36744	,, ,, (bed 122*b*)	W. D. Lang Coll., 1935.
C. 36890	,, ,, (bed 122*d*)	,, ,,
C. 36923 (Plate XIV, fig. 2)	,, ,,	W. Wingrave Coll., 1935.
C. 38403	,, ,, (bed 123*r*)	W. D. Lang Coll., 1937.
C. 38484–5	,, ,,	L. F. Spath Coll., 1937.
C. 38617	,, ,,	Dr. F. Krantz, 1937.
C. 38858 (Plate XIII, fig. 1)	West of Golden Cap (fallen block)	W. D. Lang Coll., 1935.

Androgynoceras subhybrida, sp. nov.

Plate IX, figs. 1 *a*, *b* ; Plate XX, figs. 1 *a*, *b*

Androgynoceras subhybrida Spath MS. : Lang, 1936, p. 434.
,, ,, (MS.) Spath, 1936, p. 448.

TYPE.—The Dorset example (No. C. 36924) figured in Plate IX, fig. 1 *a*.

DIAGNOSIS.—Sub-platygyral, sub-pachygyral, sub-latumbilicate *Androgynoceras*. Whorl-section slightly compressed, with flattened sides, highly arched venter, and high, but rounded, umbilical slope. Capricorn ribbing as in *A. lataecosta* on the slender inner whorls (up to between 50 and 70 mm. diameter); then the primary ribs develop two prominent tubercles and their ventral portion breaks up into small secondary riblets with others intercalated. Suture-line not seen in holotype, but very complex at the end as shown in other fragments, with saddles finely divided. Body-chamber three-quarters of a whorl in length; mouth-border plain.

MEASUREMENTS.

Holotype (Plate IX, fig. 1 *a*) . .	130	·38	·35	·42
Paratype (Plate IX, fig. 1 *b*) . .	100	·38	·37	·42
No. C. 38558 (transition to *A. lataecosta*)	134	·33	·28	·46

REMARKS.—This species resembles *A. hybrida* (d'Orbigny), discussed on pp. 133, 134, and retains to the end strong and distinctly bi-tuberculate ribs, which are as prominent on the venter as on the sides, and which are not appreciably projected. Superficially, it is so much like d'Orbigny's larger figure and the fragment of *A. hybrida* represented by Chapuis (1861, p. 38, pl. vii, fig. 2), that specific separation may seem unjustifiable. But the inner whorls are different; those of the present species are closely spaced, as in *A. lataecosta*; in *A. hybrida* (see Plate XXVI, fig. 2) they are coarse and distant, as in *A. maculatum*. In all the species of *Androgynoceras* here described in which bi-tuberculation appears at a comparatively small diameter, the thickness exceeds the whorl-height, except perhaps in the very early capricorn stage of a particularly slender individual; while d'Orbigny's drawing of *Ammonites hybrida* actually shows a decrease in the thickness of the outer whorl, from 1·25 of the height at the beginning, to ·858 at the end (85 mm. diameter, according to the text and proportions: ·42; ·36; ·37). I do not know of the outer whorl in any example of the present form expanding in this fashion, but as already mentioned, the drawing is incorrect and composite.

The paratype, of which only the peripheral view is here given, has slightly more closely set ribs than the holotype, and it leads by intermediate forms (e.g. No. C. 36431) to the compressed variety figured in Plate XX, fig. 1 (var. **leptonotus**, nov.), which again is transitional to *A. lataecosta* and its varieties, and to *A. capricornus* (e.g. Nos. C. 36395, C. 36850). Apart from the differences in coiling, the var. *leptonotus* also can be easily distinguished from *A. hybrida* by having closely ribbed inner whorls.

Other transitional examples (Nos. C. 38439, C. 38491–95) or inner whorls (No. C. 36422) listed below are perhaps more doubtful; and an example (No. C. 36450) previously (Spath, 1936, p. 448) recorded as an evolute mutation of *A. hybrida* (now *A. hybridiforme*) should probably also be included in the present species as an evolute variety. Some of the transitions to *A. lataecosta* are as much as 160 mm. in diameter.

A complete Kilsby example (No. 20130*g*) of another variety, with a diameter of 125 mm., and with the thickness equal to the whorl-height, is still extremely close to the holotype of the present species, but differs chiefly in the more distant spacing of the costae on the outer whorls and in the peripheral projection of the ribs. It is thus still nearer to what I took to be *A. hybrida* (d'Orbigny) than the type of the present species; and, although the inner whorls are quite different, it may be impossible to separate body-chamber portions of this form, similar to the fragment figured by Chapuis, from the true *A. hybrida*. This last variety, however, is also connected by transitions (e.g. No. 20130*gb*) with the typical *A. lataecosta*, differing mainly in the greater prominence of ribs and tubercles. The suture-line of such a transition is figured in Text-fig. 2 *c* (p. 7), but is apparently more simplified than that of more typical examples of the present species.

Horizon and Localities.—*Davoei* zone, *lataecosta* sub-zone. England (Dorset, beds 122*d*–123*s*; Northamptonshire), France (?).

Specimens.

20130*ga*	. . . . .	Kilsby Tunnel, Northants. .	G. Baker Coll., 1843.
C. 17027	. . . . .	Dorset Coast	T. J. Slatter Coll., 1896.
C. 18072	. . . . .	,, ,, ...	J. F. Blake Coll., 1907.
C. 36395	. . . . .	St. Gabriel's, Dorset (bed 123*m*)	H. M. Muir-Wood Coll., 1934.
C. 36422	. . . . .	Stonebarrow, Charmouth, Dorset (bed 123*a*).	W. D. Lang Coll., 1935.
C. 36431–32	. . . . .	St. Gabriel's, Dorset (bed 123*d*)	W. D. Lang & H. D. Thomas Coll., 1935.
C. 36445	. . . . .	,, ,, (bed 122*g*) .	,, ,,
C. 36450	. . . . .	,, ,, (bed 122*d*–*f*)	W. D. Lang Coll., 1935.
C. 36456	(transition between var. *leptonotus* and *A. lataecosta*).	,, ,, (bed 123*m*)	W. D. Lang & H. D. Thomas Coll., 1935.
C. 36458	. . . . .	,, ,, ,,	,, ,,
C. 36799	(var. *leptonotus*, nov.) .	,, ,, (bed 123*d*) .	W. D. Lang Coll., 1935.
C. 36912	(Paratype) . . .	,, ,, (bed 123*m*)	,, ,,
C. 36913	. . . . .	,, ,, (bed 123*d*) .	,, ,,
C. 36915	(var. *leptonotus*, Plate XX, fig. 1)	,, ,, (bed 123*m*)	,, ,,
C. 36924	(Holotype) . . .	Dorset Coast	W. Wingrave Coll., 1935.
C. 38485	. . . .	Stonebarrow, Charmouth, Dorset (bed 122*g*).	W. D. Lang Coll., 1935.
C. 38487	. . . . .	Stonebarrow, Charmouth, Dorset (not in place).	,, ,,
C. 38488	. . . . .	St. Gabriel's, Dorset (bed 123*s*) .	,, ,,
C. 38489–90	. . . . .	Stonebarrow, Charmouth, Dorset (not in place).	,, ,,
C. 38491	. . . . .	St. Gabriel's, Dorset (bed 123*m* ?)	,, ,,
C. 38492–95	. . . . .	Stonebarrow, Charmouth, Dorset (not in place).	,, ,,
C. 38558	(transition to *A. lataecosta*)	Dorset Coast	J. W. Tutcher Coll., 1937.
C. 39006	. . . . .	Stonebarrow, Charmouth, Dorset (not in place).	W. D. Lang Coll., 1935.
C. 39007	. . . . .	St. Gabriel's, Dorset (bed 123*m* ?)	,, ,,
C. 39008–09	(var. *leptonotus*, nov.) .	Stonebarrow, Charmouth, Dorset (not in place).	,, ,,

Androgynoceras subcontractum, sp. nov.

Plate XV, figs. 1 *a*, *b*

TYPE.—The Dorset example (No. 39721) figured in Plate XV, figs. 1 *a*, *b*.

DIAGNOSIS.—Sub-platy- to sub-stenogyral, sub-pachygyral, sub-latumbilicate *Androgynoceras*. Capricorn stage with ribbing of the *lataecosta* type, but with greater inflation, up to about 40 mm. diameter ; then bi-tuberculation, with imparinode *Liparoceras* ornamentation and comparatively coarse peripheral ribs. Decline of ribbing, and especially of the outer tubercle, near the end where the whorl-section is less depressed than at earlier stages. Greatest thickness at the prominent inner tubercle on the outer 1½ or 2 whorls. Suture-line rather complex, apparently as in *Liparoceras contractum*, sp. nov.

MEASUREMENTS.

Holotype (Plate XV, fig. 1) . . .	180	·30	(?)	·41
,, ,, . .	(at) 100	·40	·47	·36

REMARKS.—The holotype is distinct enough and, except for the capricorn inner whorls, shows a curious resemblance to *Liparoceras contractum*, so that fragments of

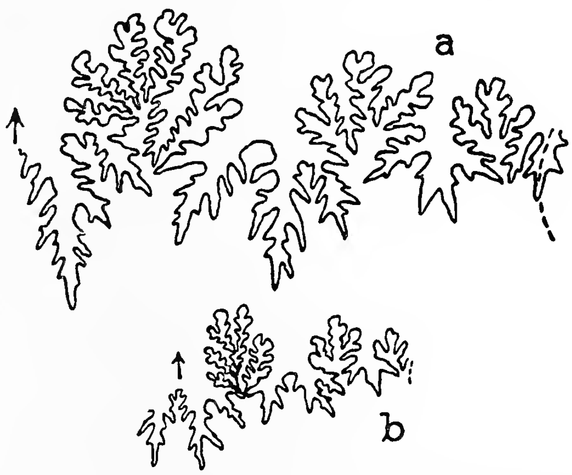

FIG. 16.—*Androgynoceras* aff. *subcontractum*, sp. nov. External suture-lines (natural size) in the *lataecosta* stage (*b*, at 70 mm.) and in the inflated *Liparoceras* stage (*a*, at 130 mm.). Stroud, No. C. 9919.

outer whorls may be difficult to identify. That species, however, is also connected by transitions with *A. hybridiforme*, and there are passage-forms between the latter and *A. subcontractum*. Thus, one example of the present species, labelled "*Amm. henleyi*, M.C. 172," in the Sowerby Collection, differs from the type merely in having more numerous inner tubercles. Another example (No. C. 9919) has the coarser ornamentation of *A. subcontractum*, but the more evolute inner whorls of *A. hybridiforme*, var. *umbilicata*; and, in fact, is indistinguishable from *A. lataecosta* at the diameter of the example figured in Plate XVIII, fig. 4. It is clear that in the circumstances reference of the latter to a different genus (i.e. *Aegoceras*) is impossible.

The suture-line of the example (No. C. 9919) just mentioned is figured (Text-fig. 16) in the *lataecosta* stage (at 70 mm. diameter), and again in the inflated *Liparoceras* stage (at 130 mm.); and it will be seen that the difference in whorl-shape is responsible for little more than a general spreading of the elements and a straightening of the first lateral lobe; but, in the capricorn stage, the coarse ribbing interfered considerably with the details of the elements on the two sides, as well as in consecutive suture-lines, a fact which must be borne in mind when the figure is compared with the suture-lines of other capricorns.

The outer whorl of this transitional example from Stroud is indistinguishable from a specimen from the same locality (No. C. 9918), described as a passage-form between *A. intracapricornus* and *A. heterogenes*. The capricorn stage, of course, is much shorter in the latter, but even the suture-line (Text-fig. 15 *a*) is very similar.

HORIZON AND LOCALITIES.—*Davoei* zone, *lataecosta* sub-zone. England (Dorset, Gloucestershire (?)).

SPECIMENS.

39721	(Holotype) .	" Lyme Regis " [near Charmouth], Dorset	J. Marder, ? 1860.
(?) **C. 9919**	. . .	Stroud, Gloucestershire	E. Witchell Coll., 1905.
C. 17636	. . .	Unrecorded [near Charmouth, Dorset]. .	Sowerby Coll., 1861.

Androgynoceras maculatum (Young & Bird)

Plate IX, figs. 2, 3; Plate XIII, figs. 2, 8 *a*, *b*; Plate XIV, fig. 3; Plate XVI, figs. 11–12; Plate XVII, figs. 2–3; Plate XIX, figs. 1, 2, 13; Plate XX, figs. 3, 5–6; Plate XXVI, fig. 5.

Ammonites maculatus Young & Bird, 1822, pp. 248, 327, pl. xiv, fig. 12.
,, ,, ,, 1828, p. 259, pl. xiv, fig. 9.
,, ,, ,, Phillips, 1829, p. 163, pl. xiii, fig. 11.
Ammonites arcigerens, Phillips, 1829, p. 163, pl. xiii, fig. 9.
Ammonites maculatus Young & Bird: Brown, 1837, pl. xviii, fig. 2.
,, ,, ,, Bronn, 1848, Index, p. 50.
Ammonites planicosta, non Sowerby: Giebel, 1852, p. 679 (*partim*).
non Ammonites maculatus Phillips: Oppel, 1853, p. 72.
Ammonites maculatus Young & Bird: Morris, 1854, p. 293.
,, ,, ,, Simpson, 1855, p. 48.
Ammonites arcigerens Phillips: Simpson, 1855, p. 47 (*partim*).
Microceras maculatum (Young & Bird): Hyatt, 1867, p. 82.
Microceras laticosta (*non* Sowerby): Hyatt, 1871, p. 35 (*partim*).
Ammonites maculatus, Amm. arcigerens Phillips (3rd edition), 1875, p. 270.
Aegoceras capricornum (Schlotheim): Blake, in Tate and Blake, 1876, p. 281 (*partim*).
Aegoceras maculatum (Young & Bird): Wright, 1880, pl. xxxiv, figs. 1–8.
Aegoceras capricornus (Schlotheim): Wright, 1882, p. 368.
Ammonites maculatus Young & Bird: Simpson, 1884, p. 79.
? Ammonites arcigerens Phillips: Simpson, 1884, p. 77.
Ammonites maculatus Young & Bird: Quenstedt, 1885, p. 268 (*partim*).
Aegoceras capricornu (Schlotheim): Steinmann & Döderlein, 1890, p. 434, fig. 526.
Ammonites (*Aegoceras*) *capricornus* (Schlotheim) Wright: Woods, 1891, p. 122.
Aegoceras capricornum (Schlotheim): Crick, 1898, p. 96 (No. C. 7150).
Aegoceras capricornu ,, Steinmann, 1907, p. 339, text-fig. 591.
Androgynoceras màculatum (Young & Bird): Buckman, 1912, pl. xlv.
,, ,, ,, Buckman, in Fox-Strangways and Barrow, 1915, p. 95.
,, ,, ,, Trueman, 1919, p. 277.
Aegoceras capricornum (Schlotheim) Blake: Crick, 1922, p. 279 (*partim*).

Androgynoceras maculatum (Young & Bird) : Spath, 1923*a*, p. 10.
,, cf. *maculatum* (Young & Bird) : Bovier (*partim*), 1932, p. 31.
Aegoceras ,, ,, ,, Lang, 1936, p. 436.
,, ,, ,, ,, Spath, 1936*a*, pp. 448–449.
non ,, ,, (Oppel) : de Brun & Brousse, 1936, p. 37.

TYPE.—The Drift specimen (Whitby Museum, No. 493) re-figured in Buckman (1912) and accepted as Young & Bird's original.

DIAGNOSIS.—Sub-stenogyral, sub-leptogyral, sub-latumbilicate to latumbilicate *Androgynoceras*. Like *A. heterogenes*, but capricorn stage persisting to between 50 and 100 mm. diameter, after which bi-tuberculation and, finally, feeble swelling may appear. Ribs, especially those between the tubercles (when developed), often remain fairly prominent and equidistant, and there is slight approximation or degeneration of the costae towards the aperture. Suture-line variable, with wide, broad-stemmed external saddle ; irregularly trifid, short, first lateral lobe ; and irregular lateral saddles (Plate XIII, fig. 8 *a*, *b* ; Plate XIX, fig. 1 *c* ; Plate XX, fig. 6 *c*).

MEASUREMENTS.

Holotype (Buckman, pl. xlv) . .	77	·30	·30	·49
Plate XX, fig. 6	67	·29	·31	·48
var. **leckenbyi,** nov. (Wright, pl. xxxiv, fig. 4)	112	·35	·38	·41
var. *leckenbyi*, nov. (Plate XIII, fig. 2) .	92	·33	·34	·48
Plate XIX, fig. 1	86	·28	·28	·53
var. *arcigerens* Phillips (Plate XVI, fig. 12)	87	·29	·29	·51
,, ,, (Plate XX, fig. 5)	145	·31	·31 (?)	·51
var. **rigida,** nov. (Plate XIX, fig. 13) .	68	·28	·30	·50

REMARKS.—This species is very variable, and the only alternative to the comprehensive interpretation here adopted is the recognition of a large number of smaller species. Though it might be possible to separate with distinctive specific names a few more-or-less perfect examples of the forms here referred to varieties of the present species, the great majority of specimens belong to less extreme, costate, types ; and there are so many, and such complete, transitions between them and the typical *A. maculatum* that the average imperfect or fragmentary individuals would always remain indeterminable specifically.

Since the two small " knobs " mentioned by Young & Bird (1822, p. 248), or the greatly enlarged outer whorl noticed by Simpson (1855, p. 48), also appear at different diameters in different individuals, the transitions to *A. heterogenes*, as Buckman (1912, p. 45*b*) correctly called them, seem a particularly variable group. Even so they are indistinguishable from the typical *A. maculatum* to a diameter of at least 40–50 mm., and even the suture-lines differ but slightly (compare Plate XX, figs. 2 and 6 *c*) in the costate stage. Phillips's *Amm. maculatus*, to judge by the square whorl-shape, must have been one of these transitions to *A. heterogenes*. In other examples, however, degeneration of the costation already set in at half that diameter (25 mm. in the original of Plate XX, fig. 3 = var. **atavus,** nov.), and some equally early types, also transitional to *Beaniceras* and here separated as var. **intermedia,** nov. (Plate XVII, figs. 2–3), combine a broad periphery and laterally projecting ribs with the ventral chevrons of much later forms of the genus *Androgynoceras*. The last two varieties may not be common, and some might have preferred to include them in the genus *Beaniceras* ; but since in this instance generic distinction is largely a matter of size, and since similar degeneration of the ribbing or, rather, pronounced peripheral projection of the costae may occur in perfectly typical large examples of *A. maculatum*, specific separation from the latter seems impossible. I may add that a fragment of the var. *intermedia* and an example intermediate between this variety and the typical *A. maculatum* in the Richardson Collection had even been labelled *Liparoceras* aff. *sparsicosta* Trueman. A specimen intermediate between the var. *intermedia* and the var. *atava* is figured in Plate XXVI, fig. 5, for comparison with somewhat similar, but later, forms of *Oistoceras*, distinguished by their finely ribbed inner whorls.

The inner whorls are at first smooth ; and blunt and indistinct folds appear on the sides at about 3–4 mm. diameter, while the whorls are still greatly depressed. The most noteworthy features in the succeeding stage (to about 10 mm. or more, where the thickness is still much greater than the height) are the feebleness of the ventral ribbing and the projection of the irregular ribs in the siphonal line, as in *Beaniceras*. It is not always easy to count the number of ribs on the first costate whorl, partly because they may be feeble, or because of the irregularities ; but there are generally 13 to 15 ; the costae remain rather blunt and distantly spaced throughout life. Counting back from the aperture towards the centre, it is noticed that the number of ribs per whorl diminishes in the following ratios : 19–17–15 (holotype) ; 20–17–15 (Plate XX, fig. 6) ; 20–18–16 (Plate XIV, fig. 3) ; 19–17–13 (Plate IX, fig. 2) ; 22–18–15 (Plate XIII, fig. 2) ; 22–20–18–15 (Plate XIX, fig. 1) or 22–21–19–16 (No. C. 38498, complete, with body-chamber at 70 mm. diameter). There is thus general constancy in the number of ribs ; and transitions to *A. artigyrus* (e.g. Plate XIX, fig. 2) or to *A. brevilobatum* can be recognised at once by counting the ribs (18–20–18), although they still retain the bluntness of the early forms. It will be seen that there is also only a very small step from these transitions to forms of the *lataecosta* group (compare Plate XIX, fig. 12).

The form figured by Wright (pl. xxxiv, figs. 4–6) is separated as a var. *leckenbyi*, because it represents a distinct step in the range of transitions to *A. heterogenes*, with bi-tuberculation appearing at a diameter of about 60–70 mm. The typical example of this variety, figured in Plate XIII, fig. 2, at 92 mm. diameter shows only the beginning of the body-chamber, and while whorl-height and thickness are still almost equal, the characteristic inflation began half a whorl earlier. In a large Dorset example (No. C. 36721), of 150 mm. diameter, transitional to the variety figured in Plate XX, fig. 5, the body-chamber (half a whorl in length) is probably complete and there is but slight decline of the ornamentation near the aperture. Again a specimen from Yorkshire, collected by Mr. L. Bairstow in his bed 590, still septate at 113 mm., has an increased whorl-height (37 per cent.) and a smaller umbilicus, and thus leads already to the var. *gigas* of *A. heterogenes*. Trueman

(1919, p. 277) compared Wright's example to his *A. obtusicosta*, but that form is much nearer to *A. lataecosta* than Trueman suspected.

The second example figured by Wright (pl. xxxiv, figs. 1–3) was compared by Trueman to his (un-figured) *Aegoceras aequicosta*, and clearly belongs to the variety figured in Plate XVI, fig. 12, and Plate XX, fig. 5, which cannot be separated from the more typical example of *A. maculatum* represented in Plate XIX, fig. 1. The ribs may be slightly sharper than in the type, and they tend to be but little diminished in strength as they cross the periphery. But they vary in the same specimen at different stages, and on the basis of suture-line, coiling, and whorl-shape also they cannot be considered to be a distinct species. Trueman's *A. aequicosta*, as pointed out below, differs from Wright's form in several important features, and after hesitating for a long time, I have now come to the conclusion that this is the only form Phillips can have had before him when he created his *Amm. arcigerens*.

At first sight that species looks entirely different from Phillips's *Amm. maculatus*, and it may seem strange now to unite in one species two forms that were already separated in 1829. But the differences, in fact, are confined to the peripheral aspect and, while Phillips's fig. 11 represents one of the transitions from *A. maculatum* to *A. heterogenes*, with the characteristic square venter, his fig. 9 is comparable to the example figured in Plate XIX, fig. 1, rather than to Wright's specimen (pl. xxxiv, figs. 1–3), which has a more flattened periphery. There is probably nothing in the relative size of the two illustrations in Phillips, as can be seen from the grouping of his sketches of various fossils in other plates.

It is very doubtful whether Hyatt (1867, p. 82; 1871, p. 36; 1874*a*, p. 25) correctly interpreted Phillips's species, since he described it as having a depressed whorl-section with the dorsal side much broader than the ventral or, elsewhere, as the English representative of *Microceras biferum*. Nor does Phillips's figure, with its rounded whorl-section, show particular resemblance to the very closely ribbed inner whorls of an *Echioceras*; on the contrary, there are only 20 ribs on the outer, and 17 on the next inner, whorl; but of course the innermost volutions may be incorrectly drawn. The peripheral chevron is also far from acute; in fact the angle on the back was described by Simpson (1855, p. 47) as very obtuse. Now this alone seems to indicate that *Amm. arcigerens* is not a species of *Oistoceras*, as Buckman (1911, p. 26*c*; 1915, p. 96) claimed, yet in 1875 Phillips included his species among the "angulati." I may also add that even a specimen (No. C. 38561) of *O. omissum* (Simpson) was labelled by Bean "*Amm. arcigerens*." Blake's three examples of *Amm. arcigerens*, discussed by Crick (1922, p. 280) include two young *Oistoceras* of the *figulinum* group (Nos. C. 18061 and C. 19227) and a young *Androgynoceras* cf. *artigyrus* (No. C. 18062); nor do they help in the identification of this species any more than does Simpson's nucleus of under 20 mm. diameter.

In the circumstances it is permissible to choose as representing Phillips's form an ammonite from the "Middle Lias" of Yorkshire, not covered by any existing name, which corresponds to the protograph in evolution, in whorl-shape, in number of ribs, and in their ventral angularity. There is only one such form, so far as I am aware, and that is the variety here discussed; and the resemblance of this variety to Phillips's figure is far more striking than is, for example, the resemblance of Phillips's sketchy figure of *Amm. maculatus* to the holotype of that species re-figured by Buckman. Thus there is the same small number of ribs, especially on the inner whorls, and the section is circular, at least at larger diameters. As regards the angularity of the ribs at the venter, there is considerable variation and, while in smaller examples the angularity often increases towards the aperture, the large bi-tuberculate example figured in Plate XX, fig. 5 has the ventral ribs (or rather the striae that remain) near the end almost perfectly straight.

I may add that Phillips's original of his *Amm. arcigerens* may be lost (*fide* Buckman, 1909, p. iii). It is neither in the Ripley Collection in the British Museum, nor in the Yorkshire Museum at York according to information kindly supplied by Dr. Collinge.

The ammonite figured by Brown (1837) as *Amm. artigyrus* seemed at first to represent another variety to be included in the present species. This variety is illustrated in Plate XIX, fig. 13. It is connected with the var. *arcigerens* by intermediate forms, and it may be remembered that Brown's mis-spelling of the trivial name (*artigerus* for *arcigerens*) possibly suggests to some that he merely meant to depict an example of Phillips's species. But his type, from the Williamson Collection in the Manchester Museum (Plate XXIII, fig. 3), shows that the drawing is wrong, and since *A. artigyrus* is now accepted as a distinct form, it is necessary to give a new name (var. *rigida*, nov.) to the variety here discussed. It is characterised by ribs that are sharp and high all round the whorl, more prominent than in the var. *arcigerens*, and without projection on the periphery.

Amm. maculatus Quenstedt (1845, p. 85, pl. iv, fig. 7; 1856, p. 121; 1885, p. 268), identified partly with *Amm. planicosta* (d'Orbigny, *non* Sowerby), probably included the form here discussed and its varieties, but they were not kept distinct from the capricorns of higher horizons which also occur in the limestones at the Gamma-Delta border. Thus two examples from Nürtingen (one calcareous, one limonitic) belong to *A. maculatum* as here restricted, as do three Göppingen specimens, but all the other Wurtemberg capricorns in the collection belong to later forms.

The specimens listed below include some doubtful forms, especially among the transitions to other species of *Androgynoceras*, notably *A. hybrida* (No. C. 35799); and others among the young examples, which show considerable resemblance to the immature *A. sparsicosta*, *A. heterogenes*, etc., as well as to *Beaniceras*, as already mentioned. Many of the Dorset specimens also are mere body-chamber fragments and are listed here only because they are from the lowest beds in the *davoei* zone. It may be added that the bed that yielded some pyritised examples, found loose on the beach at Charmouth, has never been located *in situ*.

Horizon and Localities.—*Ibex* zone (*centaurus* sub-zone) and especially *davoei* zone (*maculatum* sub-zone). It appears from the collecting so far done (especially by Mr. L. Bairstow) that small examples (including var. *atava* and var. *intermedia*) are early, and the large examples (including var. *arcigerens*), late. England, Germany, France.

SPECIMENS.

17139		Near Whitby, Yorkshire	Ripley Coll., ? date.
19581*m*		Braunston, Northamptonshire	G. Baker Coll., 1843.
20130 H 1–2		Kilsby Tunnel, Northants.	,, ,,
20901		,, ,,	,, ,,
20918 A		,, ,,	,, ,,
37638		Whitby, Yorkshire	J. Leckenby Coll., ? date.
37811		Pabba, Hebrides	History unrecorded.
62486*c*		Randen, nr. Schaffhausen, Switzerland.	Bruckmann Coll., 1868.
C. 1276		Whitby, Yorkshire	J. E. Lee Coll., 1885.
C. 1277		,, ,,	,, ,,
C. 3741	(Plate XIII, fig. 2)	Unrecorded [Yorkshire]	S. H. Beckles Coll., 1891.
C. 3743		Yorkshire	,, ,,
C. 4625	(Plate IX, fig. 3)	Napton Hill, Warwickshire	W. J. Harrison Coll., 1893.
C. 7150		Near Whitby, Yorkshire	F. I. Bradley Coll., 1898.
C. 10014	(Plate XXVI, fig. 5)	Stroud, Glos.	E. Witchell Coll., 1905.
C. 12622–24		Napton Hill, Warwickshire	C. H. Watson Coll., 1909.
C. 12625–26		,, ,,	,, ,,
C. 12628–29		,, ,,	,, ,,
C. 16766	(Plate XVII, fig. 2)	Stow Hill Cutting (G.W. Ry.), Gloucestershire	R. F. Tomes Coll., 1905.
C. 16901		Near Whitby, Yorkshire	T. J. Slatter Coll., 1896.
C. 17188	(var. *intermedia*)	Dorn Cutting (G.W. Ry.), Worcestershire.	R. F. Tomes Coll., 1905.
C. 17303	(Plate XVII, fig. 3)	Charingworth brickyard (nr. Campden), Gloucestershire.	,, ,,
C. 17527		Charingworth, Gloucestershire	,, ,,
C. 17752	(Plate XX, fig. 6)	Robin Hood's Bay, Yorkshire	T. J. Slatter Coll., 1896.
C. 18064		Whitby, Yorkshire	J. F. Blake Coll., 1907.
C. 19226		Unrecorded. [Robin Hood's Bay, Yorkshire.]	,, ,,
C. 23484–87		Napton Hill, Warwickshire	Sir H. Butlin Coll. 1921.
C. 24601	(Plate XIX, fig. 13)	Staithes, Yorkshire	D. M. S. Watson Coll., 1923.
C. 24603–4		,, ,,	,, ,,
C. 28170		Robin Wood Hill, Gloucestershire	L. Richardson Coll., 1925.
C. 28175	(Plate XIX, fig. 2)	Yorkshire	,, ,,
C. 28177		Aston Magna, Gloucestershire	,, ,,
C. 28181	(Plate XX, fig. 3)	Prestbury, nr. Cheltenham, Gloucestershire.	,, ,,
C. 28182–23	(var *intermedia*)	Dixton West Ry. Cutting, nr. Gotherington, Glos.	,, ,,
C. 35799	(transition to *A. hybrida*).	Golden Cap, Dorset (bed 123*a* ?)	L. R. Cox Coll., 1932.
C. 36367–72		Between St. Gabriel's and Golden Cap, Dorset.	Miss H. M. Muir-Wood Coll., 1934.
C. 36374		Golden Cap, Dorset (bed 122*f*)	,, ,,
C. 36391		W. of St. Gabriels, Dorset	,, ,,
C. 36410		St. Gabriel's, Dorset (bed 122*c*)	W. D. Lang & H. D. Thomas Coll., 1935.
C. 36411–21		,, ,, (bed 122*d*)	,, ,,

C. 36721		E. of Charmouth, Dorset	W. E. Cutler Coll., 1936.
C. 36722	(Plate XVI, fig. 12)	Bracebridge, Lincs.	,, ,,
C. 36742		St. Gabriel's, Dorset (bed 122*a*)	W. D. Lang Coll., 1935.
C. 36745–47		,, ,, (bed 122*b*)	,, ,,
C. 36748		Black Ven, Charmouth, Dorset (bed 122, about 5 feet above Bel. Stone)	,, ,,
C. 36749–58		St. Gabriel's, Dorset (bed 122*d*)	,, ,,
C. 36760–67		,, ,, (bed 122*d*)	,, ,,
C. 36769		,, ,, (bed 122*f*)	,, ,,
C. 36928	(Plate IX, fig. 2)	Napton Hill, Warwickshire	W. E. Cutler Coll., 1936.
C. 38388		Unrecorded. [Germany.]	Old Coll.
C. 38425	(var. *intermedia*)	Napton, Warwickshire	L. F. Spath Coll., 1937.
C. 38458	(Plate XIX, fig. 1)	Bracebridge, Lincs.	J. W. Tutcher Coll., 1937.
C. 38497	(Plate XIV, fig. 3)	Dorset Coast	L. F. Spath Coll., 1937.
C. 38498		Napton Hill, Warwickshire	,, ,,
C. 38499		Robin Hood's Bay, Yorkshire	S. S. Buckman Coll., 1929.
C. 38500		,, ,,	J. W. Tutcher Coll., 1937.
C. 38501		Near Whitby, Yorkshire	,, ,,
C. 38502		Sodbury, Gloucestershire	,, ,,
C. 38503		Broadway Lane, N. of Welton, Somerset.	,, ,,
C. 38504		Napton, Warwickshire	,, ,,
C. 38507–8		Robin Hood's Bay, Yorkshire	L. F. Spath Coll., 1937.
C. 38509–10		,, ,,	,, ,,
C. 38511		Napton Hill, Warwickshire	,, ,,
C. 38512–13		Cheltenham, Gloucestershire	,, ,,
C. 38514		Hewlitt's Road, Cheltenham, Gloucestershire.	,, ,,
C. 38516–19		Napton Hill, Warwickshire	,, ,,
C. 38520–24		Cheltenham, Gloucestershire	,, ,,
C. 38525–41		Napton Hill, Warwickshire	W. E. Cutler Coll., 1936.
C. 38542		Bracebridge, Lincs.	,, ,,
C. 38543–44		St. Gabriel's, Dorset (bed 122*c*)	W. D. Lang Coll., 1935.
C. 38545–7		,, ,, (bed 122*b*)	,, ,,
C. 38548	(Plate XX, fig. 5)	Dorset Coast	J. W. Tutcher Coll., 1937.
C. 38549		St. Gabriel's, Dorset (bed 122*d*)	W. D. Lang Coll., 1935.
C. 38550–38555		Dumbleton, Worcestershire	S. S. Buckman Coll., 1929.
C. 38556		St. Gabriel's, Dorset (bed 122*c*)	W. D. Lang Coll., 1935.
C. 38573	(Plate XVI, fig. 11)	Napton Hill, Warwickshire	W. E. Cutler Coll., 1936.
C. 38579		Dorset Coast	W. D. Lang Coll., 1937.
C. 38639–40		Napton, Warwickshire	W. Wingrave Coll., 1935.
C. 38641		Yorkshire	,, ,,
C. 38642–43		Nürtingen, Wurtemberg	C. Allmendinger, 1937.
C. 38653		Golden Cap, Dorset	Miss V. Gollancz Coll., 1937.
C. 38847		St. Gabriel's, Dorset (bed 122*f*)	W. D. Lang Coll., 1935.
C. 38861	(Plate XIX, fig. 12)	Stroud, Glos.	S. S. Buckman Coll., 1929.

C. 38871–74	. . . .	Robin Hood's Bay, Yorkshire (bed 583).	L. Bairstow Coll., 1937.
C. 38876 .	. . . .	Robin Hood's Bay, Yorkshire (bed 584).	,, ,,
C. 38877 .	. . . .	Robin Hood's Bay, Yorkshire (bed 585).	,, ,,
C. 38878–79	. . . .	Robin Hood's Bay, Yorkshire (bed 588)	,, ,,
C. 38880	(var. *leckenbyi*) .	Robin Hood's Bay, Yorkshire (bed 590).	,, ,,
C. 38881–96	(including varieties)	Robin Hood's Bay, Yorkshire (bed 590).	,, ,,
C. 38897 .	. . . .	Robin Hood's Bay, Yorkshire (loose)	,, ,,
(?) C. 38957	. . . .	Bracebridge, Lincs.	W. E. Cutler Coll., 1936.
(?) 38968	(Plate XVII, fig. 12)	Black Ven, Charmouth, Dorset (? bed 122*g*, about 10 feet above Bel. Stone).	,, ,, W. D. Lang Coll., 1935.
(?) 38974	(Plate XIX, fig. 5) .	Stonebarrow, Charmouth, Dorset, (? bed 122*g*).	,, ,,
C. 38990 .	. . . .	S.S.W. of Bettiscombe Church, Dorset. See Lang, 1932, p. 118, G. 4.	,, ,,
C. 38997 .	. . . .	W. of Golden Cap, Dorset (fallen block [beds 122*d–f*]).	,, ,,
C. 38998 .	. . . .	Westhay Water, Dorset (not in place)	,, ,,
C. 39000 .	. . . .	Between St. Gabriel's mouth and Golden Cap, Dorset (bed 122).	,, ,,
C. 39001 .	. . . .	Between St. Gabriel's mouth and Golden Cap, Dorset (bed 122).	,, ,,
C. 39002–05	. . . .	S.W. of Golden Cap, Dorset (bed 122*d*).	,, ,,
C. 39310 .	. . . .	Stonebarrow, Charmouth, Dorset (foreshore).	W. Wingrave Coll., 1935.
C. 39153–55	. . . .	Yorkshire Coast	Sowerby Coll., 1935.
C. 39158	. . . .	,, ,, ...	J. Francis Coll., 1927.
C. 39446 .	. . . .	Tranzault, Indre, France . .	N. Boubée, 1938.
C. 39447–49	. . . .	Göppingen, Wurtemberg . .	,, ,,
C. 39522	(var *intermedia*) .	Napton, Warwickshire . . .	L. F. Spath Coll., 1937.
C. 39548 .	. . . .	Between Golden Cap and Seatown, Dorset (bed 122*d*).	W. D. Lang Coll., 1935.

Androgynoceras hybrida (d'Orbigny)

Plate XXVI, fig. 2

Ammonites hybrida d'Orbigny, 1844, p. 285, pl. lxxxv, figs. 1–2.
Androgynoceras hybridum (d'Orbigny) : Hyatt, 1867, p. 83.

TYPE.—The specimen from the Vallée de Lose (Coll. d'Orbigny, No. 1673B, in the Musée National d'Histoire Naturelle at Paris), said to be the original of d'Orbigny's figs. 1–2 (see Plate XXVI, fig. 2).

DIAGNOSIS.—Sub-stenogyral, sub-leptogyral, sub-latumbilicate *Androgynoceras*. Whorl-section sub-quadrate, with flattened sides, gently arched periphery, and rounded umbilical slope. Ribs at first as in *A. maculatum* (18 ; 20 ; 21 on three inner whorls), later as in adult *A. lataecosta*, with two small tubercles (24 ribs on outer whorl). Secondary striae on periphery of whole outer whorl. Suture-line presumably similar to that of *A. lataecosta*.

MEASUREMENTS.

Lectotype (cast)	90	·30	·30	·45

REMARKS.—This species, the genotype of *Androgynoceras*, has already been noticed in the generic description (p. 110). The cast of the lectotype, here figured, shows much more distantly ribbed inner whorls than d'Orbigny's figure, and a less inflated outer volution ; while the bi-tuberculation is distinct only on the last five ribs. The roundness of the aperture and the septal surface at the end in d'Orbigny's illustration are thus due to misleading restoration, but it is possible that the artist utilised other specimens and fragments to make a composite figure. The inner whorls probably belong to quite a different form, as does the *Oistoceras* fragment of his figs. 4–5, supposed to represent "a young individual." The suture-line given by d'Orbigny may be also drawn from a different specimen, and must not be taken to be exact in every detail. If it be drawn from the lectotype, it must have been taken near the end of the specimen, since it is enlarged to two diameters ; and it would show that the lectotype is entirely septate.

The species is represented in the collection only by the cast of d'Orbigny's original, here figured ; but some young examples (Plate XVII, fig. 12, and Plate XIX, fig. 5) may belong here, and larger transitions to *A. hybrida* are listed above under *A. maculatum*. It seems probable that, if typical or complete examples of the present form are ever discovered on the Dorset coast, they will be found in the Lower Limestone (bed 123*a*) and in the clays below (beds 122*e*, *f*, and *g*), whence *A. hybrida* had indeed been recorded (Lang, 1936, p. 434), although it was then differently interpreted. Being somewhat intermediate between *A. maculatum* and *A. lataecosta*, however, the present form is difficult to distinguish, except in complete and well-preserved specimens. In the var. *leckenbyi*, nov. of *A. maculatum*, which is particularly close to the present form, the ribs are more thickened, especially in the bi-tuberculate stage. *A. subhybrida*, nov. (p. 122), with similar outer whorl, has the closely costate early stage of *A. lataecosta*, whereas the inner whorls of *A. hybrida*, when isolated, can only be mistaken for *A. maculatum*, though the latter is generally more bluntly ribbed.

The *Amm. hybridus* figured by Chapuis (1861, p. 38, pl. vii, fig. 2) is more distinctly bi-tuberculate than the lectotype, but the fragment represented in pl. vi, fig. 5, probably has nothing to do with the present species.

HORIZON AND LOCALITIES.—*Davoei* zone, top of *maculatum* and base of *lataecosta* sub-zones. France (and (?) St. Gabriel's, Dorset [beds 122*e*–123*a*]).

SPECIMEN.

C. 39452 (cast of lectotype, d'Orbigny, pl. lxxxv, figs. 1, 2).	Vallée de Lose, France .	Exch. Musée d'Hist. Nat. Paris, 1938.

Androgynoceras lataecosta (J. de C. Sowerby)

Plate XIV, fig. 4; Plate XVII, figs. 4, 6–11; Plate XVIII, figs. 3 *a*, *b*; 4 *a*, *b*; 7–9; Plate XIX, figs. 3, 4, 6; Plate XXIII, fig. 8.

Ammonites lataecosta J. de C. Sowerby, 1827, p. 106, pl. 556, fig. 2 (1 in text).
non Ammonites lataecosta Sowerby: Zieten, 1830, p. 36, pl. xxvii, fig. 3.
Ammonites lataecosta (*laticostatus*) Sowerby: Brown, 1837, pp. 21, 259, pl. xvi, fig. 2.
Ammonites planicosta, *non* Sowerby: d'Orbigny, 1844, p. 242, pl. lxv.
non Ammonites lataecosta Sowerby: d'Orbigny, 1844, p. 272.
non ,, ,, ,, Quenstedt, 1845, p. 86.
Ammonites laticosta Sowerby: Bronn, 1848, Index, p. 48 (*partim*).
Ammonites planicosta, *non* Sowerby: d'Orbigny, 1850 (Prodrome), p. 224.
non Ammonites lataecosta Sowerby: Giebel 1852, p. 681.
non ,, ,, ,, Oppel, 1853, p. 74.
Ammonites lataecosta Sowerby: Pictet, 1854, p. 690.
Ammonites laticostatus Sowerby: Morris, 1854, p. 293 (*partim*).
Ammonites planicostatus Sowerby: Hauer, 1856, p. 52, pl. xvi, figs. 4–6.
non Ammonites lataecosta Sowerby: Dumortier, 1869, p. 84, pl. xlv, figs. 1–4.
Microceras laticosta (Sowerby): Hyatt, 1871, p. 35 (*partim*).
Aegoceras latecosta (Sowerby): Neumayr, 1875, p. 906.
,, *lataecosta* (Sowerby): Wright, 1880, pl. xxxii, fig. 1; 1882, p. 365.
non Ammonites lataecosta Sowerby: Quenstedt, 1885, p. 267, pl. xxxiv, figs. 2–3.
Aegoceras lataecosta (Sowerby): Koken, 1896, p. 629.
Ammonites (*Aegoceras*) *capricornu* Schlotheim: Koken, 1896, p. 75, text-fig. 54.
Ammonites lataecosta Sowerby: Crick, 1898, p. 19.
Aegoceras capricornum (Schlotheim): Crick, 1898, p. 95, pl. xx, fig. 2.
Ammonites lataecosta Sowerby: Monckton, 1910, p. 388.
Androgynoceras lataecosta (Sowerby): Buckman, 1918*a*, p. 264.
Aegoceras aff. *lataecosta* (Sowerby): Trueman, 1919, p. 273, pl. xxiii, figs. 3 *a*, *b*; text-fig. 5, p. 274.
Aegoceras aff. *lataecosta* (Sowerby): Tutcher and Trueman, 1925, p. 652.
Androgynoceras lataecosta (J. de C. Sowerby): Lang, 1932, pp. 118, 122.
(?) *Aegoceras lataecosta* (Sowerby): Bovier, 1932, p. 32.
Aegoceras lataecosta (J. de C. Sowerby): Lang, 1936, p. 436.
,, ,, ,, Spath, 1936*a*, p. 448.

TYPE.—Sowerby's original (No. 43916) from the Drift, re-figured in Wright (1880, side), and in Plate XIX, fig. 4 (periphery).

DIAGNOSIS.—Sub-stenogyral, sub-leptogyral, sub-latumbilicate *Androgynoceras*. Whorl-section sub-quadrate, owing to more-or-less pronounced flattening of sides and periphery, and generally about as high as wide. Umbilical wall inconspicuous, except on outer whorl. Ribs single, rather close and fine on inner whorls, blunt on outer, and with a tendency to develop bi-tuberculation in the adult or to break up into fine secondaries on the periphery, where they are often crossed by traces of longitudinal striation. About 26 ribs on outer whorl of typical specimens, decreasing towards centre to about 20 per whorl. Body-chamber from over half, to about three-quarters of, the outer whorl; mouth-border with slight ventral lappet. Suture-line with comparatively broad saddles and irregularly trifid first lateral lobe, not longer than external lobe (Plate XVII, fig. 5 *c*?; Plate XVIII, figs. 3 *a*, *b*). Internal lobe (Plate XXIII, fig. 8 *c*) bifid, with two long and slender bordering saddles.

MEASUREMENTS.

Holotype (Plate XIX, fig. 4) . . .	105	·32	·30	·46
Plate XVIII, fig. 4	91	·31	·30	·48
Plate XVIII, fig. 3 (transition to *A. capricornus*)	52	·32	·30	·49
var. *obtusicosta* (Trueman) (Plate XVII, fig. 4)	86	·33	·31	·45
var. **pyritosa,** nov. (Plate XVIII, fig. 9) .	50	·30	·30	·49
	65	·29	·27	·50
,, ,, (No. 43915) . .	90	·31	·28	·48
var. **subcapricornu,** nov. (Plate XVIII, fig. 8)	62	·27	·27	·54
(?) var. *subcapricornu*, nov. (Plate XVIII, fig. 7)	42	·29	·29	·52

REMARKS.—Like *A. maculatum*, the species here described has to be interpreted rather widely. Thus, some varieties now included in *A. lataecosta* have originally been put forward as independent species ; but they are connected with the type by so many transitions that the specific identification of casually chosen, and not specially selected, specimens would be impossible if these varieties are regarded as specifically distinct. Moreover, they were all members of one contemporaneous, and probably interbreeding, population ; and as already mentioned, even separation from such apparently distinct " species " as *A. hybridiforme* and *A. subhybrida* is impossible, except in the case of large individuals. Moreover, since each of the varieties is likely to produce a hybridiform or a sub-hybrid type, more specific names would logically have to be created for them, still further increasing the difficulties of identification of the average, fragmentary examples. When Wright in 1880 described *A. lataecosta* as " the middle-age condition of *A. henleyi*," he was, in fact, much nearer to a true appreciation of their relationship than those later authors who separated them generically.

The confusion of *A. lataecosta* with *Amm. brevispina* Sowerby caused by the wrong numbering of the original figures having been recognised, it misleads no longer ; and the long-standing identification of *A. lataecosta* with *Promicroceras planicosta*, initiated by d'Orbigny, seems now also to have been generally abandoned. The resemblance of *Androgynoceras lataecosta* to the last-named species is, in fact, not very close, except in d'Orbigny's large figure, the inner whorls of which seem to have shorter ribs than those of the typical forms here figured. Their number, however (22 ; 22 ; 22 ; 21, counting inwards), shows that the form, however much restored, falls within the range of variation of the present species ; and the smooth inner whorls of d'Orbigny's small example (fig. 4) alone indicate that it has nothing to do with the present form, or indeed, any *Androgynoceras*. For the same reasons I would refer to the present form, the *Amm. planicostatus* figured by Hauer (1856), although its suture-line shows considerable resemblance to that of *Promicroceras*, with bifid, not trifid, lobes (see Spath, 1925, p. 301, Text-figs. 8 *a–f*). It may be added that d'Orbigny's figure was copied (as *Amm. capricornus* Schlotheim) by Chenu (1859, p. 87, Text-figs. 375–376) and his wood-cut was again reproduced in Wright (1880, p. 246, Text-fig. 149; 1882, p. 369, fig. 189) and still figures in some text-books (e.g. Geikie, 4th ed., 1903, p. 1135, fig. 442 *d*, and Woods, 1937, p. 328, Text-fig. 157) but it is drawn rather sketchily, and resembles *A. maculatum* more than *A. lataecosta*.

The whorl-section given by Sowerby is probably based on the transitional Dorset specimen referred to the var. *pyritosa* (see below); for in the badly figured holotype the whorl-thickness is as great as, or even slightly greater, than the height, except near the end where the uneven polishing of the un-figured side has slightly damaged the ribs. In Plate XIX, fig. 4, the upper half is thus apparently contracting, while the lower half is unduly inflated, owing to the adhering matrix.

Only the peripheral view of the holotype is now given (Plate XIX, fig. 4) because the drawing of the side-view in Wright is tolerably accurate, except in the number of ribs. This varies from 26 (outer whorl, restored) to 26, 24 and 23 on successively younger whorls; in the large specimen figured in Plate XVIII, fig. 4, it declines from 26 to 24, 23 and 23. The smaller pyritic original of Plate XVIII, fig. 3, however, having from 27 to 26 ribs (two outer whorls only) is already difficult to distinguish from *A. capricornus*, as is mentioned below. There are many still smaller examples before me, e.g. from bed 122*g* (Lang, 1936, pp. 433–4), which may be taken to be the young of the present, as well as of other, species; and down to a diameter of about 5 mm. the number of ribs to the whorl in these is fairly constant; but below this diameter there is extraordinary variation both in costation and in whorl-shape.

In an example recorded by Trueman (1919, p. 274), the ribs first appeared as low folds at a diameter of 3·5 mm., and there were no ribs on the periphery until the shell was nearly twice that size, only becoming prominent at a diameter of 11 mm. I am now figuring six young examples, all from one horizon (122*g*=10 feet above the Belemnite Stone, Plate XVII, figs. 6–11), to show some of the variability. The ribs may be coarse and blunt, fine and close, alternately thick and thin, straight or flexuous, single or even simulating bifurcation. They may already be distinct across the periphery at 4 mm. diameter, or still faint at a much larger size; and the forward projection may be so pronounced that some could easily be mistaken for young *Oistoceras*. At the same time the amount of depression of the whorl or of the width of the umbilicus varies so greatly that measurements would be useless; and the suture-line, which is shown in all the immature specimens figured, may have either a symmetrically or an un-symmetrically trifid first lateral lobe, while in one specimen (fig. 11) it is bifid on one side and trifid on the other.

The original of Plate XVII, fig. 5 already shows the typical costation of the adult with considerable reduction of the angularity of the peripheral sinus as compared with that of its inner whorls; and its suture-line (fig. 5 *c*) does not differ in any essential from that of the young *A. maculatum* (Plate XIII, fig. 8). It is indistinguishable from *A. capricornus*, and therefore doubtfully listed below as such. On the other hand, the rather coarsely ribbed specimen represented in Plate XVII, fig. 12, has 22 and 18 ribs at diameters at which the original of fig. 5 has 28 and 21, respectively. It might be taken to be an immature example of *A. maculatum* (which persists into bed 122*g*) or of *A. hybrida*, especially since its suture-line (fig. 12 *e*) also agrees; but the acuteness of the peripheral chevrons increases with age, their angularity being particularly conspicuous at the end, and this is not only because then the venter is proportionately narrower than at the beginning of the outer whorl. Yet in all the forms of *Androgynoceras* and *Oistoceras* described below, the inner whorls are finely and closely ribbed, so that the example here discussed must be looked upon as one of the earliest transitions from the *maculatum-hybrida* stock to *Oistoceras*. It is probable, however, that at larger diameters the specimen in question reverted to the usual *capricornus-lataecosta* type of ribbing and periphery, because many immature and undoubted examples of the present species and of *A. capricornus* collected from beds 123 and 124 have been observed, which possess a ventral chevron at least as acute as that of the specimen under discussion.

In the very young stages of examples from these higher horizons the variability is no less than in those from bed 122*g*. The ribbing may be so fine (Plate XIX, fig. 3) and irregular as to be altogether different from that at later stages, and distantly ribbed examples are still frequent, but the ribs are much more slender than the superficially similar young of *A. maculatum*. In the example figured in Plate XIX, fig. 5, perhaps the young of *A. hybrida*, the peripheral ribs are greatly flattened, and there is then great resemblance to *Promicroceras* (*planicosta* group), but not to young of a corresponding size, which can generally be distinguished in un-crushed specimens by their early smoothness, more or less straight peripheral ribs, and by their suture-line.

The young forms just discussed, of course, include not only *A. lataecosta* and *A. capricornus*, but probably also the inner whorls of allied species, like *A. subhybrida* and *A. hybridiforme*; for, since these have an early *lataecosta* stage, the nuclei would be expected to be more or less similar. *A. brevilobatum* (recorded as "*Amblycoceras*") and *A. artigyrus*, var. *similis* also appear in bed 123; but, since the early forms of that group are so intimately connected with the present species that they might well have been left in *A. lataecosta*, the specific separation does not reflect any great difference, and the suture-lines especially are identical. The young of *A. brevilobatum* could not be distinguished from the original of Plate XVII, fig. 5, which again is inseparable from the inner whorls of the example figured in Plate XVIII, fig. 3 (transitional to *A. capricornus*), on the one hand, and an almost identical Randen (Switzerland) specimen of *A. capricornus* (Plate XXIII, fig. 15), on the other.

One example (No. C. 38537) listed above, under *A. maculatum*, has an unusually well-developed inner tubercle, which accounts for the increased whorl-thickness, and causes some resemblance to *A. maculatum*, var. *leckenbyi*, nov. (p. 127) and to the various transitions between this form and *Androgynoceras heterogenes*. In these earlier forms, however, as in *A. maculatum* (Young & Bird) itself, the distant spacing of the ribs on the inner whorls is the most obvious distinguishing feature. What I take to be the var. *leckenbyi* of *A. maculatum*, i.e. the "adult" of his *A. capricornus*, had indeed been confused by Blake (in Tate & Blake, 1876, p. 282) with *A. lataecosta*.

The Kilsby example (No. 20130*gb*), from which was taken the (last) suture-line figured in text-fig. 2 *c* (p. 7), is nearly complete at 110 mm. diameter, but represents an individual with a highly arched periphery, and transitional to *A. subhybrida*. In side-view it resembles the " *Amm. maculatus* " figured by Quenstedt (1885, pl. xxxiv, fig. 5), but I am unable to say from the figure whether this belongs to the var. *obtusicosta*, as Trueman thought probable, or to *A. maculatum*, var. *leckenbyi*, as the more distant ribbing suggests.

This var. *obtusicosta* Trueman differs from the type merely in being very slightly more compressed, more involute, and having a higher whorl. The ribs on the periphery may, or may not, be more prominent than those of the type, of the other varieties here recognised, or of the numerous passage-forms between them and the var. *obtusicosta* ; but the differences in the more-or-less asymmetrical first lateral lobe are too insignificant to be of any diagnostic value. The holotype of the var. *obtusicosta* is here re-figured (Plate XVII, fig. 4) because the reduced illustration in Trueman, and especially the wrongly restored peripheral view, do not allow of easy comparison of this variety with the typical *A. lataecosta*, or even the somewhat similar bi-tuberculate var. *leckenbyi* of *A. maculatum*.

The example of the var. *pyritosa* Spath (No. 43915), listed in the table of measurements from " Lyme Regis " (Mrs. Murchison's Coll.), was referred to by J. de C. Sowerby (1827, p. 106) as being the only specimen of *Amm. lataecosta* that did not come from the Drift. It has already been mentioned that it has a narrower whorl-section than the type, and it shows 33 ribs on the outer whorl, instead of 26. It belongs to the same form as the example figured in Plate XVIII, fig. 9, for which I had previously used the name " *Aegoceras* " *pyritosum* (Spath, 1936*a*, p. 450) but which is now included as a variety in the present form. This var. *pyritosa*, then, differs from the typical *A. lataecosta* merely in retaining closer, generally un-tuberculate, and often rather flexuous and peripherally projected, costation to the end ; and in being more compressed, with a more evenly arched, not square, venter, and a low umbilical wall. But there are so many intermediate forms between the two, and the young are so much alike (see p. 138), that only larger, well-preserved, or fairly complete specimens can safely be identified as belonging to the var. *pyritosa* rather than to the typical *A. lataecosta*. It is probable that this var. *pyritosa* leads directly to *A. capricornus* by way of forms like that figured in Plate XVIII, fig. 10, which I had also formerly included in *A. pyritosum*. Small examples of this var. *pyritosa* as well as of the typical *A. lataecosta*, in fact, are so much like *A. capricornus*, that misidentifications of immature or less well preserved material will often occur.

Thus, on comparing Plate XVIII, fig. 3 (*A. lataecosta* transitional to *A. capricornus*), with Plate XXIII, fig. 15 (*A. capricornus*), most observers will fail to find significant differences. It is true that the ribbing tends to become slightly coarser near the end of the first example (included in *A. lataecosta*) and that the second (here referred to *A. capricornus*) has fewer ribs on the penultimate whorl, the number of ribs, per whorl, counting inwards, being 27, 26 and 29, 23 respectively. In the small paratype of *A. capricornus* there are 24 and 22 ribs, while the larger lectotype has

27, 27, 23. These, of course, are merely individual differences and of no significance. At the diameter of the example figured in Plate XVIII, fig. 9, separation of the two forms becomes less difficult, but considerable allowance must still be made for individual variation. For in a very similar Yorkshire specimen (No. 14717), of the var. *pyritosa*, the last half whorl suddenly begins to swell, the ribs are rather irregular, and their number varies from 30 to 27 and 23, while in the figured example (fig. 9) it is rather erratic (32, 38, 30, 25). When the characteristic change in ornamentation, i.e. approximation or weakening of the ribs, near the plain aperture can be observed, as in the body-chamber fragment (of dimensions: 84; ·33; ·27; ·48) figured in Plate XIV, fig. 4, separation of the var. *pyritosa* from the typical square-whorled *A. lataecosta* seems easy; but many of these compressed specimens grew to a much larger size, i.e. about 120 mm. diameter. The costae then often became duplicated, and there were produced many transitional forms to *A. subhybrida*, var. *leptonotus*, nov. (Plate XX, fig. 1), differing chiefly in the weakness of bi-tuberculation.

The transitions between *A. capricornus* and the var. *pyritosa*, then, include not only forms like the original of Plate XIX, fig. 6 (but often much larger), in which the venter is comparatively broad and the whorl-shape rather inflated, but also examples which may have remained compressed and more-or-less un-tuberculate, yet have become more distantly costate after about 40 mm. diameter.

The small example figured by Trueman (1919, pl. xxiii, fig. 3) agrees with the inner whorls of some compressed forms here included in the var. *pyritosa*, but it is less closely costate than the typical example of the present variety figured in Plate XVIII, fig. 9. The ammonite figured by Bayle (1878, pl. l, fig. 2) as "*Aegoceras*" *capricornus* from Nancy (Meurthe) appears to be another of these passage-forms, but is also probably close to *A. lataecosta*, var. *pyritosa*.

The var. *subcapricornu*, nov., also connected with the typical forms and the other varieties by numerous transitions, has a wider umbilicus and a slightly different style of ribbing, owing to the reduced whorl-height. The ribs thus appear not only shorter, but straighter, and they are only very slightly projected. The whorl-section is sub-quadrate, with flattened sides, slightly arched venter, and a low umbilical wall. The smaller second specimen (Plate XVIII, fig. 7) which, in proportions and whorl-shape is less characteristic than the type of the variety (fig. 8), is rather coarsely ribbed, and the outer whorl is crushed. It appears that this variety remained evolute and did not change its whorl-section. It is thus apparently less close to the typical *A. lataecosta* than to the var. *pyritosa*, but it seems to be rather rare, and perhaps only an evolute extreme of the latter variety, transitional to the var. *recticosta* of *A. brevilobatum*, to which a Fawler specimen (No. C. 38841) shows great resemblance. I previously (1936, p. 450) named these more evolute types as a distinct species (*A. subcapricornu*, Spath MS.) but that name was given before I had seen the originals of Schlotheim's species, and could only interpret this by Knorr's figure (1768, pl. i, fig. 5).

The ammonite described (but not figured) by Trueman as "*Aegoceras*" *aequicosta* was stated to differ from the present species in its nearly circular (not elevated) whorl-section and in its ribs being very little diminished on the periphery. Unfortunately the type specimen seems to be lost; for according to information kindly given me by Prof. Swinnerton, no one of four likely specimens from Bracebridge, Lincs., preserved in the Nottingham University College collection and re-examined by Prof. Trueman, agreed with the missing type. One topotype (A), it is true, was stated by Prof. Trueman (in litt.) to be close enough to the holotype to indicate his species. But I consider that example, of dimensions 75; ·30; ·30; ·48, and with 26 ribs (strongly flattened, at first) on the outer whorl, a typical individual of *A. lataecosta*. A third of its outer whorl belongs to the body-chamber, it shows distinct bi-tuberculation near the end, and has a suture-line comparable to that of the specimen figured in Plate XVIII, fig. 3, with the large trifid first lateral lobe resembling that figured by Trueman himself (1919, p. 274, Text-fig. 5 *h*) for *A. lataecosta*. It should be added that, since Trueman interpreted *A. lataecosta* differently, i.e. comprised in it the compressed forms comparable to what I previously called *A. pyritosum* and to what are now considered to be transitions from the var. *pyritosa* to *A. capricornus*, he would naturally regard the topotype of "*Aegoceras*" *aequicosta* in question to belong to a species other than *Androgynoceras lataecosta*. There are no examples before me, other than those referred to under *A. brevilobatum*, which are in agreement with the original description of *A. aequicosta*, and I am now proposing to include these in *A. brevilobatum* as a var. *recticostata*, nov., so as not to prejudice the future status of the name *aequicosta*.

There are yet other varieties of *A. lataecosta*, some of them previously referred to as "compressed variety," "var. nov.," "aff. *lataecosta*," and "cf. *lataecosta*," but it should be noted that the transitions from the var. *pyritosa* to *A. capricornus* (listed as *A. pyritosum*, *A.* aff. *pyritosum*, and *A.* cf. *pyritosum*) were not recognised as forms of *A. lataecosta*. For, as mentioned below, *A. capricornus* was then believed to be a species which appeared at a later date, and identification was made more difficult owing to the scarcity of recognisable capricorns in the beds above 124 on the Dorset coast. The var. *pyritosa*, then, here attached to *A. lataecosta*, may yet turn out to be a mutation of *A. capricornus*. It must be repeated that, while typical smaller individuals of that variety cannot be separated from *A. capricornus*, the name may be safely used for body-chamber examples comparable to Plate XIV, fig. 4, because *A. capricornus*, at larger diameters (Plate XXVI, fig. 13) acquires distant costation.

The compressed variety from bed 124 (Lang, 1936, p. 433) includes two forms, one of which, like a comparable example from bed 123*m* (No. C. 36456), represents a transition from the var. *pyritosa* to *A. subhybrida*, var. *leptonotus*; while the other, with flat sides and strong projection of the peripheral costae, but rather distant ribbing on the outer whorl, seems distinct. It is now doubtfully referred to *A. capricornus*, but its inner whorls are missing. In any case it will be understood that some of the many specimens listed below, especially those of defective preservation, could have been included with certain of the other species here described.

HORIZON AND LOCALITIES.—*Davoei* zone, *lataecosta* sub-zone. England, France, Germany.

SPECIMENS.

19	. . . . . .	"Lyme Regis", Dorset (polished half)	Sir H. T. de la Beche Coll., 1837.
20130*gb*	(Text-fig. 2 *c*, transition to *A. subhybrida*).	Kilsby Tunnel, Northants . .	G. Baker Coll., 1843.
20130*k*	. . . . .	Kilsby Tunnel, Northants (3 specimens).	,, ,,
20918*b*	. . . . .	Kilsby Tunnel, Northants . .	,, ,,
22153	. . . . .	"Wiltshire."	P. Mohr Coll., 1848.
43916	(Holotype) .	Unrecorded [ex Drift] . . .	Sowerby Coll., 1869.
67950	. . . . .	"Lyme Regis", Dorset . .	R. Etheridge Coll., 1869.
67961	. . . . .	Unrecorded. [Stroud, Glos.] . .	,, ,,
C. 5062	. . . . .	Artesian Well, Stockwell Green, London, S.W.	F. H. Butler, 1895.
C. 5162	. . . . .	Gloucestershire	W. C. Lucy Coll., 1895.
C. 6120	. . . . .	Dorset Coast	T. J. Slatter Coll., 1896.
C. 6234	. . . . .	Golden Cap, Dorset . . .	,, ,,
C. 9997	. . . . .	Dudbridge, nr. Stroud, Glos. . .	E. Witchell Coll., 1905.
C. 10000–02	. . . . .	,, ,, . .	,, ,,
C. 10009	(Plate XVIII, fig. 4)	Stroud, Glos.	,, ,,
C. 10010	. . . . .	,, ...	,, ,,
C. 10012	. . . . .	,, ...	,, ,,
C. 10017–18	. . . . .	,, ...	,, ,,
C. 12610	(compressed var.) .	Seatown, Dorset	H. S. Romer Coll., 1910.
C. 16555–56	. . . .	Mickleton Tunnel (G.W.R.), Glos. .	R. F. Tomes Coll., 1905.
C. 16561	. . . . .	,, ,, ,,	,, ,,
C. 16982	. . . . .	,, ,, ,,	,, ,,
C. 16984	. . . . .	,, ,, ,,	,, ,,
C. 17012	. . . . .	Gloucestershire	W. C. Lucy Coll., 1895.
C. 17305	. . . . .	Mickleton Tunnel (G.W.R.), Glos. .	R. F. Tomes Coll., 1905.
C. 17750	. . . . .	Unrecorded	T. J. Slatter Coll., 1896.
C. 20234	. . . . .	Stonebarrow, Charmouth, Dorset [bed 123*a*] (figured by Trueman, 1919, pl. xxiii, fig. 4, p. 274, text-figs. 5 *a*–9).	W. D. Lang Coll., 1919.
C. 28164	. . . . .	Cliff west of Seatown, Dorset . .	L. Richardson Coll., 1925.
C. 28171–73	. . . .	Bed of Canal, nr. Gas Works, Stroud, Glos.	,, ,,
C. 28174	. . . . .	Dudbridge Station, nr. Stroud, Glos.	,, ,,
C. 36373	. . . . .	S. bluff, Golden Cap, Dorset (bed 122*f*).	H. M. Muir-Wood Coll., 1934.
C. 36375	. . . . .	W. bluff, Golden Cap, Dorset (bed 122*f*).	,, ,,
C. 36377–9	. . . .	S.W. face of Golden Cap, Dorset (bed 122*g*).	,, ,,
C. 36380	. . . . .	S. face of Golden Cap, Dorset (bed 122*g*).	,, ,,
C. 36382–3	. . . .	Between St. Gabriel's and Golden Cap, Dorset (bed 122*g*) . .	,, ,,
C. 36393	. . . . .	W. of St. Gabriel's, Dorset (bed 123*m*).	,, ,,

C. 36427	. . . . .	Between St. Gabriel's and Golden Cap, Dorset (bed 122*g*, 22 inches from top).	W. D. Lang & H. D. Thomas Coll., 1935.
C. 36429	. . . . .	St. Gabriel's, Dorset (bed 123*c*) .	W. D. Lang Coll., 1935.
C. 36430	. . . . .	,, ,, (bed 123*d*) .	,, ,,
C. 36434–5	. . . . .	Stonebarrow, Charmouth (bed 122*g*, 10 feet above Belemnite Stone).	,, ,,
C. 36438	. . . . .	St. Gabriel's, Dorset (bed 123*d*) .	,, ,,
C. 36439	. . . . .	,, ,, (bed 123*c*) .	,, ,,
C. 36442	. . . . .	Cliff foot, St. Gabriel's, Dorset (bed 123[*b*]).	,, ,,
C. 36446	. . . . .	St. Gabriel's, Dorset (bed 123*d*) .	W. D. Lang & H. D. Thomas Coll., 1935.
C. 36451	. . . . .	,, ,, (bed 123*m*) .	W. D. Lang Coll., 1935.
C. 36453	. . . . .	,, ,, ,, .	,, ,,
C. 36454	. . . . .	,, ,, (bed 123*a*) .	,, ,,
C. 36457	. . . . .	,, ,, (bed 123*m*) .	,, ,,
C. 36460–1	. . . . .	,, ,, ,, .	,, ,,
C. 36463	. . . . .	St. Gabriel's, Dorset (bed 123*n*, just above bed 123*m*).	,, ,,
C. 36465	. . . . .	Between St. Gabriel's and Golden Cap, Dorset (bed 124, base).	W. D. Lang & H. D. Thomas Coll., 1935.
C. 36726	(Plate XVIII, fig. 3)	Golden Cap, Dorset . . .	W. D. Lang Coll., 1935.
C. 36773	. . . . .	Black Ven, Charmouth, Dorset [bed 123*m*].	,, ,,
C. 36774–7	. . . . .	St. Gabriel's, Dorset (bed 123*c*). .	,, ,,
C. 36779–80	. . . . .	,, ,, ,, .	,, ,,
C. 36781–3	. . . . .	,, ,, ,, .	,, ,,
C. 36785–7	. . . . .	,, ,, ,, .	,, ,,
C. 36790–93	. . . . .	,, ,, ,, .	,, ,,
C. 36800–1	. . . . .	,, ,, (bed 123*d*) .	,, ,,
C. 36806–7	(transitions between *A. lataecosta* and *A. artigyrus*, var. *similis*).	,, ,, (bed 123*i*) .	,, ,,
C. 36809	(transition between *A. lataecosta*, and *A. artigyrus*, var. *similis*) .	,, ,, ,, .	,, ,,
C. 36808	. . . . .	,, ,, (bed 123*j*) .	,, ,,
C. 36810	. . . . .	,, ,, (bed 123*k*) .	,, ,,
C. 36811–4	. . . . .	,, ,, (bed 123*i*) .	,, ,,
C. 36828	. . . . .	,, ,, (bed 123*m*) .	,, ,,
C. 36829–30	. . . . .	,, ,, ,, .	,, ,,
C. 36831–2	. . . . .	,, ,, ,, .	,, ,,
C. 36836–7	. . . . .	,, ,, ,, .	,, ,,
C. 36839	. . . . .	,, ,, ,, .	,, ,,
C. 36842	. . . . .	,, ,, (bed 123*l*) .	,, ,,
C. 36844	. . . . .	,, ,, ,, .	,, ,,
C. 36843	. . . . .	,, ,, (bed 123*m*) .	,, ,,
C. 36845–6	. . . . .	,, ,, ,, .	,, ,,
C. 36858	. . . . .	,, ,, ,, .	,, ,,
C. 36859–60	. . . . .	,, ,, ,, .	,, ,,
C. 36863–5	. . . . .	,, ,, ,, .	,, ,,
C. 36866	. . . . .	,, ,, ,, .	,, ,,
C. 36892	. . . . .	,, ,, (bed 123*p*) .	,, ,,
C. 36939	. . . . .	Bracebridge Brickworks, Lincs. .	W. E. Cutler Coll., 1936.
C. 36943	. . . . .	,, ,, ,, .	,, ,,

C. 38560		Dorset Coast	L. F. Spath Coll., 1937.
C. 38644		Dewangen, Aalen, Germany	C. Allmendinger, 1937.
C. 38817		Golden Cap, Dorset	L. F. Spath Coll., 1937.
C. 38822–8		Dorset Coast	,, ,,
C. 38829		Golden Cap, Dorset	,, ,,
C. 38840		Fawler, Oxfordshire	J. W. Tutcher Coll., 1937.
C. 38932		Cirencester, Glos.	S. S. Buckman Coll., 1929.
C. 38933	(transition to *A. brevilobatum* var. *recticostata*, nov.).	Bentham Lane, Crickley Hill, Glos.	,, ,,
C. 38934	(transition to *A. artigyrus*).	Stonehouse Brickworks, Glos.	W. E. Cutler Coll., 1936
C. 38936		Bracebridge Brickworks, Lincs.	,, ,,
C. 38940		Golden Cap, Dorset	S. S. Buckman Coll., 1929
C. 38941–2		Stonehouse, Glos.	,, ,,
C. 38943		Stroud Gasworks, Glos.	,, ,,
C. 38944–51		Bracebridge Brickworks, Lincs.	W. E. Cutler Coll., 1936.
C. 38954		Stonehouse, Glos.	,, ,,
C. 38958–62		Bracebridge Brickworks, Lincs.	,, ,,
C. 38966	(Plate XVII, fig. 11)	Black Ven, Charmouth, Dorset (10 feet above Belemnite Stone) [bed 122*g*].	W. D. Lang Coll., 1935.
C. 38967	(Plate XVII, fig. 6)	,, ,, ,,	,, ,,
C. 38969	(Plate XVII, fig. 7)	,, ,, ,,	,, ,,
C. 38970	(Plate XVII, fig. 8)	,, ,, ,,	,, ,,
C. 38971	(Plate XVII, fig. 9)	,, ,, ,,	,, ,,
C. 38972	(Plate XVII, fig. 10)	,, ,, ,,	,, ,,
C. 38973	(Plate XIX, fig. 3)	,, ,, ,,	,, ,,
C. 38979		Golden Cap, Dorset	G. J. Hinde Coll., 1918.
C. 38981		,, ,,	W. Wingrave Coll., 1935.
C. 38982		Dorset Coast	W. D. Lang Coll., 1937.
C. 38994	(Plate XXIII, fig. 8)	Napton, Warwickshire	W. Wingrave Coll., 1935.
C. 38996	(transition to *A. capricornus* ?).	Immediately E. of Ridge Fault, E. of Charmouth, Dorset [bed 123*m*].	W. D. Lang Coll., 1935.
C. 38999	,, ,,	St. Gabriel's, Dorset (bed 123*m*).	,, ,,
C. 39010–19		,, ,, ,,	,, ,,
C. 39020–24		Broom Cliff, Dorset (bed 123*n*)	,, ,,
C. 39025–30		,, ,, ,,	,, ,,
C. 39031–3		St. Gabriel's, Dorset (bed 123*n*)	,, ,,
C. 39034–40		,, ,, (bed 123*p*)	,, ,,
C. 39041–2		Broom Cliff, Dorset (bed 124, 6–8 feet below Red Band).	,, ,,
C. 39043–69		Broom Cliff, Dorset (bed 123*p*, 12–13 feet below Red Band, bed 126).	,, ,,
C. 39071		Stonebarrow, Charmouth, Dorset (bed 122, 11 feet above Belemnite Stone).	,, ,,
C. 39072		Westhay Water, Dorset (not in place)	,, ,,
C. 39073		St. Gabriel's, Dorset (bed 122*g*, 4 feet 7 inches below 123*e*).	,, ,,
C. 39074–5		Black Ven, Charmouth, Dorset (bed 122*g*, 9 feet above Belemnite Stone)	,, ,

C. 39076–113	Black Ven, Charmouth, Dorset (bed 122*g*, 10 feet above Belemnite Stone).	W. D. Lang Coll., 1935.
C. 39114–8	Black Ven, Charmouth, Dorset (bed 122*g* or 123, 7–12 feet above Belemnite Stone).	,, ,,
C. 39119–125	Black Ven, Charmouth, Dorset (bed 122*g* or 123, 11 feet above Belemnite Stone).	,, ,,
C. 39126–7	Stonebarrow, Charmouth, Dorset (bed 122*g*, 10 feet above Belemnite Stone).	,, ,,
C. 39128–9	Westhay Water, Dorset (bed 123*b*, immediately above Lower Limestone).	,, ,,
C. 39130	St. Gabriel's, Dorset (bed 123*c*) .	,, ,,
C. 39131–2	,, ,, (bed 123*l*) .	,, ,,
C. 39150	St. Gabriel's, Dorset . . .	W. Wingrave Coll., 1935.
C. 39152	Westhay Water, Dorset (bed 123*b*, immediately above Lower Limestone).	W. D. Lang Coll., 1935.
C. 39157	Unrecorded	Sowerby Coll., 1935.
C. 39190	Broom Cliff, Dorset (bed 123*p*, 12–13 feet below Red Band).	W. D. Lang Coll., 1935.
C. 39191–3	Stream-bed, N.E. of Peace Farm, E. of Bridge, Vale of Marshwood, Dorset.	,, ,,
C. 39194	3 feet above foot of cliff, just E. of fault between Ridge Water and St. Gabriel's, Dorset [bed 123*m*].	,, ,,
C. 39195	8 feet above Belemnite Stone, Base of Cliff, E. side of gully, St. Gabriel's, Dorset (bed 123*m*).	,, ,,
C. 39196	Just E. of St. Gabriel's, Dorset (bed 122*g*, 8–10 feet above Beach).	,, ,,
C. 39197	Between the fault E. of Ridge Water, and St. Gabriel's, Dorset [bed 123].	,, ,,
C. 39198	Bed 124, 4–5 feet below Red nodules. Broom Cliff, Dorset.	,, ,,
C. 39199	Fallen block, Mouth of River Char, Charmouth, Dorset.	,, ,,
C. 39200–203	Not in place. Stonebarrow Cliff, Charmouth, Dorset . . .	,, ,, ,, ,,
C. 39204–9	Not in place. Stonebarrow, Charmouth, Dorset. C. 39205: [bed 123*m*].	,, ,,
C. 39210	Not in place. Black Ven, Charmouth, Dorset.	,, ,,
C. 39311	Unrecorded. [Frome, Somerset.] .	History unrecorded.
C. 39313	Malzeville, nr. Nancy, France .	N. Boubée, 1938.
C. 39395	Robin Hood's Bay, Yorkshire (bed 591=Oyster Bed).	L. Bairstow Coll., 1937.

The above include many young specimens and doubtful fragments, of the typical form as well as of the varieties and transitions to other species. The following are some selected specimens of the varieties.

Var. *pyritosa*, nov.

14717		Unrecorded. [Near Whitby, Yorks]	Ripley Coll., (? 1841).
43915		"Lyme Regis", Dorset. (Sowerby, Vol. VI, p. 106.)	Sowerby Coll., 1861.
C. 3336*a*		"Weymouth" [Charmouth, Dorset]	R. Damon, 1890.
C. 11444		Golden Cap, Dorset	S. S. Buckman Coll., 1907.
C. 17302		Mickleton Tunnel (G.W. Rly.), Glos.	R. F. Tomes Coll., 1905.
C. 17751		Golden Cap, Dorset	T. J. Slatter Coll., 1896.
C. 17759		,, ,,	,, ,,
C. 17760		Unrecorded	,, ,,
C. 17762		Golden Cap, Dorset	,, ,,
C. 20233		Stonebarrow, Charmouth, Dorset [bed 123*a*]. (Figd. Trueman, 1919, pl. xxiii, fig. 3.)	W. D. Lang Coll., 1919.
C. 26162		Blaisy (Côte d'Or), France	J. Armstrong Coll., 1924.
C. 28165		Pilley, Leckhampton, Glos.	L. Richardson Coll., 1925.
C. 36384		S.W. of Golden Cap, Dorset (bed 122*g*)	H. M. Muir-Wood Coll., 1934.
C. 36386		W. of St. Gabriel's, Dorset (bed 123*j*)	,, ,,
C. 36387–89		,, ,, ,, (bed 123*m*)	,, ,,
C. 36392		E. of St. Gabriel's, Dorset (bed 123*e*)	,, ,,
C. 36394		W. of St. Gabriel's, Dorset (bed 123*m*)	,, ,,
C. 36396		,, ,, ,,	,, ,,
C. 36440–1		St. Gabriel's, Dorset (bed 122*g*, 13 feet above Belemnite Stone).	W. D. Lang Coll., 1935.
C. 36444		Stonebarrow, Charmouth, Dorset (bed 123*b*, a few inches above Lower Limestone).	,, ,,
C. 36447		Between St. Gabriel's and Golden Cap, Dorset (bed 123*d*, 20 inches from top).	W. D. Lang & H. D. Thomas Coll., 1935.
C. 36449		Stonebarrow, Charmouth, Dorset ([bed 123*m*], 15 feet above Belemnite Stone).	W. D. Lang Coll., 1935.
C. 36452		St. Gabriel's, Dorset (bed 123*m*, top of Red Nodule Beds).	,, ,,
C. 36455		Stonebarrow, Charmouth, Dorset (not in place).	,, ,,
C. 36459		St. Gabriel's, Dorset (bed 123*m*, 1 foot below top).	,, ,,
C. 36784		St. Gabriel's, Dorset (bed 123*c*)	,, ,,
C. 36789		,, ,,	,, ,,
C. 36794–98		,, ,,	,, ,,
C. 36815		,, ,, (bed 123*i*)	,, ,,
C. 36817		,, ,, ,,	,, ,,
C. 36818		,, ,, (bed 123*c*)	,, ,,
C. 36823–24		,, ,, (bed 123*l*)	,, ,,
C. 36826		,, ,, ,,	,, ,,
C. 36833–34		,, ,, (bed 123*m*)	,, ,,
C. 36838		,, ,, ,,	,, ,,
C. 36852–57		,, ,, ,,	,, ,,
C. 36861–62		,, ,, ,,	,, ,,
C. 36870		St. Gabriel's, Dorset (bed 124; 3–4 feet below Red Nodule Bed, 125).	,, ,,
C. 36932	(Plate XIV, fig. 4).	Dorset Coast	W. E. Cutler Coll., 1936.

C. 36933	(Plate XVIII, fig. 9).	Dorset coast (not in place)	W. D. Lang Coll., 1935.
C. 38562	(Plate XIX, fig. 6).	Staithes, Yorkshire (M. Lias, Ironstone) .	L. F. Spath Coll., 1937.
C. 38818 .	. . . .	Dorset Coast	,, ,,
C. 38821 .	. . . .	Golden Cap, Dorset (bed 123*i* ?) . .	,, ,,
C. 38834 .	. . . .	Kilsby, Northants. (drift)	,, ,,
C. 38837–39	. . . .	Golden Cap, Dorset (loose)	,, ,,
C. 38843 .	. . . .	Stroud, Glos.	J. W. Tutcher Coll., 1937.
C. 38844 .	. . . .	Lyme Regis, Dorset	,, ,,
C. 38937 .	. . . .	Golden Cap, Dorset	S. S. Buckman Coll., 1929.
C. 38938–39	. . . .	,, ,, ...	,, ,,
C. 38984 .	. . . .	Stonebarrow, Charmouth, Dorset . .	W. Wingrave Coll., 1935.
C. 38985 .	. . . .	Dorset Coast	S. S. Buckman Coll., 1929.
C. 39220 .	. . . .	Gas Works, Stroud, Glos.	,, ,,
C. 39221 .	. . . .	Cliff-foot, S.W. of Golden Cap, Dorset [bed 123*m*].	W. D. Lang Coll., 1935.
C. 39222 .	. . . .	Golden Cap, Dorset (not in place) . . .	,, ,,
C. 39223 .	. . . .	Road cutting, S. of Plenty House, Vale of Marshwood, Dorset (beds 125–127) (see Lang, 1932, p. 118).	,, ,,
C. 39224 .	. . . .	Broom Cliff, Dorset (bed 123*n*, just above 123*m*)	,, ,,
C. 39225–28	. . . .	St. Gabriel's, Dorset (bed 123*m*) . .	,, ,,
C. 39229–30	. . . .	Immediately E. of St. Gabriel's Water, Dorset ([bed 123*m*], 8–10 feet above beach).	,, ,,
C. 39231 .	. . . .	Between fault E. of Ridge Water and St. Gabriel's, Dorset (bed 122*g*, 5 feet below Lower Limestone).	,, ,,
C. 39232 .	. . . .	Base of Cliff, E. side of Gully at St. Gabriel's, Dorset ([bed 123*m*], 8 feet above beach.)	,, ,,
C. 39233 .	. . . .	S.W. of Whitchurch Bridge, right bank of River Char, Dorset (see Lang, 1932, p. 118, G. 10).	,, ,,
C. 39234 .	. . . .	Dorset coast (not in place)	,, ,,
C. 39235 .	. . . .	Black Ven, Charmouth, Dorset (not in place, [bed 123*m*]).	,, ,,
C. 39236 .	. . . .	Foreshore, W. of Golden Cap, Dorset [bed 123*m*]. Fallen block.	,, ,,
C. 39237 .	. . . .	Stonebarrow, Charmouth, Dorset (not in place, [bed 123*m*]).	,, ,,
C. 39238–43	. . . .	Stonebarrow, Charmouth, Dorset [bed 123*m*] (not in place).	,, ,,

Transitions from var. *pyritosa* to *A. subhybrida*, var. *leptonotus*

C. 36448 .	. . . .	St. Gabriel's, Dorset (top of bed 122*g*) .	W. D. Lang Coll., 1935.
C. 36462 .	. . . .	St. Gabriel's, Dorset (1 foot from top of bed 123*m*).	,, ,,
C. 36835 .	. . . .	St. Gabriel's, Dorset (bed 123*m*) . .	,, ,,
C. 36840 .	. . . .	,, ,, ,, . .	,, ,,
C. 36850–51	. . . .	,, ,, ,, . .	,, ,,

C. 38980		Golden Cap, Dorset	S. S. Buckman Coll., 1929.
C. 39070		Stonebarrow, Charmouth, Dorset (not in place).	W. D. Lang Coll., 1935.
C. 39145		,, ,, ,,	,, ,,
C. 39453		Dorset Coast (plaster cast of specimen referred to on p. 112).	Exch. Musée d'Hist. Nat. Paris, 1938.

Var. *obtusicosta* (Trueman).

20130*gc*		Kilsby Tunnel, Northants.	G. Baker Coll., 1843.
C. 36723	(Inflated type)	Bracebridge, Lincs.	W. E. Cutler Coll., 1936.
C. 36937–8		,, ,,	,, ,,
C. 38559	(Holotype)	,, ,,	Presd. Univ. Coll. Nottingham, 1937.
C. 38815		Staithes, Yorkshire	L. F. Spath Coll., 1937.
C. 38935		Bracebridge, Lincs.	W. E. Cutler Coll., 1936.

Var. *subcapricornu*, nov.

C. 36381		Between St. Gabriel's and Golden Cap, Dorset.	H. M. Wood Coll., 1935.
C. 36772		Golden Cap, Dorset ($4\frac{1}{2}$–$5\frac{1}{2}$ feet from top of bed 122*g*).	W. D. Lang Coll., 1935.
C. 36819	(Plate XVIII, fig. 8)	Golden Cap, Dorset (bed 123*m*)	,, ,,
C. 36820	(Plate XVIII, fig. 7).	,, ,, (bed 123*i*)	,, ,,
C. 36821		,, ,, ,,	,, ,,
C. 36935–6		Bracebridge, Lincs.	W. E. Cutler Coll., 1936.
C. 38841		Fawler, Oxfordshire	J. W. Tutcher Coll., 1937.
C. 38983		Dorset Coast (fallen block)	W. D. Lang Coll., 1935.
C. 39151		,, (not in place)	,, ,,

The following are malformations.

C. 3336*b*	[Dorset Coast]	R. Damon, 1890.
C. 20133	Stonebarrow Cliff, Charmouth, Dorset	W. T. Calman Coll., 1919.
C. 36778	Golden Cap, Dorset (bed 123*c*)	W. D. Lang Coll., 1923.
C. 36778	Golden Cap, Dorset (bed 123*c*)	W. D. Lang Coll., 1935.
C. 36788	,, ,, ,,	,, ,,
C. 36802	,, ,, (bed 123*h*)	,, ,,
C. 36816	St. Gabriel's, Dorset (bed 123*i*)	,, ,,
C. 36825	,, ,, (bed 123*l*)	,, ,,
C. 36827	,, ,, (bed 123*m*).	,, ,,
C. 36841	,, ,, ,,	,, ,,
C. 38820	Golden Cap, Dorset	L. F. Spath Coll., 1937.
C. 38986–7	St. Gabriel's, Dorset (bed 123*m*).	W. D. Lang Coll., 1935.
C. 39146	Stonebarrow, Charmouth, Dorset (not in place).	,, ,,
C. 39147	Westhay Cliff, Dorset (fallen block)	,, ,,
C. 39148–49	St. Gabriel's, Dorset (bed 123*m*)	,, ,,

The following nuclei and doubtful young examples from the top of bed 123 and from 124 may be largely referable to *A. capricornus* (Schlotheim).

C. 39211–15	Broom Cliff, Dorset (bed 124, 1–2 feet below 125*a*).	W. D. Lang Coll., 1935

C. 39216–19 . . .	Broom Cliff, Dorset (bed 124, 4–5 feet below 125*a*).	W. D. Lang Coll., 1935.
C. 39244–49 . . .	Broom Cliff, Dorset (bed 124, 2–3 feet below 125*a*).	,, ,,
C. 39250–55 . . .	Broom Cliff, Dorset (bed 124, 3–4 feet below 125*a*).	,, ,,
C. 39256–82 . . .	Broom Cliff, Dorset (bed 124, 4–5 feet below 125*a*).	,, ,,
C. 39283	Broom Cliff, Dorset (bed 124, 1 foot below 125*a*).	,, ,,
C. 39284	Broom Cliff, Dorset (bed 124, 1–2 feet below 125*a*).	,, ,,
C. 39285–89 . . .	Broom Cliff, Dorset (bed 123*p*) . .	,, ,,
C. 39290–96 . . .	,, ,, (bed 123*q*) . .	,, ,,
C. 39297	,, ,, (bed 123*r*) . .	,, ,,
C. 39298–307 . . .	,, ,, ,, . .	,, ,,
C. 39308–09 . . .	,, ,, ,, . .	,, ,,
C. 39315–23 . . .	,, ,, ,, . .	,, ,,
C. 39324–34 . . .	,, ,, ,, . .	,, ,,
C. 39335	Face of Golden Cap, Dorset (bed 123*s*) .	,, ,,

Androgynoceras capricornus (Schlotheim)

(Plate XVIII, figs. 10 *a*, *b*; Plate XXIII, figs. 1, 6, 15; Plate XXVI, figs. 13 *a*, *b*)

Ammonites spatosus Schlotheim, 1813, p. 101 (*nomen nudum*).
Ammonites capricornus Schlotheim, 1820, p. 71 (citing Knorr, 1768, pl. i, fig. 5).
Planites planicostatus (Sowerby) *partim*, de Haan, 1825, p. 92.
non Ammonites capricornus Schlotheim : Zieten, 1830, p. 6, pl. iv, fig. 8.
,, ,, ,, ,, von Buch, 1832, pl. iv, fig. 4.
Ammonites capricornus Schlotheim : Roemer, 1836, p. 192 (*partim*).
non Ammonites capricornus Schlotheim : d'Orbigny, 1844, p. 243.
,, ,, ,, ,, Quenstedt, 1848, p. 336.
Ammonites capricornus Schlotheim : Bronn, 1848, Index, p. 36 (*partim ?*).
,, ,, ,, Giebel, 1852, p. 679 (*partim*).
non Ammonites capricornus Schlotheim : Quenstedt, 1852 (Petrefaktenkunde), p. 355.
Ammonites maculatus Phillips : Oppel, 1853, p. 72, *partim*, *non* pl. i, fig. 6.
non Ammonites capricornus Schlotheim : Pictet, 1854, p. 690.
? ,, ,, ,, Hauer, 1854, p. 7.
Ammonites capricornus Schlotheim : Bornemann, 1854, p. 23.
,, ,, ,, Oppel, 1856, p. 278.
non Ammonites capricornus Schlotheim : Quenstedt, 1856, p. 96.
Ammonites capricornus major Wagener, 1860, p. 165 (*partim*).
Ammonites capricornus Schlotheim : Chapuis, 1861, p. 29 (*partim*).
Ammonites capricornus Schlotheim : Schloenbach, 1863, p. 520.
,, ,, ,, von Seebach, 1864, p. 137.
,, ,, ,, Wagener, 1864, p. 20.
,, ,, ,, Waagen, 1864, pp. 33, etc.
,, ,, ,, Schlüter, 1866, p. 52.
,, ,, ,, Dumortier, 1869, p. 81.
,, ,, ,, Waagen, 1869, p. 247.
,, ,, ,, Brauns, 1871, p. 224.
Aegoceras capricornum (Schlotheim) : Neumayr, 1875, p. 906.
,, ,, ,, Blake, in Tate and Blake, 1876, p. 281.
? non Aegoceras capricornus (Schlotheim) : Bayle, 1878, pl. l, fig. 2.
Ammonites capricornus Schlotheim : Choffat, 1880, pp. 14, 15.
Aegoceras capricornus (Schlotheim) : Wright, 1882, p. 368 (*partim*).
non Aegoceras (*Microceras*) *capricornus* (Schlotheim) : Zittel, 1884, p. 457, text-fig. 638.

Ammonites maculatus Young & Bird: Quenstedt, 1885, p. 267, pl. xxxiv (*partim ?*).
? *Aegoceras capricornu* (Schlotheim): Haug, 1891, p. 33.
non Aegoceras capricornu (Schlotheim): Futterer, 1892, p. 323.
non Aegoceras capricornum (Schlotheim): Geyer, 1893, p. 29.
Aegoceras capricornum (Schlotheim): Böse, 1894, p. 737 (*partim ?*).
Aegoceras capricornu (Schlotheim): Koken, 1896, p. 629.
non Aegoceras capricornum (Schlotheim): Crick, 1898, p. 95, pl. xx, fig. 2.
Liparoceras capricornus (Schlotheim): Buckman, 1898, p. 460.
non Amblycoceras capricornum (Schlotheim): Hyatt, in Zittel, 1900, p. 578, fig. 1204.
Ammonites capricornu Schlotheim: Haug, 1900, p. 82.
non Ammonites (*Aegoceras*) *capricornus* Schlotheim: Geikie, 1903, p. 1135, Text-fig. 442*d*.
non Liparoceras capricornu (Schlotheim): Richardson, 1904, pl. xv, fig. 7.
? *Amblycoceras capricornum* (Schlotheim): Rosenberg, 1909, p. 260.
Aegoceras capricornus (Schlotheim): Buckman, 1911, p. *iii*.
Aegoceras (*Microceras*) *capricornum* (Schlotheim): Renz, 1912, p. 77.
Aegoceras (*Microceras*) *capricornu* (Schlotheim): Meister, 1914, p. 534.
non Androgynoceras capricornum (Wright): Buckman, in Fox-Strangways & Barrow, 1915, p. 95.
Ammonites capricornus Schlotheim: Trueman, 1919, p. 275.
Aegoceras capricornum (Schlotheim): Crick, 1922, p. 279.
Aegoceras capricornu (Schlotheim): Frebold, 1922, p. 17.
Microceras capricornu (Schlotheim): Dubar, 1925, pp. 122–55.
Amblycoceras capricornum (Schlotheim): Schröder, 1927, p. 199 (*partim ?*).
Ammonites capricornus Schlotheim: Neaverson, 1928, p. 334.
? *Aegoceras capricornu* (Schlotheim): Bovier (*partim ?*), 1932, p. 32.
Aegoceras capricornus (Schlotheim): Spath, 1936*a*, p. 450.
Aegoceras capricornum (Schlotheim): Bakalov, 1936, p. 3.
non Aegoceras capricornu (Schlotheim): de Brun & Brousse, 1936, p. 36, pl. iii, fig. 5.

TYPE.—The holotype of *Amm. capricornus* might be taken to be the original of Knorr's pl. i, fig. 5 (apparently lost), since the other figures cited by Schlotheim do not agree with his description or with his type material. Oppel in 1856 (p. 278) cited Knorr to the exclusion of the other authors listed by Schlotheim. That author himself, however, was in doubt about the forms listed in the synonymy so that a lectotype will have to be chosen from among his own material. Excluding the specimens (said to belong to species now referred to *Schlotheimia* and *Oistoceras*) already removed by Schloenbach (1863, p. 520) from *Amm. capricornus*, there remain six syntypes in the Schlotheim Collection in the Geological and Palaeontological Museum of Berlin University. By the kindness of Dr. W. O. Dietrich I have been able to examine these, and the four which are true capricorns are now figured (Plate XXIII, figs. 1, 6, 7, 9). The original of Plate XXIII, fig. 1, is here chosen as the lectotype, although it is perhaps less like Knorr's original figure than the example here reproduced in fig. 9. The remaining two specimens from the Flötzkalk (with gryphites) of Amberg, labelled by Schlotheim " variet. *scalara-dorsat.*" belong to *Acanthopleuroceras* (*maugenesti-quadratum* group).

DIAGNOSIS.—Sub-stenogyral, sub-leptogyral, sub-latumbilicate *Androgynoceras*. Whorl-section sub-quadrate or slightly compressed, with gently convex sides and flattened venter. Umbilical slope comparatively high, but not steep. Ribs fairly fine and rather closely spaced on inner whorls, becoming slightly more distant on outer whorl (25 to the outer whorl, fewer on inner volutions). The ribs are flattened and projected forwards on the venter, forming almost a lappet, which may even be hollowed between the anterior and posterior edges. Suture-line with broad external saddles and asymmetrically trifid first lateral lobe, in which the outer leaflet is slightly larger than the inner (see Plate XXIII, fig. 6 *c*).

MEASUREMENTS.

Lectotype (Plate XXIII, fig. 1) . .	49	·30	·30	·48
Paratype (Plate XXIII, fig. 6) . .	35	·31	·31	·47
Plate XXIII, fig. 15	53	·31	·31	·47
Plate XVIII, fig. 10	57	·30	·29	·49
Plate XXVI, fig. 13	75	·31	·29	·48

REMARKS.—The smallest of Schlotheim's types here figured (Plate XXIII, fig. 6) shows the peculiar flattening of the ventral ribs, whose anterior border forms an obtuse angle directed forwards, while the posterior margin is straight. Between the two borders there may even be a hollow, but the posterior margin may also be inconspicuous in certain individuals in which the anterior margin forms a prominent lip. In the lectotype, however, which is larger, the ventral angularity is equally well marked at a corresponding stage, and it is only at larger diameters that the ribs appear to run sometimes almost straight across the periphery. Now the ventral flattening is just as pronounced in the young examples described above under *A. lataecosta* from the base of the *lataecosta* sub-zone (bed 122*g*), and is already present in the immature *A. maculatum* (Plate IX, fig. 3), so that the present species is rather a parallel development than a high zonal derivative of *A. lataecosta*. This is confirmed by the comparatively coarse ribbing of the inner whorls of the two typical specimens, whereas the third of Schlotheim's originals figured in Plate XXIII, fig. 7 (from a different locality) has not only more finely ribbed inner whorls, but has also the slightly expanding body-chamber and the prominent ventral ribs of *A. brevilobatum* (Trueman). Although perhaps not a typical example of that species, it probably indicates the same horizon, i.e. the *brevilobatum* or upper *lataecosta* sub-zone of Trueman (1919, p. 253).

The fourth of Schlotheim's syntypes (Plate XXIII, fig. 9) is comparable to the example figured in Plate XIX, fig. 12, which is somewhat transitional between *A. maculatum*, and especially its var. *rigida*, on the one hand, and *A. brevilobatum*, var. *recticostata* on the other. It has more depressed whorls and less close costation (23 ; 22 ; 18 ribs per whorl) than the typical *A. capricornus*, and must be excluded from that species.

The Dorset example figured in Plate XVIII, fig. 9, though possibly transitional to *A. lataecosta* var. *pyritosa*, cannot be distinguished from the lectotype, except in unimportant details of ribbing. The Cheltenham specimen figured in Plate XXVI, fig. 13, is identical at the same size, but fortunately retains part of the body-chamber, which shows more distant ribbing. The specimen is from the J. Buckman Collection and is one of the original "*Amm. planicostatus*" of the Geology of Cheltenham (p. 90) ; but it already shows great resemblance to *A. brevilobatum* (Trueman) of the same horizon. In a larger but doubtful, rather involute, body-chamber fragment from Dorset (No. C. 36867), previously listed as a compressed variety of *A. lataecosta*, the whorl-section is greatly flattened laterally and the venter is rather narrow. It is possible that, like a small Dewangen (Wurtemberg) example (No. C. 38645) with less close costation on the last half whorl, it represents a sparsicostate variety of *A. capricornus*.

Specimens like those figured in Plate XXIII, fig. 8 (with over a third of a whorl of body-chamber but with incipient inflation), or Plate XXVI, fig. 11 (with less ventral flattening of the ribs) are too immature for definite identification, but show the great similarity between the present species and the other capricorns here recognised. The first of the two specimens just mentioned is now separated from *A. capricornus* merely on account of its slightly greater terminal thickness, but like the inner whorls of the second example, it has the flattened ventral ribs of *A. capricornus*. The second example, in fact, is scarcely distinguishable from the inner whorls of *A. brevilobatum* var. *recticostata* figured in the same plate (XXVI, fig. 14); but with still smaller or less well-preserved individuals correct determination may be impossible.

In 1936 (*a*p. 450) I did not agree with Buckman, who was in great doubt about the exact identity of *Amm. capricornus*, and I called Knorr's figure "well-recognisable" (after Quenstedt, 1884, p. 155; 1885, p. 271). My interpretation, however, was influenced by Schloenbach's observations on the stratigraphical position of *Amm. capricornus*, i.e. its association with *Oistoceras curvicornis*, *Prodactylioceras davoei* and *Amaltheus margaritatus*, which seemed to confirm its high horizon.

In 1936, in fact, I identified *A. capricornus* with examples like those figured in Plate XVIII, fig. 5, and Plate XXII, fig. 5 (referred to under *Oistoceras angulatum*, Quenstedt sp.), which seem to grade into the form figured in Plate XXVI, fig. 3, and thence directly to *A. capricornus*, as now understood. Unfortunately it is impossible at present to verify the accuracy of this affiliation by stratigraphical observations. In Dorset I have identified a variety of *A. lataecosta* from as high as 6 feet below the Red Band (bed 124), but in the *bechei* zone itself (beds 125 and 126) the only "*Amblycoceras*" recorded are doubtful, crushed examples here referred to *Androgynoceras brevilobatum* and its var. *glauca*, and to *A. artigyrus*; while the "*Amblycoceras*" from bed 127 are probably already true *Oistoceras* (cf. *figulinum*?). The numerous young, not here listed, especially show the ventral angularity of *Oistoceras*, but are generally crushed. Now, if, as seems probable, there is a continuous sequence of capricorns from the compressed varieties of *A. lataecosta*, through *A. capricornus*, to *Oistoceras angulatum* (Quenstedt); then the maximum development of *A. capricornus* is apparently in the *bechei* sub-zone and the upper part of the *lataecosta* sub-zone (i.e. the *brevilobatum* horizon of Trueman). Its absence, just mentioned, from the higher beds in Dorset may thus be due merely to the unsatisfactory preservation of their capricorns, and is therefore apparent rather than real. I may add that the only reasonably well-preserved capricorn from the *bechei* zone is the unique holotype of *A. glaucum*, Spath MS. (see p. 155), and although it is now attached, as a variety, to *A. brevilobatum* because of its inflation, it is extremely close also to *A. capricornus*, having the same amount of peripheral projection of the ribs.

In any case the form figured in Plate XXIII, fig. 5, is only provisionally referred to the present species on account of the more acute ventral chevrons; like the slightly different original of Plate XXVI, fig. 3, it is considered to be a true passage-form between the typical *A. capricornus* and *Oistoceras angulatum* (Quenstedt). If such forms do occur in Dorset, they have not been distinguished from similarly crushed inner whorls of *Oistoceras* in the *figulinum* sub-zone, but the *Oistoceras* fauna of Bracebridge (Lincolnshire) also does not seem to include exactly comparable forms.

Of the many capricorns figured by Quenstedt (1885, on pl. xxxiv [as *Amm. maculatus*]) only the original of fig. 7 is perhaps identical with the present form, but the periphery is rather too narrow and the ribs are not flattened ventrally. His *A. capricornus* of pl. xxxiv, fig. 1, like the comparable forms in Futterer (1891) and de Brun & Brousse (1936), of course, have nothing to do with the present species, while Schroeder's (1927) figured example is probably closer to some of the varieties here included in *A. maculatum*. Zittel's (1884) *A. capricornus*, copied by Hyatt (1900) as *Amblycoceras capricornus* and by many other authors since, is referred to below under *Oistoceras colubrinum*, sp. nov.

In spite of all these apparent misidentifications it is gratifying to note that many of the older authors (and collectors) had a pretty good idea of what *A. capricornus* really was, and if their interpretation was rather comprehensive it is partly due to the fact that the " *capricornus* bed " is so often condensed into a few inches or feet of deposits, where the corresponding sediments of other areas, e.g. Yorkshire or Dorset, include a great thickness of strata.

HORIZON AND LOCALITIES.—*Davoei* zone, *lataecosta* and *bechei* sub-zones. Europe.

SPECIMENS.

22152	. . . . .	Füzen an der Wutach, Wurtemberg.	P. Mohr Coll., 1848.
24565*a*	(transition to *Oistoceras*).	Gundershofen, Alsace . .	,, ,,
62486*a*	(Plate XXIII, fig. 15)	Randen, nr. Schaffhausen . .	R. Bruckmann Coll., 1868.
67929	. . . . .	Unrecorded. (Foreign.) . .	R. Etheridge Coll., 1869.
74224*a*, *b*	. . . . .	Mulhouse, Alsace . . .	A. Krantz, 1875.
(?) C. 16559	(Plate XVII, fig. 5) .	Mickleton Tunnel, Glos. . .	R. F. Tomes Coll., 1905.
C. 17026 .	. . . . .	,, ,, . .	T. J. Slatter Coll., 1896.
C. 17479 .	. . . . .	Chipping Norton, Oxfordshire .	,, ,,
C. 28076 .	. . . . .	Pliensbach, Wurtemberg . .	J. R. Gregory & Co., 1925.
C. 28078 .	. . . . .	Uhrweiler, Alsace. . . .	,, ,,
(?) C. 36867	(transition to *A. lataecosta*, compressed var.).	St. Gabriel's Dorset (bed 124) .	W. D. Lang Coll., 1935.
C. 36934	(Plate XVIII, fig. 10)	,, ,, (not in place)	,, ,,
C. 38645	(sparsicostate var.) .	Dewangen, Wurtemberg . .	C. Allmendinger, 1937.
C. 38646	(transition to *Oistoceras angulatum*, Plate XXIII, fig. 5).	,, ,, . .	,, ,,
C. 38830 .	. . . . .	Dorset Coast	L. F. Spath Coll., 1937.
C. 38867	(Plate XXVI, fig. 13)	Cheltenham, Glos. . . .	S. S. Buckman Coll., 1929.
C. 38904–05	. . . . .	Uhrweiler, Alsace . . .	A. Krantz, 1937.
C. 38992 .	. . . . .	Unrecorded (Randen, nr. Schaffhausen ?).	Old Coll.
C. 38993 .	. . . . .	Mulhouse, Alsace . . .	Geol. Soc. Coll., 1911.
C. 39133–34	. . . . .	St. Gabriel's, Dorset (bed 123*m*)	W. D. Lang Coll., 1935.
C. 39187–89	. . . . .	Göppingen, Wurtemberg . .	N. Boubée, 1938.

Androgynoceras brevilobatum (Trueman)

Plate XIV, figs. 8 *a*, *b*; Plate XXI, figs. 1–2; Plate XXVI, figs. 14–15

Liparoceras capricornu (Schlotheim): Richardson, 1904, pl. xv, fig. 7.
Amblycoceras brevilobatum Trueman, 1919, p. 279, pl. xxiv, fig. 3, Text-fig. 10 *c*, p. 283.
non Amblycoceras brevilobatum Trueman: Bovier, 1932, p. 32.
Amblycoceras aff. *brevilobatum* Trueman: Lang, 1936, p. 436.
Amblycoceras glaucum, Spath MS.: Lang, 1936, pp. 432, 436.
Amblycoceras brevilobatum Trueman: Spath, 1936*a*, p. 450.
Amblycoceras glaucum, MS.: Spath, 1936*a*, p. 450.

TYPE.—Richardson's original (No. C. 28282) quoted by Trueman, from Leckhampton (Glos.).

DIAGNOSIS.—Sub-steno- to sub-platygyral, sub-lepto- to sub-pachygyral, sub-latumbilicate *Androgynoceras*. Inner whorls as in *Androgynoceras capricornus* (Plate XVII, fig. 5), but strength and curve of ventral ribbing increasing rather than decreasing, so that at larger diameters (Plate XXI, fig. 2 *b*) the peripheral ribs are very prominent. Number of ribs 26; 24; 24 (holotype) and 28; 28; 26 (Plate XXI, fig. 2) on three outer whorls, respectively. Outer whorl tending to become inflated. Body-chamber over half a whorl in length. Suture-line (fig. 1 *c*) with narrow first lateral lobe, broad external saddle showing three terminal branches, and with ascending auxiliaries.

MEASUREMENTS.

Holotype (Trueman)	48	·29	·27	·44
Holotype (Plate XXI, fig. 1) . .	49	·33	·33	·48
Plate XXI, fig. 2 . . . (at)	50	·36	·34	·44
,, ,, ...	67	·35	·36	·43
var. **recticostata**, nov. (Plate XXVI, fig. 14)	58	·31	(·31 ?)	·48
,, ,, (Plate XXVI, fig. 15)	58	·30	·31	·48

REMARKS.—This species is connected by so many transitions with *Androgynoceras lataecosta* in the wider sense that it might well have been considered a variety of that species. But it is already leading to the more involute and more quickly coiled *Oistoceras crescens* and other late forms here described, and the specific attribution of certain transitional types becomes a matter of personal opinion. Some examples (No. C. 16565) with still more pronounced ventral chevrons even resemble forms that are here included in *Oistoceras alleotypus* Trueman.

The transitions to *Androgynoceras lataecosta* are of several types. Some specimens (e.g. No. C. 38599 of 86 mm. diameter) show such gradual development of the costation that they lack the contrast between the densely ribbed inner, and more distantly ribbed outer, whorls so characteristic of the typical examples; yet they have a stronger peripheral rib-curve than similar inner whorls of *A. lataecosta*. Other specimens of *A. brevilobatum* have a more inflated whorl-section, and so lead to *A. artigyrus* var. *similis*, discussed below. Thus, an example labelled "*Amblycoceras*" *brevilobatum* from Mr. Tutcher's collection (No. C. 38569) is indistinguishable from the inner whorls of the "*Aegoceras capricornum*" (*non* Schlotheim) figured by

Crick (1898, p. 95, pl. xx, fig. 2), except in its more pronounced ventral chevrons. Other similar specimens, e.g. the "*Amblycoceras* sp." recorded from bed 123*s* (Lang, 1936, p. 433), lead directly to the form of *A. artigyrus* var. *similis* figured in Plate XIV, fig. 5; while the form previously listed as "*Amblycoceras*" aff. *brevilobatum* from bed 123*i* differs from *Androgynoceras brevilobatum* chiefly in its less closely costate inner whorls, so that it really represents a passage-form between the var. *similis* of *A. artigyrus*, discussed below, and the present species (or its var. *recticostata*), or even *A. lataecosta*.

Transitions to *Oistoceras crescens* (Hyatt) Trueman, described below (e.g. Nos. C. 17863, C. 36941–2, C. 38570), differ from the typical forms of *A. brevilobatum* in their more rapid increase in whorl-thickness and their more acute peripheral chevrons. *A. capricornus* (Schlotheim) which has the ventral projection of the ribs about equally pronounced, differs from *A. brevilobatum* chiefly in its less inflated whorls which do not pass to a distantly costate, swollen stage at so small a diameter. Its suture-line also is, perhaps, simpler than that of the present species, with a wider first lateral lobe (compare Plate XXI, fig. 1 *c*, and Plate XXIII, fig. 6 *c*); but the plan is essentially the same, and the two species are undoubtedly very intimately related.

The largest example here listed (No. C. 38599), of 88 mm. diameter, has the inner whorls apparently like the holotype, and a final stage like the specimen figured in Plate XXI, fig. 2; but the larger part of the outer whorl has a square venter with distinctly projected ribs and bi-tuberculation, as in *A. artigyrus* var. *similis*. Unlike the more involute example No. C. 38863, however, referred to under that form, the present transitional example has an umbilical width of 50 per cent. of the diameter.

The unique example (C. 36916) previously recorded as "*Amblycoceras*" *glaucum* (Lang, 1936, pp. 432, 436, and here figured in Plate XIV, figs. 8 *a*, *b*) is now provisionally attached to the present species as a var. **glauca,** nov., pending the discovery of more material. The specimen, which includes half a whorl of body-chamber, has proportions: 61; ·30; ·33; 46. These confirm its position intermediate between the more compressed *A. capricornus* and the more quickly increasing holotype of *A. brevilobatum*. Since in other comparable forms, complete to the aperture, the length of the body-chamber is between half and three-quarters of the outer whorl, there can have been no abrupt change in the ribbing after the stage here figured, except, perhaps, the peripheral projection of the ribs near the aperture. But the ventral flattening of the ribs is more pronounced in the var. *glauca* than in the typical examples of *A. brevilobatum*. While in this respect it resembles *A. capricornus* (with a less wide periphery), its very closely costate inner whorls also show that the var. *glauca* is very intimately allied with the late species of *Androgynoceras*.

In a specimen (M.P.G., No. 4361, Geol. Soc. Coll.) from Mickleton, the capricorn early whorls are indistinguishable from the present species, but they become bi-tuberculate at about 70 mm. diameter, when rapid swelling (still in the septate stage) sets in. It seems impossible to exclude this form from *A. brevilobatum* merely on account of its larger size. The suture-line of this example (Text-fig. 17) at 125 mm. diameter is much like that of the smaller holotype here figured (Plate XXI, fig. 1 *c*), and it is of the same general aspect as that figured (diagrammatically) by d'Orbigny (1844, pl. lxxxv, fig.3) for his somewhat similar *Amm. hybrida.* But this Mickleton example is interesting also because, soon after the ornament began to change and swelling set in, the body-chamber left the regular spiral with an almost scaphitid kink. Since the body-chamber is missing, it is impossible to say whether contact was re-established at a later stage ; but the unsymmetrical dorsal impression of the final, free portion suggests a pathological condition, and not normal uncoiling. It is comparable to that of a scaphitoid *Promicroceras* figured on a previous occasion (Spath, 1926*b*, pl. ix, fig. 3).

The existence of this unique example might be taken to confirm the attribution of the present form, also perhaps of *Oistoceras crescens* var. *dissotypa*, to *Androgynoceras*. Another unusual form, however, namely, the holotype of *Oistoceras alleotypum* (Trueman) which shows a similar inflated final stage, makes it probable that the return to a *Liparoceras* whorl-shape (and ornamentation) was confined

FIG. 17.—*Androgynoceras* cf. *brevilobatum* (Trueman). Complete suture-line, natural size, of malformed large example in the swollen bi-tuberculate stage, part of the lateral lobe (dotted) obscured by interference of terminations of preceding first lateral saddle. Mickleton (M.P.G., No. 4361, Geol. Soc. Coll.).

to a few pathological individuals, so that it is of no systematic importance in the later forms.

Var. *recticostata* is a slender-whorled form which differs from the typical *A. brevilobatum* in acquiring distant costation rather more rapidly, and in having in the adult hardly any peripheral projection of the ribs, which pass across the venter with scarcely any flattening. Since examples of this variety in the Collection had been assigned to *A. brevilobatum* (by Mr. Tutcher) as well as to *A. aequicosta* Trueman (by Mr. L. Richardson), I was inclined to adopt for it the latter name. Although the specimens before me do not come from Bracebridge, Lincs., and do not possess thirty ribs on the outer whorl, they seemed the only forms that agreed with Trueman's description. But after seeing the massive-whorled specimen considered by Prof. Trueman to be close to the (missing) holotype of *A. aequicosta* (referred to under *A. lataecosta*), it seems preferable to adopt a new name (var. *recticostata*) for this variety, in case the original *A. aequicosta* should yet turn out to be different from Sowerby's species.

This var. *recticostata*, then, is characterised by the prominence and straightness of the ribs on the venter of the adult, compared with that of the typical forms, but the number of ribs on the outer whorl is about the same. There are many transitions to the typical *A. brevilobatum*, to *A. lataecosta*, and to *A. capricornus*, as well as to the form figured in Plate XIX, fig. 12. This has more distant ribs on the inner whorls, and was therefore referred to above (p. 128) as a passage-form from *A. maculatum* var. *rigida* to the present variety. But the inner whorls of the large example of *A. lataecosta* figured in Plate XVIII, fig. 4, if broken out, could not be distinguished from specimens of the var. *recticostata* of less than 30 mm. diameter, and some even larger examples included with *A. lataecosta* (e.g. Nos. C. 38840, C. 38932–33) are directly transitional to the present variety.

Another example (No. 62486*b* from Randen, Switzerland) is intermediate between *A. brevilobatum* and its var. *recticostata*, on the one hand, and *A. capricornus* on the other, since it has conspicuous ventral flattening of the ribs. It was associated with the typical *A. capricornus*. The inner whorls figured in Plate XXVI, fig. 11, which differ from *A. capricornus* and *A. brevilobatum* merely in the straightness of the ventral ribs, are more closely costate than the example figured in Plate XXVI, fig. 14, but probably also belong to the var. *recticostata*. Conversely, an example (No. C. 38931) with strongly inclined costae like those of *Oistoceras colubrinum*, nov. (p. 174; i.e. Zittel's *Aegoceras capricornus*), is in all other respects intermediate between the typical *A. brevilobatum* and the var. *recticostata*, nov.

HORIZON AND LOCALITIES.—*Davoei* zone, *lataecosta* sub-zone (upper part), and *bechei* sub-zone. England, France, Switzerland (Germany ?).

SPECIMENS.

20130*h* and *k*		Kilsby Tunnel, Northamptonshire	G. Baker Coll., 1843.
20136		Crick, Northamptonshire	,, ,,
20901		Kilsby Tunnel, Northants	,, ,,
62486*b*		Randen, nr. Schaffhausen	Bruckmann Coll., 1868.
67949		Mickleton, Glos.	R. Etheridge Coll., 1869.
C. 2907	(Plate XXI, fig. 2)	Unrecorded	J. Gray Coll., 1889.
C. 10016		Stroud, Glos.	E. Witchell Coll., 1905.
C. 16552		Mickleton, Glos.	R. F. Tomes Coll., 1905.
C. 16557–58		,, ,,	,, ,,
C. 16560, 16562		,, ,,	,, ,,
C. 16564–65		,, ,,	,, ,,
C. 16983, 16985		,, ,,	,, ,,
C. 17025		,, ,,	T. J. Slatter Coll., 1896.
C. 17745		(?) Mickleton, Glos.	,, ,,
C. 17863		Unrecorded (Robin Hood's Bay, Yorks.).	History unrecorded.
C. 28168–69		Pilford, Leckhampton, Glos.	L. Richardson Coll., 1925.
C. 28176		Little Bowden, Market Harborough, Leicestershire.	,, ,,
C. 28282	Holotype (Plate XXI, fig. 1).	Pilford, Leckhampton, Glos.	,, ,,
C. 36871		St. Gabriel's, Dorset (bed 123*s*)	W. D. Lang Coll., 1935.
C. 36872		East of Ridge Fault, Dorset (bed 125*b*).	,, ,,
C. 36885		St. Gabriel's, Dorset (bed 126*c*)	,, ,,
C. 36886		Ridge Fault, Dorset (bed 126)	,, ,,
C. 36916	(Plate XIV, fig. 8)	St. Gabriel's, Dorset (? bed 126)	,, ,,
C. 36941–42		Bracebridge, Lincolnshire	W. E. Cutler Coll., 1936.
C. 38570*a*		Unrecorded	History unrecorded.
C. 38599		,,	,, ,,

C. 38870	Napton, Warwickshire . .	W. Wingrave Coll., 1935.
C. 38903	Uhrweiler, Alsace . . .	F. Krantz, date ?
(?) C. 39523–25 . . .	Broom Cliff, Dorset (bed 125, 2–3 feet below Red Band).	W. D. Lang Coll., 1935.
(?) C. 39526	Broom Cliff, Dorset (bed 125, 3–3½ feet below Red Band).	,, ,,
(?) C. 39527	Broom Cliff, Dorset (bed 125, 3–4 feet below Red Band).	,, ,,
(?) C. 39529–41 . . .	Broom Cliff, Dorset (bed 125, 3–4 feet below Red Band).	,, ,,
(?) C. 39542–47 . . .	Broom Cliff, Dorset (bed 125, 4–5 feet below Red Band).	,, ,,

The following are referred to the var. *recticostata* :—

20918*a*, *b*	Kilsby Tunnel, Northants . .	G. Baker Coll., 1843.
22153 (Plate XXVI, fig. 11)	Unrecorded (ex Drift) . .	P. Mohr, 1848.
62486*b*	Randen, nr. Schaffhausen, Switzerland.	Bruckmann Coll., 1868.
67929 (Plate XXVI, fig. 14)	Cheltenham, Glos. . . .	R. Etheridge Coll., 1869.
67949	Mickleton, Glos. . . .	,, ,,
C. 3163	,, ,, . . .	G. E. Gavey Coll., 1890.
C. 10011	Stroud, Glos.	E. Witchell Coll., 1905.
C. 16553–54	Mickleton, Glos. . . .	R. F. Tomes Coll., 1905.
C. 17024	,, ,, . . .	T. J. Slatter Coll., 1896.
C. 17749	,, ,, . . .	,, ,,
C. 28167 (Plate XXVI, fig. 15)	Pilford Brickworks, Leckhampton, Glos.	L. Richardson Coll., 1935.
(?) C. 28178	Road Cutting, Nibley, Glos. .	,, ,,
(?) C. 36822	St. Gabriel's, Dorset (bed 123*i*) .	W. D. Lang Coll., 1935.
C. 38569	Pilley, Leckhampton, Glos. .	J. W. Tutcher Coll., 1937.
C. 38931	Unrecorded	W. Wingrave Coll., 1935.

Androgynoceras artigyrus (Brown)

Plate XIV, fig. 5 ; Plate XVIII, figs. 1 *a*, *b* ; Plate XXIII, figs. 3 *a–c*, 14 *a*, *b*

Ammonites artigyrus Brown, 1837, p. 26, pl. xix, fig. 5.
,, ,, ,, 1889, pl. xix, fig. 5.
Aegoceras capricornum (Schlotheim) : Crick, 1898, p. 95, pl. xx, fig. 2.
Aegoceras simile, Spath MS., Lang, 1936, pp. 433–6.
,, ,, MS. Spath, 1936*a*, p. 450.

Type.—Brown's presumed original, here re-figured (Plate XXIII, fig. 3), from the Williamson Collection (Manchester Museum, No. LL. 230).

Diagnosis.—Sub-stenogyral, sub-pachygyral, sub-latumbilicate, capricorn *Androgynoceras*. Like *A. brevilobatum*, but more inflated and more quickly increasing in size of whorl. Ribs less curved forwards on the periphery than in the similarly shaped *Oistoceras crescens*. Suture-line (fig. 3 *c*) rather simple, with trifid lobes and plump saddles.

Measurements.

Holotype (Plate XXIII, fig. 3) . .	48	·31	·38	·43
No. C. 24602	51	·33	·35	·44
No. C. 38814	47	·34	·35	·43
var. **similis** (Plate XVIII, fig. 1) . .	74	·34	·34	·44
,, (No. C. 10013) . . .	66	·34	·37	·42

Remarks.—There is no specimen in the Manchester Museum other than that here figured which could be Brown's type. Dr. Wilfrid Jackson, who kindly lent me the specimen, agrees with me that, since Brown's illustrations are notoriously bad and inaccurate, such differences as can be observed to exist between the specimen and the figure, especially the difference in size, are of no import. Of course, the number of ribs on successive whorls of Brown's figure (16 ; 14 ; 10, counting inwards) suggested that it might represent that variety of *Androgynoceras maculatum* which is here separated as var. *rigida*. A comparison of Plate XIX, fig. 13, with Plate XXIII, fig. 3, will show how closely the two forms approximate, and even the simple suture-line is very similar in both. But the finely ribbed inner whorls of what is now accepted as the holotype of *A. artigyrus* show it to be a species near to *A. brevilobatum* and *A. lataecosta*. Phillips's *Amm. arcigerens*, quoted by Brown in the synonymy of his species, is connected by transitions with the var. *rigida*, and like it is referred to *Androgynoceras maculatum* as a variety. It may be added that the mis-spelling of the name of the present species (as *artigerus*) in one place could be held to support the suggestion that it was really meant for the same ammonite as Phillips's *A. arcigerens*, but the etymology is entirely different and it is possible to retain both names.

The example figured in Plate XVIII, fig. 1, was first taken to represent a new species (*A. simile* MS.) and later was referred to *A. lataecosta* as an extreme variety, since it is connected with that species by many transitional forms (e.g. C. 10015, C. 36806–7, C. 36809). It is still closer, however, to *A. artigyrus*, and is now attached to this species (as a var. *similis*, nov.). It has the close ribbing in the early stages characteristic of *A. artigyrus*. Later the periphery tends to become even more square than in the typical forms, the umbilical wall is high and steep, and the whorl-shape is thus more quadrate, yet less depressed, than in the type. At the same time the ribs continue to become more distantly spaced and robust, they remain strong and single across the venter to near the end, and have two small lateral tubercles which are already more-or-less distinct at the diameter of the holotype. In some transitional forms (e.g. No. C. 38842), which also resemble the var. *recticostata* of *A. brevilobatum*, the finer ribbing of the early stage persists longer.

The peripheral view of a body-chamber fragment of the var. *similis* given in Plate XIV, fig. 5, shows the final change of ribbing near the mouth-border. There is not only a renewed increase in the peripheral projection, as on the innermost whorls, but the ribs also become less robust, and the venter changes from square to arched. Similar changes, however, may be noticed in dwarf and large individuals of varieties of *A. lataecosta* as well as of its allies. In one large example comparable to the var. *similis*, but transitional to *A. lataecosta* (of 93 mm. diameter), showing such simplification and loss of tuberculation near the aperture, the body-chamber occupies three-quarters of the outer whorl.

The "*Aegoceras capricornum*" figured and carefully described by Crick, in spite of its different suture-line (Plate XXIII, fig. 12), is close to the present species, but on account of its less square whorl-shape it may be considered to be transitional to *A. brevilobatum*. Another transitional specimen is figured in Plate XXIII, fig. 14. This has slenderer inner whorls than the type, but becomes inflated and square-whorled on the last half of the outer volution, only to contract again suddenly near the end, which was probably the aperture.

A third example (No. C. 28166) was labelled by Mr. L. Richardson "*Amblycoceras* sp. intermediate between *A. brevilobatum* Trueman and *A. sinuosum* Hyatt." A number of the smaller specimens listed below are other transitions to allied species like *A. lataecosta*, *A. brevilobatum*, and perhaps even to *Oistoceras crescens*.

The (?) *Amblycoceras* sp. previously (Lang, 1936, p. 433) listed from bed 124 (Nos. C. 38868–9) are crushed and doubtful, but probably belong to the present species. Another example from bed 123*s*, associated with fragments of a large *Liparoceras* (*wrighti ?*), has most pronounced peripheral projection of the ribs on the square venter, foreshadowing the *Oistoceras* ornamentation; but it also seems referable to the var. *similis*.

Horizon and Localities.—*Davoei* zone, *lataecosta* sub-zone, upper part and *bechei* sub-zone. England (Dorset to Yorkshire), Germany (?), France.

Specimens.

37910		Whitby, Yorkshire	J. Leckenby Coll., date ?
67929		Cheltenham, Glos.	R. Etheridge Coll., 1867.
88981	(Plate XXIII, fig. 14)	"Lyme Regis" [Cheltenham, Glos.].	Presd. Hon. R. Marsham, 1877.
C. 1276*a*		Whitby, Yorkshire	J. E. Lee Coll., 1885.
C. 5163–64		Chipping Campden, Glos.	W. C. Lucy Coll., 1895.
C. 10013, 10015		Stroud, Glos.	E. Witchell Coll., 1905.
C. 11443		Golden Cap, Charmouth, Dorset	S. S. Buckman Coll., 1907.
(?) C. 17301		Mickleton Tunnel, Glos.	R. F. Tomes Coll., 1905.
C. 17420		,, ,, ,,	,, ,,
C. 18062–63		Robin Hood's Bay, Yorkshire	J. F. Blake Coll., 1907.
C. 19229–230		Unrecorded. [Yorkshire.]	,, ,,
C. 24602		Staithes, Yorkshire	D. M. S. Watson Coll., 1923.
C. 28166		Pilford, Leckhampton, Glos.	L. Richardson Coll., 1925.
C. 36385	(Plate XIV, fig. 5)	Golden Cap, Dorset	H. M. Muir-Wood Coll., 1935.
C. 36390		West of St. Gabriel's, Dorset (beds 123*a–c*).	,, ,,
C. 36443		Stonebarrow, Charmouth, Dorset (bed 123*d*).	W. D. Lang Coll., 1935.
C. 36467		St. Gabriel's, Dorset (bed 125)	,, ,,
(?) C. 36470–72		,, ,, (bed 126*e*)	,, ,,
C. 36668–69		Whitby, Yorkshire	Presd. Hackney and New College, 1935.
C. 36725	(Plate XVIII, fig. 1)	Stroud, Glos.	S. S. Buckman Coll., 1929.
C. 36809		St. Gabriel's, Dorset (bed 123*i*)	W. D. Lang Coll., 1935.
C. 36868–69		Broom Cliff, Dorset (bed 125*b*)	,, ,,
(?) C. 36873		,, ,, ,,	,, ,,
C. 36940		Bracebridge, Lincs.	W. E. Cutler Coll., 1936.
C. 38557		Stonehouse Brickworks, Glos.	,, ,,
C. 38568		Bracebridge Brickworks, Lincolnshire.	,, ,,
C. 38570*b*		Unrecorded	History unrecorded.
C. 38814		Yorkshire	W. Wingrave Coll., 1935.
(?) C. 38816, 38819		Golden Cap, Dorset	L. F. Spath Coll., 1937.
C. 38831–33		Drift (Northants ?)	,, ,,
C. 38836		Staithes, Yorkshire	,, ,,

C. 38842 . . .	Stonehouse, Glos. . . .	J. W. Tutcher Coll., 1937.
C. 38862	Pilley (Pilford) Leckhampton, Glos.	S. S. Buckman Coll., 1929.
C. 38863	Golden Cap, Dorset (bed 123s) .	W. D. Lang Coll., 1935.
C. 38865	Napton, Warwickshire . .	W. Wingrave Coll., 1935.
C. 38866	Bracebridge Brickworks, Lincolnshire.	W. E. Cutler Coll., 1936.
C. 38868–69	Stonehouse Brickworks, Glos. .	,, ,,
(?) C. 38952–53 . . .	Bracebridge, Lincs.	,, ,,
C. 38955–56 (transitions to *Oistoceras crescens*).	,, ,, ...	,, ,,
(?) C. 38963–65 . . .	,, ,, ...	,, ,,
C. 39160, C. 39161–2 (transitions to *A. latæcosta*).	Staithes, Yorkshire . . .	J. Francis Coll., 1927.
C. 39314 (transitional to *Oistoceras crescens*)	Stubbs Coppice, Monkton Wyld valley, N.W. of Charmouth, Dorset (see Lang, 1932, p. 119, G. 12).	W. D. Lang Coll., 1935.

Genus OISTOCERAS, Buckman, 1911

GENOTYPE.—*O. figulinum* (Simpson) Buckman, 1911, pl. xxi.

DIAGNOSIS.—Serpenticone capricorns, like immature *Androgynoceras*, with ribbing showing a very pronounced, forwardly directed sinus on the square or sulcate periphery. Bi-tuberculation, with or without feeble swelling of the whorls, generally appearing sooner or later; occasionally there is sub-tri-tuberculation, combined with more distant spacing of the (at first fine and close) ribbing. Suture-line similar to that of *Androgynoceras capricornus*, with comparatively large external saddle.

DISTRIBUTION.—Lower and Upper Pliensbachian (Carixian, upper *davoei* zone, and Domerian, lower *margaritatus* zone). Europe.

REMARKS.—This genus seemed distinct enough when Buckman created it, yet he already cited as a species comparable to the genotype (*O. figulinum*) such a typical capricorn as Oppel's *Amm. maculatus* of 1853, which was subsequently made the genolectotype of "*Amblycoceras.*" In 1919 Trueman (p. 262) had to admit that some forms of *Oistoceras* had a peripheral rib-curve not much stronger than that of "*Amblycoceras,*" and that, similarly, occasional specimens of "*Amblycoceras*" had a rib-curve equal to that of *Oistoceras*. The main distinction from "*Amblycoceras*" and certain other capricorns thus became largely artificial, and there remained chiefly the development of bi- (and tri-) tuberculation to differentiate *Oistoceras*, if it be kept apart at all; for the differences in the suture-lines are negligible, as, for example, a comparison of Text-fig. 4 (p. 9) and Plate XXII, fig. 5 *c*, will show. As in the case of so many other genera, *Oistoceras* was created before the stratigraphical position and true relations of its established allies had been sufficiently studied, and consequently its interpretation has to be modified. *Oistoceras* is now retained as a separate genus chiefly on account of its position, which is transitional to the genera *Amaltheus* and *Pleuroceras*, discussed above (p. 30); and for that reason the inclusion of passage-forms to *Androgynoceras*, like *O. omissum*, *O. orbignyi*, etc., is open to criticism.

Amm. dumortieri, Reynès (1879, pl. xxxi, figs. 24–26), which was also listed by

Buckman as a species of *Oistoceras* comparable to *O. figulinum*, includes two distinct forms, both of which I would exclude from the present genus. The evidence provided by the inner whorls of the larger lectotype example, like those of "*Defossiceras*" *defossum*, Bean-Simpson sp. (Buckman, 1913, pl. lxxvi), are entirely against such comparison ; but, while "*D.*" *defossum* in my opinion is a *Euagassiceras* of the *bucklandi* zone, I cannot place the former, and it is chiefly the attribution of *Amm. dumortieri* to the same low beds that leads me to exclude that species from the family Liparoceratidae. In spite of its resemblance to the genus *Oistoceras*, it is not listed in the table of Liparoceratid species on p. 35.

Oistoceras figulinum (Simpson)

Plate XIX, figs. 10 *a*, *b* ; Plate XX, figs. 4 *a*, *b* ; Plate XXI, figs. 7, 8 ; Plate XXII, figs. 2, 6, 8

Ammonites figulinus Simpson, 1855, pp. 47, 48.
Aegoceras defossum (Simpson) : Blake, in Tate and Blake, 1876, p. 282, pl. viii, fig. 9.
Ammonites figulinus Simpson, 1884, p. 78.
Oistoceras figulinum (Simpson) : Buckman, 1911, pl. xxvi A.
Aegoceras defossum (Simpson), Blake : Crick, 1922, p. 280.
Oistoceras figulinum (Simpson) : Trueman, 1919, p. 285, fig. 12 *b*.
(?) *Oistoceras figulinum* (Simpson) : Bovier, 1932, p. 33.
Oistoceras figulinum (Simpson) : Lang, 1936, p. 436.
,, ,, ,, Spath, 1936*a*, p. 451.

TYPE.—Simpson's original (Whitby Museum, No. 115) figured by Buckman (1911).

DIAGNOSIS.—Sub-stenogyral, sub-leptogyral, latumbilicate *Oistoceras*. Whorl-section sub-quadrate ; venter first rounded, then flattened, and finally sulcate. Ribs sharp, fine and close at first (30, 28, and 24 to the whorl, counting inwards from about 30 to 35 mm. diameter), later becoming separated and coarse, strongly projected on periphery. Two small tubercles on each rib, appearing at about 15 mm. diameter, and becoming increasingly more conspicuous, the outer even tending to become duplicated, as in *O. curvicorne* ; with connecting ventral lappet reduced to striae in the sulcate siphonal zone. Suture-line comparatively simple in young (Text-figs. 4 *d* and *g*, p. 9, and Plate XXII, fig. 2 *c*), with lateral lobe asymmetrically bifid or trifid, but very variable ; saddle-terminations becoming more finely divided at larger diameters.

MEASUREMENTS.

Holotype (Buckman's, pl. xxvi A) . .	46	·30	(?) ·29	·50
Buckman's pl. xxvi B (No. C. 38577) .	63	·28	·31	·52
Plate XXI, fig. 8	102	·32	·33	·52

REMARKS.—There is no specimen in the Collection exactly like Simpson's type, and even the Charmouth example figured by Buckman (pl. xxvi B) shows the *curvicorne* stage beginning at a smaller diameter, so that it is transitional to *O. wrighti*, nov. (p. 166). The specimen, which is almost certainly from the Upper Limestone (bed 129), bears Wright's label : "*Aegoceras curvicornis*, Schloenbach." Another such specimen is figured in Plate XXII, fig. 8, but its inner tubercle is faint, even on the last whorl, half of which is body-chamber. The original of Plate XXII, fig. 2, on the other hand, is bi-tuberculate from about 15 mm. onwards, and has a body-chamber of just over half a whorl, the last suture-line (fig. 2 *c*) being clearly visible. The Yorkshire specimen, figured by Blake as *Aegoceras defossum* and noticed by Buckman (1913, p. *vi*) as *Oistoceras omissum*, is represented in Plate XIX, fig. 10; it cannot be distinguished from the inner whorls of the example figured in Plate XXII, fig. 8; but at still smaller diameters (e.g. Plate XXI, fig. 7) it is perhaps impossible to distinguish *O. figulinum* from most of the other species of *Oistoceras* here described. Thus the more inflated young form of *O. curvicornis* figured in Plate XIX, fig. 11, is very similar to *O. figulinum* in side-view; and the immature French specimen depicted in Plate XX, fig. 4, as *O.* aff. *figulinum* with a simple suture-line (Text-fig. 4 *d*, p. 9) is again almost identical with the original of Plate XIX, fig. 10, mentioned above. The largest example here figured (Plate XXI, fig. 8), also from the Upper Limestone (to judge by preservation), is complete, although the mouth-border is damaged, and the body-chamber occupies over three-quarters of the outer whorl.

There are various transitions between *O. figulinum* and *O. wrighti*, described below, characterised chiefly by earlier appearance of the *curvicorne* stage; there are also apparent passage-forms to *O. omissum*, such as the example figured in Plate XXI, fig. 9. The other species of *Oistoceras* here described are less close, but the inner whorls of *O. langi*, *O. lincolnense*, and *O. orbignyi* are also finely and closely ribbed, so that the numerous crushed impressions of small forms of *Oistoceras* listed below from beds 129 and 130 of Charmouth cannot all be taken to be definitely referable to *O. figulinum*.

HORIZON AND LOCALITIES.—*Davoei* zone, *figulinum* sub-zone. England, France, Germany (?).

SPECIMENS.

23862	(Plate XXII, fig. 2).	"Lyme Regis", Dorset	R. F. Damon, 1849.
23911	. . . .	Whitby, Yorkshire	H. Daniels, 1849.
37973*a*, *b*	(Plate XXII, fig. 8).	,, ,, ...	W. Bean Coll., 1849.
37188*b*, *c*	. . .	Vieux Pont, Calvados, France . .	Tesson Coll., 1857.
39890	(Plate XXI, fig. 8).	Dorset Coast	J. Harrison Coll., 1865.
C. 10816	. . .	Doubtful ("Himalayas; elevation, 13,000 ft.").	Exchange, Surveyor's Inst., 1906.
C. 17852	. . .	Near Whitby, Yorkshire . . .	T. J. Slatter Coll., 1896.
C. 17988	(Plate XIX, fig. 10).	Yorkshire	J. F. Blake Coll., 1907.
C. 18061	. . .	Peak, Yorkshire	,, ,,
C. 19227	. . .	Yorkshire	,, ,,
C. 28065	(Plate XX, fig. 4).	Les Cottards, nr. St. Amand, Cher, France	J. R. Gregory & Co., 1925.
C. 28134	. . .	Venarey, Côte d'Or, France . . .	,, ,,
C. 36887–88 (?)	. .	Broom Cliff, Dorset (bed 127) . .	W. D. Lang Coll., 1935.
C. 36893	. . .	Black Ven, Charmouth, Dorset (bed 127)	,, ,,
C. 36894	. . .	100 yards E. of Ridge Fault, Broom Cliff, Dorset (not in place).	,, ,,

C. 36907 . . .	Stonebarrow Cliff, Charmouth, Dorset (bed 130).	W. D. Lang Coll., 1935.
C. 36914 . . .	Stonebarrow, Charmouth, Dorset (bed 129).	,, ,,
C. 38575 (Plate XXI, fig. 7).	Stonebarrow Cliff, Charmouth, Dorset .	L. F. Spath Coll., 1937.
C. 38577 . . .	" Lyme Regis ", Dorset . . .	J. W. Tutcher Coll., 1937.
C. 38585 . . .	Dorset Coast	,, ,,
C. 38586–89 . . .	Yorkshire	L. F. Spath Coll., 1937.
C. 38655–64 . . .	Stonebarrow, Charmouth, Dorset (bed 129*b–c*)	W. D. Lang Coll., 1935.
C. 38665 . . .	Golden Cap, Dorset (bed 129) . .	,, ,,
C. 38666–74 . . .	Stonebarrow, Charmouth, Dorset (bed 129)	,, ,,
C. 38675–6 . . .	Stonebarrow, Charmouth, Dorset (bed 129*b*).	,, ,,
C. 38677–79 . . .	Stonebarrow, Charmouth, Dorset (bed 129*a*).	,, ,,
C. 38680 . . .	Golden Cap, Dorset (bed 129*a*) . .	,, ,,
C. 38681–90 . . .	Stonebarrow, Charmouth, Dorset (bed 129*a*).	,, ,,
C. 38691–93 . . .	Golden Cap, Dorset (bed 128) . .	,, ,,
C. 38694–98 . . .	Stonebarrow, Charmouth, Dorset (beds 129–130).	,, ,,
C. 38699–700 . . .	St. Gabriel's, Dorset (bed 128) . .	,, ,,
C. 38701–2 . . .	Stonebarrow, Charmouth, Dorset (bed 129*b*).	,, ,,
C. 38703 . . .	Stonebarrow, Charmouth, Dorset (bed 128).	,, ,,
C. 38704–07 . . .	Stonebarrow, Charmouth, Dorset (bed 130).	,, ,,
C. 38708 . . .	Golden Cap, Dorset (bed 129*a*) . .	,, ,,
C. 38709 . . .	Broom Cliff, Dorset (bed 125*b*) . .	,, ,,
C. 38710–11 . . .	15 yards E. of Ridge Fault, Dorset (beds 127–128).	,, ,,
C. 38975 (Plate XXIII, fig. 10).	Stonebarrow, Charmouth, Dorset (beds 128–30).	,, ,,
C. 38976 (Plate XXII, fig. 6).	Stonebarrow, Charmouth, Dorset (beds 129–30, slopes above Upper Limestone).	,, ,,
C. 39440–41 . . .	St. Amand, Cher, France . . .	N. Boubée, 1938.
C. 39442–43 . . .	Les Cottards, nr. St. Amand, Cher, France	,, ,,
C. 39457–59 . . .	Stonebarrow, Charmouth, Dorset (beds 130*a–c*).	W. D. Lang Coll., 1935.
C. 39520–21 . . .	Stonebarrow, Charmouth, Dorset (beds 129–30).	,, ,,
C. 39528 . . .	Broom Cliff, Dorset (bed 127, 5 feet above Red Band).	,, ,,
(?) C. 39558 . . .	Robin Hood's Bay, Yorkshire (not in place)	L. Bairstow Coll., 1937.

Oistoceras curvicorne (Schloenbach)

Plate XIX, fig. 11 ; Plate XXII, figs. 9 *a*, *b*

(?) *Ammonites dorsuosus* Schlotheim, 1820, p. 72.
Ammonites curvicornis Schloenbach, 1863, p. 522, pl. xii, figs. 4 *a–c*.
,, ,, ,, 1865, p. 17, pl. xxvi, fig. 6.
Aegoceras curvicorne (Schloenbach) : Wright, 1882, p. 377 (*partim*).
Aegoceras curvicornis (Schloenbach) : Koken, 1896, p. 629.

Aegoceras curvicornum (Schloenbach) Wright: Buckman, 1911, p. 26*c*.
Oistoceras curvicornum (Schloenbach): Trueman, 1919, p. 286.
Aegoceras curvicorne (Schloenbach): Frebold, 1922, p. 17.
Oistoceras curvicornis (Schloenbach): Lang, 1936, p. 436.
,, ,, ,, Spath, 1936*a*, p. 451.

TYPE.—The body-chamber fragment figured by Schloenbach in 1863, from Osnabrück, Germany.

DIAGNOSIS. — Sub-stenogyral, sub-pachygyral, sub-latumbilicate *Oistoceras*. Whorl-section sub-quadrate in young, soon becoming depressed and already having a ventral groove at about 20 mm. diameter. Ribs sharp, fine, and close at first, becoming more distantly spaced when bi-tuberculation is prominent (already developed at 15 mm.), and with third, outermost tubercle or swelling already present at 25 mm. Striate, linguiform processes of ribs in sulcate siphonal area very conspicuous, also lines of growth in between ribs on test as well as on internal cast. Suture-line (Plate XXIII, fig. 2) with deep external lobe, sub-trifid lateral lobes, and fair amount of frilling.

MEASUREMENTS.

Holotype (Schloenbach's figure) . .	42	·29	·45	·45
Schloenbach, 1865, p. 17 . . .	57	·28	·28	·46
Plate XXII, fig. 9	43	·30	·40	·47

REMARKS.—The differences in thickness shown in the above table make it probable that the several hundred individuals of which Schloenbach wrote in 1865 were not all identical with his earlier type, and included probably not only the intermediate form now separated as *O. wrighti*, but possibly even *O. figulinum*, not to mention the numerous transitions between the three species. This, however, is a nomenclatorial point; I sympathise with Schloenbach's comprehensive interpretation, and nobody could have recognised Simpson's numerous species from his descriptions. But the malformations noticed by Schloenbach are important, especially the fragment with a ropy keel, in view of the probable connection of *Oistoceras* with the Amaltheidae (see p. 30). Schloenbach's comprehensive interpretation also accounts for his inclusion in the present species of *Amm. dorsuosus* Schlotheim; but since this is said to be badly preserved, and since the description suggests a species like the present, it may well be left in the synonymy. Wagener's *Amm. maculatus angulatus* (1860, p. 166), however, also quoted in the synonymy of *A. curvicorne* by Schloenbach and Wright, is probably not specifically identical.

The suture-lines figured by Schloenbach in 1863 (pl. xii, fig. 4*c*) and 1865 (pl. xxvi, fig. 6), and by Frebold in 1922 (pl. iv, fig. 2), seem to differ considerably from the suture-line now given (Plate XXIII, fig. 2); but in reality the general plan is the same. In a highly ornamented form like the present, no two individuals have identical suture-elements, owing to the interference of the tubercles, nor are these elements quite the same on the opposite side of the same suture-line or in those that precede or succeed it.

O. wrighti, nov., has a prolonged *figulinum* stage, and does not develop the characteristic and deeply sulcate periphery of *O. curvicorne*, even on the body-chamber. There are intermediate examples, however, as mentioned under *O. wrighti*, and the example from which the suture-line (Plate XXIII, fig. 2) was taken is one of them. The two young specimens figured in Plate XIX, fig. 11, and Plate XX, fig. 7, of course are doubtful and included here only because they are too inflated to be the inner whorls of *O. figulinum*.

HORIZON AND LOCALITIES.—*Davoei* zone, *figulinum* sub-zone. England, Germany, France.

SPECIMENS.

50633	(Plate XXIII, fig. 2)	" Lyme Regis ", Dorset . . .	J. Morris Coll., 1867
66358	. . . . .	,, ,, . . .	B. M. Wright, 1870.
C. 6235	(Plate XXII, fig. 9).	Near Whitby, Yorkshire . . .	T. J. Slatter Coll., 1896.
C. 17744	. . . . .	Westhay, Dorset	,, ,,
C. 17590	(Plate XX, fig. 7) .	Aston Magna, Glos. . . .	R. F. Tomes Coll., 1905.
C. 19228	(Plate XIX, fig. 11)	Yorkshire (to judge by matrix) .	J. F. Blake Coll., 1907.

Oistoceras wrighti Spath

Plate XXII, figs. 7 *a*, *b*

Aegoceras curvicornum (*non* Schloenbach) : Wright, 1880, pl. xxxi, figs. 3–4.
Aegoceras curvicorne Wright, 1882, p. 377.
Aegoceras curvicornum Wright : Buckman, 1911, p. 26*c*.
Oistoceras curvicornum (Wright, *non* Schloenbach) : Trueman, 1919, p. 286.
Oistoceras wrighti Spath, 1936, p. 451.

TYPE.—The Charmouth example figured by Wright, now in the Sedgwick Museum (see Woods, 1891, p. 122, Leckenby Coll.).

DIAGNOSIS.—Like *O. curvicornis*, but with a prolonged *figulinum* stage (to about 35–40 mm. diameter) and with the distant spacing of the ribbing appearing more gradually. Venter (as a whole) still rounded in the final stage, not truly sulcate. Body-chamber over half, to three-quarters of, a whorl. Suture-line (Text-figs. 4 *h*, *i*, p. 9) similar to that of other forms of *Oistoceras*.

MEASUREMENTS.

Holotype (Wright, text) . . .	80	—	—	·50
Holotype (Wright, figure) . . .	86	·28	·33	·50
Plate XXII, fig. 7	85	·30	·35	·48
No. C. 18067	61	·31	·33	·48

REMARKS.—This form was stated by Trueman to differ from Schloenbach's species in having a flattened, instead of a rounded, venter, and in having more prominent tubercles. This must be a slip, for the reverse holds. In typical examples of *O. curvicorne* (e.g. Plate XXII, fig. 9) the venter is already flat at a very early stage, and becomes sulcate at 20 mm., whereas Wright's form still has a rounded venter at 80 mm. The innermost whorls also are more finely ribbed in the true *O. curvicorne*, and there is a projection on each side of the ventral sulcus, reminiscent of the third, or outermost, tubercle in *Pleuroceras*.

Some of the examples listed below (including some French specimens whose suture-lines are here figured) differ from the typical *O. wrighti* in certain details, for, as already mentioned, in a species like the present, or in *O. curvicorne*, no two individuals are identical. Thus, one example (No. 39891) has a slight peripheral sulcus throughout the outer whorl (at 67 mm. diameter), and is already very close to the Charmouth example of *O. figulinum* figured by Buckman; others are transitional to *O. curvicorne* in its "advanced" inner whorls, yet have the ribs more closely set on the outer whorl than has Wright's example. The figured specimen (Plate XXII, fig. 7) has a flattened periphery at the beginning of the last whorl, but is rounded, like Wright's type, towards the end of the body-chamber, which is probably complete and shows a prominent ventral lappet. The French example (No. C. 28058), whose suture-line is represented in Text-fig. 4 *h* (p. 9), is unfortunately crushed, but its inner whorls are essentially like the original of Plate XXII, fig. 7.

Isolated inner whorls cannot be distinguished from those of *O. figulinum* (Simpson), except perhaps by their greater thickness. Some small examples listed below are essentially like the young and equally doubtful *O. curvicorne* figured in Plate XIX, fig. 11, and Plate XX, fig. 7, but less closely costate at first. Others are crushed, and their identification, therefore, is equally provisional.

HORIZON AND LOCALITIES.—*Davoei* zone, *figulinum* sub-zone. England, France, Germany.

SPECIMENS.

39848		Dorset Coast	E. C. H. Day Coll., ? date.
39891		,, ,,	Harrison Coll., 1865.
C. 6680		Chipping Norton, Oxfordshire	T. J. Slatter Coll., 1896.
C. 10067		"Lyme Regis", Dorset	J. F. Blake Coll., 1907.
C. 28058		Les Cottards, nr. St. Amand, Cher, France	J. R. Gregory & Co., 1925.
C. 28064		,, ,, ,,	,, ,,
C. 36898–99		Stonebarrow, Charmouth, Dorset (bed 129)	W. D. Lang Coll., 1935.
C. 36906		Stonebarrow, Charmouth, Dorset (bed 129 or 130).	,, ,,
C. 38574		Dorset Coast	L. F. Spath (ex T. Wright) Coll., 1937.
C. 38576	(Plate XXII, fig. 7).	,, ,,	J. W. Tutcher Coll., 1937.
C. 38581		Golden Cap, Dorset (bed 129*c*)	W. D. Lang Coll., 1935.
C. 38582		Broom Cliff, Dorset (bed 127)	,, ,,
C. 38583–4		Stonebarrow, Charmouth, Dorset (bed 129)	,, ,,
C. 39445		Tranzault, Indre, France	N. Boubée, 1938.

Oistoceras sinuosiforme, sp. nov.

Plate XVIII, fig. 6; Plate XIX, figs. 7 *a, b*; Plate XXVI, figs. 6–9

TYPE.—The Bracebridge (Lincoln) specimen (No. C. 38564) figured in Plate XIX, fig. 7.

DIAGNOSIS.—Sub-stenogyral, sub-leptogyral, sub-latumbilicate to latumbilicate *Oistoceras*. Whorl-section sub-quadrate, with flattened venter and sides, and rounded umbilical slope. Ribs very fine and close on inner whorls, becoming more widely spaced (and very sharp) on outer whorl, with ventral lappet projecting forwards and conspicuously depressed, or breaking up into striae. More-or-less distinct bi-tuberculation when ribs become prominent. Body-chamber over half a whorl; mouth-border plain, strongly drawn forward, like last few degenerate ribs. Suture-line comparable to that of *A. capricornus* (Plate XXIII, fig. 6 *c*), but with still smaller lobes, wider first lateral saddle, and auxiliary elements more ascending towards umbilicus.

Measurements.

Holotype (Plate XIX, fig. 7) . .	45	·29	·29	·49
Plate XXVI, fig. 6	57	·28	·30	·50

Remarks.—I was at first inclined to adopt for this species Hyatt's (1867, p. 82) name *sinuosum*, since this form was referred by Buckman (in Fox-Strangways and Barrow, 1915, p. 96) to the genus *Oistoceras*, while Trueman (1919, p. 280) suggested that it might be an "*Amblycoceras*," having a peripheral rib-curve similar to that of the present form. But Hyatt's "*Microceras*" *sinuosum* is virtually a *nomen nudum*, for although there was a description, the species remained unrecognisable, and a second attempt by Hyatt (1871, pp. 24, 35) to define his species was even less successful than the first. In fact, judging by Hyatt's later (see also 1874*a*, p. 25) description of *M. sinuosum* as a compressed variety of *M. lataecosta*, and the identification of that species with *Platypleuroceras brevispina* (J. de C. Sowerby), Hyatt's form probably was not even a Liparoceratid. There is at least one species of *Bifericeras* (*nudicosta* group) with a pronounced peripheral rib-curve, and a remarkable similarity to young *Oistoceras* (Plate XXI, fig. 6).

Neither Buckman (1911, p. 26*c*) nor Trueman (1919) referred to Lapparent & Fritel's (1888, pl. iii, figs. 19–20) illustration of *Ammonites* (*Aegoceras*) *sinuosus*; and since this is the first figured form to which the specific name had been attached, it might be claimed to be the type of *O. sinuosum*. It is probably generically distinct, however, from Hyatt's originals, as already mentioned; and although it is undoubtedly an *Oistoceras*, like the form here described, the illustration in Lapparent & Fritel cannot be exact. For a form with the angular peripheral ribbing shown in their fig. 20 undoubtedly has very finely costate inner whorls, even if the ribs are reduced to 18 or 20 on the outer volutions. Similarly, the description of this species as a variety (var. à côtes arquées) of *Amm. capricornus* is not very helpful for distinguishing this French *O. sinuosum* from other forms of *Oistoceras*. Thus the form figured in Plate XIX, fig. 7, which requires a new name, is not sufficiently close to Lapparent & Fritel's figure to adopt for it the name *O. sinuosum*. It could even be held that the example of *O. crescens* figured in Plate XIX, fig. 9, is a much better match of the French species, or inner whorls of still other forms of *Oistoceras*. In the circumstances it is advisable to adopt a new name for the species here described.

The holotype is small, but complete; it has already over half a whorl of body-chamber, and in the three larger examples figured in Plate XVIII, fig. 6, and Plate XXVI, figs. 6–7, there is also about half a whorl of body-chamber. While the ribbing becomes increasingly more distantly spaced, the change is far less conspicuous than in *O. crescens*, and the whorls remain evolute and narrow.

The largest example, figured in Plate XXVI, fig. 7, owing to its distinct tuberculation shows considerable resemblance to some (more involute) examples here listed under *O. wrighti* Spath, as do the less slender individuals of the present species. The originals of Plate XVIII, fig. 6, and Plate XXVI, fig. 3, converge towards *Androgynoceras capricornus*, on the one hand, and the forms figured in Plate XVIII, fig. 5, and Plate XXII, fig. 5, on the other. The latter are referred to under *O. angulatum* and, while they have much more angular peripheral chevrons than *O. sinuosiforme*, *A. capricornus* itself has the ventral ribbing only slightly projected. The example figured in Plate XXII, fig. 8, and described as a transition from *O. figulinum* to *O. wrighti*, also differs from the holotype of the present species in its much more acute ventral chevrons, and in being strongly tuberculate.

Two examples with narrower whorls and more serpenticone coiling than the type, also with closer ribbing and greater angularity of the peripheral ribs, are directly transitional to *O. colubrinum*, sp. nov. (p. 174). The smaller is figured in Plate XXVI, fig. 9, and, like the larger specimen (of 38 mm. diameter), it is complete and shows just over half a whorl of body-chamber. These two specimens, in fact, might equally well have been considered as a slender variety of *O. colubrinum*. Isolated inner whorls can be distinguished from the immature *O. omissum* (Simpson) by their less acute peripheral chevrons.

The French form, of which the suture-line is figured in Text-fig. 4*j* (p. 9) and the peripheral aspect in Plate XXVI, fig. 8, was at first believed to represent *O. sinuosum* (Hyatt) as figured in Lapparent & Fritel. It differs from the present species in having much more acute ventral chevrons and a comparatively wide, almost sulcate periphery. It is possible that it represents a distinct species, intermediate between *O. sinuosiforme* and the group of *O. figulinum*–*O. wrighti*; but the only example available (with a third of the outer whorl body-chamber at 48 mm. diameter) does not show the inner whorls.

The examples C. 39399–436, C. 39499–510, C. 39549, and C. 39559–79, listed below are very poorly preserved and almost certainly include other species beside *O. sinuosiforme*.

HORIZON AND LOCALITIES.—*Davoei* zone (upper part). England, France, Germany.

SPECIMENS.

C. 2483	. . . .	Uhrweiler, Alsace	Dr. A. Krantz, ? date.
(?) C. 28067	(Plate XXVI, fig. 8).	Tranzault, Indre	J. R. Gregory & Co., 1925.
C. 36929	(Plate XVIII, fig. 6).	Bracebridge, Lincs.	W. E. Cutler Coll., 1936.
C. 38563	. . . .	Robin Hood's Bay, Yorkshire . .	L. F. Spath Coll., 1937.
C. 38564	(Holotype) .	Bracebridge, Lincs.	W. E. Cutler Coll., 1936.
C. 38901	(Plate XXVI, fig. 7).	,, ,, ...	,, ,,
C. 38902	(Plate XXVI, fig. 6).	,, ,, ...	,, ,,
C. 38918	(Plate XXVI, fig. 9).	,, ,, ...	,, ,,
C. 38919	. . . .	,, ,, ...	,, ,,
C. 38920–23	. . .	,, ,, ...	,, ,,

C. 38930	Robin Hood's Bay, Yorkshire (bed 598)	L. Bairstow Coll., 1937.
C. 39396–98 . . .	Robin Hood's Bay, Yorkshire (beds 596–7).	,, ,,
(?) C. 39399–436	,, ,, ,,	,, ,,
(?) C. 39440–59 . . .	Robin Hood's Bay, Yorkshire (beds 596–8).	L. Bairstow Coll., 1938.
(?) C. 39549 . . .	Robin Hood's Bay, Yorkshire (bed 596·3).	L. Bairstow Coll., 1937.
(?) 39559	Robin Hood's Bay, Yorkshire (beds 596–7).	,, ,,
(?) C. 39560–79 . . .	,, ,, ,,	,, ,,

Oistoceras omissum (Simpson)

Plate XXI, figs. 3 *a*, *b* ; 9 *a*, *b*

Ammonites omissus Simpson, 1855, p. 47.
Aegoceras defossum (Simpson) : Blake, in Tate and Blake, 1876, p. 282 (*partim*).
Oistoceras omissum (Simpson) : Buckman, 1911, pl. xxvii.
,, ,, ,, Trueman, 1919, p. 282 (*partim*).
Aegoceras defossum (Simpson) : Crick, 1922, p. 280.
non Oistoceras omissum (Simpson) : Schröder, 1927, p. 202, pl. x, fig. 7.
Oistoceras omissum (Simpson) : Lang, 1936, p. 436.
,, ,, ,, Spath, 1936*a*, p. 451.

Type.—Simpson's specimen from Robin Hood's Bay (Whitby Museum, No. 502) figured by Buckman.

Diagnosis.—Sub-stenogyral, sub-leptogyral, latumbilicate *Oistoceras*, presumed to be in the pre-tuberculate stage. Ribbing close and fine (thirty ribs on outer whorl of holotype, thirty-one in Plate XXI, fig. 3), whorl-section sub-quadrate, slightly depressed ; venter flattened. Suture-line (Text-fig. 4 *f*, p. 9) fairly simple, with asymmetrical first lateral lobe, large external saddle, and deep external lobe.

Measurements.

Holotype (Trueman)	28	·25	·32	·54
Holotype (figure in Buckman) . .	29	·24	·30	·56
Plate XXI, fig. 3	42	·25	·30	·56
Plate XXI, fig. 9	50	·28	(?) ·30	·50

Remarks.—The holotype of this species is small, and even the larger example now figured in Plate XXI, fig. 3, and bearing Bean's original label "*Ammonites arcigerens*" shows septation for at least two-thirds of the outer whorl. It is improbable, however, that this species represents only the immature whorls of some larger known form of *Oistoceras* ; it is certainly distinct from the other species here described.

O. angulatum (Quenstedt) has a more-or-less distinct ventral keel, and its ribs become inclined and more distantly spaced at an earlier stage. *O. lincolnense*, nov. (p. 174), also differs in its inclined costae. *O. figulinum* (Simpson) already becomes distantly costate at the diameter of the holotype of *O. omissum*, and has less serpenticone coiling ; but there are transitions between the two forms, such as the original of Plate XXI, fig. 9. This is un-tuberculate and fairly closely costate in the septate stage, i.e. to within five ribs from the end, but it is possible that on the missing portion of the body-chamber the ribs became coarse and distant. It also has less serpenticone whorls than the typical examples of *O. omissum*, and might thus perhaps be considered to be merely a retarded individual of *O. figulinum*. Another such transitional form from Yorkshire (No. C. 19231) yielded the suture-line figured in Text-fig. 4 *f* (p. 9), but at the end of the septate stage (at about 30 mm. diameter) there is already a distinct outer tubercle. At a smaller size it is of course still less easy to separate the species; for example, the original of Blake's (in Tate & Blake, 1876, pl. viii, fig. 9, p. 282) *Aegoceras defossum*, identified by Buckman (1913, p. *vi*) with *O. omissum*, represents merely the inner whorls of *O. figulinum*. It is re-figured in Plate XIX, fig. 10, and is already more-or-less distinctly bi-tuberculate on the penultimate whorl. Another example formerly listed as *O. omissum* (No. C. 36917; Lang, 1936, p. 432) is referred to below as transitional between the present species, *O. figulinum* and *O. langi*, sp. nov. (p. 172), and is characterised by much finer and closer costation.

HORIZON AND LOCALITIES.—*Davoei* zone, *figulinum* sub-zone. England, France, Germany (?).

SPECIMENS.

C. 19231	Unrecorded (Yorkshire, by matrix) .	J. F. Blake Coll., 1907.
C. 28066 (Plate XXI, fig. 9)	Bettant, Ain, France . . .	J. R. Gregory & Co., 1925.
C. 38561 (Plate XXI, fig. 3)	Robin Hood's Bay, Yorkshire . .	L. F. Spath Coll., 1937.
C. 39444	Les Cottards, nr. St. Amand, Cher, France.	N. Boubée, 1938.

Oistoceras angulatum (Quenstedt)

Plate XVIII, figs. 5 *a*, *b*; Plate XXI, figs. 5 *a*, *b*; Plate XXII, figs. 5 *a–c*; Plate XXVI, figs. 3, 10, 12

Ammonites maculatus angulatus Quenstedt, 1856, p. 121, pl. xiv, fig. 12.
(?) *Ammonites maculatus angulatus* Quenstedt: Wagener, 1860, p. 166.
Ammonites capricornus angulatus Quenstedt: Schloenbach, 1863, p. 523.
Ammonites maculatus angulatus Quenstedt, 1885, p. 270, pl. xxxiv, fig. 11.
Amaltheus angulatus (Quenstedt): Frebold, 1922, p. 12 (*partim ?*).
,, ,, ,, Monestier, 1928, p. 22.
Oistoceras angulatum (Quenstedt): Spath, 1936*a*, p. 452.

TYPE.—The Metzingen example figured by Quenstedt in 1856.

DIAGNOSIS.—Sub-stenogyral, sub-leptogyral, latumbilicate *Oistoceras*. Like *O. figulinum*, but with less close and more oblique costation, and with the median line of the venter raised into a pseudo-carina which, however, is not continuous in side-view. Rate of increase of whorls slow, as in *O. omissum*. Suture-line simple, like that of *O. figulinum*, but with two short and trifid or bifid lateral lobes (Plate XXII, fig. 5 *c*).

MEASUREMENTS.

Holotype (Quenstedt, 1858)	28	—	·30	—
Paratype (Quenstedt, 1884)	29	·24	·31	·55
Plate XXI, fig. 5	25	·26	·30	·52
Plate XXII, fig. 5	43	·26	·30	·56

REMARKS.—Schloenbach thought that Quenstedt's form could be the young of his own *Amm. curvicornis*; but, as a comparison of the examples of the present form here figured with Plate XX, fig. 7, will show, the resemblance is only general, not specific. *O. angulatum* is not only far less quickly coiled, but has a more uniform and more oblique ribbing, which changes little throughout its development. Frebold figured the entire suture-line (internal and external) of a form he attributed to the present species, but the drawing may be diagrammatic, since at least in the French example here figured, the first lateral lobes are straight and regularly trifid. Moreover, Frebold probably interpreted *O. angulatum* rather comprehensively and included in it the passage-forms between *Oistoceras* and *Amaltheus* already referred to (p. 30). For I can see little sign of branching of the ribs at the ventro-lateral edge, either in Quenstedt's type or the specimens here figured; but in many examples of *Oistoceras* such branching occurs near the siphonal line and, in fact, this feature forms the origin of the ropy keel of the descendants of *Oistoceras*.

O. orbignyi, nov. (p. 176), has straighter ribs in the young and is more quickly coiled. *O. lincolnense*, nov. (p. 174), is similarly evolute, but has the closely and finely ribbed inner whorls of *O. figulinum*. The present species, in fact, is transitional to *Androgynoceras capricornus* (Schlotheim) by way of the passage-forms figured in Plate XVIII, fig. 5, and Plate XXII, fig. 5, and is now included in *Oistoceras* chiefly on account of its median pseudo-carina. The original of Plate XXII, fig. 5, could also be held to be transitional to species like *O. sinuosiforme*.

The new species previously (1936, p. 452) recorded as resembling *O. angulatum* is now described separately as *O. langi* (see below), but the pyritised example of the *angulatum* group (No. C. 35948) there referred to, may be a crushed *Uptonia*, the venter of which must have been originally malformed. Others are probably Schlotheimids of the Hettangian.

HORIZON AND LOCALITIES.—*Davoei* zone, upper *Oistoceras* sub-zone. England, Germany, France, Switzerland?

SPECIMENS.

24565*b*	(Plate XXVI, fig. 3).	Gundershofen, Alsace . . .	P. Mohr Coll., 1848.
C. 1440	(Plate XVIII, fig. 5).	Unrecorded (Randen, nr. Schaffhausen ?).	J. E. Lee Coll., 1885.
C. 38566	(Plate XXI, fig. 5) .	Vernay, France	L. F. Spath Coll., 1937.
C. 38578	(Plate XXII, fig. 5) .	Bracebridge, Lincolns. . . .	W. E. Cutler Coll., 1936.
C. 38928	(Plate XXVI, fig. 10)	,, ,, . . .	,, ,,
C. 38929	(Plate XXVI, fig. 12, transitional to *Androgynoceras capricornus*).	,, ,, . . .	,, ,,

Oistoceras langi, sp. nov.

PlateXXIII, figs. 4, 11

Oistoceras aff. *angulatum* (Quenstedt) : Lang, 1936, p. 431.
Oistoceras sp. nov. (?), Spath, 1936*a*, p. 452.

TYPE.—The Dorset (Golden Cap) example (No. C. 36905) recorded in 1936 and now figured (Plate XXIII, fig. 11).

DIAGNOSIS.—Sub-stenogyral, sub-leptogyral, sub-latumbilicate *Oistoceras*. Like *O. figulinum* in young, but remaining un-tuberculate and closely costate (37 ribs on outer whorl). Ribs straight on side but strongly projected near the periphery, forming acute chevrons which may be joined up into a pseudo-carina. Whorl-section slightly compressed. Suture-line probably as in other species of *Oistoceras*.

MEASUREMENTS.

Holotype (Plate XXIII, fig. 11) . .	30	·30	(?)	·47
Plate XXIII, fig. 4	22	·36	·30	·46

REMARKS.—The holotype of the present form was previously recorded as representing possibly a new species, with great resemblance to *O. angulatum* (Quenstedt), but rather more closely costate. A comparison of Plate XXIII, fig. 11, with Quenstedt's pl. xxxiv, fig. 11, will show that the difference is more considerable than the mere number of the costae present in each (37 and 29 respectively) would suggest, and the typical example of *A. angulatum* now figured in Plate XXI, fig. 5, can also be seen to be specifically distinct. Moreover, the coiling is less slow in the present species, and there is more overlap, especially of the inner whorls. The second, smaller example, however, from an earlier bed, listed in the above table of measurements and figured in Plate XXIII, fig. 4, is only provisionally referred to the present form. It has the same style of ribbing, presumably also a similar compressed whorl-section and peripheral aspect, but it represents already half a whorl of body-chamber.

Smaller crushed specimens are difficult to distinguish from the other forms of *Oistoceras* with finely ribbed inner whorls, like *O. lincolnense*, nov., or *O. figulinum* (Simpson). It is possible, in fact, that a crushed example (No. C. 36917) previously listed as *O. omissum* (Simpson) is a transition from *O. figulinum* to the present form, differing chiefly in having the costae slightly less close on the last half whorl. In the somewhat similar original of Plate XIX, fig. 10, which was referred by Buckman to *O. omissum* but which is now included in *O. figulinum*, it will be seen that near the end the ribs become separated by wide interspaces, whereas in *O. langi* they remain closely spaced to the aperture, where they may be slightly weakened.

The evolute Bracebridge example listed below (of dimensions: 38; ·26; ·29; ·55) has 35 ribs, but they are strongly inclined forwards. It may represent a form intermediate to *O. colubrinum*, or at least some more slender-whorled examples included in that species.

HORIZON AND LOCALITY.—*Davoei* zone, *figulinum* sub-zone. England.

SPECIMENS.

C. 36905	Holotype (Plate XXIII, fig. 11)	Golden Cap, Dorset (bed 130*c*) .	W. D. Lang Coll., 1935.
(?) **C. 36917**	. . . .	Fairy Dell, Stonebarrow, Dorset (bed 128).	,, ,,
C. 38590	(Plate XXIII, fig. 4)	Stonebarrow, Dorset (bed 129) .	,, ,,
(?) **C. 38927**	. . . .	Bracebridge, Lincs. . . .	W. E. Cutler Coll., 1936.

Oistoceras lincolnense, sp. nov.

Plate XXII, figs. 4 *a, b*

Type.—The Bracebridge (Lincoln) specimen (No. C. 38580) figured in Plate XXII, fig. 4.

Diagnosis.—Sub-stenogyral, sub-leptogyral, latumbilicate *Oistoceras*. Inner whorls finely and closely costate as in *O. figulinum*; outer whorl with more distant ribs (26 to the whorl), inclined forwards, especially near the periphery, where they join up with the ribs of the opposite side in very acute chevrons without subdivision. Connecting keel scarcely visible. Body-chamber over half a whorl in length, slightly contracted near elliptical aperture (probably provided with ventral lappet). Suture-line presumably as in *O. angulatum*.

Measurements.

Holotype (Plate XXII, fig. 4) . .	37	·27	·25	·54

Remarks.—It seems possible that the present form corresponded with Phillips's (1829, p. 192, pl. xiii, fig. 19) *Ammonites anguliferus*, because this was said to be from the Ironstone and Marlstone Series. Blake (in Tate & Blake, 1876, p. 282) considered it a capricorn, and Buckman (1911, p. 26*c*) listed it as a species of *Oistoceras*, comparable to *O. figulinum*. But the original figure is quite unrecognisable and undoubtedly wrongly drawn, and the type is not in the Yorkshire Museum at York, according to information kindly supplied by Dr. Collinge. Since Phillips's species had been identified even with *Schlotheimia angulata* (Schlotheim) by Wright (1881, p. 318) and Pompeckj (1893, p. 75), it is clearly inadvisable to use the name for the present form (which does not even come from Yorkshire) merely because it also has 26 ribs. The *Amm. anguliferus* recorded in 1936 (p. 452) has already been referred to under *O. angulatum*, which differs from the present species in its less close ribbing.

In *O. omissum* (Simpson) there is less difference in the ribbing of the inner and outer whorls than there is in *O. lincolnense*, and *O. langi* remains more closely costate throughout. *O. figulinum* is characterised by its tuberculation, no trace of which is found in either of the two species just cited or in *O. omissum*.

Horizon and Locality.—*Margaritatus* zone, lowest (?). England.

Specimen.

C. 38580 . . .	Bracebridge, near Lincoln . . .	W. E. Cutler Coll., 1936.

Oistoceras colubrinum, sp. nov.

Plate XXIII, figs. 13 *a, b*; Plate XXVI, figs. 4 *a, b*

Type.—The Bracebridge example (No. C. 38900) figured in Plate XXIII, fig. 13.

Diagnosis.—Sub-stenogyral, sub-leptogyral, sub-latumbilicate to latumbilicate *Oistoceras*. Whorl-section rounded, with slightly flattened sides and venter and rounded umbilical slope. Capricorn ribbing fine and very close on inner whorls, more distant on outer (24; 24; 23 per whorl, counting inwards). Ribs slightly inclined forwards on side, but strongly projected on venter, with very acute chevrons. Body-chamber about three-quarters of outer whorl; aperture with ventral lappet. Suture-line probably as in *O. sinuosiforme.*

Measurements.

Holotype (Plate XXIII, fig. 13) . .	45	·27	·29	·50
Plate XXVI, fig. 4	38	·32	·34	·47

Remarks.—This form is connected by transitions with the more distantly ribbed *O. sinuosiforme*, sp. nov., and the more inflated *O. crescens* (Hyatt) Trueman sp.; but it is now separated on account of its resemblance to Zittel's (1884, p. 457, Text-fig. 638) *Aegoceras* (*Microceras*) *capricornus* (*non* Schlotheim), copied in so many later publications, and especially by Hyatt (1900, p. 578, fig. 1204), and chosen as the genolectotype of "*Amblycoceras*" by Trueman (1919, p. 262). Zittel's figure is diagrammatic, but shows 23 ribs on the last three whorls, which is in very close agreement with the holotype of *O. colubrinum.* In Oppel's figure (1853, pl. i, fig. 6), the presumed original of Zittel's re-drawn illustration, the corresponding numbers are 23; 23; 20; but it may be remarked that, while Zittel's figure shows a circular whorl-section, perhaps in conformity with Schlotheim's original remarks about the uniformly rounded whorls of his *Amm. capricornus*, the rather square whorl-section of Oppel's figure is really more accurate, if his original be identical with the present species. Since Oppel specially mentioned in 1856 (p. 279) that the ammonite he described and figured in 1853 (as *Amm. maculatus*) agreed with the typical figure of *Amm. capricornus* in Knorr, it is clear that he interpreted that species rather widely, and his disciples Schloenbach (1863, p. 520) and Waagen (1864, pp. 33, etc.) probably followed Oppel in including in *A. capricornus* the non-tuberculate species of *Oistoceras.*

While the smaller example figured in Plate XXVI, fig. 4, shows a certain resemblance to the passage-form between *O. crescens* and *O. alleotypus*, represented in Plate XXVI, fig. 1, at least one specimen (No. C. 2483) listed under *O. sinuosiforme*, sp. nov. is distinguishable at the diameter of 33 mm. from Zittel's figure only by the ribs, which are beginning to separate. Two of the examples listed below (Nos. C. 38924–5), with slenderer whorls than the type of the present species and with closer ribbing, are transitional to *O. omissum.* But superficially even more like *O. colubrinum* is the variety of *A. maculatum*, figured in Plate XXVI, figs. 5 *a*, *b*. It illustrates the difficulty of identifying a capricorn ammonite like that represented by Zittel by means of a more-or-less diagrammatic figure; and, since the illustration shows besides a suture-line near the end, and therefore a specimen much larger than the present form, it is not impossible that the resemblance to *O. colubrinum* also is superficial, i.e. that it is closer to certain varieties of *A. maculatum*, in which both inclination of the ribs and peripheral projection occur. The example here figured, somewhat intermediate between the var. *intermedia* and the var. *atava* of *A. maculatum*, can be distinguished both by the blunt and coarse costae of its inner whorls and by the fact that the peripheral ribs, although drawn forwards, are but slightly flattened, and thus do not really form the characteristic *Oistoceras* chevrons, but merely sharp folds on the venter.

HORIZON AND LOCALITIES.—Upper *davoei* zone (or base of *margaritatus* zone ?). England (France ?, Germany ?).

SPECIMENS.

C. 38899	(Plate XXVI, fig. 4)	Unrecorded (Lincs. ?) . .	Old Coll.
C. 38900	(Plate XXIII, fig. 13)	Bracebridge, Lincs. . . .	W. E. Cutler Coll., 1936.
C. 38924–26	. . . .	,, ,, . . .	,, ,,

Oistoceras orbignyi, sp. nov.

Plate XXII, figs. 3 *a*, *b*

TYPE.—The Vieux Pont (Calvados) example (No. 37188*a*) figured in Plate XXII, fig. 3 (Tesson Coll.).

DIAGNOSIS.—Sub-stenogyral, sub-leptogyral, sub-latumbilicate *Oistoceras*. Whorl-section sub-rectangular with greatest thickness near the rounded umbilical wall, with almost parallel sides and slightly flattened venter which is provided with a faint, sub-crenulate, median pseudocarina. Umbilical wall almost vertical and comparatively high. Ribs straight, fairly close (30 on inner, 26 on outer whorl), with strong peripheral projection, splitting up on venter and forming acute chevrons with apices simulating a siphonal keel. A suggestion of two external tubercles near the end, but umbilical thickening of ribs scarcely visible. Suture-line (Text-fig. 2 *e*, p. 7) with low external lobe and two conspicuous leaflets supporting the external saddle.

MEASUREMENTS.

Holotype (Plate XXII, fig. 3) . .	63	·31	·27	·47

REMARKS.—The holotype had been labelled *Amm. planicosta*, and it may be noted that d'Orbigny (1844, p. 244), who listed Vieux Pont as the first locality for that species, characterised it as always occurring together with *Amm. margaritatus*. There thus seems to be little doubt about its high horizon, and the incipient trituberculation as well as the straightness of the costation also supports the reference to *Oistoceras*. The holotype is entirely septate, and although morphologically the present species seems to be directly transitional to *Pleuroceras* and the family Amaltheidae, the suture-line still resembles that of typical Liparoceratids. I previously referred the present form to *O. angulatum* (Quenstedt), but the ribbing of the inner whorls is obviously quite different from that of the typical small example of Quenstedt's species figured in Plate XXI, fig. 5.

O. figulinum differs from *O. orbignyi* chiefly in the earlier appearance of tuberculation and the absence of the median, ventral elevation ; but the inner whorls are probably very similar. The much smaller species here described as *O. lincolnense* is more evolute than the present form and has far more acute ventral chevrons.

HORIZON AND LOCALITY.—*Margaritatus* zone, lowest (?). France.

SPECIMEN.

37188*a* (Holotype) . . .	Vieux Pont, Calvados, France . .	Tesson Coll., 1857.

Oistoceras allœotypus (Trueman)

Plate XXI, figs. 4 *a*, *b*

Oistoceras allœotypum Trueman, 1919, p. 287, pl. xxv, fig. 1 ; Text-fig. 12 *a*, p. 285.
non Oistoceras alleotypum Trueman : Lang, 1936, p. 436.

Type.—Trueman's original Bracebridge specimen (No. C. 38571) refigured in Plate XXI, fig. 4.

Diagnosis.—Sub-platygyral, sub-pachygyral, sub-latumbilicate *Oistoceras*. Inner whorls as in *Androgynoceras capricornus* to about 50 mm., with 26 and 24 ribs, respectively, on second and inner whorls of that stage, but with more peripheral projection. Last half of final whorl swollen, with conspicuous outer tubercle, but ribs becoming much enfeebled, dividing into fine secondaries across periphery with a sharp bend in convexi-fastigate siphonal area. Suture-line complex, having rather slender saddles and rather deep and narrow lateral lobes with very asymmetrical subdivisions.

Measurements.

Holotype (Trueman)	(at) 90	·40	·37	·38
,, ,, ...	,, 45	·35	·35	·44

Remarks.—The holotype of this form is unique ; and the combination of *capricornus*-like inner whorls (to a diameter of 50 mm.) with a very peculiar final stage suggests a malformation. Nothing like it has ever been figured in geological literature, so far as I know. Moreover, the outer whorl, though possibly crushed by mechanical agencies, is very different on the two sides. The side not figured by Trueman is therefore now illustrated in Plate XXI, fig. 4 *a* ; and it will be seen that the last half whorl is much narrower on this side, with the fimbriate ribs shorter and quite different from those of the other side, and that the tubercles at the ventro-lateral edge are higher up on the whorl-side. The strongly angular ventral ribs of the first half of the outer whorl, between the early *capricornus* stage and the modified final stage figured in fig. 4 *b*, are also all displaced, so as to make it uncertain whether the angularity is genuine or not. Unfortunately, owing to the fact that the *capricornus* inner whorls shown in fig. 4 *a* are hollow, i.e. unsupported at the back, and pyritised, it is impossible to expose the periphery at that early stage ; in side-view there is little resemblance to the closely-ribbed early stage of typical *Oistoceras*.

Whether the unique holotype be malformed or not, its inner whorls are indistinguishable from such smaller examples as that figured in Plate XXV, fig. 7, or the still more immature originals of figs. 8 and 9. These are close to the more evolute *O. colubrinum*, sp. nov. (Plate XXIII, fig. 13), on the one hand, and to *O. crescens* on the other (Plate XXVI, fig. 1) ; and the latter form especially, as here interpreted, is merely an accelerated development of the same stock, so that its inclusion in *Oistoceras* rather than in *Androgynoceras* is suggested.

Horizon and Localities.—Top of *davoei* zone (or lower *margaritatus* zone ?). England (Northants, Leicester, Lincolnshire, Yorkshire).

SPECIMENS.

20942	(Plate XXV, fig. 9)	Road [Roade ?], Northants.	G. Baker Coll., 1843.
39681		Near Whitby, Yorks.	J. Leckenby Coll.,
C. 38845	(Plate XXV, fig. 8)	Bracebridge, Lincs.	W. E. Cutler Coll., 1936.
C. 38846	(Plate XXV, fig. 7)	Kilsby, Northants.	G. Baker Coll., 1843.
C. 38906–10	(juv.)	Bracebridge, Lincs.	W. E. Cutler Coll., 1936.
C. 38911		Leicestershire	,, ,,
C. 38912	(transition to *Oistoceras crescens*).	Bracebridge, Lincs.	,, ,,
C. 38913		,, ,,	,, ,,
C. 38914	(juv.)	Leicestershire	,, ,,
C. 38915	(Holotype)	Bracebridge, Lincs.	Presd. Univ. Coll., Nottingham, 1936.

Oistoceras crescens (Hyatt) Trueman sp.

Plate XIX, figs. 8–9; Plate XXII, figs. 1 *a*, *b*

(?) *Microceras crescens*, Hyatt, 1867, p. 82.
(?) ,, ,, ,, 1871, p. 36.
(?) ,, ,, ,, 1874*a*, p. 25.
Microceras crescens (Hyatt): Buckman, 1911, p. 26*c*.
(?) *Microceras* (*Amblycoceras*) *crescens* (Hyatt): Buckman, in Fox-Strangways and Barrow, 1915, pp. 69, 95.
Amblycoceras crescens (Hyatt): Trueman, 1919, p. 280, pl. xxiv, figs. 1–2, Text-figs. 9, 10 *b*, pp. 281, 283.
Amblycoceras dissotypum Trueman, 1919, p. 282, pl. xxiii, fig. 1, Text-fig. 10 *a*, p. 283.
(?) *Amblycoceras* cf. *crescens* (Hyatt): Bovier, 1932, p. 32.

TYPE.—The Bracebridge (Lincoln) example (No. C. 38567) figured by Trueman.

DIAGNOSIS.—Sub-stenogyral to sub-platygyral, sub-pachygyral, sub-latumbilicate to sub-angustumbilicate *Oistoceras*. Like *O. allœotypus*, but increasing more quickly in thickness and with capricorn ribbing rapidly becoming more distantly spaced; 25 ribs to the whorl at first, later reduced to about 18 or even 14. Ribs prominent on sides and venter, especially on stout outer whorl. In the var. *dissotypus*, after 36 mm., the ribs divide into two or three on the venter. Outer whorl expanded and feebly bi-tuberculate for a short period after 60 mm. diameter, but the inner tubercles scarcely visible, and ribs close, weak, and un-tuberculate at end. Suture-line fairly simple, with shallow first lateral lobe and deep external lobe, broad external saddle and rather small, trifid second lateral lobe, becoming more complicated at a larger size (Plate XXII, fig. 1 *b*).

MEASUREMENTS.

Holotype (Trueman)	32	·31	·34	·40
No. C. 38565 (Plate XIX, fig. 8)	31	·30	·37	·45
No. 19583*c*, *b* (Plate XIX, fig. 9)	39	·33	·36	·45
var. *dissotypus* (Plate XXII, fig. 1)	105	·45	·43	·30
,, (Trueman)	100	·44	·36	—
,, ,,	65	·45	(?) ·44	—
,, ,,	46	·37	·40	—

REMARKS.—Hyatt's original description is insufficient for the recognition of this species, and in the later (1871) account of his "*Microceras*" *crescens* Hyatt even called it intermediate between "*M.*" *lataecosta* (probably a *Platypleuroceras* in Hyatt's interpretation) on the one hand, and *Echioceras raricostatum* on the other; so that the species may not be a Liparoceratid, especially since one of the original examples was said to show turrilitoid coiling, which also suggests some earlier Liassic form (*Bifericeras?*). In 1874 Hyatt included "*M.*" *crescens* in "*M. lataecostum*," then referred to the *jamesoni* zone. Trueman did not mention Hyatt's second and third descriptions, but since the species which he referred to *A. crescens* requires a name in any case, I am adopting Trueman's interpretation.

The holotype is decomposing, and the swelling of the pyrites is partly responsible for the stoutness of the final half whorl, which is probably part of the body-chamber. The dimensions thus, are not reliable, especially as regards thickness. The well-preserved example figured in Plate XIX, fig. 8, from the same locality as the type is almost identical, but the larger specimen, fig. 9, has the close ribbing of the inner whorls persisting to a larger diameter, as do the acute peripheral chevrons of the early stage, while the periphery is slightly wider. The examples listed below include still other variations, and there are also passage-forms to *O. allœotypus*, such as the example figured in Plate XXVI, fig. 1, in which the separation of the ribs on the outer whorl is less noticeable. These transitional forms may even return to closer costation near the aperture, without developing the typical, coarse, *crescens* ornamentation. Other examples (e.g. No. C. 38916) are passage-forms to *O. sinuosiforme*, sp. nov., especially to such larger individuals as the originals of Plate XXVI, figs. 6–7, but the whorls are less slender in *O. crescens* than in that species. Many of the specimens of under 25 or 30 mm., of course, are not definitely identifiable.

It might be added that there is some resemblance between fragments of the present species and corresponding portions of forms from much earlier beds, such as the fragment figured by Geyer (1893, pl. iii, fig. 9). This might belong to a species of *Beaniceras* (like No. C. 17529, listed under *B. luridum*) or to the var. *intermedia* of *Androgynoceras maculatum*, Young & Bird sp. (compare Plate XXVI, fig. 5), but is too small for accurate determination, at least from the figure.

The unique holotype of Trueman's "*Amblycoceras*" *dissotypus*, he reconsidered as a variety of the present species, is completely septate; but it is poorly preserved and there is a possibility that it is malformed like the other large examples with hybrid outer whorls, here recorded from the higher beds. No peripheral view is therefore given, but the restored outline figured by Trueman (pl. xxiii, fig. 1 *b*) does not show correctly either the inflation of the final stage, where the thickness is almost equal to the whorl-height, nor the pronounced peripheral rib-curve, which is the distinguishing feature of "*A.*" *dissotypus* compared with other hybrids, but which is lost on the last half whorl.

Trueman stated that this transitional form was presumably derived from "*A.*" *crescens*. The latter, at the size of the inner whorls of the var. *dissotypus* (at about 30–35 mm.), has slightly less distantly spaced ribs, the change from fine to coarse ribs being more gradual, but in the absence of large examples of the typical *O. crescens* it is impossible to carry the comparison further.

The inflated outer whorl of (the equally malformed ?) *O. allœotypus* (Trueman) is distinguished by its strong outer tubercle and the retention of peripheral chevrons even in the final stage, although these also, near the (septate) end of the specimen, become less pronounced.

HORIZON AND LOCALITIES.—*Davoei* zone (upper part, *figulinum* sub-zone ?). England (Gloucestershire, Northamptonshire, Leicestershire, Lincolnshire, and Yorkshire).

SPECIMENS.

19583*c*	(Plate XIX, fig. 9)	Northamptonshire	G. Baker Coll., 1843.
24996		Chipping Campden, Glos.	W. Hawer Coll., 1850.
(?) **C. 6233**		Mickleton Tunnel, Gloucestershire.	T. J. Slatter Coll., 1896.
(?) **C. 16563**		,, ,,	R. F. Tomes Coll., 1905.
(?) **C. 16566**		,, ,,	,, ,,
C. 38565	(Plate XIX, fig. 8)	Bracebridge, Lincs.	W. E. Cutler Coll., 1936.
C. 38567	(Holotype)	,, ,,	Presd. Univ. Coll., Nottingham, 1936.
C. 38572	(var. *dissotypa*)	,, ,,	,, ,,
C. 38835		Staithes, Yorkshire	L. F. Spath Coll., 1937.
C. 38898	(Plate XXVI, fig. 1)	Leicestershire	W. E. Cutler Coll., 1936.
C. 38916		Bracebridge, Lincs.	,, ,,
C. 38917		Braunston, Northants.	G. Baker Coll., 1843.
(?) **C. 39437–8**		Robin Hood's Bay, Yorkshire (bed 596).	L. Bairstow Coll., 1937.
(?) **C. 39556**		Robin Hood's Bay, Yorkshire (bed 598).	L. Bairstow Coll., 1938.
C. 39628–44		Bracebridge, Lincs.	W. E. Cutler Coll., 1936.

Oistoceras nortonense, sp. nov.

Plate XVIII, figs. 2 *a*, *b*

TYPE.—The Chipping Norton specimen (No. C. 6165) figured in Plate XVIII, fig. 2).

DIAGNOSIS. — Sub-stenogyral, sub-pachygyral, sub-latumbilicate *Oistoceras*. Whorl-section sub-quadrate, with flattened venter on outer whorl, but evenly arched periphery on earlier volutions. Ribs very fine and close at first, becoming more and more distantly spaced, and tending to break up into striae on venter near the apertural end. Strong forward projection of ribs in median line of venter. Suture-line simple, with short, sub-bifid, first lateral lobe and broad and low external saddle.

MEASUREMENTS.

Holotype (Plate XVIII, fig. 2)	37	·32	·38	·43
Paratype (No. C. 6679)	55	·28	·35	·50

REMARKS.—The larger paratype specimen, with about two-thirds of the outer whorl belonging to the body-chamber, does not show the inner whorls, but it indicates that the ventral aspect does not change at larger diameters as might be thought possible, considering the smallness of the holotype. A third example (No. C. 17756), in which the peripheral flattening is perhaps slightly less conspicuous, is also complete at 60 mm. A transition to *A. brevilobatum* Trueman is represented by an example (No. C. 17478) in which the coiling is evolute and the ribbing fine to about the same size as in that species, but in which the periphery is as flattened as in the typical examples.

This species may be considered to be connected directly with *Androgynoceras artigyrus* (Brown). For instance, a Yorkshire example of that species (No. C. 24602) has only slightly less projected ventral chevrons than the type of *O. nortonense* but a very similar whorl-shape and general appearance. It also shows approximate ribs near the plain mouth-border, and a body-chamber of about two-thirds of the last whorl. A Cheltenham specimen (No. C. 28166), already referred to under *A. artigyrus* and labelled "*Amblycoceras* sp. intermediate between *A. brevilobatum*, Trueman, and *A. sinuosum*, Hyatt," except in the almost unprojected peripheral ribbing, is also very similar to *O. nortonense* in side-view. Closer still is the Chipping Campden specimen (No. C. 5164) listed above, which differs from the type of *A. artigyrus* in being already complete at 40 mm. diameter (with approximation of the ribbing near the aperture and two-thirds of the outer whorl belonging to the body-chamber), and which can be distinguished from the present form merely by its feeble ventral sinus.

While *O. allœotypus* is much more closely ribbed than *O. nortonense* at the same diameter, *O. crescens* shows a more conspicuous change in the ribbing, but it is probably closer to the species here described than any of the other forms of *Oistoceras*. These are either much less inflated or else distinguished by their tuberculation.

Horizon and Locality.—*Davoei* zone (probably *bechei* sub-zone). England (Oxfordshire).

Specimens.

C. 6165 (Holotype)	Chipping Norton, Oxfordshire	T. J. Slatter Coll., 1896.
C. 6679	,, ,,	,, ,,
C. 17478	,, ,,	,, ,,
C. 17756	,, ,,	,, ,,

GLOSSARY

For convenience of reference the technical terms used in this work are listed alphabetically.

acme. The period of maximum (faunal) development.
ammonitic. Of a suture-line with both lobes and saddles showing indentations or frilling.
anagenesis ; anagenetic. Ascending, or progressive, evolution ; of such.
anguliradiate. Of ribs (costae or striae) with a sharp lateral bend.
angustumbilicate. Narrowly umbilicated (umbilicus being between 8 and 17 per cent. of the diameter).
apophyses. Lateral processes of the aperture.
arched. Of a ventral area evenly rounded, whether wide or narrow.
auxiliary. Of elements of the suture-line below (dorsal to or dorsad of) line of involution, but usually taken to comprise the elements beyond the second lateral saddle.
bi-tuberculate. Provided with two tubercles, generally on the whorl-sides.
brephic. The first post-embryonic stage of growth (=" nepionic ").
bulla. A tubercle, elongated transversely, *i.e.* radially.
bullate. Provided with bullae.
cadicone. A barrel-shaped shell, greatly depressed, with divergent sides, and very wide venter.
camerate. Septate, *i.e.* provided with air-chambers.
capricorn. A shell with ribbing resembling that of a goat's horn (usually, but not necessarily, a serpenticone).
catagenesis ; catagenetic. Declining or descending evolution ; of such, " degenerate."
ceratitic. Of a suture-line with only the lobes subdivided, but the saddles entire.
clavate. Provided with clavi.
clavus. A tubercle elongated longitudinally, *i.e.* spirally.
collar. A constriction, bordered by a ridge, generally at the aperture.
compressed. With whorl-height greater than thickness, *i.e.* whorl-section higher than wide.
concentrumbilicate. With the coiling regular, and with umbilical suture forming a perfect spiral.
constricted. Of a shell or cast with periodic sulci, representing former mouth-borders or periodic thickenings of test.
convergent. Of lateral areas approximating towards venter.
costa. Rib.
costate. Provided with distinct ribs.
crenate. Of a venter provided with tooth-like projections along siphonal line.
densicostate. With ribs closely set.
densiseptate. With septa close together.
densistriate. With closely set striae.
depressed. With whorl-thickness greater than height, i.e. whorl-section wider than high.
dimorph. A shell with markedly different ornamentation or whorl-shape in young and adult stages, often with rapid transition.
divergent. Of lateral areas diverging towards broad ventral area.
dorsum. The antisiphonal side of a shell, in typical ammonoids the inner side, in contact with previous whorl.
embryonic. The earliest (protoconch) stage of growth.
epacme. The period of increasing development.
ephebic. The adult stage of growth.
evolute. Loosely coiled, so as to disclose much of the earlier whorls in the umbilicus.
excentrumbilicate. With the umbilicus suddenly opening out or narrowing, i.e. not coiled in a perfect spiral.
falcoid. Sickle-shaped (bend of the ribs or striae).
flexiradiate. With curved striae or costae.
genotype. The type-species of the genus.
gerontic. The " old age " or senile stage of growth. Often wrongly used in connection with modified body-chambers or apertures.[1]
goniatitic. With the saddles and lobes of the suture-line entire, i.e. not indented, but not necessarily angular.
gradumbilicate. With the inner margins (umbilical slopes) of whorls forming perpendicular steps.
gyral. With whorls not in contact, but forming a regular spiral.
heteromorphous. Of irregular coiling, i.e. not in a regular spiral as in typical ammonites.

[1] In all probability the ammonite animal, like the living *Nautilus*, did not propagate until after the shell was completely formed.

holotype. The one and only type-specimen ; or the one specimen designated by the nomenclator as the type-specimen out of several mentioned in the original description.

homoeomorphous. Having similar shape in unrelated stocks ; apparent identity of heterophyletic species.

imparinodate. Of two parallel rows of tubercles, having unequal numbers, i.e. the tubercles not being arranged in pairs.

inverse. Of auxiliary elements of the suture-line if ascending towards the umbilical suture instead of going straight across whorl-side.

involute. Closely coiled, so as to show little of the inner whorls.

laevigate. Of a shell, smooth or with only faint radial lines of growth.

latumbilicate. With wide umbilicus (50–60 per cent. of the diameter).

lectotype. A specimen selected by a subsequent author as the type from a number of syntypes.

leptogyral. Thin-whorled (thickness being between 8 and 17 per cent. of the diameter).

lobe. The portions of the septal suture directed backward.

megalomorph. A species of a large size ; an individual of a giant species.

metatype. A topotype identified by the nomenclator himself.

micromorph. A species of a small size—an individual of a dwaff species.

multituberculate. Provided with many tubercles.

neanic. The adolescent stage of growth.

neotype. A newly selected type, in place of lost holotype or lectotype, such specimen being from the same locality and horizon as the holotype or lectotype of the original species.

nodate. Provided with blunt and low tubercles.

occlusal. Of shells so closely coiled that the inner whorls are entirely hidden.

oligogyral. With few whorls, the outer ones considerably, or entirely, overlapping the inner.

ornatilobate. Provided with unusually complex suture-line.

oxycone. A compressed, involute shell, with very sharp venter.

pachygyral. Thick-whorled (thickness being between 50 and 66 per cent. of the diameter).

paracme. The period of decline in development.

paratype. A specimen, other than holotype or lectotype, upon which a species has been founded.

parinodate. Of tubercles, arranged in pairs, i.e. two on every rib, so that the inner and outer rows have an equal number of tubercles.

paucicostate. Provided with distantly-spaced ribs.

perangustumbilicate. With very small umbilicus (1–8 per cent. of the diameter).

periphery. The siphonal (outer) side of the whorls in normal ammonoids.

perlatumbilicate. With very wide umbilicus (over 66 per cent. of the diameter).

perleptogyral. With very thin whorls (1–8 per cent. of the diameter).

perpachygyral. With very thick whorls (over 66 per cent. of the diameter).

perplatygyral. With very wide (high) whorls (over 66 per cent. of the diameter).

perstenogyral. With very narrow (low) whorls (1–8 per cent. of the diameter).

phylloid. Of saddles with leaf-like endings.

platycone. A discoidal shell with broad, flat sides, like an oxycone, but with the venter not acute.

platygyral. With wide whorls (50–60 per cent. of the diameter).

polygyral. With many whorls, and comparatively little overlap.

prorsiradiate. With ribs inclined forwards.

protoconch. The initial chamber of a shell ; the embryonic stage.

quadrituberculate. Provided with 4 tubercles ; or, rather, with 8, 4 on each side.

rectiradiate. With ribs or striae radial and straight.

rostrum. A ventral process at the aperture.

rursiradiate. With the ribs or striae inclined backwards.

saddle. The portions of the septal suture directed forward.

scaphitoid. With modified or loosened body-chamber, resulting in elliptical or angular, boat-like shells.

septituberculate. With the tubercles separated from the rest by septa at the base.

serpental. Loosely coiled, like a coiled snake.

serpenticone. A shell with serpental coiling.

sigmoidal. Of an S-shaped bend in striae or costae.

sparsiseptate. With septa fairly widely apart.

sphaerocone. A globose shell with small umbilicus.

spinate. Provided with spines, i.e. high and conical tubercles.

stenogyral. With narrow whorls (height being 8–17 per cent. of the diameter).

striate. Provided with striae, or faintly raised lines parallel to the lines of growth.

strigate. Provided with longitudinal, spiral, striae or ridges.

subammonitic. With the saddles of the suture line imperfectly notched or frilled.

subangustumbilicate. With fairly narrow umbilicus (17–34 per cent. of the diameter).

subceratitic. With the lobes of the suture-line remaining simple while saddles are already modified, as in many Permian stocks.

subcostate. With fairly distinct lines or striae, but not actual ribs.

sublatumbilicate. With rather wide umbilicus (34–50 per cent. of the diameter).

subleptogyral. With fairly thin whorls (thickness being 17–34 per cent. of the diameter).
subpachygyral. With fairly thick whorls (thickness being 34–50 per cent. of the diameter).
subplatygyral. With fairly wide whorls (height being 34–50 per cent. of the diameter).
subsphaerocone. An inflated, but not quite globose, shell.
substenogyral. With fairly narrow whorls (height being 17–34 per cent. of the diameter).
sulcate. Of a shell with a groove at the periphery.
suspensive. Of dependent umbilical (auxiliary) elements of the suture-line.
syntype. One of several specimens on which a species has been founded, when no one has been designated as the holotype. It is the duty of the next investigator to select one among the syntypes as a lectotype.
tabulate. Of a truncated or flattened periphery or venter.
tachygenesis. Accelerated development, or the earlier inheritance of characters.
topotype. A specimen from the same locality and bed as the holotype.
trituberculate. Provided with three tubercles, generally on the ribs.
tuberculate. Provided with tubercles or nodes.
unituberculate. Provided with one tubercle (generally on the ribs).
venter. The siphonal side of a shell, i.e. the outer (peripheral) in normal ammonoids.

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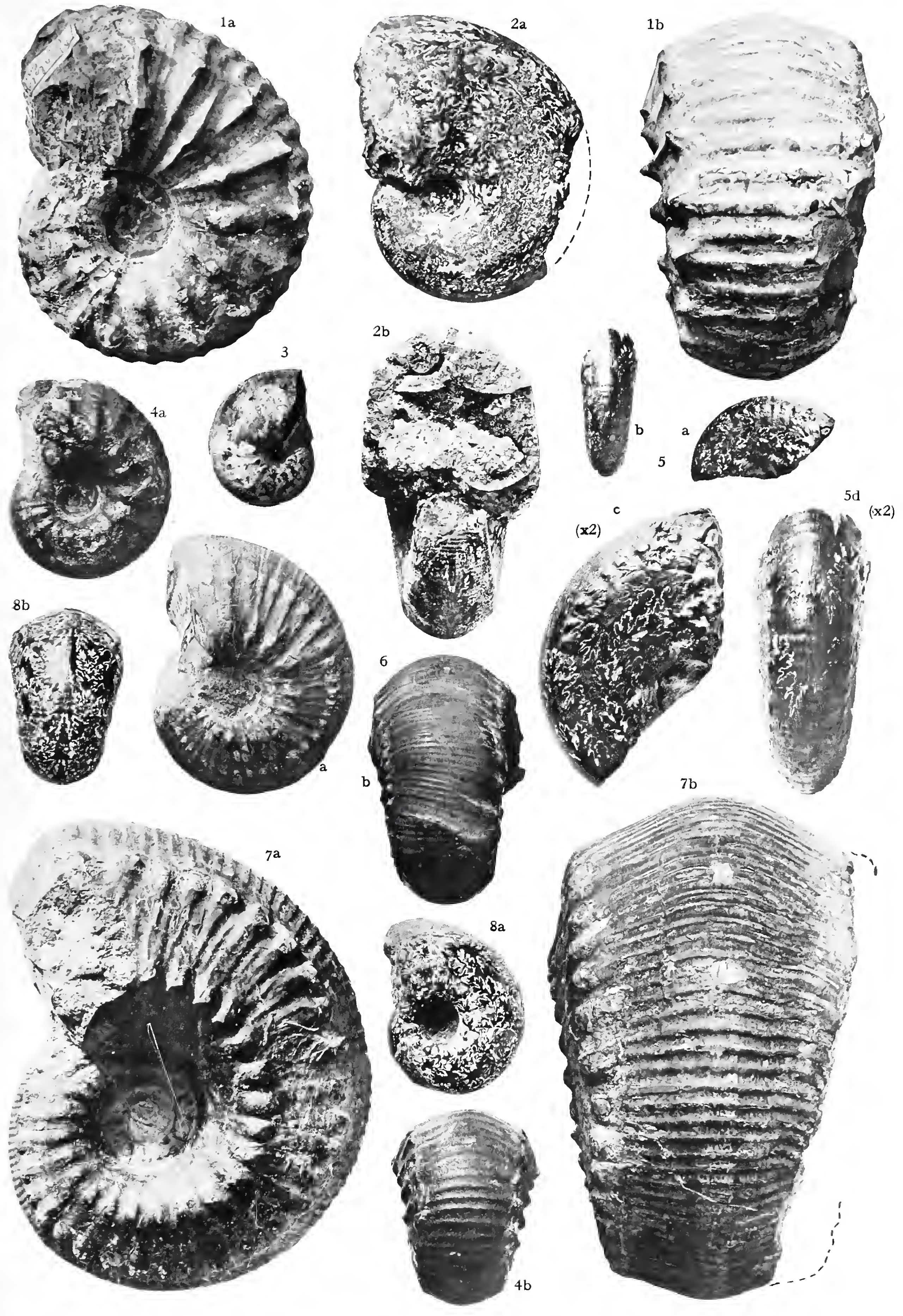

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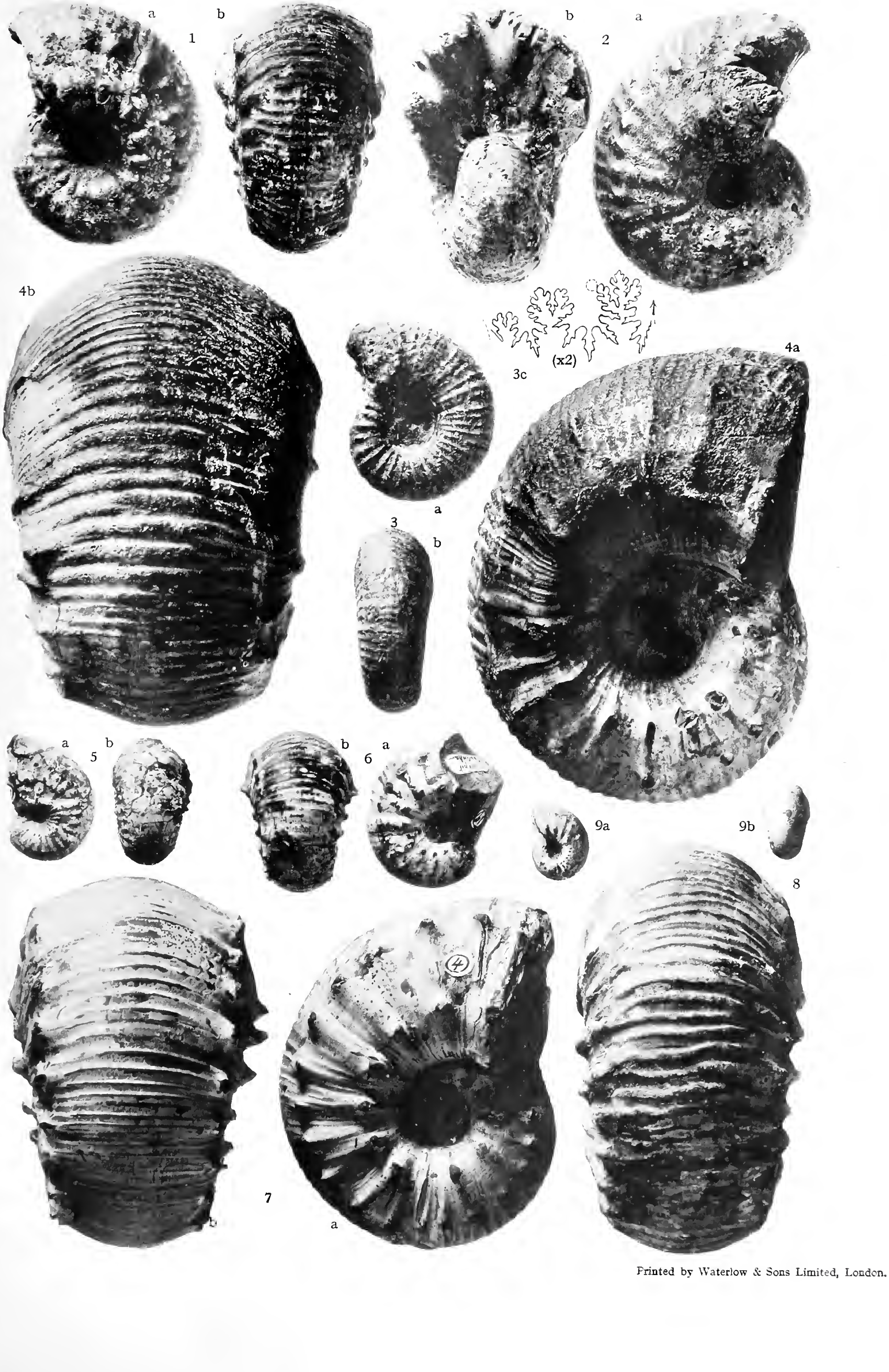

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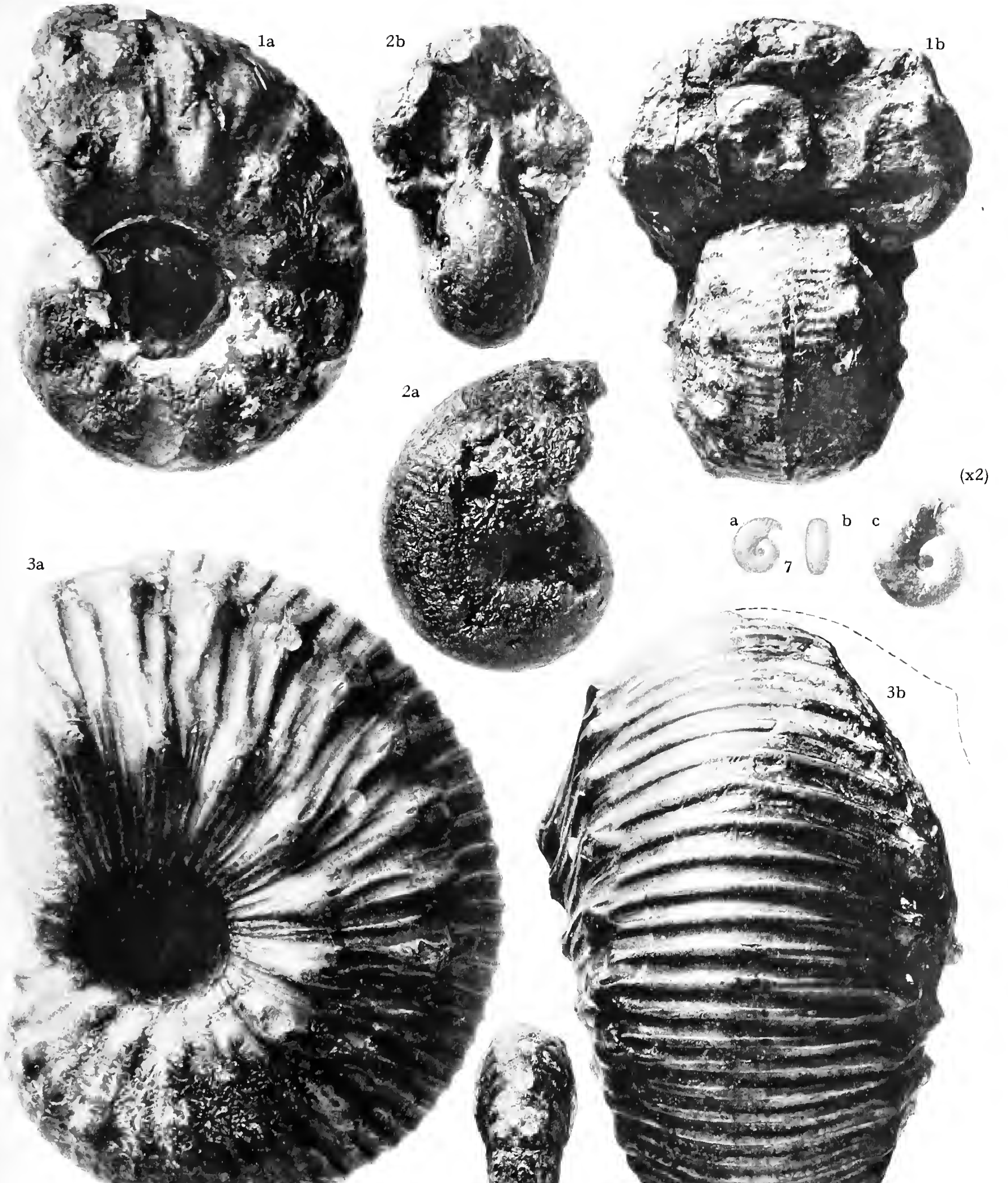

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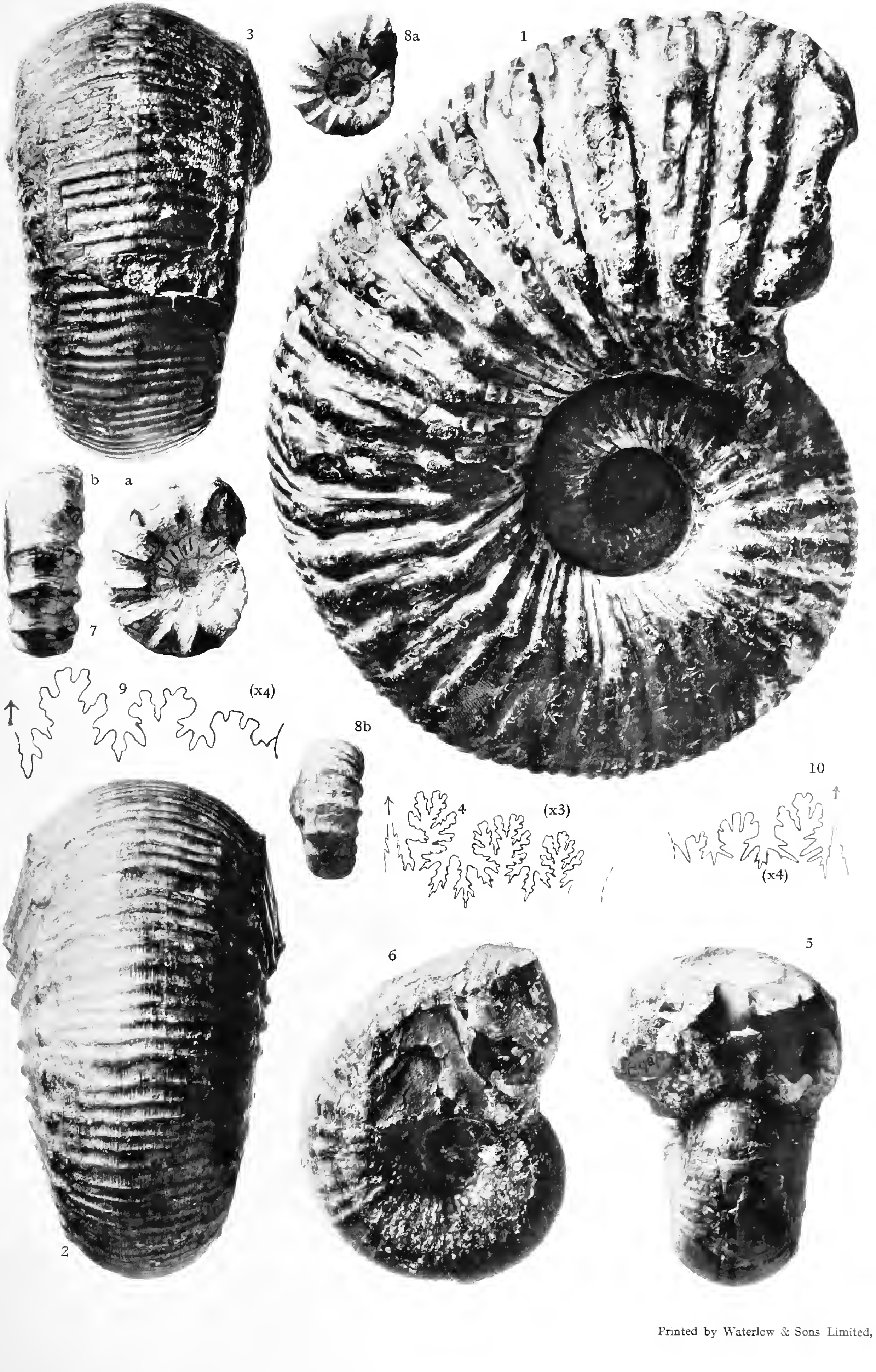

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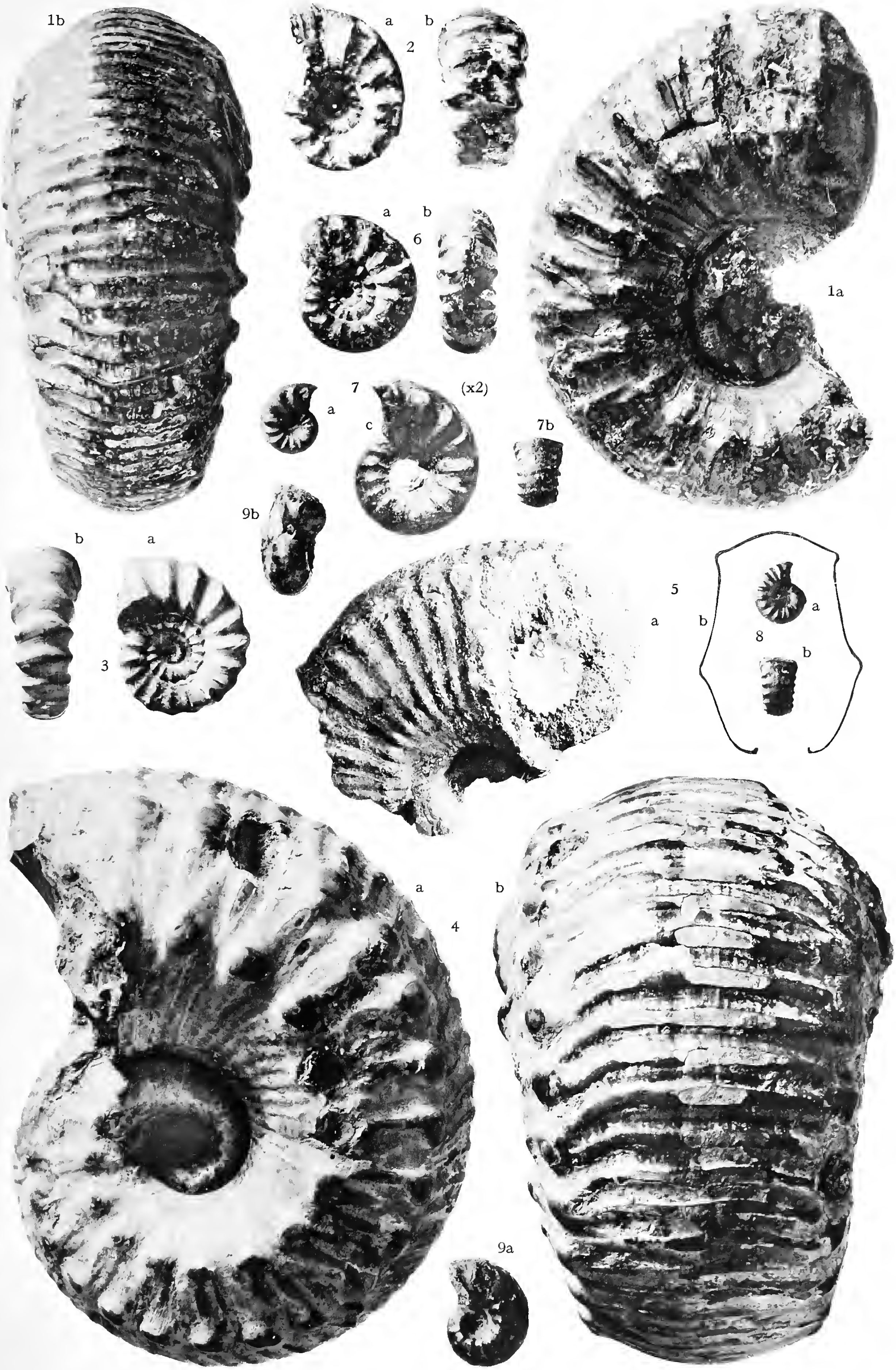

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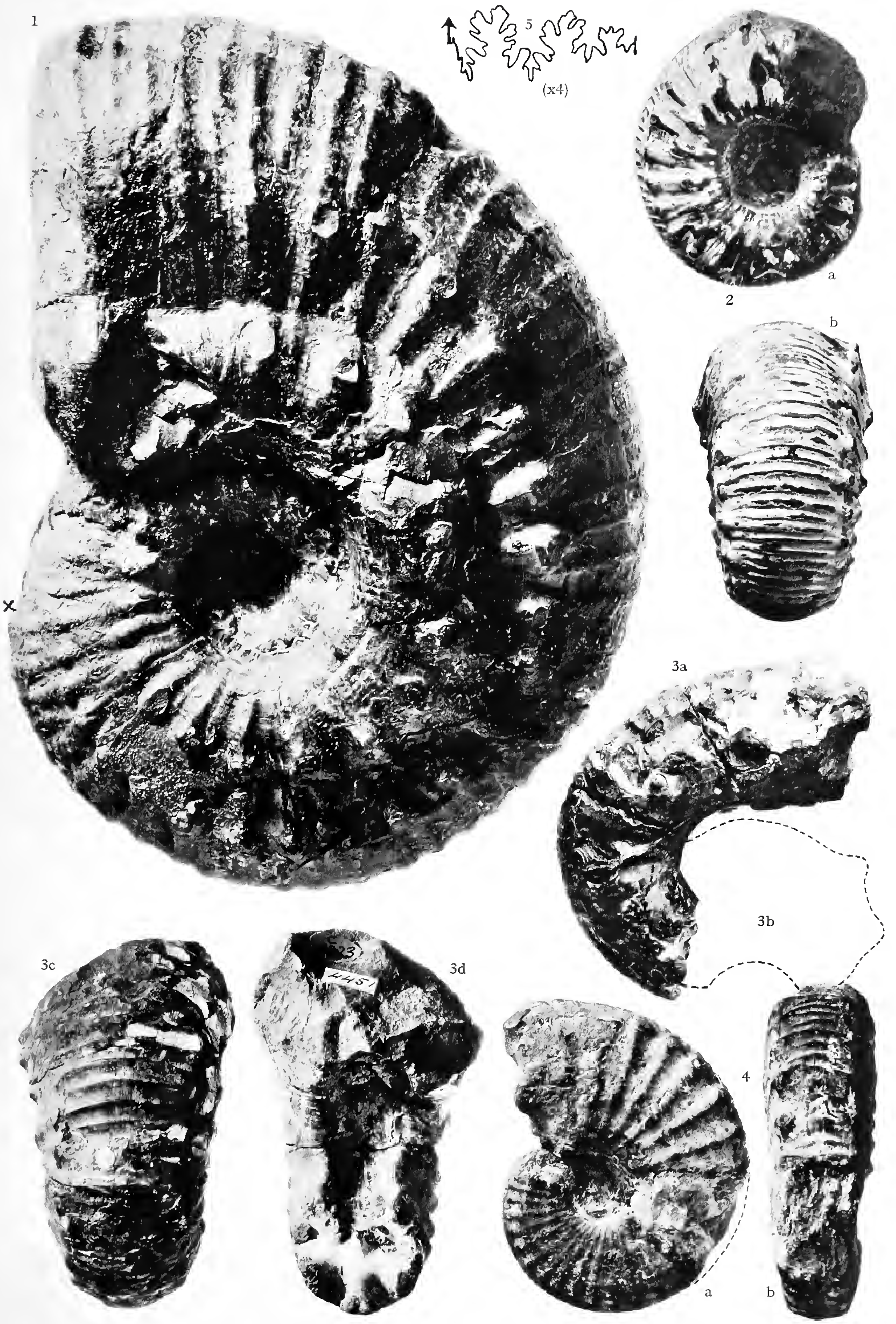

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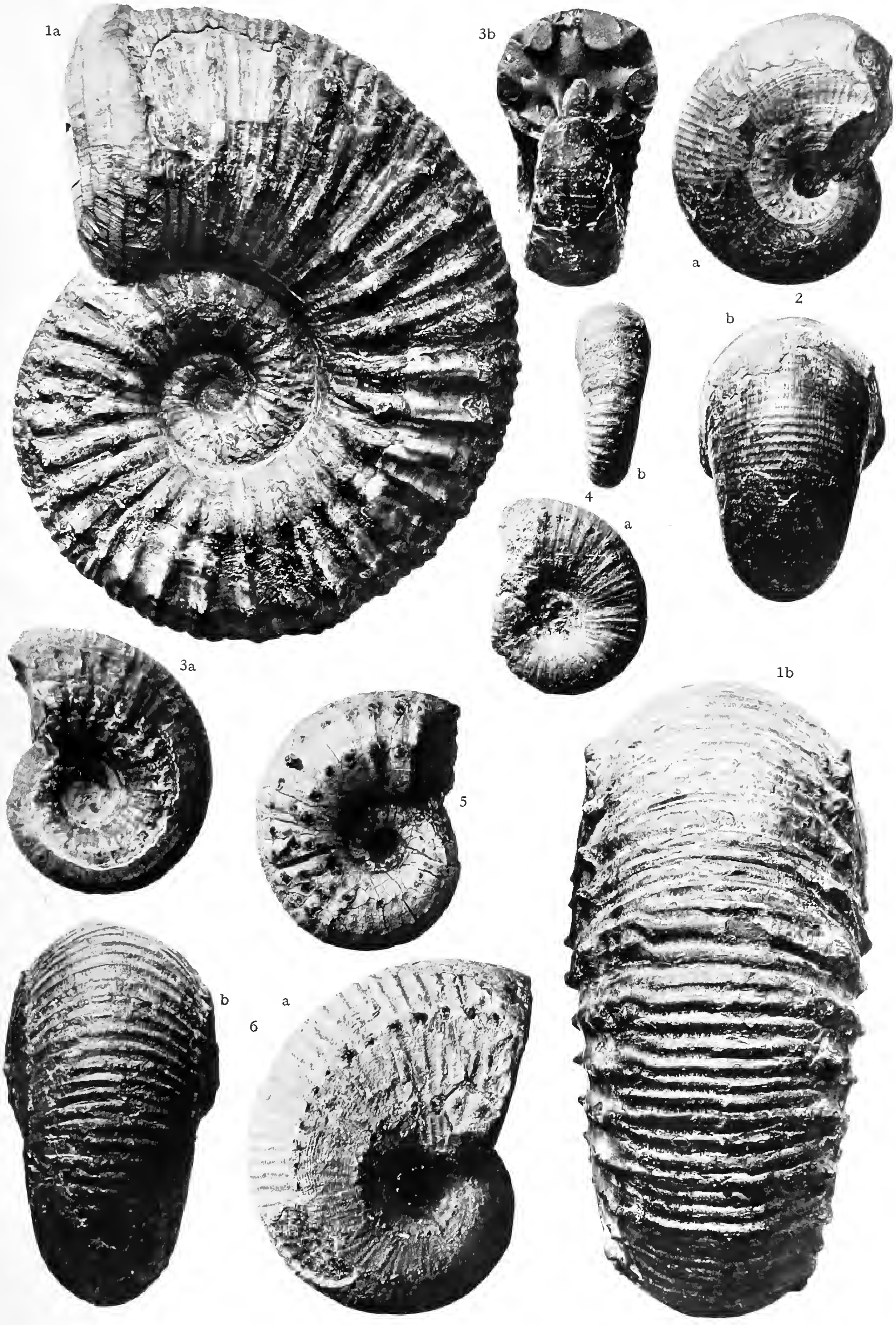

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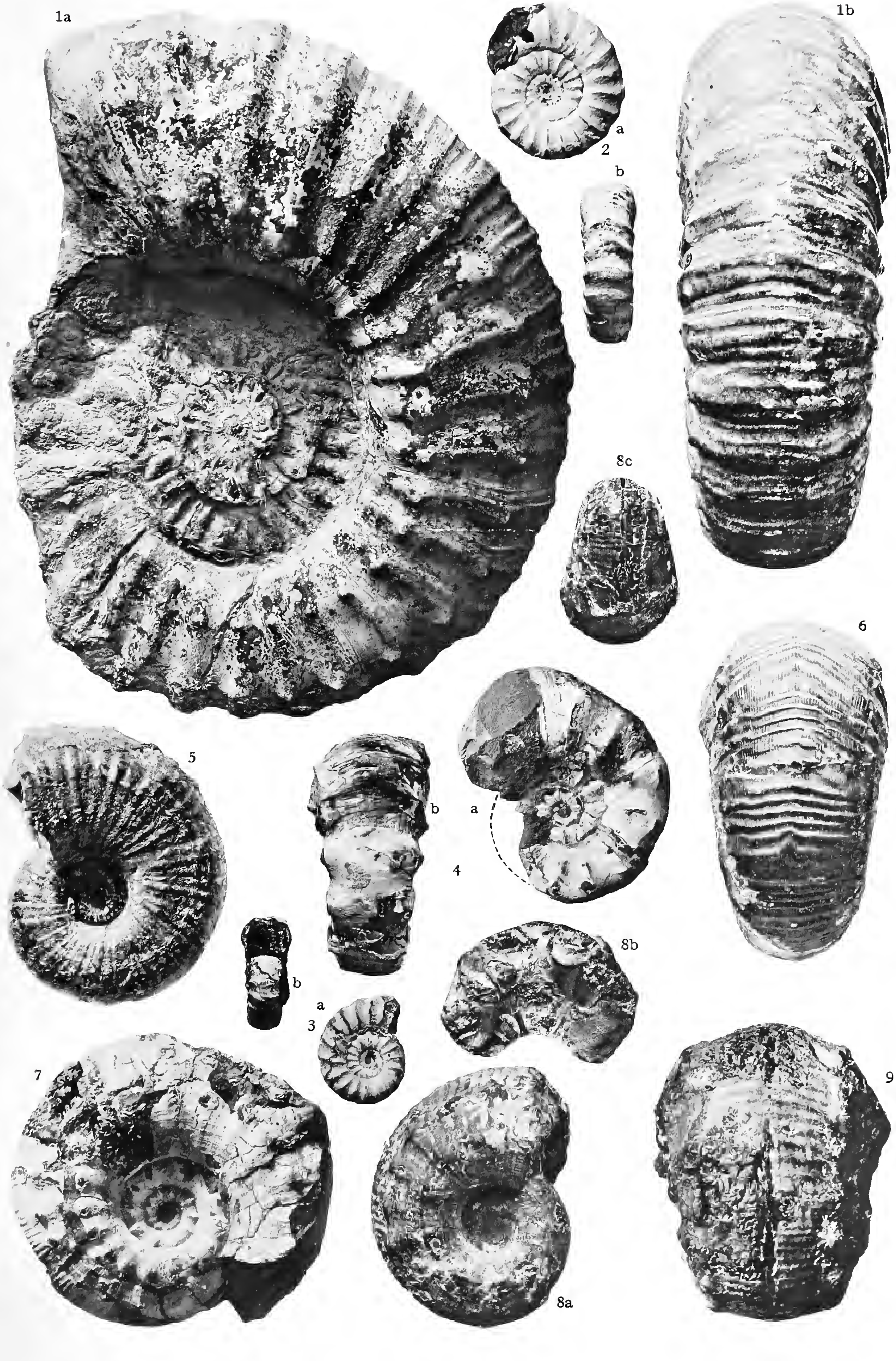

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PLATE X

EXPLANATION OF PLATE X

FIG. 1 *a, b*. *Liparoceras lytoceroides*, sp. nov. Holotype. Green Ammonite Beds, *davoei* zone (bed 123*n*). St. Gabriel's, Dorset. (No. C. 36464.) Page 70.

,, 2 *a, b*. *Beaniceras crassum* S. S. Buckman. Recorded Lang, 1914, p. 236, and Buckman, 1917, p. 264. Belemnite Stone (*ibex* zone) of Black Ven, Charmouth. (No. C. 22323.) Page 106.

,, 3 *a, b*. *Liparoceras geyeri*, sp. nov. Holotype. *Ibex* zone. Cheltenham. (No. C. 38416.) Page 65.

,, 4 *a, b*. *Liparoceras* aff. *geyeri*, sp. nov. Passage-form to *L. naptonense*, sp. nov. *Ibex* zone. Napton, Warwickshire. (No. C. 18029.) Page 65.

,, 5 *a, b*. *Androgynoceras* aff. *sparsicosta* (Trueman). Small individual with body-chamber. Same horizon and locality. (No. C. 12627.) Page 115.

,, 6 *a, b*. *Liparoceras naptonense*, sp. nov. Holotype. Same horizon and locality. (No. C. 12638.) Page 63.

,, 7 *a–c*. *Beaniceras centaurus* (d'Orbigny), var. *cherensis*, nov. Side- and front-views, enlarged $\times 1\frac{1}{2}$, and inner whorls $\times 2$. *Ibex* zone. St. Amand, Cher. (No. C. 28072.) Page 107.

,, 8 *a–c*. *Metacymbites centriglobus* (Oppel). Natural size and enlarged $\times 2$. Middle Lias. Heiningen, Wurtemberg. (No. C. 38362.) Page 95.

,, 9 *a–e*. *Metacymbites primus* sp. nov. Three examples, natural size and enlarged $\times 2$. Green Ammonite Beds, upper *davoei* zone. Stonebarrow, Charmouth. (Nos. C. 36902 [holotype *a, b*], C. 36903 [*c, d*], and C. 36908 [*e*].) Page 97.

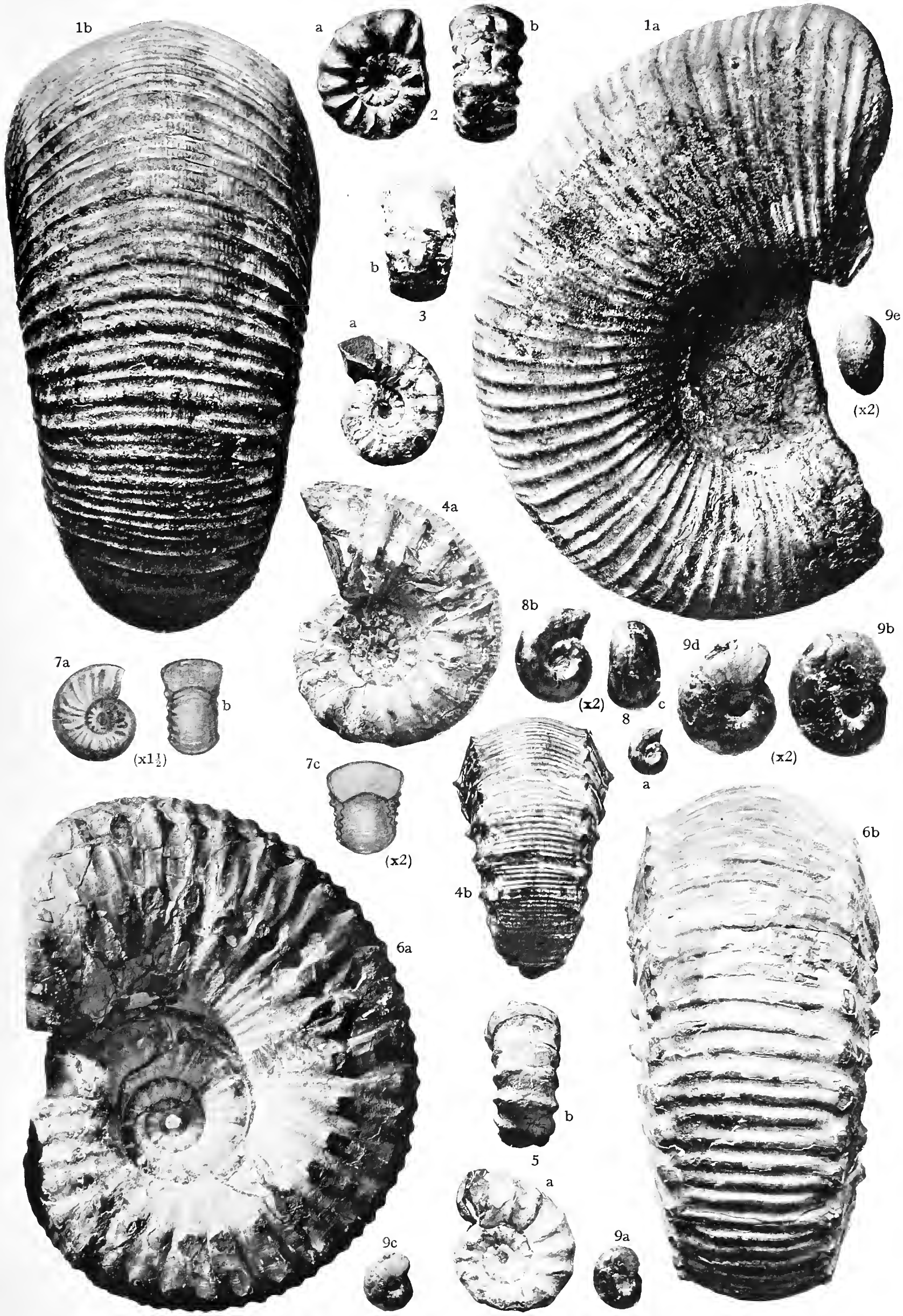

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PLATE XI

EXPLANATION OF PLATE XI

FIG. 1 *a*, *b*. *Liparoceras* (*Becheiceras*) *bechei* (J. Sowerby). Typical inner whorls. [*Bechei* sub-zone (Red Band). Dorset coast.] (No. C. 17635, Sowerby Coll.) Page 74.

„ 2. *Liparoceras* (*Becheiceras*) *bechei* (J. Sowerby), var. *obesa*, nov. Same bed and locality. (No. C. 38629.) Page 74.

„ 3. *Liparoceras* (*Becheiceras*) *gallicum* Spath. Holotype, cited in 1936, with *Tragophylloceras loscombi* (J. Sowerby) in the body-chamber. Upper Limestone (bed 129=*figulinum* sub-zone). Dorset coast. (No. C. 36716.) Page 77.

„ 4. *Liparoceras mickletonense*, sp. nov. Outline whorl-section of holotype (partly figured in Plate XIV, fig. 7). *Lataecosta* sub-zone. Mickleton Tunnel, Glos. (No. C. 3161.) Page 73.

„ 5 *a*, *b*. *Liparoceras* (*Vicininodiceras*) *simplicicosta* (Trueman). Holotype. *Jamesoni* or *ibex* zone. (" *Valdani* Limestone.") Radstock, Somerset. (No. C. 38329.) Page 85.

„ 6 *a*–*c*. *Metacymbites centriglobus* (Oppel). Natural size (*a*) and enlarged ×2 (*b*, *c*). Middle Lias, *margaritatus* zone. Heiningen, Wurtemberg. (No. C. 38360). Page 95.

„ 7 *a*–*d*. *Metacymbites centriglobus* (Oppel). Natural size (*a*) and enlarged ×2 (*b*–*d*). Same bed and locality. (No. 22098.) Page 95.

„ 8 *a*–*c*. *Metacymbites ?* (or Liparoceratid ?) sp. ind. Middle Lias. Milhaud, Aveyron, France. (No. C. 38364.) Page 96.

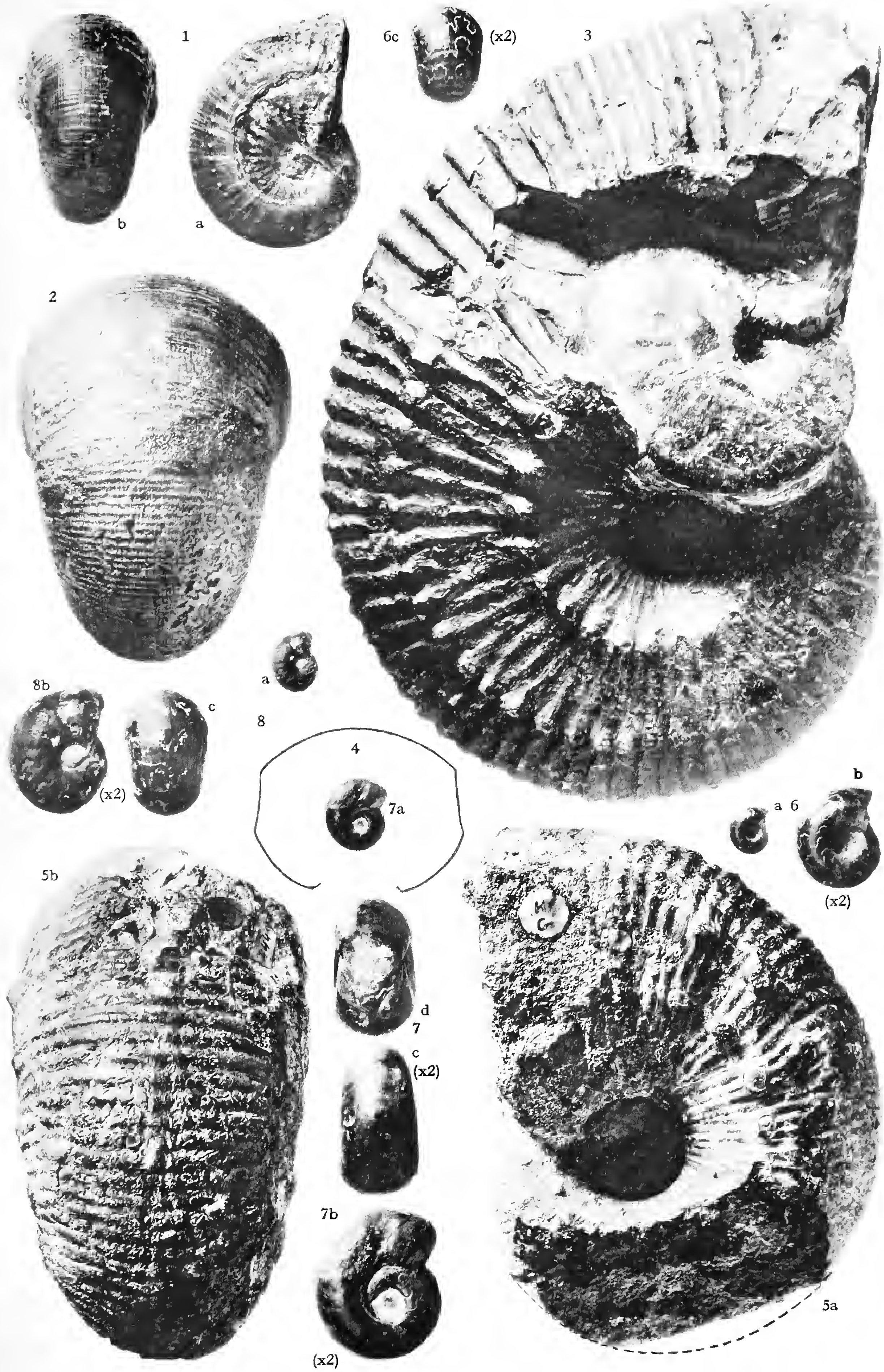

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PLATE XII

EXPLANATION OF PLATE XII

FIG. 1 *a*, *b*. *Liparoceras* (*Becheiceras*) *nautiliforme* (J. Buckman). Pyritised example, with malformed periphery. *Margaritatus* zone. Reutlingen, Wurtemberg. (No. C. 38785.) Page 79.

„ 2 *a*, *b*. *Platynoticeras haugi*, sp. nov. Inner whorls. *Jamesoni* zone. Nürtingen, Wurtemberg. (No. C. 38794.) Page 89.

„ 3 *a*, *b*. *Liparoceras* sp. ind. nov. ? (aff. *zieteni* Quenstedt sp.). With radially elongated tubercles. *Ibex* zone. Same locality. (No. C. 38779.) Page 45.

„ 4 *a*, *b*. *Liparoceras* sp. juv. aff. *densistriatum*, sp. nov. Inner whorls. Same bed and locality. (No. C. 38810.) Page 54.

„ 5 *a*, *b*. *Liparoceras tutcheri*, sp. nov. Holotype. *Ibex* zone (*Valdani* Limestone). Radstock, Somerset. (No. C. 38413.) Page 50.

„ 6 *a*–*c*. *Platynoticeras transitorium*, sp. nov. Holotype, with suture-line, enlarged ×3·5. *Jamesoni* zone. Nürtingen, Wurtemberg. (No. C. 38795.) Page 90.

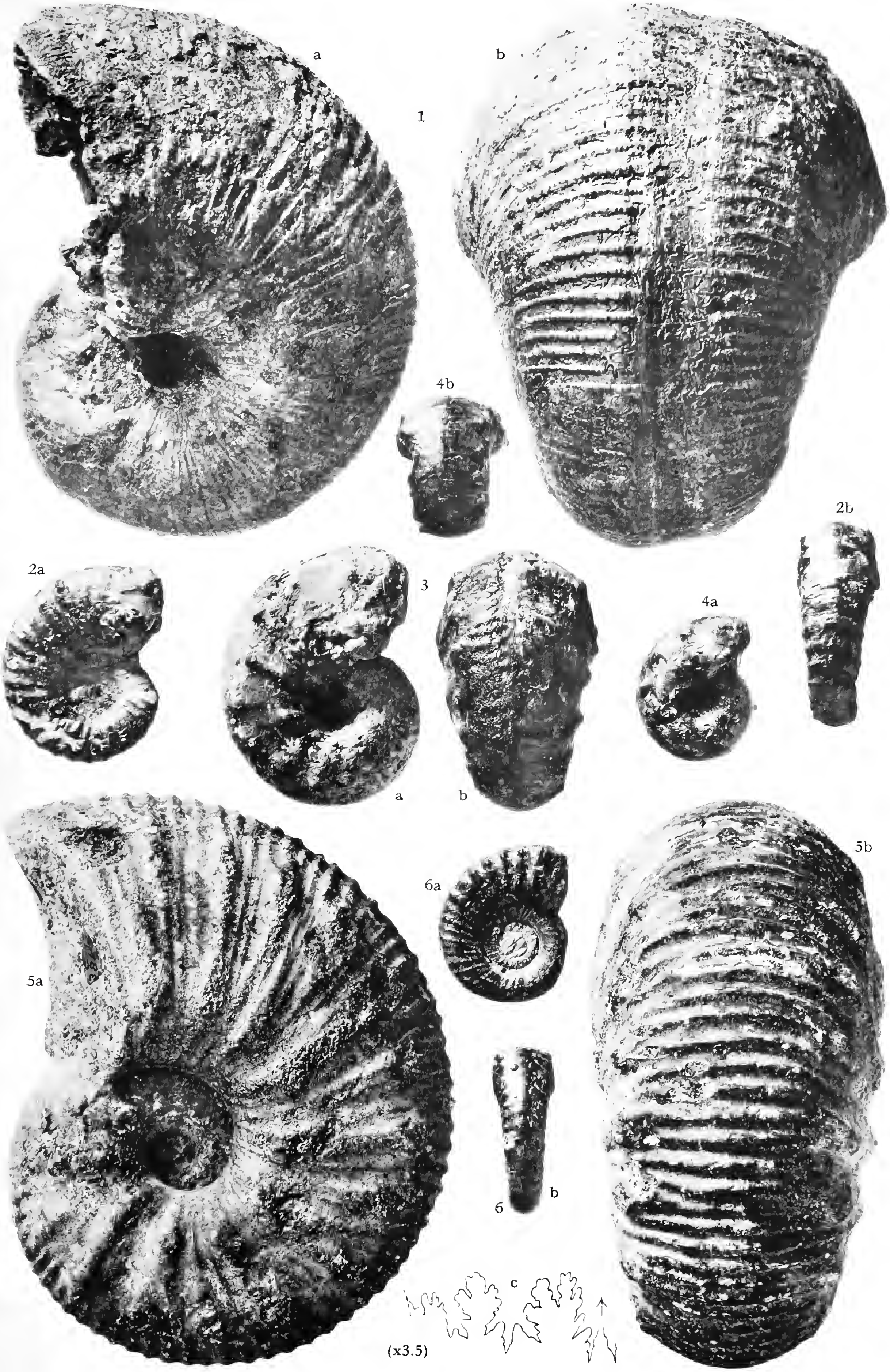

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PLATE XIII

EXPLANATION OF PLATE XIII

FIG. 1 *a*, *b*. *Androgynoceras hybridiforme*, sp. nov. Body-chamber fragment. *Lataecosta* sub-zone. Golden Cap, Dorset. (No. C. 38858.) Page 120.

" 2 *a*, *b*. *Androgynoceras maculatum* (Young & Bird), var. *leckenbyi*, nov. Example with portion of body-chamber. *Maculatum* Beds, Yorkshire coast. (No. C. 3741.) Page 126.

" 3. *Liparoceras* aff. *naptonense*, sp. nov. Inner whorls. Upper *ibex* zone (?). Napton, Warwickshire. (No. C. 38468.) Page 63.

" 4 *a–d*. *Beaniceras* aff. *costatum* S. Buckman. Two examples, one of them (4 *a*, *b*) transitional to *Androgynoceras maculatum*. Upper *ibex* zone. Germany ?. (Nos. C. 38389–90.) Page 104.

" 5 *a–c*. *Beaniceras* aff. *costatum* S. Buckman. Transition to *Androgynoceras maculatum*, var. *intermedia* (?). With suture-line, enlarged ×5. *Centaurus* sub-zone. Cheltenham, Glos. (No. C. 38461.) Page 104.

" 6 *a–c*. *Androgynoceras heterogenes* (Young & Bird). Small example, with suture-line, enlarged ×3, at 36 mm. diameter. Napton, Warwickshire. (No. C. 22588.) Page 113.

" 7 *a*, *b*. *Androgynoceras heterogenes* (Young & Bird). Small example from *maculatus* beds of Robin Hood's Bay (No. C. 19225) and suture-line of a larger specimen intermediate between *A. intracapricornus* and *A. heterogenes* from the same locality (No. C. 38457) at diameter=90 mm. Page 113.

" 8 *a*, *b*. *Androgynoceras* aff. *maculatum* (Young & Bird). Suture-lines (enlarged ×4) of two young examples from the Yellow Lias ? Hewlitt's Road, Cheltenham, Glos. (No. C. 38513) at 14 mm., with half a whorl of body-chamber, and (No. C. 38512) at 16 mm., septate to end. Page 126.

" 9 *a*, *b*. *Beaniceras rotundum* S. Buckman. Crushed example, with body-chamber. Yellow Lias. Hewlitt's Road, Cheltenham, Glos. (No. C. 38462.) Page 103.

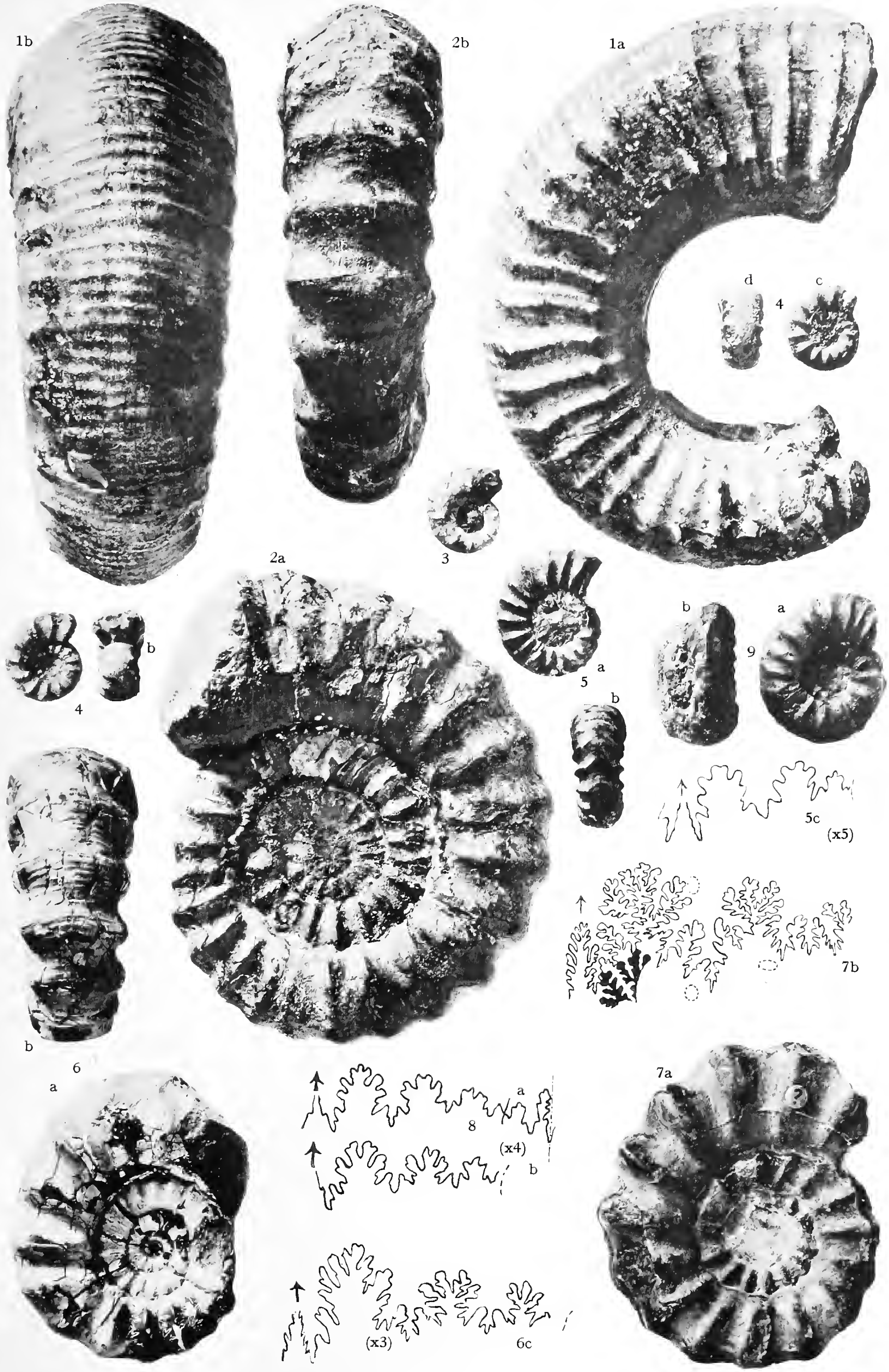

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PLATE XIV

EXPLANATION OF PLATE XIV

FIG. 1 *a, b*. *Androgynoceras hybridiforme*, sp. nov., var. *praecox*, nov., transitional to *A. henleyi* (J. Sowerby). *Davoei* zone. Stroud, Gloucestershire. (No. C. 10019.) Page 120.

„ 2 *a, b*. *Androgynoceras hybridiforme*, sp. nov. Holotype example with shorter capricorn stage than form figured in Wright (pl. xxxiii). Green Ammonite Beds, *davoei* zone. St. Gabriel's. (No. C. 36923.) Page 120.

„ 3 *a, b*. *Androgynoceras* aff. *maculatum* (Young & Bird). Pyritised inner whorls. Base of Green Ammonite Beds or just below. Dorset coast. (No. C. 38497.) Page 126.

„ 4. *Androgynoceras lataecosta* (J. de C. Sowerby), var. *pyritosa*, nov. Body-chamber fragment. Green Ammonite Beds, *davoei* zone. Dorset coast. (No. C. 36932.) Page 135.

„ 5. *Androgynoceras artigyrus* (Brown), var. *similis*, nov. Body-chamber fragment. Green Ammonite Beds, *davoei* zone. Golden Cap. (No. C. 36385.) Page 158.

„ 6. *Liparoceras naptonense*, sp. nov. Transitional example. *Ibex* zone. Napton, Warwickshire. (No. C. 12640.) Page 63.

„ 7 *a–c*. *Liparoceras mickletonense*, sp. nov. Holotype (part), with separated inner whorls. *Davoei* zone. Mickleton, Gloucestershire. (No. C. 3161.) (For whorl-section, see Plate XI, fig. 4.) Page 73.

„ 8 *a, b*. *Androgynoceras brevilobatum* (Trueman), var. *glauca*, nov. Green Ammonite Beds, *davoei* zone (Red Band). St. Gabriel's, Dorset. (No. C. 36916.) Page 154.

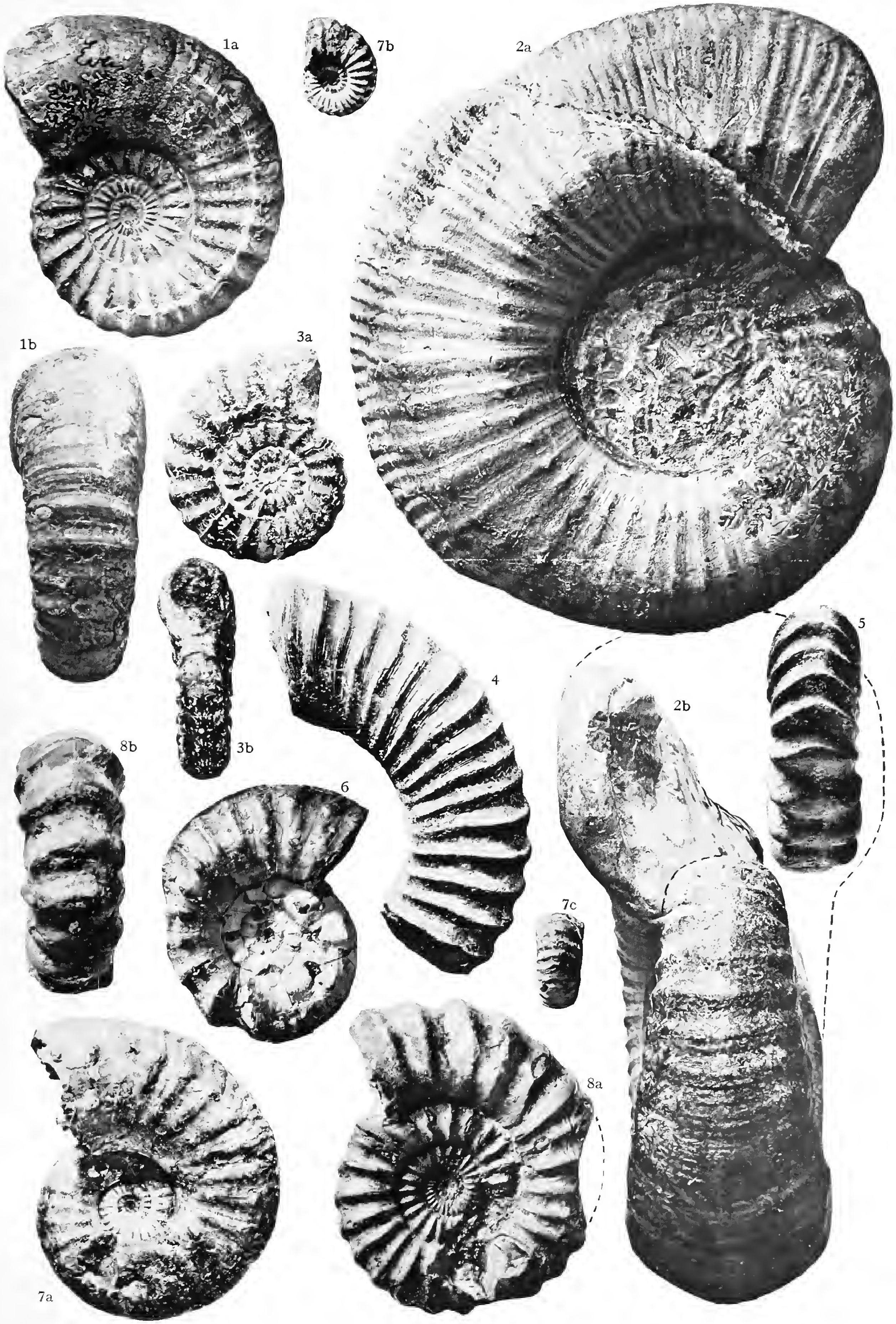

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PLATE XV

EXPLANATION OF PLATE XV

FIG. 1 *a, b*. *Androgynoceras subcontractum*, sp. nov. Holotype with outline whorl-section at ×. *Lataecosta* sub-zone. Near Charmouth, Dorset. (No. 39721.) Page 125.

" 2 *a, b*. *Beaniceras* aff. *senile* S. Buckman. Complete example, transitional to *B. luridum* or *B. rotundum*. *Centaurus* sub-zone. Rugby, Warwickshire. (No. C. 38464.) Page 109.

" 3–4. *Beaniceras costatum* S. Buckman, var. *transiens*, nov. (3 *a–c*). Complete example, with last two suture-lines (enlarged ×4 and diagrammatic) at diameter=11 mm. (4) Another example. Marston, Glos. (Nos. C. 10681 and C. 10684.) Page 104.

" 5 *a–c*. *Beaniceras luridum* (Simpson), var. *wrighti* Fucini. Typical example (*a, b*) and venter of a second specimen. *Beaniceras* Beds. Stow Hill Cutting, Glos. (No. C. 16762); and Hewlitt's Road, Cheltenham, Glos. (No. C. 38463.) Page 100.

" 6 *a, b*. *Beaniceras* aff. *luridum* (Simpson), var. *involuta*, nov. Specimen recorded by Buckman (1917, p. 264). Belemnite Stone, *centaurus* sub-zone (bed 121). Charmouth, Dorset. (No. C. 22321.) Page 100.

" 7. *Beaniceras luridum* (Simpson), var. *submaculata*, nov. (Compare Plate XVI, fig. 5.) *Beaniceras* Beds. Stow Hill Cutting, Glos. (No. C. 16765.) Page 100.

" 8 *a, b*. *Beaniceras* aff. *subluridum*, sp. nov. (Transition to *Liparoceras geyeri*, sp. nov. ?.) Belemnite Stone (=*Centaurus* sub-zone, bed 102). Charmouth, Dorset. (No. C. 22322.) Page 102.

" 9. *Beaniceras subluridum*, sp. nov. Suture-line of holotype, figured in Plate VI, fig. 6. Belemnite Stone (=*Centaurus* sub-zone). Charmouth, Dorset. (No. C. 22325.) Page 102.

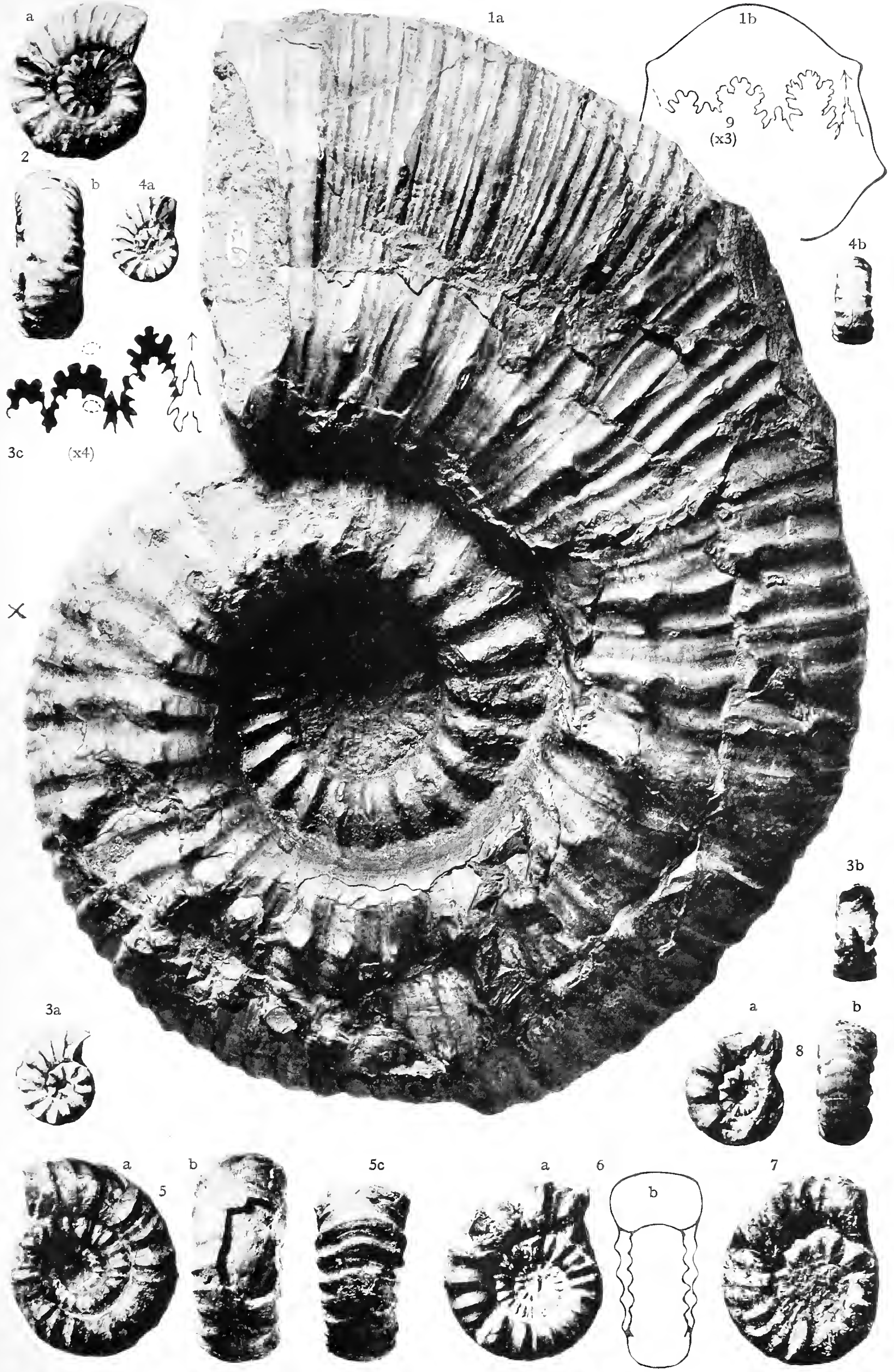

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PLATE XVI

EXPLANATION OF PLATE XVI

FIG. 1 *a, b.* *Androgynoceras intracapricornus* (Quenstedt). Septate inner whorls. *Davoei* zone. Kilsby Tunnel, Northants. (No. 20901.) Page 117.

,, 2 *a, b.* *Liparoceras lytoceroides*, sp. nov. Inner whorls. *Lataecosta* sub-zone (bed 123*i* ?). St. Gabriel's, Dorset. (No. C. 38466.) Page 70.

,, 3 *a, b.* *Beaniceras* aff. *luridum* (Simpson), var. *submaculata*, nov. Example with slender whorls. *Centaurus* sub-zone. Stow Hill Cutting, Glos. (No. C. 16763). Page 101.

,, 4 *a, b.* *Beaniceras luridum* (Simpson), aff. var. *involuta*, nov. Crushed at end. Belemnite Stone (*Centaurus* sub-zone, bed 121). Dorset coast. (No. C. 38467.) Page 100.

,, 5 *a, b.* *Beaniceras luridum* (Simpson), var. *submaculata*, nov. Example transitional to *Androgynoceras maculatum* var *intermedia*, with strongly projecting lateral ribs. *c*=last suture-line (composite and enlarged ×3) at 30 mm. *Centaurus* sub-zone. Tranzault, Indre, France. (No. C. 28079.) (See also Text-fig. 4 *b*, p. 9.) Page 100.

,, 6 *a–d.* *Beaniceras* aff. *rotundum* S. Buckman. Septate nucleus. Natural size (*a, b*) and enlarged ×2 (*c, d*). *Centaurus* sub-zone. Balingen, Wurtemberg. (No. C. 38391.) Page 103.

,, 7. *Liparoceras kilsbiense*, sp. nov. Internal suture-line of a specimen from Kilsby, Northants. (*maculatum* sub-zone ?) at diameter =13 mm. (enlarged ×4). (No. C. 38480.) Page 60.

,, 8 *a, b.* *Beaniceras centaurus* (d'Orbigny), var. *subcrassa*, nov. Upper *ibex* zone. Les Cottards, nr. St. Amand, Cher, France. (No. C. 28118.) Page 107.

,, 9 *a–d.* *Beaniceras centaurus* (d'Orbigny) (*a, b*) and var. *elegans* (*c, d*). Inner whorls. Same bed and locality. (Nos. C. 28122–23.) Page 107.

,, 10. *Liparoceras naptonense*, sp. nov., var. *gracilis*, nov. Ventral aspect. *Centaurus* sub-zone ? Kilsby Tunnel, Northants. (No. 20901 *r*.) Page 63.

,, 11 *a, b.* *Androgynoceras maculatum* (Young & Bird). Inner whorls. *Maculatum* sub-zone. Napton, Warwickshire. (No. C. 38573.) Page 126.

,, 12 *a, b.* *Androgynoceras maculatum* (Young & Bird), var. *arcigerens* (Phillips). Body-chamber example. *Maculatum* sub-zone. Bracebridge, Lincs. (No. C. 36722.) Page 126.

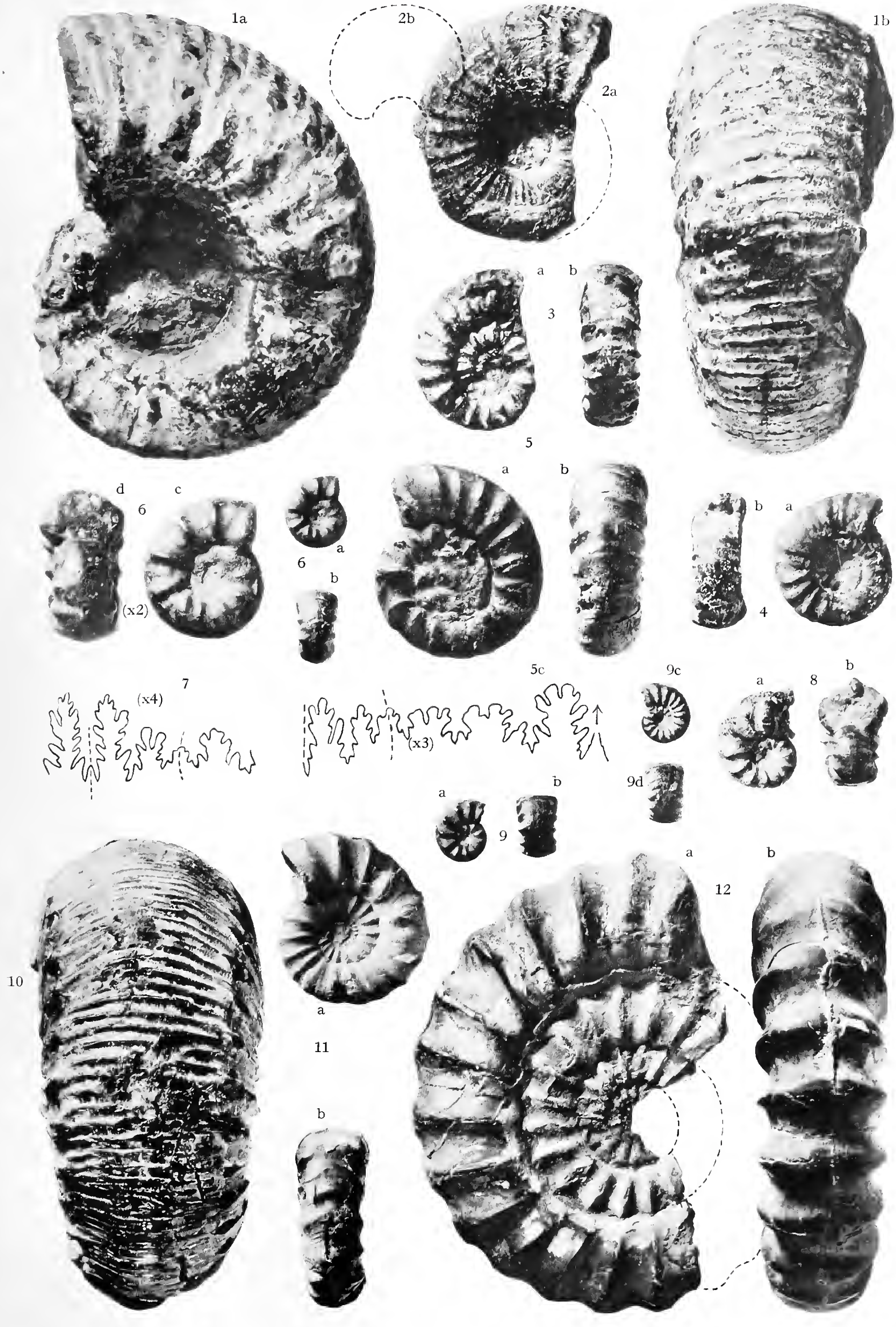

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PLATE XVII

EXPLANATION OF PLATE XVII

FIG. 1 *a, b*. *Androgynoceras henleyi* (J. Sowerby). Two lateral views. *Lataecosta* sub-zone (probably bed 123*i*). Dorset coast. (No. C. 38486.) Page 119.

„ 2 *a, b*. *Androgynoceras maculatum* (Young & Bird), var. *intermedia*, nov. Typical example from the *Beaniceras* beds. Stow Hill Cutting (G.W.R.), Glos. (No. C. 16766.) Page 126.

„ 3. *Androgynoceras maculatum* (Young & Bird), var. *intermedia*, nov. Peripheral view of a body-chamber. *Centaurus* sub-zone. Charingworth, nr. Campden, Glos. (No. C. 17303.) Page 126.

„ 4 *a, b*. *Androgynoceras lataecosta* (J. de C. Sowerby), var. *obtusicosta* Trueman. Holotype of *Androgynoceras obtusicosta* Trueman. *Lataecosta* sub-zone. Bracebridge, Lincs. (No. C. 38559.) Page 135.

„ 5 *a–c*. *Androgynoceras* sp. juv., aff. *capricornus* (Schlotheim) or *lataecosta* (Sowerby). Inner whorls, with suture-line (enlarged ×3) of unfigured outer whorl. *Davoei* zone. Mickleton Tunnel, Glos. (No. C. 16559.) Page 149.

„ 6–7. *Androgynoceras lataecosta* (J. de C. Sowerby). Inner whorls, natural size (6, 7 *a, b*) and enlarged ×2 (7 *c, d*). *Lataecosta* sub-zone (bed 122*g*). Charmouth, Dorset. (Nos. C. 38967 and C. 38969.) Page 135.

„ 8 *a–d*. *Androgynoceras lataecosta* (J. de C. Sowerby). More inflated and with stronger peripheral ribs. Natural size (*a, b*) and enlarged ×2 (*c, d*). Same bed and locality. (No. C. 38970.) Page 135.

„ 9 *a–d*. *Androgynoceras lataecosta* (J. de C. Sowerby). Inner whorls, with irregular, flexuous ribs. Natural size (*a, b*) and enlarged ×2 (*c, d*). Same bed and locality. (No. C. 38971.) Page 135.

„ 10 *a–d*. *Androgynoceras* sp. juv. ind. Subcoronate inner whorls, with some branching ribs. Natural size (*a, b*) and enlarged ×2 (*c, d*). Same bed and locality. (No. C. 38972.) Page 135.

„ 11 *a–d*. *Androgynoceras* aff. *lataecosta* (J. de C. Sowerby). Depressed inner whorls. Natural size (*a, b*) and enlarged ×2 (*c, d*). Same bed and locality. (No. C. 38966.) Page 135.

„ 12 *a–e*. *Androgynoceras* sp. juv. ind. (Compare less inflated inner whorls of *A*. cf. *hybrida* figured in Plate XIX, fig. 5.) Natural size (*a, b*), and enlarged ×2 (*c, d*); also suture-line (*e*, enlarged ×3). Same bed and locality. (No. C. 38968.) Page 134.

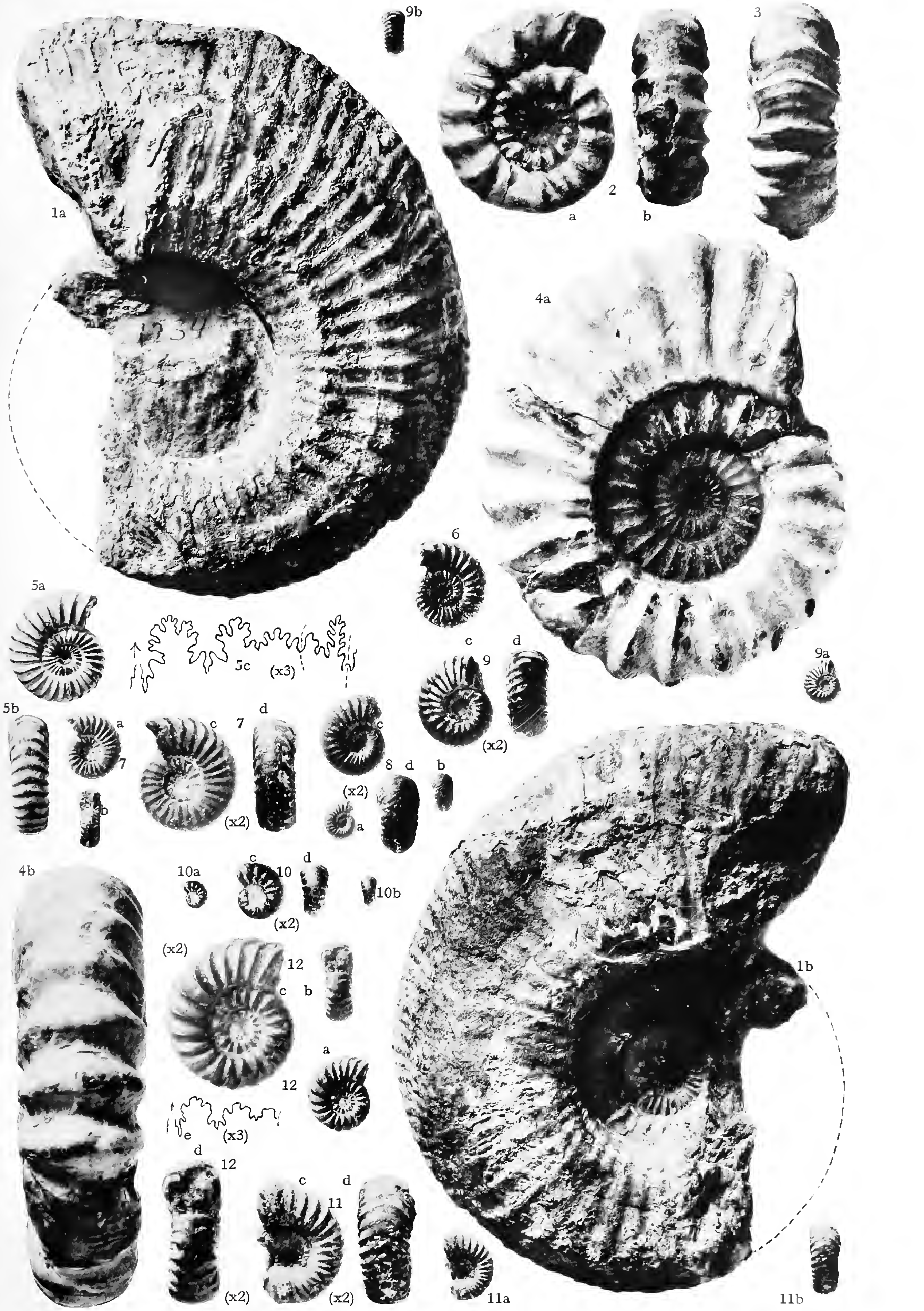

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PLATE XVIII

EXPLANATION OF PLATE XVIII

FIG. 1 *a*, *b*. *Androgynoceras artigyrus* (Brown), var. *similis*, sp. nov. Typical example. *Davoei* zone. Stroud, Gloucestershire. (No. C. 36725.) Page 158.

,, 2 *a*, *b*. *Oistoceras nortonense*, sp. nov. Holotype. *Davoei* zone. Chipping Norton, Oxfordshire. (No. C. 6165.) Page 180.

,, 3 *a*, *b*. *Androgynoceras lataecosta* (J. de C. Sowerby), transitional to *A. capricornus*. Pyritised inner whorls. Green Ammonite Beds, *davoei* zone. Golden Cap. (No. C. 36726.) Page 135.

,, 4 *a*, *b*. *Androgynoceras lataecosta* (J. de C. Sowerby). Large, typical example. *Davoei* zone. Stroud, Gloucestershire. (No. C. 10009.) Page 135.

,, 5 *a*, *b*. *Oistoceras angulatum* (Quenstedt), transition to *Androgynoceras capricornus*. Septate inner whorls. *Davoei* zone. Füzen (Randen), Switzerland. (No. C. 1440.) Page 171.

,, 6 *a*, *b*. *Oistoceras sinuosiforme*, sp. nov. *Davoei* zone. Bracebridge, Lincs. (No. C. 36929.) Page 167.

,, 7 *a*, *b*. *Androgynoceras lataecosta* (J. de C. Sowerby), var. *subcapricornu*, nov. Small example. Green Ammonite Beds, *davoei* zone. Golden Cap. (No. C. 36821.) Page 135.

,, 8. *Androgynoceras lataecosta* (J. de C. Sowerby), var. *subcapricornu*, nov. Typical example. Same bed and locality. (No. C. 36819.) Page 135.

,, 9 *a*, *b*. *Androgynoceras lataecosta* (J. de C. Sowerby), var. *pyritosa*, nov. Typical example. [Same bed.] Dorset coast. (No. C. 36933.) Page 135.

,, 10 *a*, *b*. *Androgynoceras* aff. *capricornus* (Schlotheim). Transition to *A. lataecosta* (J. de C. Sowerby), var. *pyritosa*, nov. Same bed and locality. (No. C. 36934.) Page 149.

,, 11 *a*, *b*. *Liparoceras geyeri*, sp. nov. Paratype. Belemnite Stone (*ibex* zone), Charmouth. (No. C. 22324.) Page 65.

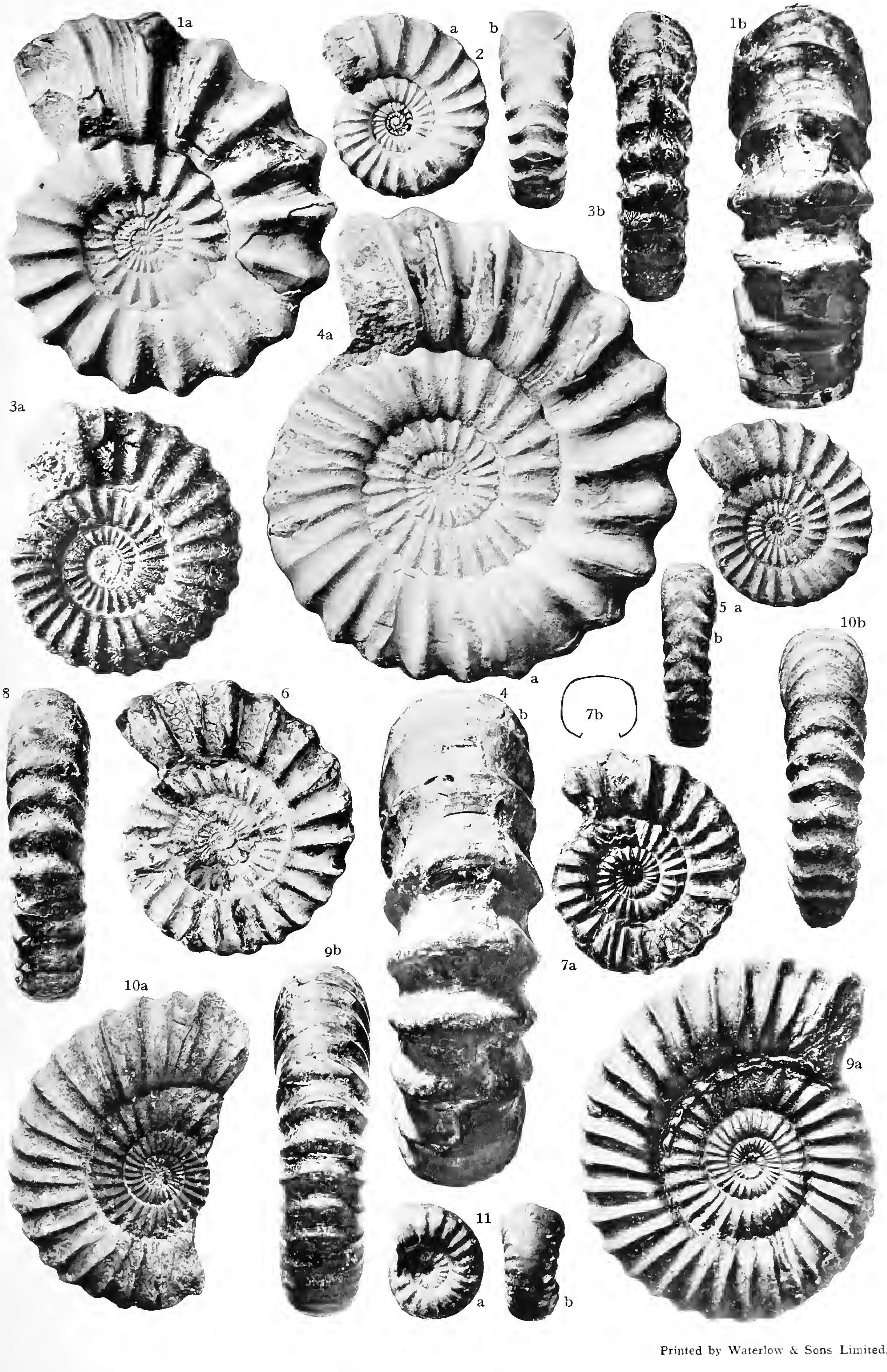

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PLATE XIX

EXPLANATION OF PLATE XIX

FIG. 1 *a–c*. *Androgynoceras maculatum* (Young & Bird), aff. var. *arcigerens* (Phillips). Complete, with over half a whorl of body-chamber; also suture-line (enlarged ×2) at 63 mm. diameter. *Maculatum* sub-zone. Bracebridge, Lincs. (No. C. 38458.) Page 126.

,, 2 *a*, *b*. *Androgynoceras maculatum* (Young & Bird), var. *rigida*, nov. Transition to *A. artigyrus* (Brown). *Maculatum* Beds. Yorkshire coast. (No. C. 28175.) Page 126.

,, 3 *a–d*. *Androgynoceras lataecosta* (J. de C. Sowerby) ?. Inner whorls, with irregular ribbing, natural size and enlarged ×2. *Lataecosta* sub-zone (base, bed 122*g*). Charmouth, Dorset. (No. C. 38973.) Page 135.

,, 4. *Androgynoceras lataecosta* (J. de C. Sowerby). Peripheral view of holotype. Drift (ex *davoei* zone). Locality unknown. (No. 43916.) Left-hand side polished unevenly, so that lower half is too thick. Page 135.

,, 5 *a–d*. *Androgynoceras* sp. juv. (cf. *hybrida* d'Orbigny). Inner whorls, natural size and enlarged ×2. *Lataecosta* sub-zone (base, bed 122*g*). (No. C. 38974.) Charmouth, Dorset. Page 134.

,, 6 *a*, *b*. *Androgynoceras lataecosta* (J. de C. Sowerby), var. *pyritosa*, nov. Example with part of body-chamber and rather inflated whorl-section; transitional to *A. capricornus*. *Lataecosta* sub-zone. Staithes, Yorkshire. (No. C. 38562.) Page 135.

,, 7 *a*, *b*. *Oistoceras sinuosiforme*, sp. nov. Holotype. *Oistoceras* Beds. Bracebridge, Lincs. (No. C. 38564.) Page 167.

,, 8 *a*, *b*. *Oistoceras crescens* (Hyatt) Trueman sp. Inner whorls. Same beds and locality. (No. C. 38565.) Page 178.

,, 9 *a*, *b*. *Oistoceras crescens* (Hyatt) Trueman sp. Typical, larger example. Upper *davoei* zone. Northamptonshire. (No. 19583*c*.) Page 178.

,, 10 *a*, *b*. *Oistoceras figulinum* (Simpson). Bituberculate inner whorls. (Example figured by Blake, in Tate and Blake, 1876, pl. viii, fig. 9, as *Aegoceras defossum* and noticed by Buckman, 1913, p. iv, as *Oistoceras omissum*.) *Figulinum* sub-zone. Yorkshire. (No. C. 17988.) Page 162.

,, 11 *a*, *b*. *Oistoceras curvicorne* (Schloenbach). Inner whorls. *Figulinum* sub-zone. Yorkshire coast. (No. C. 19228.) Page 164.

,, 12 *a*, *b*. *Androgynoceras* aff. *maculatum* (Young & Bird). Transition to *A. brevilobatum*, var. *recticostata*, nov. Lower *davoei* zone. Stroud, Glos. (No. C. 38861.) Page 126.

,, 13 *a*, *b*. *Androgynoceras maculatum* (Young & Bird), var. *rigida*, nov. *Maculatum* beds (8 feet below Sandy Series). Staithes, Yorkshire. (No. C. 24601.) Page 126.

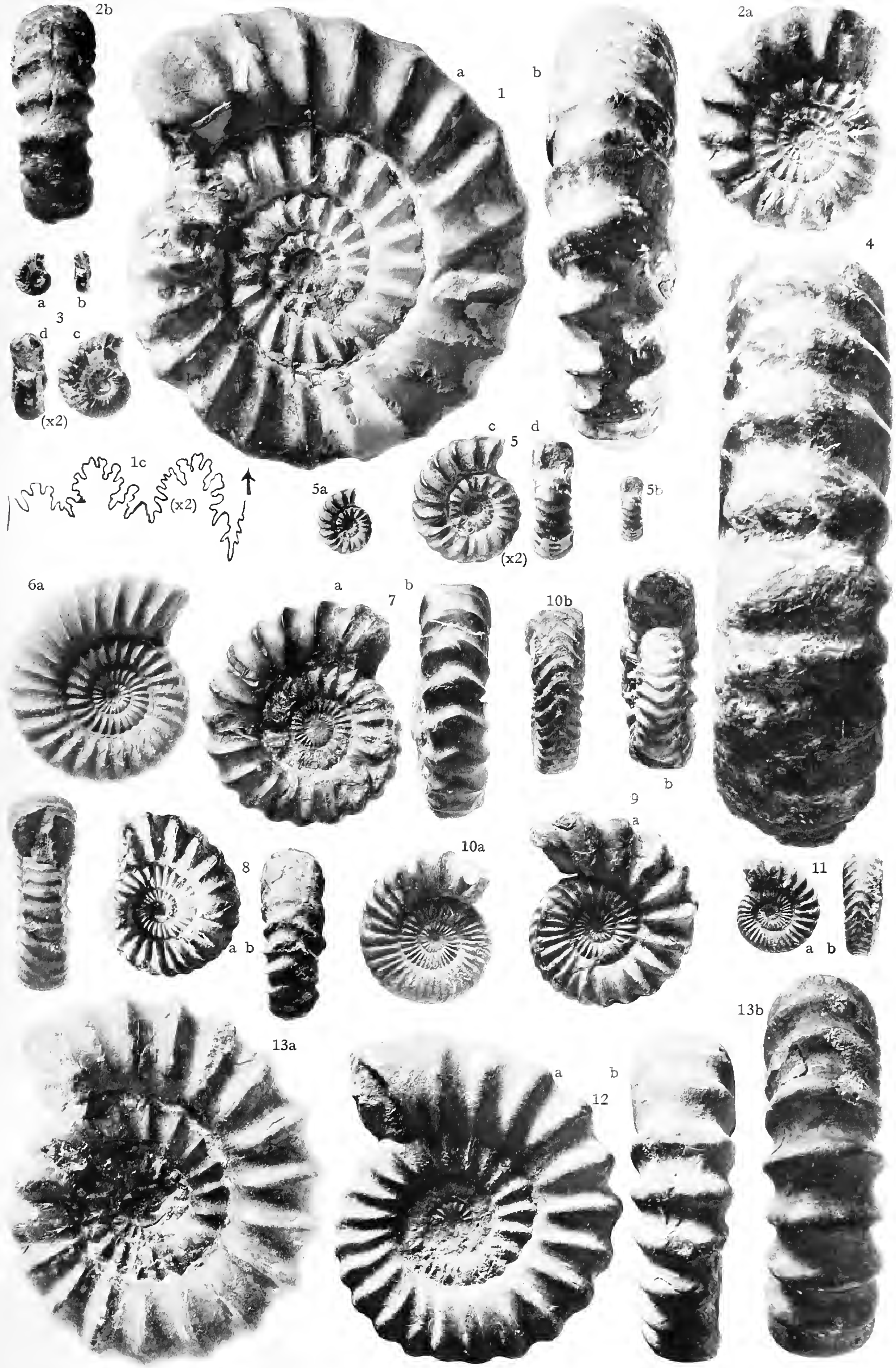

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PLATE XX

EXPLANATION OF PLATE XX

FIG. 1 *a, b*. *Androgynoceras subhybrida*, sp. nov., var. *leptonotus*, nov. *Lataecosta* sub-zone (bed 123*n*). St. Gabriel's, Dorset. (No. C. 36915.) Page 122.

„ 2. *Androgynoceras heterogenes* (Young & Bird), var. *gigas*, Spath. Suture-line of inner whorls, at 56 mm. (enlarged ×2·5). *Maculatum* sub-zone. Robin Hood's Bay, Yorks. (No. C. 38496.) Page 113.

„ 3 *a, b*. *Androgynoceras maculatum* (Young & Bird), var. *atavus*, nov. *Maculatum* sub-zone. Prestbury, nr. Cheltenham, Glos. (No. C. 28181.) Page 126.

„ 4 *a, b*. *Oistoceras* aff. *figulinum* (Simpson). Upper *davoei* zone. Les Cottards, nr. St. Amand, Cher, France. (Suture-line figured in Text-fig. 4 *d*, p. 9.) (No. C. 28065.) Page 162.

„ 5 *a, b*. *Androgynoceras maculatum* (Young & Bird) aff. var. *arcigerens* (Phillips). Large body-chamber example. [Lower *davoei* zone.] Dorset coast. (No. C. 38548.) Page 126.

„ 6 *a–c*. *Androgynoceras maculatum* (Young & Bird). Example with half a whorl of body-chamber, and suture-line (enlarged ×2·5) at 38 mm. diameter. *Maculatum* Beds. Robin Hood's Bay, Yorks. (No. C. 17752.) Page 126.

„ 7 *a, b*. *Oistoceras* aff. *curvicorne* (Schloenbach). Inner whorls. *Figulinum* sub-zone. Aston Magna, Glos. (No. C. 17590.) Page 164.

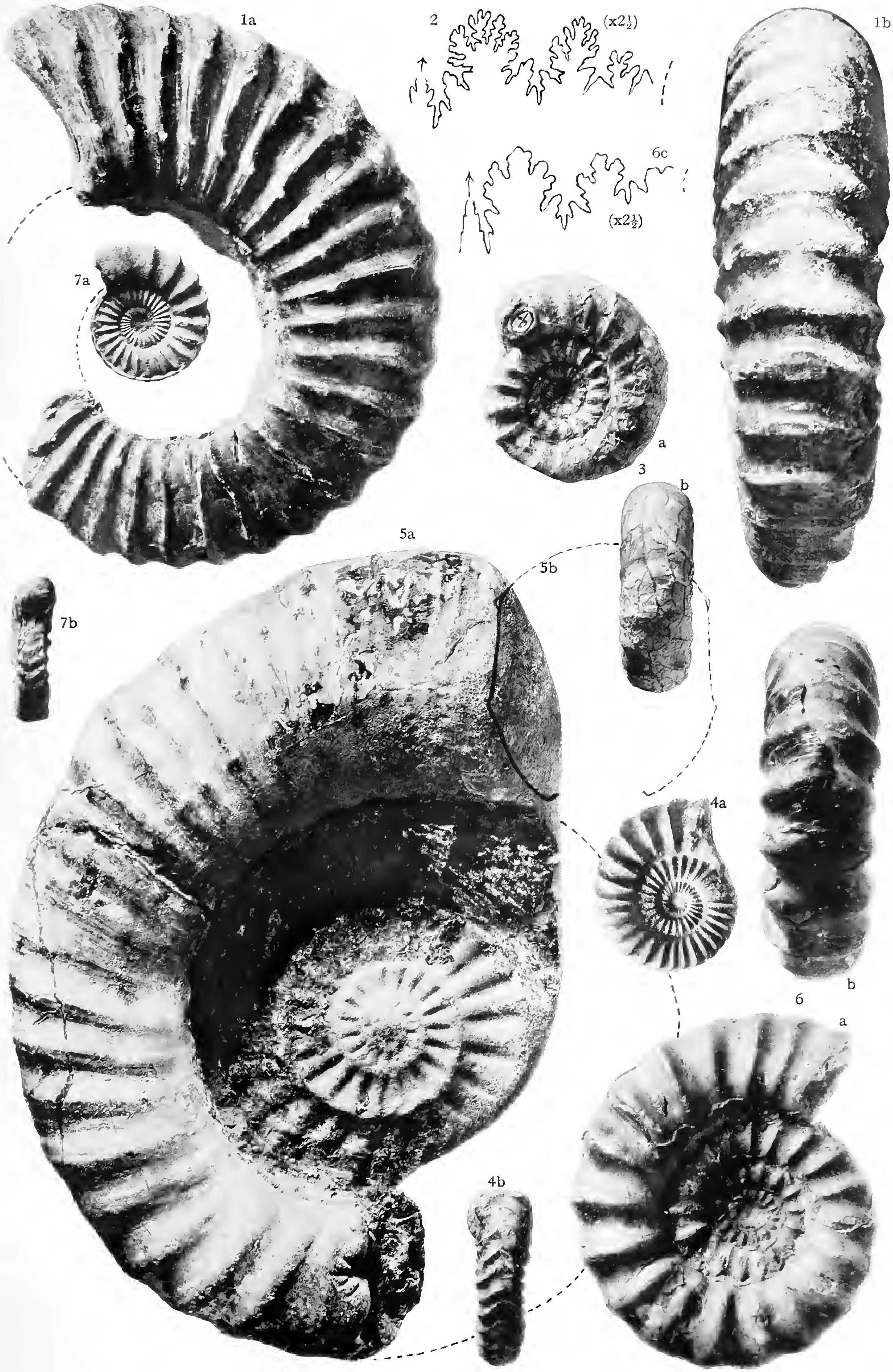

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PLATE XXI

EXPLANATION OF PLATE XXI

FIG. 1 *a–c*. *Androgynoceras brevilobatum* (Trueman). Holotype (figured by Richardson, 1904, pl. xv, fig. 7, as *Liparoceras capricornu*) with suture-line, enlarged ×2. *Lataecosta* sub-zone. Pilley, Leckhampton, Glos. (No. C. 28282.) Page 154.

,, 2 *a, b*. *Androgynoceras brevilobatum* (Trueman). Larger example, with nearly ¾ whorls of body-chamber. Same beds (Gloucestershire). (No. C. 2907.) Page 154.

,, 3 *a, b*. *Oistoceras omissum* (Simpson). Specimen with Bean's original label " *Amm. arcigerens* Phillips ; Marlstone, Robin Hood's Bay." *Oistoceras* Beds. (No. 38561.) Page 170.

,, 4 *a, b*. *Oistoceras allœotypus* Trueman. Holotype. " Base of *margaritatus* zone." Bracebridge, Lincs. (No. C. 38915.) Page 177.

,, 5 *a, b*. *Oistoceras angulatum* (Quenstedt). Typical inner whorls. Upper *davoei* zone. Vernay, France. (No. C. 38566.) Page 171.

,, 6. *Bifericeras* sp. ind. (cf. *bifer nudicosta* Quenstedt [?] *partim*). Sinemurian, *oxynotus* zone (Gloucestershire). For comparison with *Oistoceras* peripheries. (L. F. Spath Coll., No. 17753.) Page 168.

,, 7. *Oistoceras figulinum* (Simpson). Venter of inner whorls. *Davoei* zone, Upper Limestone (bed 129). Charmouth. (No. C. 38575.) Page 162.

,, 8 *a, b*. *Oistoceras figulinum* (Simpson). Large, typical example, with nearly whole whorl of body-chamber. [Same bed.] Dorset coast. (No. 39890.) Page 162.

,, 9. *Oistoceras* aff. *omissum* (Simpson). Transitional example. Upper *davoei* zone. Bettant, Ain, France. (No. C. 28066.) Page 170.

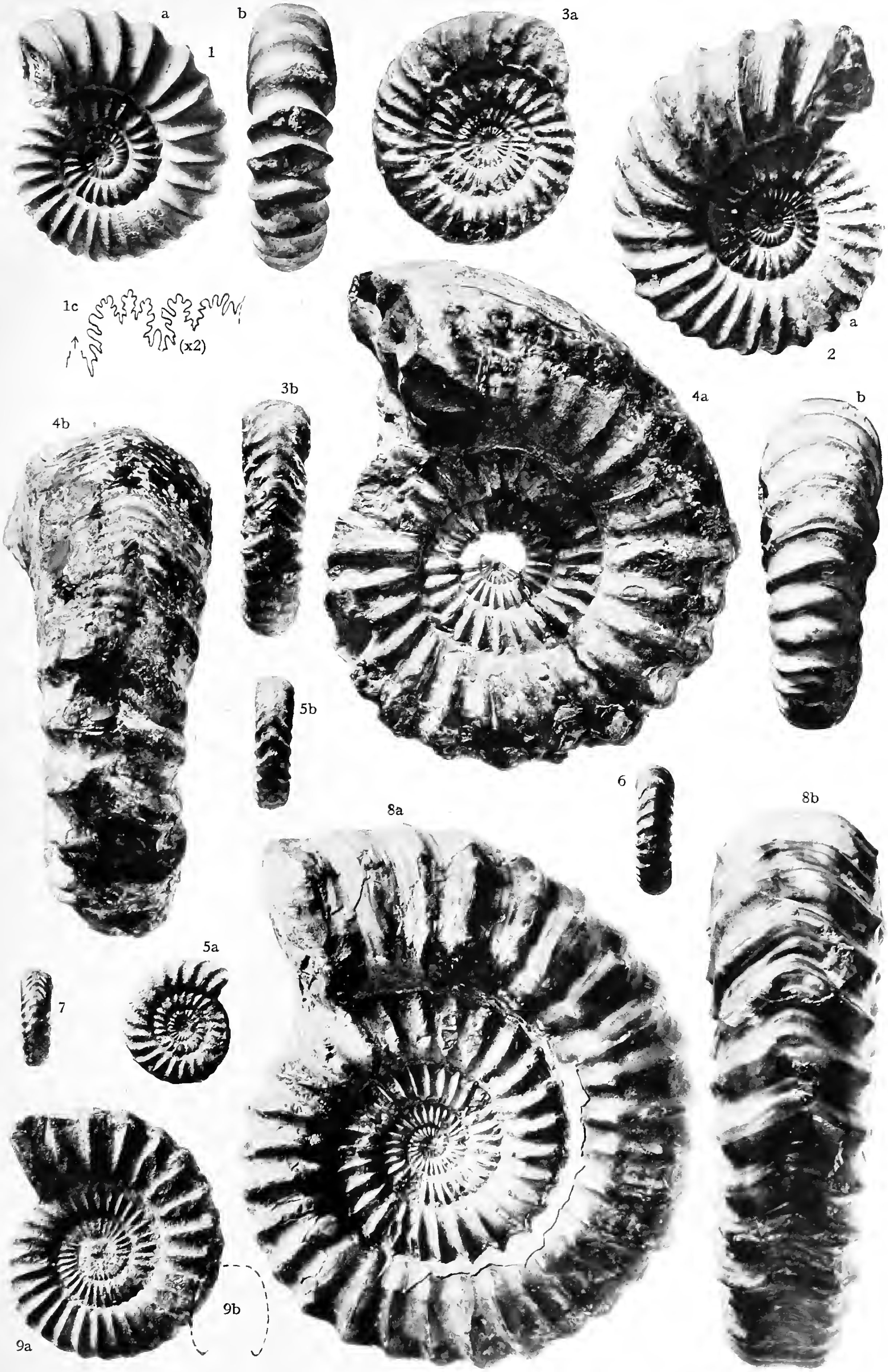

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PLATE XXII

EXPLANATION OF PLATE XXII

FIG. 1 *a, b*. *Oistoceras crescens* (Hyatt) Trueman, var. *dissotypus* (Trueman). Side-view of type (with external suture-line) from the upper *davoei* zone of Bracebridge, Lincs. (No. C. 38572.) Page 178.

„ 2 *a–c*. *Oistoceras figulinum* (Simpson). Example with last suture-line, enlarged ×3·5, from the Upper Limestone (bed 129). Dorset coast. (No. 23862.) Page 162.

„ 3 *a, b*. *Oistoceras orbignyi*, sp. nov. Holotype. Top of *davoei* zone or lower *margaritatus* zone. Vieux Pont, Calvados, France. (No. 37188*a*.) Page 176.

„ 4 *a, b*. *Oistoceras lincolnense*, sp. nov. Holotype. *Oistoceras* Beds. Bracebridge, Lincs. (No. C. 38580.) Page 174.

„ 5 *a, b*. *Oistoceras* aff. *angulatum* (Quenstedt). Transition to *Androgynoceras capricornus* (Schlotheim), with suture-line, enlarged ×2·5. *Oistoceras* Beds. Bracebridge, Lincs. (No. C. 38578.) Page 171.

„ 6 *a–d*. *Oistoceras* sp. juv. Natural size and enlarged ×2 with suture-line (×6). *Figulinum* sub-zone (beds 129–130). Charmouth. (No. C. 38976.) Page 162.

„ 7 *a, b*. *Oistoceras wrighti* Spath. Example from the Dorset coast. [Upper Limestone (bed 129).] (No. C. 38576.) Page 166.

„ 8 *a, b*. *Oistoceras* aff. *figulinum* (Simpson). Transition to *O. wrighti* Spath. *Figulinum* sub-zone. Yorkshire coast. (No. 37973*a*.) Page 162.

„ 9 *a, b*. *Oistoceras curvicorne* (Schloenbach). Typical example from the same beds and locality. (No. C. 6235.) Page 164.

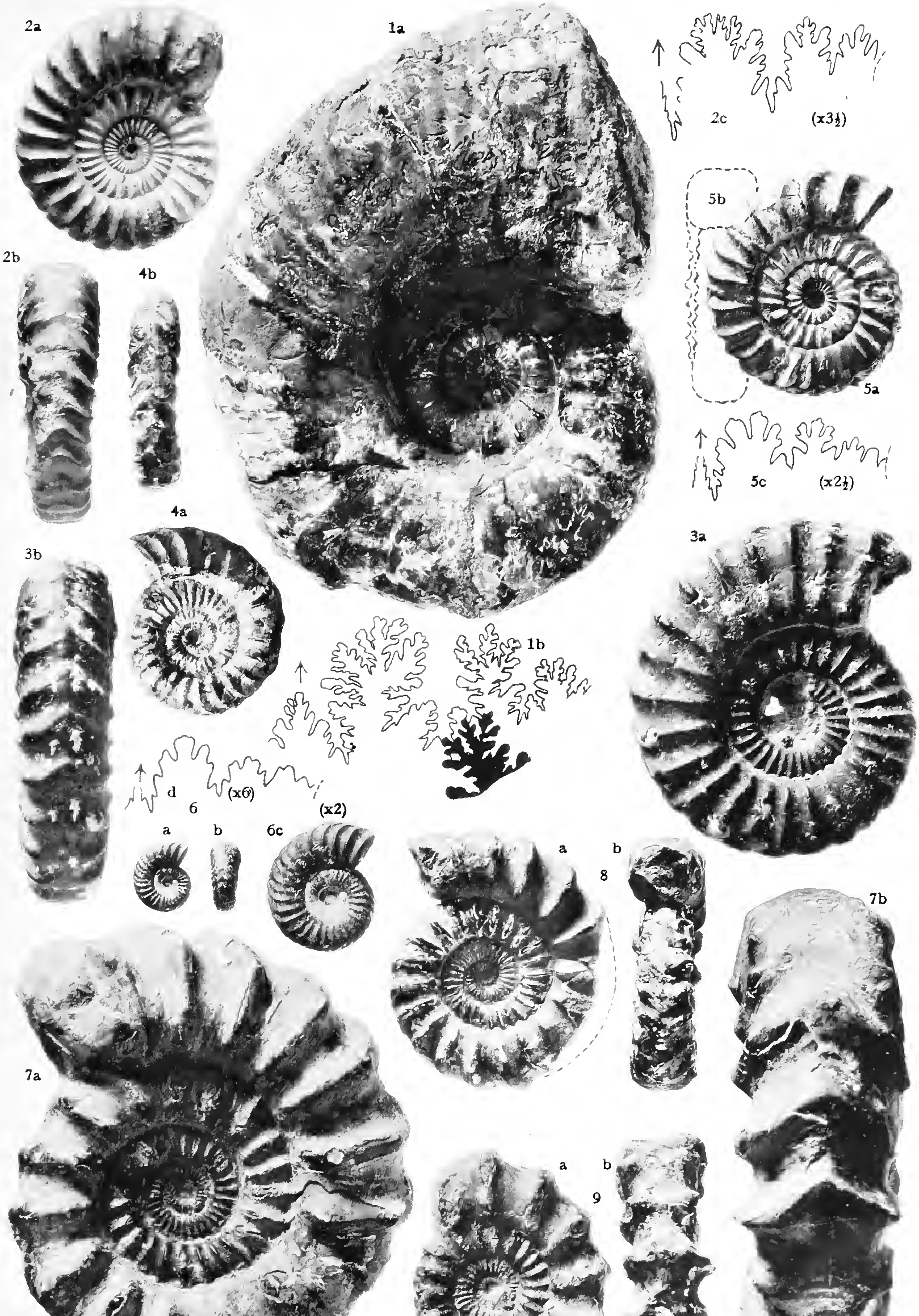

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PLATE XXIII

EXPLANATION OF PLATE XXIII

FIG. 1 *a, b*. *Androgynoceras capricornus* (Schlotheim). Lectotype. Upper *davoei* zone. Amberg, Bavaria. Geol. Palaeont. Mus. Berlin (Coll. Schlotheim). Page 149.

,, 2. *Oistoceras curvicorne* (Schloenbach). Suture-line, enlarged ×2 of an example from the Dorset coast. [Upper Limestone (bed 129=*figulinum* sub-zone)]. (No. 50633.) Page 164.

,, 3 *a–c*. *Androgynoceras artigyrus* (Brown). Holotype, with suture-line, enlarged ×3. *Davoei* zone. Yorkshire coast. Manchester Museum. (No. L.L. 230.) Page 158.

,, 4. *Oistoceras* aff. *langi*, sp. nov. Peripheral view of small example from the Upper Limestone (bed 129*a*=*figulinum* sub-zone). Charmouth. (No. C. 38590.) Page 172.

,, 5 *a–c*. *Androgynoceras* aff. *capricornus* (Schlotheim), transition to *Oistoceras angulatum* (Quenstedt). Three views of an example showing conspicuous ventral arrows. *Davoei* Bed. Dewangen, Wurtemberg. (No. C. 38646.) Page 149.

,, 6 *a–c*. *Androgynoceras capricornus* (Schlotheim). Smaller paratype, with suture-line, diagrammatic and composite, and enlarged ×4. Upper *davoei* zone. Amberg, Bavaria. Geol. Palaeont. Mus. Berlin (Coll. Schlotheim). Page 149.

,, 7 *a, b*. *Androgynoceras* aff. *brevilobatum* (Trueman). One of Schlotheim's syntypes of *Amm. capricornus*. Upper *davoei* zone. Falkenhagen, Lippe, Germany. Geol. Palaeont. Mus. Berlin (Coll. Schlotheim). Page 151.

,, 8 *a–c*. *Androgynoceras lataecosta* (J. de C. Sowerby). Small example from Napton, Warwickshire (*davoei* zone), with internal suture-line, enlarged ×5. (No. C. 38994.) Page 135.

,, 9 *a, b*. *Androgynoceras* aff. *maculatum* (Young & Bird). Transition to *A. brevilobatum*, var. *recticostata*, nov. One of Schlotheim's syntypes of *Amm. capricornus*. Upper *davoei* zone. Amberg, Bavaria. Geol. Palaeont. Mus. Berlin (Coll. Schlotheim). Page 151.

,, 10. *Oistoceras* sp. juv. Suture-line enlarged ×6. Upper *davoei* zone (beds 128–130). Charmouth. (No. C. 38975.) Page 162.

,, 11. *Oistoceras langi*, sp. nov. Holotype. Upper *davoei* zone, *figulinum* sub-zone (bed 130). Golden Cap. (No. C. 36905.) Page 172.

,, 12. *Androgynoceras artigyrus* (Brown), var. *similis*, nov. Last suture-line of the "*Aegoceras capricornum*" figured by Crick (1898, pl. xx, fig. 2), enlarged ×2. *Lataecosta* sub-zone. Cheltenham, Glos. (No. 67929.) Page 158.

,, 13 *a, b*. *Oistoceras colubrinum*, sp. nov. Holotype. *Oistoceras* Beds. Bracebridge, Lincs. (No. C. 38900.) Page 174.

,, 14 *a, b*. *Androgynoceras artigyrus* (Brown), var. *similis*, nov. Inner whorls. *Lataecosta* sub-zone. [Cheltenham, Glos.] (No. 88981.) Page 158.

,, 15 *a, b*. *Androgynoceras capricornus* (Schlotheim). Upper *davoei* zone. Randen, nr. Schaffhausen. (No. 62486*a*.) Page 149.

,, 16. Gen. nov. (*Oistoceras* ?) sp. juv. (Transition to *Amaltheus* ?, figured in Plate XXVI, fig. 16.) Suture-line enlarged ×9. *Figulinum* sub-zone (bed 130). Westhay Water, E. of Charmouth. (No. C. 38977.) Page 32.

,, 17. *Amaltheus* ? sp. juv. (Transition from *Oistoceras*, figured in Plate XXV, fig. 10.) Suture-line, enlarged ×9. Same zone (bed 130). Stonebarrow, Charmouth. (No. C. 38978.) Page 32.

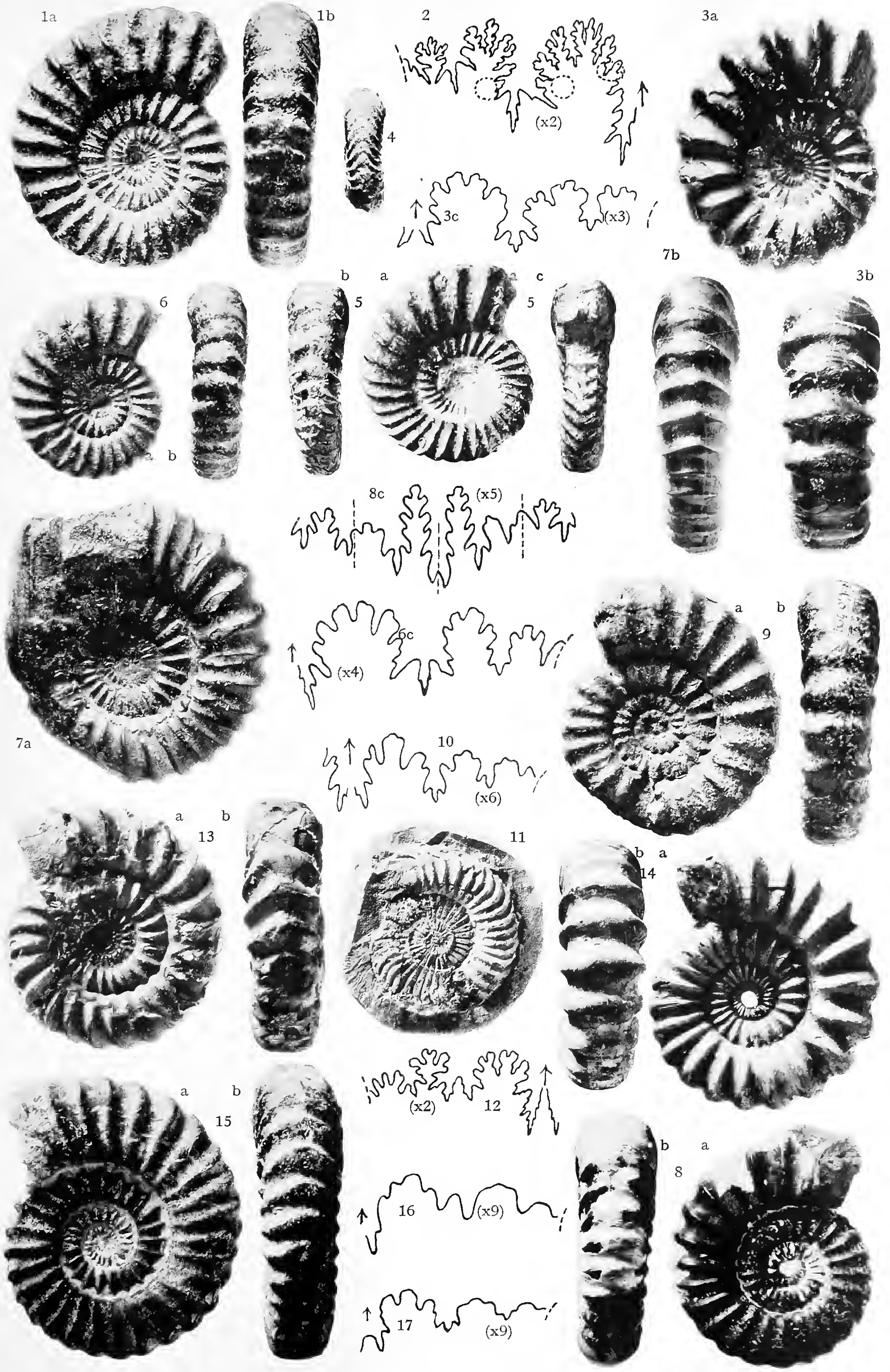

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PLATE XXIV

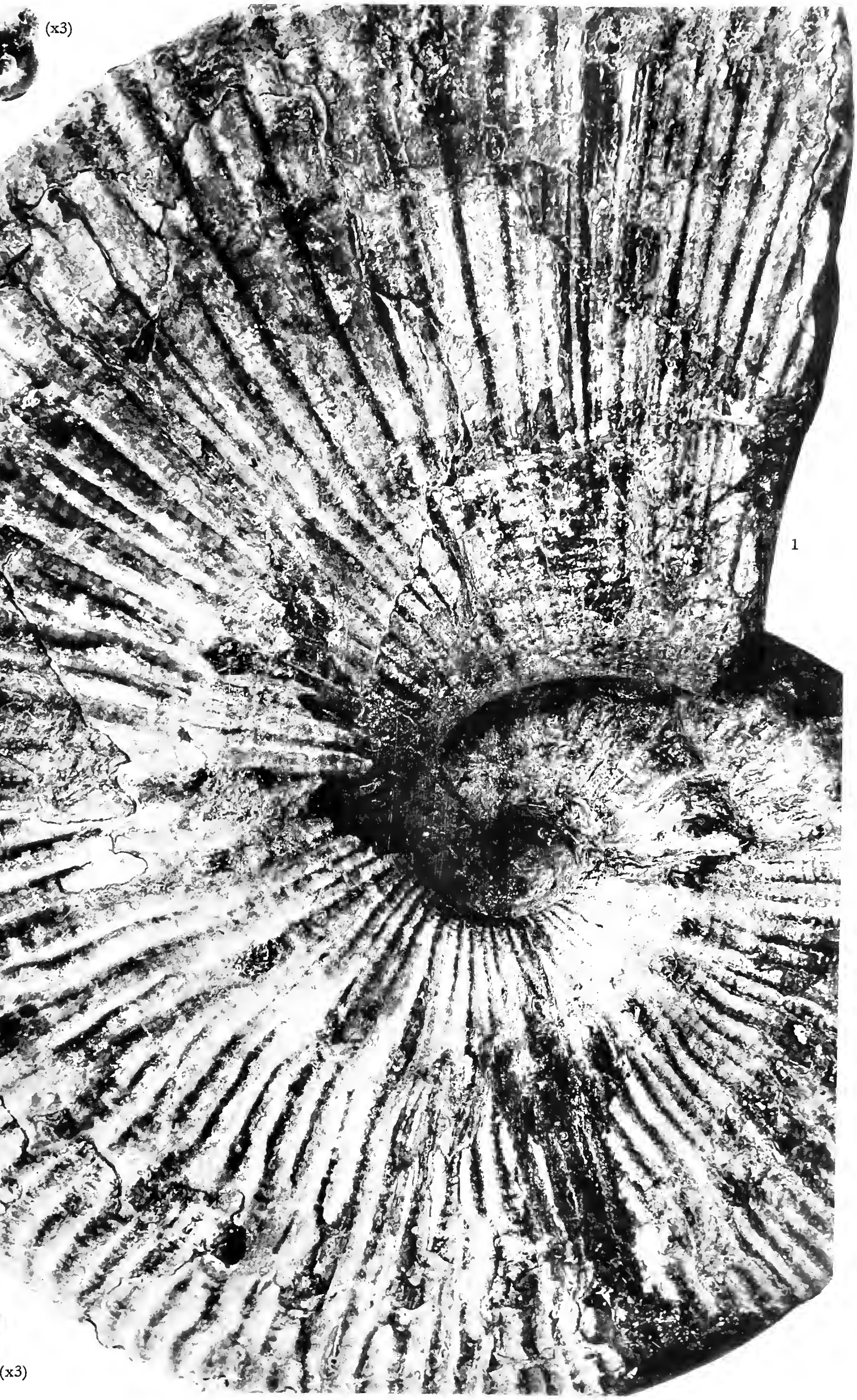
EXPLANATION OF PLATE XXIV

FIG. 1. *Liparoceras* (*Becheiceras*) *bechei* (J. Sowerby). Part of a very large example [from the Red Band (bed 126, *bechei* sub-zone)]. Dorset coast. (No. C. 1.) Page 74.

,, 2 *a*, *b*. *Amaltheus ?* sp. juv. (Transition from *Oistoceras ?*.) Enlarged ×3. *Figulinum* sub-zone (bed 130). Stonebarrow, Charmouth. (No. C. 39439.) Page 32.

(x3)

2a



1

2b

(x3)

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PLATE XXV

EXPLANATION OF PLATE XXV

FIG. 1 *a*, *b*. *Liparoceras* (*Parinodiceras*) *parinodus* (Quenstedt). For comparison with fig. 2. *Jamesoni* zone. Nürtingen, Wurtemberg. (No. C. 38788.) Page 82.

,, 2 *a*, *b*. *Liparoceras* (*Becheiceras*) *gallicum* Spath. Typical specimen from the *davoei* zone of Subles, Calvados, France. (No. C. 38619.) (For comparison with fig. 1.) Page 77.

,, 3 *a*–*c*. *Platynoticeras haugi*, sp. nov. Holotype, with suture-line (natural size). *Jamesoni* zone. Nürtingen, Wurtemberg. (No. C. 38793.) Page 89.

,, 4. *Liparoceras* (*Parinodiceras*) *parinodus* (Quenstedt). Peripheral view of example transitional to var. *stenonotus*, nov. Same bed and locality. (No. C. 38790.) Page 82.

,, 5 *a*, *b*. *Liparoceras* (*Parinodiceras*) *parinodus* (Quenstedt), var. *stenonotus*, nov. Transition (?) to *Platynoticeras alterum* (Oppel). Same bed and locality. (No. C. 38791.) Page 82.

,, 6 *a*, *b*. *Platynoticeras alterum* (Oppel). Typical example. Same bed and locality. (No. C. 38797.) Page 88.

,, 7–9. *Oistoceras* aff. *allæotypus* Trueman. Doubtful inner whorls from *Oistoceras* Bed. (7) Kilsby, Northants (No. C. 38846); (8) Bracebridge, Lincs. (No. C. 38845), and (9) Road, Northants (No. 20942). Page 177.

,, 10 *a*–*c*. *Amaltheus ?* sp. juv. (Transition from *Oistoceras*.) Natural size (*a*) and enlarged ×2 (*b*–*c*). For suture-line, see Plate XXIII, fig. 17. *Figulinum* sub-zone (bed 130). Stonebarrow, Charmouth. (No. C. 38978.) Page 32.

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PLATE XXVI

EXPLANATION OF PLATE XXVI

FIG. 1 *a*, *b*. *Oistoceras* aff. *crescens* (Hyatt) Trueman sp. Transition to *O. allœotypus* (Trueman). *Oistoceras* Beds. Leicestershire. (No. C. 38898.) Page 178.

,, 2. *Androgynoceras hybrida* (d'Orbigny). Cast of specimen No. 1673 B in the d'Orbigny Collection (Musée d'Histoire Naturelle, Paris) from "Vallée de Lose" (Pouilly, Côte d'Or ?) believed to be original of pl. lxxxv, figs. 1–2, of d'Orbigny. (Base of *lataecosta* sub-zone ?.) Page 133.

,, 3 *a*, *b*. *Oistoceras angulatum* (Quenstedt). Transition to *Androgynoceras* aff. *capricornus* (Schlotheim). Upper *davoei* zone. Gundershoffen, Alsace. (No. 24565*b*.) Page 171.

,, 4 *a*, *b*. *Oistoceras* aff. *colubrinum*, sp. nov. Transition to *O. crescens* (Hyatt) Trueman sp. History unrecorded (*Oistoceras* Beds, Lincs ?). (No. C. 38899.) Page 174.

,, 5 *a*, *b*. *Androgynoceras maculatum* (Young & Bird), between var. *intermedia*, nov. and var. *atavus*, nov. *Maculatum* sub-zone ?. Stroud, Glos. (No. C. 10014.) Page 126.

,, 6 *a*, *b*. *Oistoceras sinuosiforme*, sp. nov. With mouth-border. *Oistoceras* Bed. Bracebridge, Lincs. (No. C. 38902.) Page 167.

,, 7. *Oistoceras sinuosiforme*, sp. nov. Peripheral aspect of a large example. Same bed and locality. (No. C. 38901.) Page 167.

,, 8. *Oistoceras* sp. ind., aff. *sinuosiforme*, sp. nov. Peripheral view. Upper *davoei* zone. Tranzault, Indre, France. (No. C. 28067.) (For suture-line, see Text-fig. 4 *j*, p. 9.) Page 167.

,, 9 *a*, *b*. *Oistoceras* aff. *sinuosiforme*, sp. nov. Slender variety. *Oistoceras* Beds. Bracebridge, Lincs. (No. C. 38918.) Page 167.

,, 10 *a*, *b*. *Oistoceras angulatum* (Quenstedt). Same bed and locality. (No. C. 38928.) Page 171.

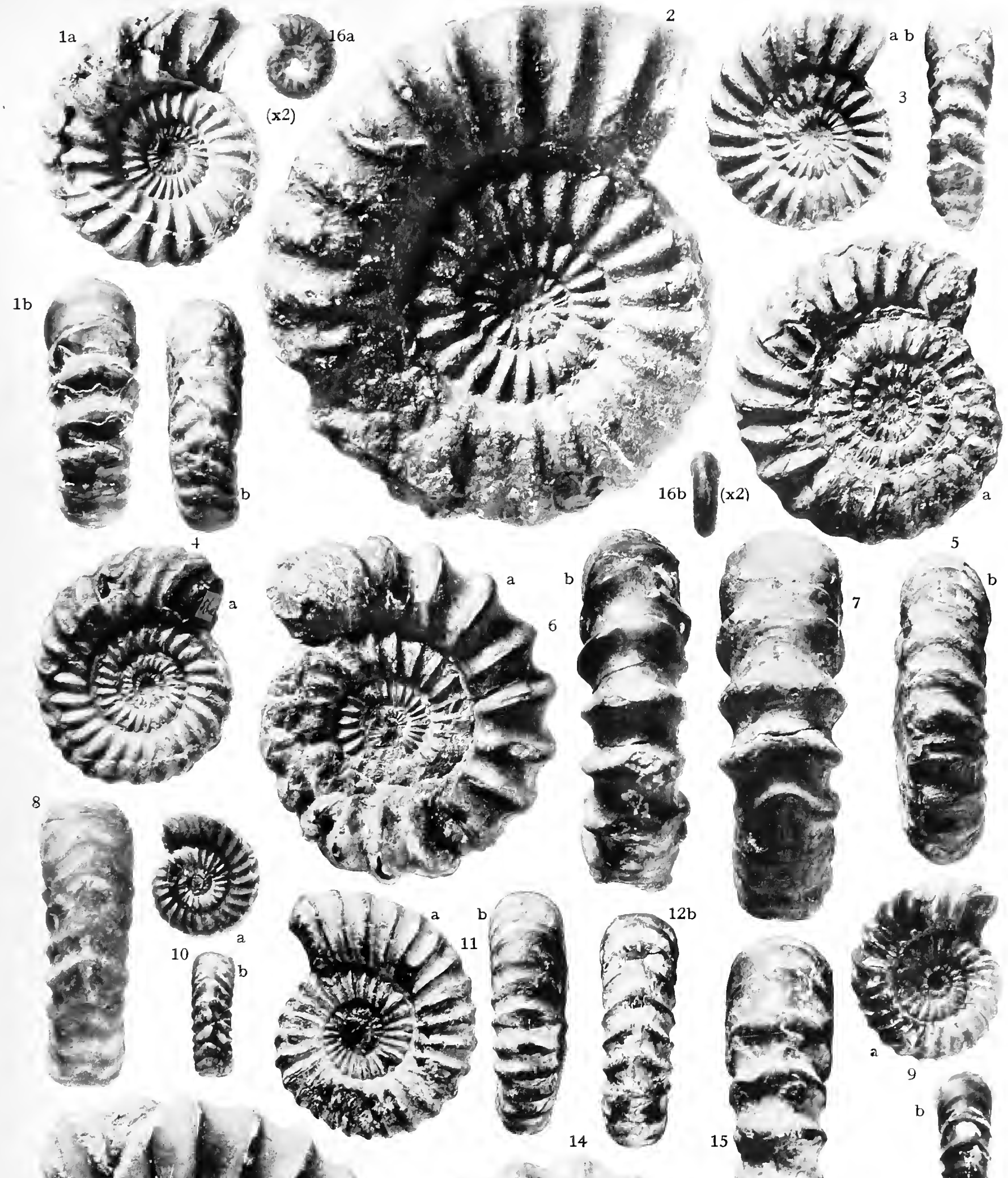
,, 11 *a*, *b*. *Androgynoceras* sp. Probably inner whorls of var. *recticostata* of *A. brevilobatum*, showing great resemblance to *A. capricornus*, except in ventral ribbing. Locality doubtful (Kilsby Tunnel, Northants ?). (No. 22153.) Page 154.

,, 12 *a*, *b*. *Oistoceras angulatum* (Quenstedt). Transition to *Androgynoceras* aff. *capricornus* (Schlotheim), like fig. 3. *Oistoceras* Beds. Bracebridge, Lincs. (No. C. 38929.) Page 171.

,, 13 *a*, *b*. *Androgynoceras capricornus* (Schlotheim). Upper *lataecosta* sub-zone. Cheltenham, Glos. (No. C. 38867.) Page 149.

,, 14, 15. *Androgynoceras brevilobatum* (Trueman) var. *recticostata*, nov. Side-view of type example from Cheltenham, Glos. (No. 67929) and ventral view of example from Leckhampton, Glos. (No. C. 28167). *Lataecosta* sub-zone. Page 154.

,, 16 *a*, *b*. Gen. nov. (*Oistoceras ?*) sp. juv. (Transition to *Amaltheus ?*). Enlarged ×2. (For suture-line, see Plate XXIII, fig. 16.) *Figulinum* sub-zone (bed 130). Westhay Water, E. of Charmouth. (No. C. 38977.) Page 32.



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