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THE CRETACEOUS AMMONOIDEA OF EASTERN AUSTRALIA.

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GEOLOGICAL SURVEY OF QUEENSLAND.

(Plates XXXIV.-XLI.)

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INTRODUCTION.

THE present paper is an attempt to revise the ammonite fauna of the "Rolling Downs Formation" of Eastern Australia in the light of recent palæontological work in other countries. Hitherto no comprehensive attempt has been made to establish and correlate palæontological horizons within the formation; and it is to be hoped that the present review may serve as the basis of a more minute treatment of the whole fauna.

For very many years almost the sole worker on the fossils of the "Rolling Downs" has been the late Robert Etheridge junr. His patient,

detailed and richly illustrated work has paved the way towards a zonal treatment of the fauna; and the writer is deeply indebted to the fine series of monographs which Etheridge produced on the Cretaceous Palæontology of Australia. It is no reflection upon the work of Etheridge that in this paper, in accordance with recent developments, more modern generic determinations are used. Etheridge keenly appreciated the generic analyses of the mesozoic cephalopods; and much of the effective work on the Lower Cretaceous lineages has been done since the appearance of his last important paper on the Australian forms (1909).

The present examination, which has been carried out in the Sedgwick Museum, Cambridge, has been made possible largely by a grant from the University of Queensland. The material used has been drawn mainly from the collections of the Queensland Museum, Australian Museum and British (Natural History) Museum. To all these institutions the writer expresses his gratitude. To Mr. H. A. Longman, Prof. H. C. Richards, Mr. W. H. Bryan and Sir Edgeworth David for constant interest in the progress of the work; to Mr. H. Woods for general advice; to Mr. A. G. Brighton for critical and other assistance; and particularly to Dr. L. F. Spath for much ever-ready help and kindly criticism he is deeply indebted.

STRATIGRAPHICAL AND GENERAL RESULTS.

Within the "Rolling Downs" two main series are apparent, which on both lithological and palæontological grounds are markedly distinct. The lower, to which the name *Roma Series* is now given, comprises the group of bluish clays (mainly) with calcareous concretions; the upper, for which the name *Tambo Series* is proposed, consists mainly of yellowish limestones often with cone-in-cone structure. Both series are widely distributed.

A. MORVEN BED.—The one specimen containing *Simbirskites spp.* is all the evidence so far available of this bed, which is the oldest marine mesozoic horizon known in Eastern Australia. It indicates the presence of the Simbirskitan stage of the Hauterivian.

B. ROMA SERIES.—The ammonite genera recorded from this series are: *Parahoplitoides* (?), *Aconeceras*, *Sanmartinoceras*, *Australiceras*,¹ *Tropæum*, *Toxoceratoides* and *Aioloceras*.¹ Three palæontological divisions are possible:—

- iii. Beds with *Sanmartinoceras* and *Aioloceras*;
- ii. Beds with *Tropæum* and *Aconeceras walshense*;
- i. Beds with *Australiceras* and *Toxoceratoides*.

As mentioned below the genus *Australiceras* is first known with certainty in the *bodei* zone of the Bedoulian (Lower Aptian) and is replaced in the *hillsi* zone of the Lower Gargasian by *Tropæum*. The beds with *Australiceras*.

¹ New genera (v. inf.).

correspond therefore to the Upper Bedoulian. Whether any of the Lower Bedoulian is present is uncertain. The four zones of the Upper Bedoulian (*bodei*, *weissi*, *hambrovi* and *consobrinoides*) cannot be recognised at present, though *Australiceras robustum* is probably low zonal while *A. transiente* most probably occurs at the top of the beds.

The beds with *Tropæum* naturally correspond to the Tropæuman of Europe (Lower Gargasian). Species of *Tropæum* are abundant, the only other genus recorded being *Aconeceras* (*A. walshense*).² As mentioned below the vertical ranges of *Australiceras* and *Tropæum* may overlap, so that there may be a very indefinite junction between these two divisions.

The highest division of the Roma Series has yielded *Aioloceras jonesi*, *Sanmartinoceras fontinale* and *S. olene*. *Sanmartinoceras* is restricted to the top of the Gargasian; while *Aioloceras*, from its position in the section in Patagonia, is apparently also Upper Gargasian.

If the deposition of the Roma Series was continuous, then the series ranges at least from the *bodei* to the *aschiltaensis* zone of the Aptian (*Sanmartinoceras* defines the latter zone). But there is no evidence at present that it extends into the Lowest Albian as it may do in the central (concealed) portion of the area. Ammonites from all three divisions have been found in the Queensland areas; but in New South Wales and South Australia the upper division only has yielded ammonites (*Parahoplitoides*? *sp.*, however, from South Australia may be from the lower (*Australiceras*) division). But the evidence, to be published later, of the other elements of the fauna shows that all three divisions are well represented in these States.

C. MARYBOROUGH BEDS.—As shown by Richards (82, p. 182) and others these beds are composed of a lower (sandstone) and an upper (chert) division. The sandstones have yielded fragments of *Australiceras jacki* but no ammonites are known from the cherts. The sandstones, therefore, from their ammonite remains correspond to part of the lower division of the Roma Series. The writer hopes to show in a later paper, when considering the Lamellibranchs, that the whole of the Maryborough Marine beds are to be correlated with the *Australiceras* beds of the Roma Series.

D. TAMBO SERIES.—The ammonite genera recorded from the Tambo Series are: *Puzosia*, *Beudanticeras*, *Prohysterocheras*, *Inflatoceras*, *Hamites*, *Anisoceras*, *Labeceras*,³ *Appurdiceras*,³ *Myloceras*,³ *Aleteceras*,³ and *Flindersites*.³

The species of *Prohysterocheras* and *Inflatoceras* are shown to be characteristic of the upper *orbigny* and the *varicosus* zones of the Upper Albian and the specimens are preserved in a deep yellow, marly limestone. Specimens

² *Aconeceras walshense* is placed in this division from the agreement of its matrix with that of *Tropæum rarum* rather than with that of the species of *Australiceras* from the same locality.

³ New genera (v. inf.).

of *Flindersites baccatus*, *Aleteceras plectoides*, *A. tardicostatum*, *A. nautiloides*, *Myloceras ammonoides*, *M. davidi*, *Labeceras bryani*, *L. compressum*, *Puzosia longmani*, etc., also occur in this type of matrix and no doubt represent the same horizon.⁴ The matrix of the specimens examined of *Beudanticeras flindersi*, *B. (?) daintreei*, *Flindersites intermedius*, *Myloceras orbiculus*, *Hamites* aff. *maximus*, etc., is rather lighter in colour. This may represent local variations of the other matrix or may point to a slightly different horizon for these species. Since the species of *Beudanticeras* and *Hamites* do not give any very definite indication of their zonal position within the Upper Albian, it is tentatively assumed that these species represent the same horizon as *Prohysterocheras richardsi*, etc.

The position of the Tambo Series is, therefore, Upper Albian, and at present there is no evidence of more than the *orbigny* and *varicosus* zones being present.

CONVENTIONS.

The nomenclature used throughout this paper for specific descriptions is that of Buckman (11) and Spath (101, p. 7). The terms "crioceratid," "ancyloceratid," etc., are used to denote types of coiling and not to indicate relationships with the genera *Crioceras*, *Ancyloceras*, etc.

Dimensions are given according to the generally adopted plan instituted by Buckman, where the first numeral gives the diameter in mm., the other three numbers being (in order) the whorl-height, whorl-thickness and width of umbilicus, reckoned as percentages of the diameter. Where a number is inserted in brackets after the first numeral, as e.g. in the topotype of *Aconeceras walshense*, the first number is the maximum diameter noted, while that in brackets is the diameter at which the other dimensions are taken. The Greek letter ϕ is attached in such cases where the measurements are taken from a published figure and not from the actual specimen.

In comparing fragments of crioceratids the writer proposes an additional method of measurement. Two numbers are given (as in the case of *Aleteceras tardicostatum*), the first of which is the maximum height of whorl in mm., and the second is the width of whorl given as a percentage of the height. Such measurements are prefixed by the Greek letter θ . In cases where measurement is made from a published figure and not from the original specimen the letter ϕ is used as well (see *Tropæum leptum*).

The zonal nomenclature used is that of Dr. Spath (99 and 100), to whose comprehensive and detailed work on the Cretaceous the author is particularly indebted.

⁴ A specimen of *Flindersites baccatus*, in the writer's collection, is associated, in the hand specimen, with *Prohysterocheras richardsi*.

The following abbreviations have been used to indicate the collections in which types and other specimens are lodged:—

- A.M.—Australian Museum (Sydney).
 B.M.—British Museum (Natural History).
 F.W.W.—The author's collection.
 G.S.Q.—Geological Survey of Queensland.
 G.S.S.A.—Geological Survey of South Australia.
 Q.M.—Queensland Museum.
 N.M.—National Museum (Melbourne).
 M.G.M.—Mining and Geological Museum (Sydney).
 M.M.—Macleay Museum (University of Sydney).
 R.D.—Daintree Collection (now in the Queensland Museum).
 U.Q.—University of Queensland.

ON HETEROMORPHIC AMMONOIDEA.

Probably the most notable feature about the ammonoid faunas of the Cretaceous of Eastern Australia is the profusion of heteromorphic forms. Yet, strangely enough, no helicoid genus has been found in these beds. Many of the genera present are inadequately known from other areas, and consequently Etheridge, who appreciated fully the richness of the fauna in these aberrant types, left them all provisionally in *Crioceratid* sensu lato.

According to the theory of cyclical development, crioceratid forms were regarded as the phylogerontic stage of cycles of genera all with more or less the same general trend. But the recent work of Spath and Salfeld has cast grave doubts on this theory, and has shown that it is far more probable that the two persistent leiostrachous stocks, *Phylloceratidæ* and *Lytoceratidæ*, have been the main sources from which the transient waves of the normal trachyostrachous ammonoids have developed. *Lytoceratidæ* and *Phylloceratidæ* in most features are at opposite extremes—the one being extremely evolute with a septal suture having the minimum number of major indentations, the other with highly involute whorls and a septal suture with a profusion of accessory lobes. Crioceratid forms could be produced from these stocks in three main ways:—

- (1) They may be end points of offshoots from *Phylloceratidæ*, the lineages having passed through all degrees of normal volution on the way;
- (2) They may be derived directly from *Lytoceratidæ*, which, in their extreme involution, are but one step removed from crioceratid coiling; or
- (3) They may be derived indirectly from *Lytoceratidæ*, occurring at a late stage in a lineage which has passed through other modifications before developing "uncoiled" forms.

It might naturally be expected, therefore, that most crioceratids are directly derived from *Lytoceratidæ*, and the essential simplicity⁵ of the venter

⁵ Fastigate, carinate, or sulcate forms being unknown.

in all such forms might also suggest this. But such genera as *Distoloceras* and *Astiericeras* give evidence that many stocks of normal trachyostrachous ammonites produce "uncoiled" forms.

The details of septal sutures are of interest. In the normal large lytoceratids the suture is of the essential (I.U.L.E.) type; and without exception this type of suture is a feature of the heteromorphic forms. But this agreement in sutural plan among the latter has no genetic significance (even in tracing ancestry), for there can be no doubt that this type of suture is merely due to the mode of coiling. This is well seen in the genus *Distoloceras*, which has both "coiled" and "uncoiled" species; for in the former there are accessory lobes present, whereas in the latter the sutures are of the I.U.L.E. type. Zittel (116, vol. i., p. 332), Spath (95, p. 28), and others have drawn attention to the modification of septal suture due to the whorl shape. It may be pointed out that in the *Lytoceratidæ* the large forms (*Lytoceras* s. str., *Thysanoceras*, etc.) the septal sutures are of the I.U.L.E. type, while the smaller forms (*Gaudryceras*, *Alocolytoceras*, etc.) have accessory lobes. But unfortunately the complete development of a large lytoceratid has never been made, and even in the small *Gaudryceras* (?) *alamadense* developed by Perrin Smith⁶ there is reduction of sutural elements.

The sutural simplification in, e.g., *Baculites* has been adduced as evidence of a benthonic habit. But many crioceratids, e.g. *Tropæum*, have quite complicated sutures; and this throws doubt upon the idea sometimes advanced that all crioceratids were benthonic. Certainly the increased fragility due to loose coiling would hinder rapid motion through the water; but this is compensated for by the increased thickness of shell which these forms attain.

But even though the number of lobes and saddles is reduced to the minimum, yet the details of the indentations of the septal sutures are still of service in tracing generic affinity, while the type of ornamentation is of fundamental importance.

DESCRIPTION OF SPECIES.

A. NEOCOMIAN SPECIES.

Family SIMBIRSKITIDÆ Spath.

Genus SIMBIRSKITES Pavlow (emend. Spath).

SIMBIRSKITES SPP. NOV.

1909 *Perisphinctes kayseri* (non Neumayr and Uhlig) Etheridge Jr. (30), p. 238, pl. 68.

The two associated specimens figured by Etheridge were regarded as the same species and identified by him with the *Perisphinctes kayseri* Neumayr and Uhlig (65, p. 146, pl. 19, fig. 1) of North Germany. But the German and Australian specimens differ considerably in proportions and cannot therefore be specifically identical.

⁶ Proc. California Acad. Sci., Ser. 3, Geol., vol. i., 1898, pp. 138 *et seq.*

The zonal place of the large (*kayseri*) group has sometimes been misstated. Buckman (11, vol. iv., p. 16), e.g., by analogy with the Mexican *Proniceras*, has lately placed it even in the Lower Tithonian. But Spath (103, p. 87), in restricting *Simbirskites* to the *decheni* group with trifurcating ribs, has placed it in its true position in the Upper Hauterivian.⁷ From Etheridge's figure (the specimens have not been seen by the writer) *S. kayseri* is the most similar form but has less rapidly increasing whorls. At the same time, however, it must be remembered that his specimen is considerably larger than the holotype of *S. kayseri*. The septal suture seems to be definitely simbirskitid. Most of the species of *Simbirskites* are known only from young specimens, which makes the comparison of this large form difficult. The large species figured by Neumayr and Uhlig (*S. hauchecornei*, *S. inverselobatus*, etc.) are less widely umbilicate, while *Perisphinctes losseni* Neumayr and Uhlig (65, p. 144, pl. 18) is probably a *Speetoniceras*.

The smaller specimen, which is probably a different species, is of the more normal⁸ *Simbirskites* type.

Since the writer has not seen the specimens⁹ it is not definitely established that the species do not belong perhaps to an earlier genus (e.g. the Kimmeridgian *Virgatites*), although their resemblance to *Simbirskites* is so strong. But they certainly represent the oldest marine mesozoic horizon yet known in Eastern Australia.

Simbirskites has been recorded (50, p. 114) though not figured from New Caledonia.

Locality.—Victoria Downs, Morven (Q.M. Coll.).

B. APTIAN SPECIES.

Family ACONECERATIDÆ Spath.

Two genera only, both represented in the "Rolling Downs," have hitherto been included in this family—*Aconeceras* Hyatt¹⁰ and *Sanmartinoceras* Bonarelli. In erecting the genus *Aconeceras* Hyatt (41, p. 100) called attention to its phylloceratid characters, particularly the details of the septal suture, though he included it in the later family *Coilopoceratidæ*. But, from his manuscript notes,¹¹ he finally placed it "with the *Desmoceras* group" in *Phylloceratidæ*. Spath also has suggested that the family is derived from

⁷ Large specimens of these *Simbirskites* have been found by the writer in bed C₄ at Speeton.

⁸ Compare e.g. *S. payeri* (Toula) Pavlow (72, p. 148, pl. 11, fig. 1).

⁹ Since the above description was written the writer has been able to examine the specimens and confirm their position within the genus *Simbirskites*. A further note on these forms will appear in a later paper.

¹⁰ = *Adolphia* Stolley (105), p. 269.

¹¹ See footnote by J. P. Smith to Hyatt (41, pp. 100, 101).

Desmoceratidæ (101, p. 35). But the approximation of the earlier genus, *Aconeceras*, to *Phylloceras* in involution, ornament and septal suture gives evidence of a direct connection with *Phylloceratidæ*, and the view is here held that, like *Desmoceratidæ*, it is an independent branch from *Phylloceratidæ*.

The aconeceratid type of shell—i.e., an oxyconic form with falciform radial line and complicated septal suture of the phylloceratid type—is perhaps the most recurrent among the many oft-recurring types of trachyostrachous ammonites. The Lower Lias *Oxynotoceras* is an early type while the Mæstrichtian *Pseudoschlenbachia* (*umbulazi* group) is the last. On the theory of cyclical development such forms have been regarded as end points of series passing from an original capricorn type. But it is far more probable that these genera are heterochronous homœomorphs very close to *Phylloceratidæ*.¹² The Bajocian and Bathonian with *Lioceras*, *Strigoceras*, etc. is particularly rich in such forms. Comparison with *Strigoceras* is interesting, for similar concentric ornamentation typical of that genus is to be seen on *Aconeceras walshense* (Etheridge fil.).

The family ranges throughout the Aptian but is unknown in the Neocomian or Albian. Stolley (106, p. 217), it is true, has a zone of *Sanmartinoceras trautscholdi* which has sometimes been placed in the Lower Albian; but from the association of that species with *Parahoplites*, etc., it belongs to the uppermost Aptian. *Aconeceras* ranges through the Bedoulian and Lower Gargasian, and in the Upper Gargasian is replaced by *Sanmartinoceras*. But in the Bedoulian there is an offshoot from *Aconeceras*, **THEGANECERAS** gen. nov.,¹³ which closely simulates *Sanmartinoceras*, and, as indicated below, probably accounts for certain records of the genus *Sanmartinoceras* in the Bedoulian.

Genus ACONECERAS Hyatt.

Specific distinctions within this genus are not easy to define. Stolley (106, pp. 211, 215) has recorded *A. nisus* (d'Orbigny) from the *sparsicosta* zone (the lowest zone of the Aptian) and *A. nisoides* (Sarasin) from the *bodei* zone of the Bedoulian. On the other hand Haug (38, p. 1170) places *A. nisus* as Lower Gargasian; and Kilian has recorded (48, p. 338) *A.*

¹² Interesting evidence on this point is given by the ornamentation. Most of the genera have the simple costulæ ("striæ") which are typically developed on *Phylloceras*; but on many lineages peripheral costation is suddenly developed similar to that of the phylloceratid *Tragophylloceras ibex* (Quenstedt). In that species, however, the course of the costæ and the costulæ does not correspond, and a costula may transgress two costæ as shewn by an example in the Sedgwick Museum Collection. This may be paralleled in the trachyostrachous oxycones, and a similar transgression of the peripheral costæ is seen e.g. in "*Hebetoxytes*" *incongruens* Buckman (11, vol. v., pl. 497) from the Bajocian.

¹³ *θηγανη*, a whetstone; genotype *Oppelia scalata* von Koenen (51, p. 54, pl. xlv., fig. 6). The genus is ribbed like *Sanmartinoceras* but the ribs are finer and more numerous. The septal suture is characterised by broad, short saddles. Other species are *T. falcatum* (v. Koenen), *T. "nisoides"* (pars) (v. Koenen non Sarasin).

nisoides as Bedoulian and *A. nisus* as Gargasian. In a later paper, however, Kilian¹⁴ places *A. nisoides* also as Gargasian. Kilian and Haug therefore both agree in placing *A. nisoides* as Gargasian, only Stolley disagreeing in recording it in the Bedoulian. The specimens figured under this name from Zululand by Spath (96, pl. 26, fig. 4) and Delagoa Bay by Krenkel (54, pl. 17, fig. 1) are both recorded with Gargasian species.

Danford, however, figures a Speeton form as *A. nisoides* (19, pl. 14, fig. 7) which has been shown by Spath (103, p. 83) to belong to the *bidentatum* zone of the Bedoulian. The thickness of these figured specimens, given as a percentage of the whorl diameters, are—

A. nisoides (holotype) 21%; Speeton (Danford) 25%;
Zululand (Spath) 23%; *Basses Alpes* Specimens (B.M. Coll.) 21%;
Delagoa Bay (Krenkel) 22%.

Danford's specimen is thus thicker than the true *nisoides* and requires another specific name. It is probable, therefore, that Stolley's "*A. nisoides*" from the Bedoulian is this species rather than the true *nisoides*, which must be considered (? Lower) Gargasian. Von Koenen has recorded *A. nisoides* (51, p. 51) from the Bedoulian; but some of his specimens belong to *Theganeceras*, and it is doubtful if he has a form (even pl. 16, fig. 6) which is comparable with *nisoides*.

The horizon of such unfigured forms as that of Coquand (14, p. 46), e.g., is of course unknown.

ACONECERAS WALSHENSE (Etheridge fil.).

Pl. XXXIV., figs. 1 *a*, *b*; Pl. XXXVII., fig. 3.

1892 *Ammonites (Amaltheus) walshense* Etheridge Jr. (42), p. 493, pl. 42, figs. 10, 11.

Sp. Chars.—Coiling oligogyral, angustumbilicate, concavifastigate; sides slightly curved, convergent; anguliradiate, radial line with long peripheral projection; ornamentation by radial costulæ and a few mediolateral concentric costulæ; septal suture complicated, with many auxiliary lobes.

Dimensions.—

Holotype (Q.M. Coll.): ϕ 78. 58. 16. 13.

Topotype (Q.M. Coll.): $\left\{ \begin{array}{l} 80 \text{ (68). } 54. 18. 13. \\ 49. 56. 19. 14. \end{array} \right.$

Remarks.—This species is the largest known member of the genus and is particularly distinguished by the long peripheral curve of the radial line. It is most similar to *A. nisoides* (Sarasin) (84, p. 155, pls. 4-6, fig. 10), which it resembles closely in proportions, ornament, and septal suture. The numerous radial costulæ which characterise *A. nisoides* are present on *A. walshense*,

¹⁴ Trav. Lab. Géol. Univ. Grenoble, vol. xii., 1919, p. 94.

and both species have the mediolateral concentric costulae. Besides the difference in radial line *A. walshense* may be distinguished by its whorl section. *A. nisus* (d'Orbigny) (69, p. 184, pl. 55, figs. 7-9) and *A. aptiana* (Sarasin) (84, p. 155, pl. 4-6, fig. 12) also have different whorl sections, while the latter species, in its ornament, is transitional to *Sanmartinoceras*.

The species had been compared by Etheridge with forms belonging to several oxyconic genera, including *Amaltheus*, *Forbesiceras*, etc.

Locality.—Walsh River (Q.M. Coll.; holotype and others).

Genus SANMARTINOCERAS Bonarelli.

Sanmartinoceras includes the costate *Aconeceratidæ* of the Upper Gargasian. Stolley had recorded it from the Aptian of Ahaus (106, p. 217), where it is associated with *Parahoplites schmidti* and represents the uppermost Gargasian. Stolley (106, p. 215) has, however, recorded *S. haugi* (Sarasin) from the Bedoulian. This is certainly an error and perhaps the species meant was a *Theganoceras*.

In 1880 Prof. W. J. Stephens¹⁵ recorded "*Ammonites biflexuoides*" from New South Wales. Such a specific name might refer to any member of the *Aconeceratidæ*. It is possible that Hudleston's later *Am. fontinale* may be indicated; but unless the specimen be found the name *biflexuoides* must be abandoned.

SANMARTINOCERAS FONTINALE (Hudleston).

1890 *Ammonites fontinalis* Hudleston (39), p. 241, pl. 9, fig. 1.

1902 *Amaltheus* sp. ind. Etheridge Jr. (25), p. 45, pl. 7, fig. 8.

1924 *Sanmartinoceras fontinale* Spath (103), p. 74.

Sp. Chars.—Coiling oligogyral, angustumbilicate, compressed; concavifastigate; sides subparallel; anguliradiate with costation which diminishes towards the umbilicus.

Dimensions.—Holotype (B.M. Coll.): 25. 50. 26. 19.

Remarks.—Three other species of *Sanmartinoceras* have been described—the genotype *S. patagonicum* Bonarelli (6, p. 27, pl. 5, figs. 3-6), *S. trautscholdi* (Sinow) (90, pl. 5, fig. 6) and *S. haugi* (Sarasin) (84, p. 156, pl. 4-6, figs. 11). Kilian (48, p. 337) has suggested that the last two are identical; but, although very similar, they must probably be regarded as distinct since, as figured by Sinow, *S. trautscholdi* has the ribs continued to the umbilicus, whereas in *S. haugi* this is not so. Stolley (106, p. 217) records the former from Germany; but a specimen of *S. aff. trautscholdi* from near Lehrte (N.W. Germany) in the British Museum Collection has a wider umbilicus though, in that specimen, it widens with age.

¹⁵ Proc. Linn. Soc. N.S. Wales, vol. viii., pt. 2, p. 281.

In having the ribs only on the ventro-lateral region *S. fontinale* is most similar to *S. haugi* and *S. patagonicum*. It is closer to the former in size and intensity of ribbing. A new species in the B.M. collection (c. 14366) from Germany has a very much wider umbilicus.

Localities.—Primrose Springs (B.M. Coll. holotype); Lake Eyre Basin (Tate Coll.).

SANMARTINOCERAS OLENE (Tenison-Woods).

Pl. XLI., fig. 3.

1883 *Ammonites olene* Tenison-Woods (109), p. 150, pl. 7, fig. 8; pl. 8, fig. 1.

1892 *Ammonites (Amaltheus) olene* Etheridge Jr. (42), p. 492, pl. 30, fig. 4.

1901 *Amaltheus olene* Etheridge Jr. (24), p. 32, pl. 2, fig. 4.

Sp. Char.—Coiling oligogyral, angustumbilicate, compressed; concavifastigate; sides subparallel; anguliradiate with costæ diminishing towards the umbilicus; costate portion begins very late; septal suture complicated, densisepate.

Dimensions.—Q.M. Coll. $\left\{ \begin{array}{l} 56. 56. 20. 11 \\ 37. 56. 23. 13. \end{array} \right.$

Remarks.—It is of interest that, since the related *Aconeceras walshense* is the largest member of its genus, the present species is the largest *Sanmartinoceras*.

The figure given by Etheridge in 1901 (24, pl. 2, fig. 4) of this species is somewhat incorrectly drawn.¹⁶ The ribs were represented as rectiradiate whereas the course is typically falciform.

Etheridge believed that *S. olene* and *S. fontinale* represented but one species. There is certainly a considerable amount of variation in the forms that must be included in *S. olene*; but there seems to be a distinct specific difference between the forms from North Queensland (*S. olene*) and those of the Lake Eyre Basin (*S. fontinale*) in that, on the latter species, costation begins at an earlier stage than on *S. olene*.

S. patagonicum is apparently the most closely related species outside Australia, although *S. trautscholdi*, in which costation is not so prominent, is also close.

Localities.—Palmer River (M.M. Coll., holotype); Walsh River (G.S.Q. and Q.M. Colls.).

Family PARAOPLITIDÆ Spath.

This important family, which includes such genera as *Parahoplites*, *Parahoplitoides*, *Stenhoplites*, *Dufrenoyia* and *Columbiceras*, is only doubtfully known in Australia from a single fragment. The family has a wide distribution; and, considering the large collections of Aptian Ammonites known from the Roma Series, the apparent rarity or absence of the group is remarkable.

¹⁶ The specimen has been examined by the writer.

Genus PARAOPLITOIDES Spath.

PARAOPLITOIDES (?) SP.

1901 *Haploceras daintreei* Etheridge Jr. (non Etheridge Sen.) (25), p. 44, pl. 7, fig. 1.

This South Australian specimen was thought by Etheridge to be an aged example of *Puzosia daintreei*. But the type of ribbing (particularly the straightness of the costæ) is rather against this. The species may be a specialised form of *Parahoplitoides*, similar perhaps to *P. læviusculus* (von Koenen) (51, p. 224, pl. 8, figs. 4, 5). The type section of *Parahoplitoides* has rather flexed costæ as shown on *P. deshayesi* (Leymerie) (56, pl. 17, fig. 17); but species with more or less straight costæ are common.

Locality.—Dulkaninia Bore at a depth of 1,400 feet (Brown Collection).

Family CLEONICERATIDÆ nov.

The family is proposed for *Pseudosaynella* Spath, *Aioloceras* gen. nov. (v. inf.), *Cleoniceras* Parona et Bonarelli and *Sonneratia* Bayle. *Pseudosaynella*, which connects the family with *Aconeceratidæ*, might well be included in either family for it is closely related to *Aconeceras*. It is most probable that *Aioloceras*, which apparently gave rise to *Cleoniceras*, is directly derived from *Pseudosaynella*. The *balmense* group of *Cleoniceras* and the genus *Sonneratia* specialise in ornate forms; and it is not unlikely that even *Hoplitidæ* (via *Leymeriella*) may be in part derived from *Cleoniceratidæ*.

Genus AILOCERAS nov.¹⁷

Genotype *Cleoniceras argentinum* Bonarelli (6), p. 24, pl. 4, figs. 3, 6.

Diagnosis.—Platyconic shells with narrow venter; early whorls with sharp, falcate ribs, later whorls smooth; septal suture with narrow-stemmed bifid saddles, irregularly trifold L₁, and prominent suspensive lobe with a number of accessory lobes.

The genus includes *A. argentinum*, the "*Beudanticeras* cfr. *stoliczkai*" and "*Uhligella quercifolia*" of Bonarelli (6, pl. 3), and *Desmoceras jonesi* Gregory and Smith. It differs from *Cleoniceras* in the sharper ribs and absence of umbilical tubercle.

The Patagonian forms which were referred to the Albian genera *Beudanticeras* and *Cleoniceras* by Bonarelli occur in a bed below the horizon with *Sanmartinoceras patagonicum*, and, presumably, are Gargasian.

Although the genera *Aioloceras* and *Cleoniceras* are so similar there may be a slight hiatus between their ranges, for similar forms are not known from the lowest Albian. They may, therefore, possibly be homœomorphs in the same family.

¹⁷ αἰόλος, changing (i.e. in ornament).

AIOLOCERAS JONESI (Gregory and Smith).

1903. *Desmoceras jonesi* Gregory and Smith (36), p. 142, pl. 22.

The writer has not seen the type of this species, whose whorl-section has not been figured. But the description of the feature given by Gregory and Smith shows that it agrees in general with that of *A. argentinum* as it does in the other features of involution and ribbing.

In the ornamentation ceasing at an early stage the genus is more like *Cleoniceras* of the *cleon* type (d'Orbigny, 69, pl. 84, fig. 1) than like *C. seunesi* Bonarelli.¹⁸

The ribbing ceases at a slightly earlier stage than in most of the forms figured by Bonarelli, though it is most like *A. argentinum*. In the density of ribbing it is nearer to the typical form of that species rather than to *A. argentinum* var. *meseticum* (Bonarelli) (6, p. 24, pl. 4, fig. 7).

Unfortunately the ventro-lateral ornamentation of the early whorls of *A. jonesi* is not known, so that it is not certain whether the species possessed the rather *Cleoniceras*-like ribs which develop on *A. "stoliczkai"* (Bonarelli non Kossmat) (6, pl. 3, fig. 4).

The species had been compared to the *Ammonites beudanti* of Stoliczka (= *Beudanticeras stoliczkai*, Kossmat sp.). But, as Spath (101, p. 52) has stated, it has nothing to do with *Beudanticeras*.

Locality.—Mitchell River (Bourke Museum Coll.).

Family ANCYLOCERATIDÆ Hyatt (emend. nov.).

Hyatt (40, p. 587) included in this family the trituberculate heteromorphic genera of the Neocomian and Aptian, together with such widely different forms as the Lower Albian *Pictetia*. Even if restricted to the trituberculate genera the family is certainly heterogeneous. Most of the forms may be of more or less direct lycoceratid origin; but such genera as, e.g., *Distiloceras* have a more complex ancestry. *Ancyloceras* (s. str.) is found in the Lower and in the lower portion of the Upper Bedoulian, but its immediate ancestor is unknown. In the Upper (possibly at the top of the Lower) Bedoulian the new genus *Australiceras* (v. inf.) appears and is replaced in the Lower Gargasian by *Tropæum*. The inner whorls of *Australiceras* have trituberculation essentially of the *Ancyloceras* type; and it is most probable that this genus is derived directly from *Ancyloceras*. *Tropæum* is non-tuberculate; but the trituberculate *Australiceras* type is continued into the Lower Gargasian by the group of *A. (?) gigas* J. de C. Sowerby (92, vol. 6, p. 188, pl. 593, fig. 2). A specimen of *A. (?) aff. gigas* in the Sedgwick Museum collection shows that the early whorls were trituberculate similar to the

¹⁸ See Seunes (88), pl. 12, fig. 1.

normal *Australiceras*. Further the tubercles are regained on the body-chamber; so that the only difference from the *jacki* group lies in the ancyloceratid type of coiling. However, as shown by specimens figured by Sinzow (91), *Tropæum* includes both crioceratid and ancyloceratid types so that there may be little genetic significance in this feature. But since only ancyloceratid types of trituberculate forms are known in the Lower Gargasian the group may be natural and require separation. Further the Upper Bedoulian group of "*Ancyloceras*" *urbani* Neumayr et Uhlig (65, pl. 50) may connect the *gigas* group directly with *Ancyloceras* thereby making it homœomorphous with *Australiceras*. But whether the group is derived from *Ancyloceras* or *Australiceras* must be determined by detailed zonal collecting.

Following immediately upon the disappearance of *Tropæum* the genus *Ammonitoceras*¹⁹ makes its appearance. In every feature of size, ribbing, and coiling, even to the possession of similar coarse costæ on the body-chamber (see 17, pl. 6), the two genera are identical. But the whorls of *Ammonitoceras* have bituberculation. From these two criteria of direct replacement in time and perfect agreement but for tuberculation, it is believed that *Ammonitoceras* is directly derived from *Tropæum*. This implies that tuberculation is suddenly developed throughout; and not first produced on the body-chamber, spreading to earlier whorls in later species. Such abrupt changes are known in other cases; and it may be remarked that, as suggested below, the transition from *Australiceras* to *Tropæum* appears to be effected by the sudden loss of tuberculation.

It is therefore suggested that, instead of including such extraneous genera as *Crioceras* (s. str.), *Acrioceras* and *Distoloceras*, the family *Ancyloceratidae* should be restricted to the trituberculate *Ancyloceras* and *Australiceras*, the non-tuberculate *Tropæum* and the bituberculate *Ammonitoceras*. The relationship, if any, between the family and the micromorph genera *Toroeratoides* and *Tonohamites* is yet to be decided.

Genus **AUSTRALICERAS** nov.

Genotype *Crioceras jacki* Etheridge Jr.

Diagnosis.—Crioceratid shells with initial whorls trituberculate, later whorls without tubercles until the adult body-chamber which is trituberculate; costæ simple or bifurcating near the umbilical margin; septal suture I.U.L.E. with prominently bifid, relatively short-stemmed saddles and regularly trifid lobes.

The genus is proposed for a group of species richly represented in the Australian²⁰ Aptian but known also in India by *Crioceras australe* Waagen

¹⁹ See Dumas (21, p. 405, pl. 5). "*Ancyloceras*" *ackermanni* Krenkel, which was included in *Ammonitoceras* by Kilian, may however be an uncoiled *Chelonicerias* (49, p. 799).

²⁰ The genus is named from its typical development in this country.

non Moore (111, p. 246, pl. 60, fig. 1); in Russia by *Crioceras ramosseptatum* Anthula (3, p. 127, pl. 14, fig. 4), *Crioceras gracile* Sinzow (91, p. 327), etc.; and in England. In England it has been recorded²¹ from the *bodei* zone of the Bedoulian; while in India, from its association with *Parahoplitoides* and *Chelonicer*, *A. australe* (Waagen non Moore) represents an Upper Bedoulian horizon. The genus is apparently represented in the Aptian portion of the Hilsbildungen of North Germany; for one of Neumayr and Uhlig's figures (65, pl. 53, fig. 2) appears to represent an *Australiceras* with the mediolateral tubercle diminishing at the transition to the non-tuberculate stage. None of the Australian species has such small tubercles.

From its known occurrence in the *bodei* zone and from the fact that it gives rise to *Tropæum*, *Australiceras* has a range of the whole Upper Bedoulian. Whether it ranges down into the Lower Bedoulian is unknown. If the *gigas* group is also to be included the genus ranges into the Lower Gargasian. No member of that group, however, is yet known in Australia.

The genus had been compared by Boule (9, p. 181) to *Diadochoceras* (*nodosocostatum* group).

AUSTRALICERAS JACKI (Etheridge fil.).

(Pl. XXXIV., fig. 2.)

- 1880 *Crioceras jackii* Etheridge Jr. (23), p. 305, pl. 17, figs. 55-58.
 1892 *Crioceras australe* (pars) (non Moore) Etheridge Jr. (42), pl. 32, figs. 1, 2.
 1909 *Crioceras jackii* (pars) Etheridge Jr. (30), pl. 37, fig. 1; pl. 38, fig. 3.
 1913 *Crioceras australe* Richards (82), p. 182.

Sp. Chars.—Coiling crioceratid; whorl-section slightly depressed, sub-triangular; costæ rectiradiate, slightly flexed; initial whorls with fine tubercles on every rib, later whorls with prominent ribs with blunt or thorn-like prominent tubercles, and interspersed non-tuberculate ribs.

Dimensions.—

Holotype	77. 33. 43. 43.
(30, pl. 37, fig. 1)	90. 35. —. 48.
(30, pl. 38, fig. 3)	65. 36. —. 44.

Remarks.—The specific name was spelt *jackii* by Etheridge but is here emended to *jacki* to conform with the rules of nomenclature. Under this name Etheridge included many distinct forms, his interpretation of the "species" covering the genera *Australiceras* and *Tropæum* (pars). Specific distinctions are often difficult to define in heteromorphic genera; but several distinct groups are recognisable in the *Australiceras* of the "Rolling Downs."

²¹ Spath (103), p. 79. Recorded as *Ancyloceras* cf. *gracile* (Sinzow). The species is represented by four specimens in the Sedgwick Museum Collection, which have been examined by the writer.

The four figured specimens included above in the synonymy of this species differ in the number of ribs per whorl, but have common features in type of ribbing and tuberculation. A large number of specimens is required to determine the limits of variation. The specimen now figured has unusually large tubercles but must be retained in the species.

Localities.—Walsh River (Q.M. Coll.; holotype and other specimens); Hughenden (Q.M. Coll.); Woody Island, Hervey Bay (U.Q. Coll.)

AUSTRALICERAS IRREGULARE (Tenison-Woods).

(Pl. XXXVII, figs. 1 *a*, *b*.)

1882 *Crioceras irregulare* Tenison-Woods (109), p. 151, pl. 8, fig. 2.

1892 *Crioceras irregulare* Etheridge Jr. (42), p. 501, pl. 33, fig. 1; pl. 49, fig. 16.

1905 *Crioceras jackii* (pars) Etheridge Jr. (28), p. 14.

1909 *Crioceras jackii* (pars) Etheridge Jr. (30), p. 145.

Sp. Chars.—Coiling crioceratid; whorl-section circular; costæ wide, rounded; tubercles sharply defined.

Remarks.—Tenison-Woods's species was united with *A. jacki* by Etheridge, but it differs from it in whorl-section (not having a flattened dorsum) and in greater width of umbilicus. The figure of the holotype had the initial stage restored to show a widely open first whorl. But Etheridge (28, p. 14), who re-examined the type and developed the inner whorls, states that this restoration is quite unjustifiable and that the initial whorls were of the same type in coiling as those of *A. jacki* proper. On the specimen now figured the whorl previous to the one preserved (as shown by an impression on the matrix of the dorsum) was very close to the later whorl.

Localities.—Palmer River (M.M. Coll., holotype); Walsh River (Q.M. Coll., G.S.Q. Coll.).

AUSTRALICERAS aff. IRREGULARE (Tenison-Woods).

1909 *Crioceras jackii* (pars) Etheridge Jr. (30), pl. 35, fig. 1.

The large specimen figured by Etheridge has not been seen by the writer; but its initial whorls appear to be very similar to those of *A. irregulare*. The species becomes more closely coiled in later whorls. At the transition to the non-tuberculate stage the inner row of tubercles are still retained for a short period after the outer and median rows have disappeared.

Locality.—Walsh River (Q.M. Coll.).

AUSTRALICERAS ROBUSTUM sp. nov.

1909 *Crioceras jackii* (pars) Etheridge Jr. (30), pl. 32, fig. 1; pl. 33, fig. 1.

Sp. Chars.—Coiling erioceratid; whorls robust with early whorls septi-tuberculate; costæ fairly straight, rectiradiate; whorl-section depressed; septal suture very similar to that of *A. jacki*.

Dimensions.—

Holotype: ϕ 144. 37. 42. 40.

B.M. Coll.: 123. 41. 54. 38.

Remarks.—This species differs from other members of the genus in being prominently septi-tuberculate.²² The holotype, being an internal mould, only shows the truncate nature of the cast of the tubercles, but a British Museum specimen, with test preserved in places, shows the septate condition very well. Otherwise, in ribbing, whorl-section and thorn-like tubercles it is very similar to *A. jacki* but has the tuberculate stage persisting to a larger diameter. In both the holotype and the British Museum specimen tuberculation ceases at a diameter of 90 mm. The depressed whorl-section is another important feature distinguishing it from the other species. A young specimen in the Queensland Museum collection has earliest whorls of the *jacki* type but is septi-tuberculate at a diameter of 30 mm.

Both *A. robustum* and *A. jacki* are in some respects similar to *A. ramoseptatum* (Anthula) (3, p. 127, pl. 14, fig. 4), but differ in ribbing and tuberculation.

Localities.—South Central Queensland (A.M. Coll., holotype); Flinders River (B.M. Coll.); Walsh River (Q.M. Coll.).

AUSTRALICERAS GRACILE (Sinzow).

(Pl. XXXIV., fig. 4.)

1908 *Crioceras gracile* Sinzow (91), p. 327, pl. 18, fig. 1.

1909 *Crioceras jackii* (pars) Etheridge Jr. (30), pl. 36, fig. 1; pl. 37, fig. 2.

Sp. Chars.—Coiling erioceratid; whorl-section circular; costæ straight, thin and reclined; septal suture unknown.

Dimensions.—

Figd. (30), pl. 36, fig. 1. ϕ 220. 32. —. 47.

Figd. (30), pl. 36, fig. 2. ϕ 105. 36. —. 46.

Remarks.—Under the name *Crioceras gracile* Sinzow figured a number of specimens which may belong to more than one species of *Australiceras*. No specimen appears to have been selected as holotype; but if we are to take

²² Judging from the figure, however, the last two tuberculate ribs of the holotype of *A. jacki* may also be septi-tuberculate. This condition recalls the earlier *Ancyloceras*.

his best specimen as such (91, pl. 18, fig. 1), the two specimens figured by Etheridge and quoted above must be regarded as belonging to the species. Etheridge's specimens differ from Sinzow's form in being more widely umbilicate and in having the tuberculate stage persisting to a greater diameter. But, considering the variation in crioceratid species, it is not advisable to erect a new specific name until more is known of the Australian forms.

The species has circular whorl-section and numerous, thin, strongly reclined ribs. The English form recorded by Spath (103, p. 79) as *Ancyloceras* cf. *gracile* (specimens of which have been seen by the writer) has more compressed whorls and thicker ribs, more like another of Sinzow's forms (91, pl. 17, figs. 1-4). *A. gracile* bears considerable resemblance to *A. irregulare* which has thicker ribs; while the ribs of *A. graciloides* (Sinzow) (91, p. 328, pl. 20, figs. 1, 2) are not so reclined.

Localities.—Victoria Downs, Warrego (Q.M. Coll.); Walsh River (Q.M. and G.S.Q. Colls.).

AUSTRALICERAS TRANSIENTE sp. nov.

(Pl. XXXIV., figs. 3 a, b.)

Sp. Chars.—Coiling crioceratid; whorl-section equidimensional, sides sub-parallel; costæ very faintly flexed, rectiradiate; tubercles faint, obtusely conical.

Dimensions.—Holotype: 84. 39. 40. 39.

Remarks.—On the holotype there are about 70 costæ to the last whorl. Tuberculation is not very marked, especially on the first half-whorl exposed. The species is perhaps most similar to *A. jacki* but is distinguished by more numerous costæ, sub-parallel sides, and faintness of tubercles. The tuberculate stage ceases on the holotype at a diameter of 50 mm. The septal suture is little known but has apparently broad-stemmed lobes and saddles.

Locality.—Walsh River (Q.M. Coll.).

AUSTRALICERAS LAMPROS (Etheridge fil.).

(Pl. XXXV., figs. 1 a, b.)

1909 *Crioceras lampros* Etheridge Jr. (30), p. 157, pl. 48.

Sp. Chars.—Coiling crioceratid; whorls massive; whorl-section sub-triangular, almost equidimensional; rectiradiate; costæ thin, straight, close together on earlier whorls, coarse and widely separated on the body-chamber; initial and final stages trituberculate; septal sutures interlocking, with multi-dentate branches.

Dimensions.—

B.M. Coll. (figured): 340 (224). 35. 38. 41.

B.M. Coll. (25366): 325. 36. —. 44.

Remarks.—The specimen upon which Etheridge founded this species consisted of a body-chamber, with very coarse, trituberculate costæ, in the possession of the Geological Survey of Queensland. Recently, however, the earlier portion of the specimen has been found in this collection; and it is hoped that the complete holotype may be figured in a future paper. The earlier whorls are of the type shown by the fine specimen figured on Plate II.

The holotype has not the initial whorls preserved; but it is sufficiently complete to show that the early trituberculation ceased at a diameter of 55 mm. The initial whorls of the specimen now figured are also not preserved; but, at a diameter of about 45 mm. (i.e., the earliest stage preserved), there are faint suggestions of tubercles. There is thus a difference at which, in these two specimens, the initial tuberculation ceases; but there is every reason to believe that the specimens are co-specific.

A. lampros is very like certain forms of *Tropæum*, particularly the group of *T. bowerbanki* (J. de C. Sowerby) (94, p. 410, pl. 34, fig. 1), *T. hillsi* (J. de C. Sowerby) (93, p. 339, pl. 15, figs. 1, 2), and *T. cadoceriforme* (Sinzow) (93, pl. 21, fig. 3). The last-named species has a septal suture apparently identical with that of *A. lampros*. It is probable that this group of *Tropæum* is derived from the present species.

Localities.—Queensland! (G.S.Q. Coll., holotype); Glendower Station, Flinders River (B.M. Coll.).

Genus TROPÆUM J. de C. Sowerby.

The name *Tropæum* proposed in 1837 by J. de C. Sowerby (94, p. 409), but discredited in the same paper, was revived in 1900 by Hyatt (40, p. 571). The genotype is *Crioceratites bowerbanki* J. de C. Sowerby; and although the geno-holotype has not the initial whorls preserved, yet, as shown by a young specimen in the Sedgwick Museum Collection, the species is non-tuberculate. The genus is derived from *Australiceras*, with which it is identical in coiling, costation, and septal sutures, but it appears to have developed along several lines—*T. arcticum* being related to *A. transiente* and *T. rarum* to *A. aff. irregulare*. In all the species of *Australiceras* (with the exception perhaps of *A. robustum*) tuberculation ceases about the same diameter of whorl. In some forms all three tubercles disappear simultaneously (30, pl. 37, fig. 2), while in others the outer (30, pl. 38, fig. 3) or the inner (30, pl. 35, fig. 1) tubercle may be retained somewhat later than the other two. *A. transiente* agrees in every feature with *T. arcticum* except for tuberculation, and it is noteworthy that the tubercles on the former species are faint. Further, the tubercles on the earliest part visible of the holotype are fainter than on the last two tuberculate ribs, suggesting that the change from *Australiceras* to *Tropæum* was achieved by the abrupt cessation of tuberculation, and not that the tuberculate stage was driven further and further towards the origin in successively later species.

Tropæum is known in Europe in the two zones *bowerbanki* and *hillsi*, of the Lower Gargasian.

TROPÆUM AUSTRALE (Moore).

1870 *Crioceras australe* Moore (64), p. 257, pl. 15, fig. 3.

1892 *Crioceras australe* Etheridge Jr., pl. 31, fig. 1.

Sp. Chars.—Coiling crioceratid, whorls massive. Whorl-section equidimensional. Costæ very numerous, thin and close together, rectiradiate to slightly reclined. Coarse costæ of the body-chamber regular and smooth.

Remarks.—By kind permission of the council of the Royal Literary and Philosophical Society of Bath (England), the writer was recently permitted to examine the collections of the Bath Museum in search for Moore's missing types of Australian Cretaceous fossils. The type of *Crioceras australe* has been lost and no record of it could be found.²³

On the grounds of insufficient description and loss of type, Etheridge (30, p. 136) proposed that Moore's name should be abandoned. But the other figures of ammonites (Jurassic) given by Moore give a true representation of their species, and there is no reason to suppose that the same was not true of *Crioceras australe*. Further, there is one form in the Roma Series²⁴ which agrees in features with the species as figured by Moore. It is therefore not permissible to reject the specific name *australe*; and the writer now chooses a specimen figured by Etheridge²⁵ in 1892 as the neotype of the species.

The neotype is a large specimen and one of the most complete crioceratids recorded from the series. The initial whorls are, unfortunately, not preserved; but since the coarse costæ of the body-chamber are non-tuberculate the species is to be placed in *Tropæum* rather than in *Australiceras*.

T. australe is a member of the *bowerbanki* group (94, p. 410, pl. 34, fig. 1), but differs from Sowerby's species in its thinner ribs (which are more numerous) and in whorl-section (slightly). Some of the forms figured as *Crioceras bowerbanki* by Sinzow (91) are very similar.

Crioceras australe Waagen²⁶ non Moore (111, p. 246, pl. 60, fig. 1) is generically distinct from the species, being an *Australiceras*. Krenkel, quite unjustifiably, has identified the species as a *Chelonicerias* (*martini* group) (54, p. 162). Lemoine (55, p. 385) has correctly stated the form to be Aptian.

Localities.—Upper Maranoa River (holotype, specimen destroyed); Walsh River (neotype; Q.M. Coll.).

²³ The writer has since learnt that these specimens perished in the Garden Palace Fire of London.

²⁴ From its locality (Upper Maranoa River) Moore's specimen must have been from the Roma Series.

²⁵ Etheridge (42), pl. 31, fig. 1. A plaster cast of the specimen in the B.M. Collection has been examined by the writer.

²⁶ The writer has seen Waagen's type which represents a species not known in Australia.

TROPÆUM LEPTUM (Etheridge fil.).

1909 *Crioceras leptus* Etheridge Jr. (30), p. 143, pl. 30.

Sp. Chars.—Coiling crioceratid; whorls compressed, with very numerous, narrow, rectiradiate costæ; whorl-section sub-triangular.

Dimensions.—Holotype, θ . ϕ . 73. 77.

Remarks.—This species differs from all other forms in the “Rolling Downs” in its compression. The inner whorls are unknown so that it may even be an *Australiceras*. It is very similar in lateral view to *T. bowerbanki* (Neumayr et Uhlig) non Sowerby (65, pl. 53, fig. 1), whose whorl-section is not known. *T. spp.* of Neumayr and Uhlig (65, pl. 54) are similar but not as compressed. *T. percostatum* Gabb (35, vol. i., pl. 16) has thicker ribs.

Locality.—Lind River (G.S.Q. Coll., holotype).

TROPÆUM ARCTICUM (Stolley).

1909 *Crioceras jackii* (pars) Etheridge Jr. (30), pl. 32, fig. 2; pl. 34, fig. 1.

1911 *Crioceras arcticum* Stolley (107), p. 16, pl. 1, fig. 1 (also text-figs. 1, 2).

Sp. Chars.—Coiling crioceratid; whorls with about 65 simple rounded costæ, slightly flexiradiate, separated by sulci of approximately the same width; aperture almost equidimensional.

Dimensions.—(30) Pl. 34, fig. 1: ϕ 118. 38. 38. 42.

The perfect agreement of the specimen figured by Etheridge with Stolley's holotype from the Gargasian of Spitzbergen is a matter of considerable interest; for the species otherwise has not been recorded beyond Spitzbergen. The dimensions, course of the ribbing, type and intensity of the costæ are precisely similar. Further there is the same number of ribs per whorl. The holotype is somewhat crushed so that Stolley was unable to give the shape of the whorl-section exactly; but it appears to have been approximately equidimensional as in Etheridge's specimen.

T. arcticum agrees perfectly with *Australiceras transiente* in every feature except tuberculation; and there is no doubt a close connection between the two species.

Locality.—Roma (Q.M. Coll.).

TROPÆUM UNDATUM sp. nov.

1909 *Crioceras jackii* (pars) Etheridge Jr. (30), pl. 31; pl. 38, figs. 4, 5.

1911 *Crioceras sp. nov.* (aff. *arcticum*) Stolley (107), p. 19, pl. 2, fig. 1.

Sp. Chars.—Coiling crioceratid; whorl with about 50 almost straight prorsiradiate ribs; aperture subcircular.

Dimensions.—

Holotype (Q.M. Coll.): ϕ 320. 32. 36. 44.

Paratype (G.S.Q. Coll.): ϕ 85. 33. 31. 44.

The larger of Etheridge's two specimens (pl. 31) is selected as holotype. The main features of the species are the regularly coiled, equidimensional whorls with prominent rounded costæ in the young stage (becoming thinner and wider apart with age), which continue with slight forward inclination across the sides. The septal suture is unknown. Stolley's Spitzbergen specimen appears to be identical with this species though the state of preservation is unsatisfactory.

The closest known form is undoubtedly *T. arcticum* Stolley, which differs in the greater number of costæ per whorl and their slight curvature. *T. simbirskense*²⁷ Jasikowski is somewhat similar but more loosely coiled.

Localities.—

Holotype Q.M. Coll.): Queensland! (G.S.Q. Coll.): Walsh River.

TROPÆUM RARUM sp. nov.

(Pl. XXXVI., figs. 1 a, b.)

Sp. Chars.—Coiling crioceratid; whorls massive, depressed, whorl-section almost semicircular; costæ wide, rectiradiate.

Dimensions.—

Holotype: 177 (164). 38. 43. 39.

B.M. Coll. (25358): 220. 40. 46. 39.

Remarks.—This species is very similar to the *Australiceras* aff. *irregulare*, from which it may be derived. It differs from other Australian species of *Tropæum* in its depressed whorl-section. *T. hillsi* (J. de C. Sowerby) (93, p. 339, pl. 15, figs. 1, 2), particularly the type figured by Keeping (p. 91, pl. 2), is probably the most similar European form, especially in whorl-section.

Localities.—Walsh River (Q.M. Coll., holotype); Flinders River (B.M. Coll.).

Genus TOXOCERATOIDES Spath.

TOXOCERATOIDES TAYLORI (Etheridge fil.)

1892 *Ancyloceras taylori* Etheridge Jr. (42), p. 498, pl. 42, fig. 13.

non 1909 *Crioceras taylori* Etheridge Jr. (30).

Sp. Chars.—Micromorph, coiling ancyloceratid; non-tuberculate; costæ broad; cross-section sub-circular, slightly compressed.

Remarks.—Two specimens of this species are known—the holotype from the Walsh River and a fragmentary specimen, associated with *Australiceras robustum*, from the same locality. Both specimens are in the collection of the Queensland Museum.

²⁷ See Sinzow (90), pl. 6, fig. 1. The species was wrongly identified as *Australiceras gracile* by Kilian (48, p. 355).

Toxoceratoides includes both tuberculate and non-tuberculate species, the latter no doubt derived from the former. Forms like *T. royerianus* (d'Orbigny) (69, p. 481, pl. 118, figs. 7-11) have trituberculation; in others, e.g. *T. royeri* (v. Koenen pars, non d'Orbigny) (51, p. 399, pl. 37, fig. 7), the row of umbilical tubercles has disappeared. *T. taylori*, in being non-tuberculate, agrees with *T. rotundus* (Phillips);²⁸ but a closer relationship exists with *T. æquicingulatus* (von Koenen) (51, p. 394, pl. 37, figs. 5, 6). Von Koenen's species has faint ventro-lateral tubercles, which are not present on *T. taylori*, otherwise the agreement is very close.

As mentioned below, there is unfortunately a very close resemblance between *T. taylori* and *Labeceras bryani* which occurs at another horizon in the "Rolling Downs."

Locality.—Walsh River (Q.M. Coll.).

C.—ALBIAN SPECIES.

Family DESMOCERATIDÆ Zittel.

This family has been critically revised by Dr. Spath in recent papers (98 and 101).

In tracing the generic succession in the *Desmoceratidæ* the apparent continuity of a puzosid stock is particularly noticeable. The Upper Barremian to Lower Aptian *Melchiorites* is replaced in the Aptian (? Lower Gargasian) by *Uhligella* (s. str.). *Puzosia* itself appears in the Lower Albian—e.g. *P. kiliani* Fallot, *P. quenstedti* (Parona and Bonarelli), etc.—and continues into the Cenomanian where *Austiniceras* makes its appearance. All three genera have a strong community of character (in ornament, coiling, constrictions, and septal suture); and, since they replace one another in time, most probably form a lineage.²⁹ Inflated forms (*Pleuropachydiscus*, *Callizoniceras*, *Desmoceras*, etc.) have been produced from time to time, and *Desmoceras*, e.g., may be connected with *Puzosia* via the group of *P. cf. emerici* (Parona and Bonarelli) non Raspail sp. (71, p. 80, pl. 11, figs. 1, 2). Such inflated forms, though often of long duration, were apparently not very important as nuclei from which other genera developed. Such specialised genera as, e.g., *Hauericeras* and *Pachydiscus* are also probable offshoots from the puzosid lineage.

²⁸ Phillips (75), pl. 1, fig. 24. The species, specimens of which have been collected by the writer at Speeton, has not been adequately figured.

²⁹ Dr. Spath, however, doubts whether there is a connection between *Puzosia* and *Uhligella* (101, p. 34); but the writer believes that the type *Uhligella* is very close to *Puzosia*. The occurrence of the *Uhligella* type of ornament on a rare form of *Puzosia communis* as mentioned by Spath (101, p. 49) is of interest in this connection. The other possible explanation of the family *Desmoceratidæ* would be that it is an assemblage of homœomorphous genera repeatedly derived from *Phylloceratidæ*, etc.; and, while the writer believes that some forms have been thus derived, a central puzosid lineage from which other genera developed is regarded as the most satisfactory explanation of the majority of the desmoceratids.

Spath (98, p. 128) has suggested that the genus *Parapuzosia* is not directly developed from *Austiniceras* and points to "*Puzosia*" *curvatisulcata* Chatwin and Withers as a more nearly related form. But it is admitted later that this species may also be an *Austiniceras*; and the writer believes that *Parapuzosia* is probably the end form of the lineage.

The relationships of *Beudanticeras* Hitzel are not clear. Within the genus there are two groups represented by forms with narrow and wide stems respectively to the septal saddles. This was realised by Jacob (45), who placed them in different but ineligible genera. Whether, therefore, the genus had a dual origin is a matter for investigation. Spath (101, p. 37) believes *Beudanticeras* to be a special "wave" of phylloceratids; but the writer believes that, at least in part, the group is derived from *Uhligella*. The ornamentation of such forms as *B. dupinianum* d'Orbigny is very like that of *Uhligella* on the one hand and *Cleonicerias* on the other.

It is most probable that *Desmoceratidæ* were derived from *Phylloceratidæ*, particularly owing to the nature of the septal suture. But the close approximation of such forms as *Desmoceras* and certain *Parapachydiscus*—e.g. *P. umtafunensis* (Crick ms.) Spath (98, p. 133, pl. 9, fig. 4—to *Lytoceratidæ* (*Gaudryceras* and *Tetragonites*) makes distinctions very difficult, particularly since little is known of developmental details of the species in the various genera. Spath has suggested (101, p. 33) that *Desmoceratidæ* as known at present may even contain some derivatives of *Lytoceratidæ*.

Genus PUZOSIA Bayle.

PUZOSIA LONGMANI sp. nov.³⁰

(Pl. XXXVII., fig. 5; Pl. XXXIX., figs. 1 a, b.)

Sp. Chars.—Coiling serpental, subangustumbilicate; sides slightly convergent (sub-parallel), venter evenly arched; gradumbilicate; seven or eight faint constrictions per whorl, each slightly flexed and with a very small (almost negligible) peripheral projection; densiseptate; septal suture with irregularly bifid saddles and slightly irregularly trifid lobes.

Dimensions.—Holotype (Q.M. Coll.): 105 (94). 47. 34. 24.

Remarks.—Only the one specimen (of unusually large size) is known at present. The most similar species is *P. communis* Spath (101, p. 47, pl. 2, fig. 3), which has the same dimensions and agrees almost perfectly in whorl-section and type of septal suture. *P. longmani*, however, is gradumbilicate whereas the umbilical shoulder in *P. communis* is rounded; further, the constrictions are less prominent and the saddles of the septal sutures have narrower stems. *P. sharpei* Spath (101, p. 46, pl. 1, figs. 11, 12) has a wider umbilicus and fewer constrictions. *P. mayoriana* (d'Orbigny) (69, p. 267,

³⁰ In honour of Mr. H. A. Longman, Director of the Queensland Museum.

pl. 79) has a similar (though wider) gradumbilicus but fewer constrictions and there is a deeper suspensive lobe to the septal suture. Further the constrictions have a very pronounced peripheral projection. *P. mayoriana* var. *natalensis* Crick (16, p. 213, pl. 14, fig. 4) is closer in the faintness of constrictions; but whorl-section and the peripheral projection of the constrictions are still different. The huge *P. (?) subtilis* Crick (16, p. 217, pl. 14, fig. 5) has strongly prorsiradiate constrictions but agrees fairly well otherwise. The constrictions of *P. furnitana* (Pervinquière) (73, p. 157, pl. 6, figs. 27, 28), *P. crebrisulcata* Kossmat, and *P. odiense* Kossmat (52, c, pl. 17, fig. 4; pl. 16, fig. 5) have different curvature. The Lower Cenomanian *P. planulata* (J. de C. Sowerby) (92, vol. vi., p. 134, pl. 570, fig. 5) and *P. octosulcata* (Sharpe) (89, p. 42, pl. xix., fig. 3) differ in dimensions.

In the Lower Albian there are several groups of *Puzosia*; and the group of *P. quenstedti* (Parona and Bonarelli)³¹ (71, p. 81, pl. 11, fig. 3) and *P. kiliani* Fallot (32, p. 513, pl. 1, figs. 1-3) bears considerable resemblance to the present species. The writer believes that *P. quenstedti* is ancestral to both *P. mayoriana* and *P. communis*.

Locality.—Barcoo River (Q.M. Coll.).

Genus BEUDANTICERAS Hitzel.

BEUDANTICERAS FLINDERSI (McCoy).

- 1865 *Ammonites flindersi* McCoy (58), p. 51.
 1865 *Ammonites flindersi* McCoy (59), p. 334.
 1867 *Ammonites flindersi* McCoy (60), p. 196.
 1868 *Ammonites flindersi* McCoy (61), p. 42.
 1878 *Ammonites beudanti* var. *mitchelli* Etheridge (Senior) (22), p. 345, pl. 23, fig. 1 only.
 1892 *Haploceras flindersi* Etheridge Jr. (42), p. 494, pl. 30, figs. 1, 2 only.
 1902 *Haploceras flindersi* Etheridge Jr. (26), p. 31.

Sp. Chars.—Coiling oligogyral, subangustumbilicate; sides flattened, venter evenly arched, whorl-section subovate; gradumbilicate; fine subfalciform striæ radially directed, sometimes also faint sub-costæ; constrictions rare and faint; septal suture with irregularly trifid external lobe, narrow-stemmed saddles and prominent suspensive lobe.

Dimensions.—

Figured Etheridge (22), pl. 23, fig. 1: ϕ 130. 44. 28. 29.

Q.M. Coll. $\left\{ \begin{array}{l} 187. 46. 28. 29. \\ 142. 43. 27. 28. \end{array} \right.$

Remarks.—Etheridge jr. (42, p. 495), who examined McCoy's type, believed this species to be identical with *Ammonites beudanti* var. *mitchelli*

³¹ *P. mayoriana* Bayle non d'Orbigny sp. (69, vol. iv., pl. 45, figs. 6-8) is probably this species as Spath has indicated (101, p. 45).

Etheridge (Senior). This identification is confirmed by the present writer, who hopes to figure McCoy's types of Australian Cretaceous invertebrates in a forthcoming paper.

Spath (101, p. 52) believed that the species, as represented by Etheridge's original figure, is not a *Beudanticeras*. With this view the writer disagrees. Within the genus there are two groups—one, typified by *B. beudanti* (Brongniart),³² having narrow-stemmed saddles; the other, typified by *B. levigatum* (J. de C. Sowerby),³³ with wide stems. Both groups appear in the Lower and continue to the Upper Albian. *B. flindersi* belongs to the first (type) group. The genus is really of little use for the zonal correlation of distant areas (unless identical species occur) owing to its long duration and rather conservative characters.

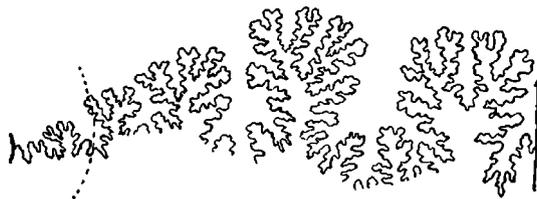


Fig. 1. - Septal suture of *Beudanticeras flindersi* (McCoy). Specimen from Hughenden (Q.M. Coll.). Nat. size.

The septal suture of *B. flindersi*, with its prominent suspensive lobe, agrees fairly well with that of *B. beudanti* and *B. sphaerotum* (Seeley),³⁴ but the Lower Albian *B. convergens* (Jacob) (44, p. 29, pl. 2, figs. 24-26) also possesses this feature, although it is apparently absent from *B. walleranti* (Jacob) (44, p. 31, pl. 3, figs. 1-4). The ornament never becomes as prominent as in *B. rebouli* (Jacob) (44, p. 32, pl. 4, figs. 1-5), although a Queensland Museum specimen has faint costæ on the body-chamber similar to that on a specimen of *B. walleranti* figured by Jacob (44, pl. 3, fig. 2). The venter is not narrowed as in *B. beudanti*, but is more like that of *B. sphaerotum*, which is perhaps the nearest European species. The Indian *B. stoliczkai* Kossmat (52, p. 119, pl. 18, fig. 6) is probably the most similar species, but the suspensive lobe is more prominent. Further, although several young specimens of *B. flindersi* have been examined by the writer, none have shown the prominent constrictions which are developed in the young stages of *B. stoliczkai*.

Localities.—Base of Walker's Tableland, Flinders River (N.M. Coll., holotype); Hughenden Station, Flinders River (R.D. Coll.); Hughenden (Q.M. Coll.).

³² Brongniart (18), pp. 95, 99, 394, pl. 7, fig. 2. See also Spath (101), p. 49.

³³ J. de C. Sowerby (92), vol. vi., p. 93, pl. 549, fig. 1. See also Spath (101), p. 55.

³⁴ Type figured by Spath (101), p. 53, pl. 3, fig. 1.

BEUDANTICERAS (?) DAINTREEI (Etheridge).

- 1872 *Ammonites daintreei* Etheridge (22), p. 346, pl. 24.
 1892 *Haploceras daintreei* Etheridge Jr. (42), p. 495, pl. 29, figs. 1-3.
 1901 *Haploceras daintreei* Etheridge Jr. (24), p. 30, pl. 1, fig. 3.
 1902 *Haploceras daintreei* Etheridge Jr. (26), p. 49, pl. 7, figs. 2-4.
 ? non 1902 *Haploceras daintreei* Etheridge Jr. (25), p. 44, pl. 7, fig. 1.
 non 1913 *Haploceras daintreei* Etheridge Jr. (31), p. 23.
 non 1921 *Beudanticeras daintreei* Bonarelli (6), p. 23, pl. 3, fig. 5.

Sp. Chars.—Coiling oligogyral, sublatumbilicate, subgradumbilicate; sides convergent, venter arched, whorl-section ovate; subcostate, with intermittent constrictions; septal suture complex, with many auxiliary lobes and prominent suspensive lobe.



Fig. 2.—Septal suture of *Beudanticeras* (?) *daintreei* (Etheridge). Specimen from Hughenden (Q.M. Coll.). Nat. size.

Dimensions.—

Holotype (R.D. Coll.): ϕ 98. 43. 30. 35.

Figured (26), pl. vii.: ϕ 135. 42. 32. 34.

Q.M. Coll.: $\left\{ \begin{array}{l} 124. 45. 31. 31. \\ 96. 44. 34. 33. \end{array} \right.$

Remarks.—This species is rather difficult to place generically. In many respects it resembles the Upper Aptian *Uhligella*, particularly the group of *U. sequenzae* (Coquand) (15, p. 40, pl. 11, fig. 10) and *U. stremmei* (Zwierzycki) (116, p. 69, pl. vii., figs. 3, 4). It has relationships with both *Puzosia* and *Beudanticeras* and may indeed be a separate offshoot from the former, parallel to *Beudanticeras*. The ornament is distinctly puzosid although certain groups of *Beudanticeras* (e.g. *B. rebouli* Jacob sp.) are prominently costate. The inflation of the shell is also reminiscent of *Puzosia*.

The South Australian specimen figured by Etheridge (25, p. 44, pl. 7, fig. 1) may be a *Parahoplitoides* as mentioned above. Etheridge (31, p. 23) also recorded the species doubtfully from the Gin Gin chalk (Lower Santonian) of Western Australia. These specimens, however, seen by the writer, belong to *Parapuzosia*. The Aptian "*Beudanticeras daintreei*" figured by Bonarelli from Patagonia is not this species and probably belongs to *Uhligella* or *Aioloceras*.

Localities.—Hughenden (R.D. Coll., holotype); Hughenden (Q.M. Coll.); Yandamah Creek (M.G.M. Coll.).

BEUDANTICERAS (?) SUTHERLANDI (Etheridge).

1872 *Ammonites sutherlandi* Etheridge (23), p. 345, pl. 21, fig. 4.

1892 *Ammonites (Haploceras) sutherlandi* Etheridge Jr. (42), p. 496, pl. 29, fig. 4.

The writer has not seen an example of this species. It appears to be an abnormally involute *Beudanticeras*, and in the absence of further evidence is tentatively placed in that genus. Etheridge (42, p. 496) compared it with *Ammonites cassida* Raspail which is a Hauterivian *Barremites* and quite distinct.

Locality.—Marathon (R.D. Coll., holotype).

Family DIPLOCERATIDÆ Spath.

Genus PROHYSTERO CERAS Spath.

PROHYSTERO CERAS RICHARDSI sp. nov.³⁵

(Pl. XXXVI., fig. 2; pl. XXXVIII., figs. 1 a, b.)

1909 *Schloenbachia rostratus* (J. Sowerby) Etheridge Jr. (pars) (30), pl. 67, fig. 1 only.

Sp. Chars.—Coiling serpental, sublatumbilicate; alticarinate; sides almost flat, venter planicarinate, whorl-section approximately square; costæ broad, rounded, and very slightly flexed, bifurcating at the umbilical edge where, in the young stage, there is a prominent tubercle (bullate) which diminishes with age; ventro-lateral tubercle barely developed, but with faint spiral grooving; septal suture with bifid saddles and regularly trifold lobes, L₁ much shallower than EL.

Dimensions.—

Holotype (Q.M. Coll.):	{ 145. 42. 30. 41.
	{ 100. 44. 33. 43.
Figured (30), pl. 67, fig. 1: ϕ	106. 33. —. 43.
(F.W.W. Coll.):	84. 32. 33. 46.

Remarks.—The species belongs to the group of quadrate-whorled forms with planicarinate venter characteristic of the *varicosus* and upper *orbigny* zones. *P. richardsi*³⁶ actually appears to be present at Folkestone. *P. goodhalli* (J. Sowerby) (92, vol. ii., p. 100, pl. 255) is very similar but more compressed; and the Madagascan species, erroneously identified by Boule, Lemoine and Thevenin³⁷ as *Schloenbachia (Mortoniceras) bourchardiana* (d'Orbigny) appears to differ only in having slightly more ribs per whorl. *P. burckhardt* (Böse) (7, p. 61, pl. 1, figs. 1, 2, 4, 5) is rather similar but more compressed and the costæ are more flexed. *P. balmatianum* Pictet (79, p. 97, pl. 9, fig. 1) has

³⁵ In honour of Professor H. C. Richards.

³⁶ Represented by a specimen in the Sedgwick Museum Collection.

³⁷ Boule, Lemoine and Thevenin (10), p. 39, pl. 9, fig. 11. D'Orbigny's species is a *Diploceras*.

a similar whorl-section but there are considerable differences in ornamentation, particularly in the development of the ventro-lateral tubercle. The Indian *P. propinquum* (Stoliczka) (104, p. 53, pl. 31, figs. 1-2) is similar but differs in whorl-section and in the peculiar decline of ornament on the body-chamber. *P. decipiens* Spath (97, p. 145, pl. 4, fig. 13) has certain points of resemblance but the ribs are straighter and rarely bifurcate.

The septal suture of *P. richardsi* is peculiar in the shallowness of L_1 , a condition reminiscent of the *Diploceras* and *Inflatoceras* type of suture.

Localities.—"Toliness," Augathella (Q.M. Coll., holotype); South Central Queensland (A.M. Coll.); 23 miles S.W. of Tambo (west bank of Ward River) (F.W.W. Coll.).

PROHYSTERO CERAS RICHARDSI var. NITIDUM nov.

(Pl. XXXVI., fig. 3.)

1909 *Schloenbachia rostratus* var. *antipodeus* Etheridge Jr. (non olim) (30), p. 237, pl. 67, figs. 3, 4.

The small form figured by Etheridge differs from *P. richardsi* proper mainly in having sharper ribs, and may be separated as a variety of that species, Etheridge's specimen being taken as the type. It has nothing to do with Etheridge's *Hystrihoceras* (?) *antipodeus* from Point Charles which belongs to another genus. The measurements given here are taken from a plaster cast of the holotype kindly supplied by the Australian Museum.

Dimensions.—Holotype: 44. 30. 35. 47.

Locality.—South Central Queensland (A.M. Coll., holotype).

PROHYSTERO CERAS ANGOLAENSE (Boule, Lemoine et Thevenin).

1892 *Ammonites* (*Schloenbachia*) *inflatus* Etheridge Jr. (non Sowerby) (42), p. 493, pl. 34, figs. 1-3.

1907 *Schloenbachia inflata* var. *angolaensis* Boule, Lemoine and Thevenin (10), p. 41, text-fig. 21.

1909 *Schloenbachia rostratus* Etheridge Jr. (non Sowerby) pars. (30), pl. 65; pl. 66, fig. 1 only.

P. angolaense is undoubtedly very closely related to *P. richardsi*, differing in the wider spacing of the ribs and probably in the peculiar ventro-lateral tubercle which develops on later whorls. The writer has not found it possible to separate specifically the Queensland and Madagascan forms; and this is of interest in view of the presence of other species in Madagascar closely allied to *P. richardsi*.

Boule, Lemoine and Thevenin's treatment of *Inflatoceras aequatoriale* (Kossmat) included several species of both *Inflatoceras* and *Prohysteroce ras*. One of the latter (10, pl. 9, figs. 8, 9) is probably related to *P. richardsi* and, in its ventro-lateral tubercle, develops parallel to *P. angolaense*.

The group of species which develops this peculiar tuberculation on advanced whorls is characteristic of the Upper *orbigny* and the *varicosus* zones in the Folkestone section. In the later costæ not bifurcating the group apparently is somewhat parallel to *Elobiceras*. Spath (97, p. 101) included Etheridge's specimen³⁸ in *Inflatoceras* (= *Subschloenbachia*); but although the group is transitional to *Inflatoceras* it is more advisable to leave the species in *Prohysteroceeras*.

Locality.—South Central Queensland (A.M. Coll.); Glanmire Block, near Tambo (G.S.Q. Coll.).

Genus INFLATICERAS Stieler.

INFLATICERAS SP. NOV.

1909 *Schloenbachia rostratus* Etheridge Jr. (non Sowerby), pars. (30), pl. 66, fig. 2; pl. 67, fig. 2 only.

This species is only known from fragments at present. It belongs to a group of forms characteristic of the *varicosus* zone and of which *Schloenbachia rostrata* Bayle non Sowerby sp. (5, pl. 91) may be taken as the type. This group differs from later species of *Inflatoceras* (*rostrata* group, etc.) in the concentric ornament being developed on the sides also, and not confined to the ventro-lateral tubercle. It probably leads directly to the group of *I. perinflata* Spath³⁹ in which, besides having the concentric ornament only on the outer tubercle, there are differences in the duplication of the ventro-lateral and prominence of the medio-lateral tubercle.

This group, unfortunately, is inadequately figured and the whorl-section of Bayle's specimen is unknown.

A specimen in the Australian Museum Collection shows that, at least at a whorl thickness of 30 mm., the ventro-lateral tubercle had not developed; so that the group has very early features of *Inflatoceras*. On a badly worn specimen in the writer's collection bifurcation of costæ ceases at a diameter of about 145 mm.

Localities.—South Central Queensland (A.M. Coll.); 23 miles S.W. of Tambo, west bank of Ward River (F.W.W. Coll.).

Family HAMITIDÆ Hyatt (emend. Spath).

Three names are in common use for the costate non-tuberculate hamitids of the Albian—*Hamites* Parkinson, *Torneutoceras* Hyatt and *Helicoceras* d'Orbigny; but the significance of each name is not definite. *Hamites* includes

³⁸ Etheridge (30), pl. 65.

³⁹ Spath (97), p. 113; holotype, Pictet and Campiche (78), pl. 22, fig. 3.

the groups of *attenuatus* J. Sowerby (small "Lower" Gault forms) and *maximus* J. Sowerby (large forms of the "Upper" Gault), though little is known of species from the *delaruei* and lower *cornutus* zones.

The Upper Albian forms have delicate attenuated shells with either spiral or "ptychoceratoid" initial whorls. For the group of *Hamites attenuatus* d'Orbigny non Sowerby (69, p. 533, pl. 131, figs. 9-13), Hyatt (40, p. 586) proposed the genus *Torneutoceras*, no definition being given. D'Orbigny's figure is apparently somewhat idealised; but the species differs from the *maximus* group in the costæ being less inclined and not continued across the dorsum, and (possibly) in the "ptychoceratoid" beginning. Unless a division into two such groups has a zonal significance there is little occasion for separating "*Torneutoceras*"; for the costal distinction is not particularly momentous and, with the known variation in initial whorls of these forms, the "ptychoceratoid" character is of doubtful importance. When more complete individuals of *H. venetianus* Pictet (79, p. 134, pl. 14, fig. 6) are known this may have to be separated as a new genus, but it is advisable to retain *H. attenuatus* d'Orbigny non Sowerby in *Hamites*.

There is a constant tendency in the normally coiled ammonites towards asymmetry, sometimes shown in the disagreement between two halves of a septal suture, in the siphuncle deviating from the median line, in the alternation of ventro-lateral tubercles or in a tendency for the coiling to vary from a plane. In *Hamites* with its delicate initial whorls so far apart such a tendency must lead to helicoid forms; and a species may include forms some with uniplanous and some with helicoid initial whorls. But *Helicoceras* d'Orbigny (69, p. 611; see Spath 97, p. 149) has been proposed for the helicoid hamitids differing from *Hamites* only in coiling. Such a genus must have little systematic value and very probably may have to be abandoned. The genus *Turrilitoides* Spath (99, p. 76), however, which is also a non-tuberculate hamitid, covers a natural group.

Smooth developments of the *Hamitidæ* appear in the Upper Albian. *Lechites* Nowak (66. a, p. 350), which is closely related to *Hamites*, is derived by the decreasing costation and increased length of the shell. *Cyrtochilus* Meek (63, p. 392), which develops from *Lechites*, continues the decline of costation, most of the septate portion being smooth. It is most characteristic of the Lower Cenomanian though the Upper Albian *C. bouchardianus* (d'Orbigny) is an early member of the genus. Nowak (66a, p. 350), apparently overlooking Meek's generic name but recognising the relationship between the two genera, included *C. baculoides* (Mantell) in *Lechites*; but he gives erroneous data for the age of the species, and *Lechites gaudini*, which is narrowly restricted in the Upper Albian, is stated to range through the entire Cenomanian.

Genus HAMITES Parkinson.

HAMITES aff. MAXIMUS J. Sowerby.

(Pl. XXXIX., figs. 2 a, b.)

One specimen is known, represented by a body-chamber, with an injury on one side (not shown in the figure). The cross-section is circular. Costæ are discontinuous across the dorsum. The thin flange-like costæ remove it from *H. maximus* J. Sowerby (92, vol. i., pl. 62, fig. 1) and *H. attenuatus* d'Orbigny non Sowerby (69, pl. 131, fig. 9), though this difference may be due to the specimen being an internal mould. Similar flange-like costæ occur on the *H. rotundus* (non Sowerby) of d'Orbigny (69, pl. 132, fig. 1) and Pictet (79, p. 129, pl. 14, fig. 1), and on the American *H. æquicostatus* Gabb (35, vol. i., p. 74, pl. 13, fig. 20). It is larger than *H. intermedius* J. Sowerby (92, vol. i., pl. 62, fig. 2) and the costæ are wider apart than in *H. charpentieri* Pictet (79, p. 131, pl. 14, figs. 2-4). The group is particularly characteristic of the *cristatus* zone at Folkestone.

The septal suture has short prominently bifid wide-stemmed saddles and regularly trifid lateral lobes.

Locality.—Ward River (head of Warrego) (Q.M. Coll.).

HAMITES SP. NOV.

1909 *Criocerat* sp. Etheridge Jr. (30), pl. 42, fig. 1.

The specimen figured by Etheridge is a member of the *maximus* group of *Hamites* but distinct from all species described. Its huge size renders comparison difficult though some undescribed Folkestone forms approach it closely.

Locality.—Tambo (A.M. Coll.).

Genus LABECERAS nov.

Genotype: *Labecerat papulatum* sp. nov.

Diagnosis.—Small shells with ancyloceratid coiling; aperture with short lateral lappets but no rostrum, costæ simple; septal suture I.U.L.E., with broad saddles and relatively narrow lobes.

It is doubtful whether this genus is related to *Hamitidæ* or *Scaphitidæ*; and for the present it is left with the former family. The early whorls are crioceratid, but the body-chamber is developed on a hook-shaped termination. Five species are known: *L. laqueus* (Etheridge fil.), *L. bryani* sp. nov., *L. compressum* sp. nov., *L. papulatum* sp. nov., and *L. (?) trifidum* sp. nov. The first three show no signs of tuberculation, but on *L. papulatum* and *L. (?) trifidum* tubercles are developed on the inner margin of the hook.

The genus has not been figured outside Australia at present.

LABECERAS BRYANI sp. nov.

(Pl. XXXIX., figs. 4 a, b.)

1909 *Crioceras taylori* (pars, non olim) Etheridge Jr. (30), pl. 49, figs. 3, 5, 6 only.

Sp. Chars.—Micromorph, coiling ancyloceratid, with the aperture pointing towards the shaft; non-tuberculate; costæ very broad and, on the body-chamber, fairly widely spaced; cross-section subcircular, slightly compressed; aperture with rather long lappets; septal suture with broad saddles and narrow lobes.

Remarks.—This species is somewhat variable, to judge from the specimens examined. It is here restricted to the broadly costate forms with subcircular whorl-section. Etheridge (30, pl. 49, fig. 4), however, included in the species one form belonging to *L. laqueus*. In the holotype (pl. vi., fig. 4) the lateral lappet is visible at the aperture. Further the crioceratid portion of the whorl gave place to the straight limb at the base of the specimen, for there is an impression of the dorsum of the coil around it. The maximum thickness of the whorl is at the dorsum.

There is an interesting, though unfortunate, homœomorphic resemblance between *L. bryani* and *Toxoceratoides taylori* (Etheridge fil.), and the two had been grouped in the one species by Etheridge. *L. bryani* is a species from the Tambo Series whereas *T. taylori* is from low in the Roma Series. Small isolated fragments of the two are bound to be confused; but on complete specimens the closeness of coiling of the early whorls is a good distinguishing feature, while it is probable that, when discovered, the aperture of *T. taylori* will, in accordance with the general features of *Toxoceratoides*, not be directed towards the shaft as in *Labeceras*.

The species is named in honour of Mr. W. H. Bryan.

Locality.—South Central Queensland (A.M. Coll.).

LABECERAS LAQUEUS (Etheridge fil.).

1892 *Hamites* (or *Hamulina*) *laqueus* Etheridge Jr. (42), p. 496, pl. 42, figs. 14, 15.1909 *Crioceras taylori* (pars) Etheridge Jr. (30), pl. 49, fig. 4 only.

Sp. Chars.—Micromorph, coiling ancyloceratid with aperture facing towards the shaft; cross-section circular; non-tuberculate; costæ thin, numerous.

Remarks.—This species differs from *L. bryani*, to which it is closely related, in the costæ being finer and more numerous, and in the whorl-section being circular. Etheridge, in a subsequent work (30, p. 160) confused his earlier species and appears to have regarded as *L. laqueus* the tuberculate form here separated as a new species (*L. trifidum*). But the holotype (42, pl. 42, fig. 14)

is non-tuberculate, and the species must be restricted to forms agreeing with this. Such a form was figured by Etheridge in 1909 (**30**, pl. 49, fig. 4) as *L. taylora*. Two species were figured by Etheridge in 1905 as *Anisoceras* (?) sp. (**28**, pl. 2, figs. 1-3); and these were later included in the synonymy of *L. laqueus* (**30**, p. 160). But two of the specimens are apparently *Hamites* while the third (fig. 3) may belong to *Labeceras* but is apparently not *L. laqueus*.

Localities.—Tower Hill (Q.M. Coll., holotype); South Central Queensland (A.M. Coll.).

LABECERAS COMPRESSUM sp. nov.

(Pl. XXXVI., fig. 5; pl. XXXIX., figs. 5 *a*, *b*.)

Sp. Chars.—Micromorph, coiling ancyloceratid with aperture facing towards the shaft, whorl-section compressed; non-tuberculate; costæ numerous, thin, slightly prorsiradiate; septal suture normal.

Remarks.—This species is notable for its very compressed section in which the height of the whorl is nearly twice the breadth. It is related to *L. laqueus* which it resembles in costation. On the holotype the lateral lappet at the aperture is well seen.

Locality.—Tower Hill, Muttaborra (Q.M. Coll.).

LABECERAS PAPULATUM sp. nov.

(Pl. XXXVI., fig. 4; pl. XXXIX., figs. 3 *a*, *b*.)

Sp. Chars.—Micromorph, coiling ancyloceratid with aperture facing towards the shaft; small dorso-lateral tubercles are developed on the body-chamber; costæ very thin, close together; whorl-section circular; septal suture with very broad paucidentate saddles and very narrow lobes.

Remarks.—This species is distinguished by (1) the papillate tubercles on the body-chamber, (2) the fineness of the ribs, and (3) the extreme narrowness of the septal lobes. It is perhaps related to *L. laqueus* to which, except for the development of tubercles, it is very similar.

Locality.—Longreach (B.M. Coll.).

LABECERAS TRIFIDUM sp. nov.

1892 *Crioceras* sp. Etheridge Jr. (**42**), p. 502, pl. 33, fig. 4.

1909 *Crioceras laqueus* (pars) Etheridge Jr. (**30**), pl. 49, figs. 7 and 9 (non fig. 8).

Sp. Chars.—Complete specimens unknown (? micromorph ancyloceratid); body-chamber with prominent dorso-lateral tubercles from which very fine but prominent ribs trifurcate. Whorl-section subcircular with rather flattened dorsum.

Remarks.—As holotype is taken a specimen (G.S.Q. Coll.) figured by Etheridge (30, pl. 49, fig. 9). The species in its tuberculation is closest to *L. papulatum* to which it is probably connected via such forms as a figured paratype (Etheridge, 30, pl. 49, fig. 7). But it is distinguished from that species in the prominence of the tubercles, the thin flange-like ribs which trifurcate at the tubercles, and in its larger size. Three specimens have been figured, while a fourth has been examined by the writer. In all cases they consist of the initial part of the body-chamber and the suture line is thus unknown. But one of the specimens figured by Etheridge (30, pl. 49, fig. 7) shows that the shell previous to the body-chamber was non-tuberculate.

Labeceras in mode of coiling is homœomorphous with *Leptoceras* and *Acrioceras*; and it is a point of interest that, in the last-named genus, similar dorso-lateral tubercles are developed on the body-chamber in such species as *A. tabarelli* (Astier) (4, p. 19, pl. 7, fig. 9).

Localities.—15 miles S.W. of Hughenden (G.S.Q. Coll., holotype); Landsborough Creek (G.S.Q. Coll.); South Central Queensland (A.M. Coll.).

Genus APPURDICERAS nov.⁴⁰

Genotype *Ancyloceras cordycepoides* Etheridge fil.

Diagnosis.—Micromorph shells with ancyloceratid coiling; strongly oostate and with prominent ventro-lateral tubercles; septal suture I.U.L.E.

This genus includes two Australian and a number of foreign species. In the English Gault it is represented by *A. spinigerum* (J. Sowerby). The Wiltshire collection in the Sedgwick Museum contains a large number of complete specimens of *A. spinigerum*; and from an examination of these it seems that the early whorls of a species, usually in one plane (crioceratid), may often be slightly helicoid. *Hamites alternatus* Mantell may be a Lower Cenomanian member of the genus. At Folkestone the genus appears to be characteristic of the *auritus* zone (Spath, 99, p. 76).

Appurdiceras is very similar to *Anisoceras* from which it differs in not having a medio-lateral row of tubercles; while the group of "*Hamites*" *elegans* d'Orbigny is another parallel development. *Anisoceras* is directly related to *Hamites* whereas there can be little doubt that *Appurdiceras* is derived from *Labeceras*; and the two genera therefore probably represent hamitid stocks independently developing tuberculation.

In the uppermost Aptian a group appears, typified by "*Ancyloceras patagonicum*" Stolley (108, p. 11, pl. 1, figs. 2, 3) which also has ventro-lateral tubercles only. This group extends into the Lower Albian at least to the *mamillatum* zone, but has no genetic relationship with *Appurdiceras*.

⁴⁰ From *Appurda*, which (fide Etheridge) is the name given to these fossils by the natives of the Lake Eyre region (from the resemblance to "purda," worms).

APPURDICERAS CORDYCEPOIDES (Etheridge fil.).

1905 *Ancyloceras cordycepoides* Etheridge Jr. (28), p. 14, pl. 1, figs. 3-5; pl. 2, fig. 4.

Sp. Chars.—Micromorph, coiling ancyloceratid; costæ broad rounded close together, prorsiradiate, ventro-lateral tubercles strong, subcircular; whorl-section subrectangular (rhomboidal); costæ bundled in groups of 2 or 3.

Remarks.—If the three specimens figured by Etheridge are the same species then the tubercles appear to have been septate; for one shows long spines whereas two first specimens (casts) have truncate tubercles. There are some forms in the Wiltshire collection in the Sedgwick Museum from the Gault of Folkestone which are very similar to *A. cordycepoides*. Of the species figured by Sowerby perhaps *A. nodosus* (92, vol. iv., pl. 216, fig. 3) is the closest, but it differs in the inclination of the ribs.

Locality.—Dalhousie Springs (G.S.S.A. Coll.).

APPURDICERAS (?) ETHERIDGEI sp. nov.

(Pl. XXXVIII., figs. 2 a, b.)

Sp. Chars.—Micromorph, coiling ancyloceratid, with the aperture pointing towards the shaft; costæ prominent rounded; slightly compressed in cross-section; ventro-lateral tubercles appear on the shaft only; septal suture similar to that of *Labeceras bryani*.

Remarks.—This very interesting species agrees very well with *Labeceras* but for its tubercles. Coiling and septal sutures are identical with *L. bryani*. The early (crioceratid) whorls are not known; but tubercles are not present on the early part of the shaft. This suggests that the species is an early form of *Appurdiceras*, although it may represent another branch from *Labeceras* with similar ventro-lateral tubercles.

The species is named in honour of the late R. Etheridge Jr.

Locality.—Kensington, W. Queensland (N.M. Coll.).

Family ANISOCERATIDÆ Hyatt emend. Spath.

Genus ANISOCERAS Pictet.

ANISOCERAS SP. NOV.

1909 *Crioceras* sp. Etheridge Jr. (30), pl. 35, fig. 2; pl. 46, fig. 2; pl. 47, fig. 5.

Whether the two specimens figured by Etheridge represent different species cannot yet be decided, although the lateral row of tubercles has not quite the same position in the two forms. The larger develops peculiar flange-like costæ on the body-chamber on which the tubercles tend to decline.

Pictet (76, p. 705) established the genus *Anisoceras* with *Hamites saussureanus* Pictet (79, p. 118, pl. 13, figs. 1-4) as genotype. But the large composite "specimen" illustrated, composed of several separate fragments, may include two genera and it is advisable to select fig. 2a as genotype and holotype. The genus should be restricted to the bituberculate hamitids of the Upper Albian and Lower Cenomanian.

The present species is related to *A. saussureanum* (restricted) but differs slightly in ribbing and tuberculation.

A. perarmatum Pictet et Campiche (78, p. 65, pl. 49) is somewhat similar but the ribs are finer and more numerous. On the Cenomanian *A. armatus* (Mantell) (62, p. 121, pl. 23, figs. 3, 4) the lateral row of tubercles is nearer the venter and the ribbing is different.

Locality.—Ward River watershed (A.M. Coll.).

Family ALETECERATIDÆ nov.

The four Upper Albian genera *Aleteceras*, *Myloceras*, *Flindersites* nov. (v. inf.) and *Algerites* Pervinquière (all characterised by openly coiled shells, very lytoceratid, and possessing ventro-lateral tubercles) are included in this family. The group is evidently a direct offshoot from *Lytoceratidæ* via *Cicatriles* Anthula (3, p. 100, pl. 7, fig. 6) which is markedly similar to *Aleteceras*, differing merely in not having crioceratid whorls and the septate (?) nature of the tubercles. *Cicatriles*, at present, is only known in the Caucasus where it occurs in the *aschiltaensis* zone (the topmost zone of the Aptian). How high it extends is of course unknown; but being a lytoceratid its range may be considerable. The type of ribbing of the *Aleteceratidæ* is decidedly lytoceratid;⁴¹ while the septal sutures, which are of the I.U.L.E. type, agree in every detail with the *Lytoceratidæ*, particularly *Cicatriles*.

Algerites, which differs from the other genera in the relative smoothness of its whorls, is the only member of the family unknown in Australia; but the other three genera have not yet been recorded beyond Australia.

Genus ALETECERAS nov.⁴²

Genotype *Crioceras plectoides* (Etheridge fil.).

Diagnosis.—Coiling crioceratid; whorl-section subcircular to subquadrate; costæ thin; usually reclined; large ventro-lateral tubercles at which the ribs are bundled usually in groups of three; septal suture I.U.L.E. with strongly bifid saddles and regularly trifid lobes.

⁴¹ Compare e.g. *Aleteceras* and such ribbed lytoceratids as the Senonian *Gaudryceras cinctum* (Crick ms.) Spath (98, p. 118, pl. 9, fig. 3).

⁴² ἀλέτης, a millstone.

Four species are known—*A. plectoides* (Etheridge fil.), *A. tardicostatum* sp. nov., *A. nautiloides* (Etheridge fil.) and *A. (?) axonoides* (Etheridge fil.). Both *A. plectoides* and *A. tardicostatum*, so far as is known, retain tubercles throughout life; but a change in type of tuberculation takes place in *A. (?) axonoides*, while in *A. nautiloides* a non-tuberculate stage succeeds the tuberculate. Although zonal collecting has not been made it is probable that the two latter species are later than the two former.

ALETECERAS PLECTOIDES (Etheridge fil.).

(Pl. XL., figs. 2 *a*, *b*, *c*.)

1909 *Crioceratid* *Crioceratid* Etheridge Jr. (30), p. 152, pl. 33, fig. 2; pl. 46, fig. 1; pl. 47, figs. 1-4.

Sp. Chars.—Coiling crioceratid; whorl-section equidimensional, subquadrate; venter arched; costæ slightly reclined; ventro-lateral tubercle hemispherical, at which the ribs trifurcate; septal suture with saddles and lobes of equal size, moderately narrow-stemmed.

Lectotype.—Etheridge (30), pl. 46, fig. 1 (A.M. Coll.).

Dimensions.—

Holotype: ϕ 160: 37. — 38.

(30), pl. 47, fig. 1: ϕ 86. 40. 48. 36.

Pl. xl., fig. 2: 78. 42. 42. 35.

Remarks.—The first whorl, as in all members of the family as far as is known, is openly coiled (gyral). The tuberculate ribs in the younger whorl are more prominent than the non-tuberculate, varying numbers of which (from 3 to 10) are interposed between each pair of tuberculate ribs. The latter have a tendency to bifurcate near the umbilical margin, the two branches being united finally by the tubercle from which three ribs proceed across the venter. In later whorls the tubercle is often spread over three ribs, which do not subdivide further on passing the tubercle.

Localities.—Central or South-west Queensland (A.M. Coll., holotype); South Central Queensland (A.M. Coll.); Wellshot (G.S.Q. Coll.); Walsh River (Q.M. Coll.).

ALETECERAS TARDICOSTATUM sp. nov.

(Pl. XL., figs. 1 *a*, *b*, *c*.)

Sp. Chars.—Coiling crioceratid; costæ very numerous, close together, strongly reclined; tubercles subcircular, massive; in earlier whorls tubercles on about every fourth rib which trifurcates at the tubercle; in later whorls the tubercle spreads over three ribs and between are about eight non-tuberculate, simple ribs; whorl-section subrectangular; septal suture narrowly divided.

Dimensions.—Holotype (A.M. Coll.): θ 51. 90.

Remarks.—This species differs from *A. plectoides* in several respects—ribs are more numerous, closer together, and more reclined; whorl-section is slightly more compressed; tubercles are more prominent, and on later whorls tuberculation is different: and the branches of ES are more indented. Only the one specimen has been seen.

The tuberculation of the inner whorls is precisely similar to that of *A. plectoides*, but the tubercles are more massive while on later whorls the position of the tubercles joining three otherwise unaffected ribs is apparently constant (in *A. plectoides* this type is not constant on any individual.)

Locality.—South-Central Queensland (A.M. Coll., holotype).

ALETECERAS NAUTILOIDES (Etheridge fil.).

1909 *Crioceras nautiloides* Etheridge Jr. (30), p. 148, pl. 45 and text-figure 8.

Sp. Chars.—Coiling crioceratid; whorl-section depressed; sides convergent, venter evenly arched; early whorls with tuberculation of the *plectoides* type, later whorls non-tuberculate; costæ straight, reclined; septal suture with broad saddles and narrow lobes.

Remarks.—The species has been described in detail by Etheridge. The massive depressed whorls distinguish it from the other species. The tuberculation of the inner whorls is of the same massive type as that seen in the inner whorls of *A. tardicostatum*. Later whorls, while having costation essentially similar to the latter species, have lost all tubercles. The septal suture is not so indented as that of *A. tardicostatum*, being rather more like that of *A. plectoides*.

On account of the tubercles ceasing at a relatively early age Etheridge (30, p. 150) called attention to the similarity to "*Crioceras jackii*." Such similarity is, of course, purely morphic and there is no connection between the present species and *Australiceras*.

Locality.—Aramac (G.S.Q. Coll., holotype).

ALETECERAS (?) AXONOIDES (Etheridge fil.).

1909 *Crioceras axonoides* Etheridge Jr. (30), p. 150, pl. 32, fig. 4; pl. 44, fig. 1.

This species has been well described by Etheridge. It differs markedly from the other three in its wider umbilicus, the situation of the tubercles nearer to the central line of the venter, and by the ribs being almost directly radial. Eventually it may be necessary to remove it from *Aleteceras*. Tuberculation in early whorls is of the *Aleteceras* type; but on later whorls it is of the type seen in *Myloceras*. The flatness of the venter and the position of the tubercle are also more suggestive of *Myloceras* though the whorl-section is that of *Aleteceras*. The species may be an offshoot from *Aleteceras* developing somewhat parallel to *Myloceras*.

Locality.—"Queensland" (M.M. Coll., holotype).

Genus **MYLOCERAS** nov.⁴³Genotype *Crioceras ammonoides* (Etheridge fil.).

Diagnosis.—Coiling crioceratid; whorl-section compressed, rectangular; costæ thin, slightly curved, with small, simple tubercles on the ventro-lateral angles; septal suture I.U.L.E. with deeply bifid saddles and regularly trifid lobes.

Three species are known: *M. ammonoides* (Etheridge fil.), *M. orbiculus* sp. nov., and *M. davidi* sp. nov. The genus is remarkably similar to *Algerites* Pervinquière (74, p. 46), differing mainly in costation. From *Aleteceras* it differs in being more compressed and in having finer and more numerous tubercles at which the ribs are not associated in groups of three. The tubercles are mainly papillate and generally cover one rib only, though in some cases the ribs may be associated in pairs at the tubercles.

MYLOCERAS AMMONOIDES (Etheridge fil.).

(Pl. XLI., figs. 2 a, b.)

? 1892 *Crioceras edkinsi* Etheridge Jr. (42), p. 502, pl. 30, figs. 8, 9.1909 *Crioceras ammonoides* Etheridge Jr. (30), p. 151, pl. 49, figs. 1, 2.? 1909 *Leptoceras* (?) *edkinsi* Etheridge Jr. (30), p. 165.

Sp. Chars.—Coiling crioceratid; whorl-section very compressed, rectangular; venter flattened, sides subparallel; costæ very slightly flexed on sides, straight on venter, bearing small rather elongate tubercles on intermittent ribs; tubercles occasionally bundling ribs in pairs; costæ not bifurcating at the tubercles; septal suture not known.

Dimensions.— Holotype (G.S.Q. Coll.): ϕ 62. 39. 24. 40.

Remarks.—In the bundling of ribs in pairs at the tubercles the species is probably nearer to *Aleteceras* than any other member of the genus. This relationship is stressed by the size of the tubercles, which, though distinctly smaller than in *Aleteceras*, are somewhat larger than in any other species of *Myloceras*. In its compressed whorls the species is markedly distinct from the former genus and is the most compressed species in *Myloceras*.

The writer has examined the inner whorls of the specimen now figured. They are remarkably similar to "*Crioceras*" *edkinsi* but there is primitive bifurcation of the ribs at the tubercles, a feature not mentioned by Etheridge on "*Crioceras*" *edkinsi*. It appears, therefore, that *M. edkinsi* and *M. ammonoides* may be identical. Until that can be tested definitely the name *ammonoides* is retained. The genus has nothing to do with *Leptoceras*, to which Etheridge provisionally referred *M. edkinsi*; and the resemblance does not even extend to mode of coiling, for *Leptoceras* is an ancyloceratid micro-morph.

Locality.—Port Douglas (G.S.Q. Coll., holotype); Dalhousie Springs (A.M. Coll.).

⁴³ μύλος, a millstone.

MYLOCERAS ORBICULUS sp. nov.

(Pl. XLI., figs. 1 *a*, *b*.)

Sp. Chars.—Coiling crioceratid; whorl-section compressed, with slightly convergent sides and very slightly arched venter; costæ thin, very numerous, slightly flexed on the sides, straight on the venter; tubercles very small, pappillate, on occasional ribs which do not bifurcate at the tubercle; costæ on the body-chamber non-tuberculate; septal suture with relatively broad, rectangular, bifid saddles and narrow regularly trifold lobes.

Dimensions.—Holotype (A.M. Coll.): 122 (95). 48. 34. 31.

Remarks.—One specimen only is known definitely. This is the most massive-whorled species of the genus and differs from the other forms, not only in width of whorl, but in the faintness of the pappillate tubercles. These are to be seen only up to the penultimate chamber, the body-chamber being non-tuberculate. The septal suture agrees well with that of *M. ammonoides* and it is probable that *M. orbiculus* is derived from *M. ammonoides* which it resembles in many ways.

The slightly greater curvature of the ribs at the end of the holotype suggests that the specimen is almost complete to the aperture and that the body-chamber was about half a whorl in length and had short lateral lappets.

Locality.—Beaconsfield (A.M. Coll.); West side of Ward River, 23 miles S.W. of Tambo (F.W.W. Coll.).

MYLOCERAS DAVIDI sp. nov.

(Pl. XXXVII., figs. 2 *a*, *b*, *c*.)

1909 *Crioceras* sp. Etheridge Jr. (30), p. 144, pl. 38, figs. 1, 2.

Sp. Chars.—Coiling crioceratid, whorls compressed; first whorls more loosely coiled than later; costæ thin, numerous, with small pappillate ventrolateral tubercles; septal suture with rectangular saddles and deep very narrow L_1 .

Remarks.—This species is closely related to *M. orbiculus*. In ribbing and tuberculation it is markedly similar to that species but differs in being more compressed and in the deep narrow lateral lobe of the septal suture. The septal suture of the first whorl, however, is very similar to that of *M. orbiculus*. The costæ on the specimen figured by Etheridge are straight; while on the holotype they are slightly flexed. This may not be a specific difference; and the curvature on the holotype is exaggerated by medio-lateral crushing.

Localities.—Bowen Downs, Thomson River (Q.M. Coll., holotype); Barcoo, Ward, and Nive Rivers area (A.M. Coll.).

Genus **FLINDERSITES** nov.⁴⁴Genotype *F. baccatus* sp. nov.

Diagnosis.—Coiling ancyloceratid; whorl-section subcircular to subrectangular, compressed; costæ straight or slightly flexed with ventro-lateral tubercles; apertures with short lateral lappets; septal suture I.U.L.E.

The genus is proposed for group of forms with ancyloceratid coiling. It is derived apparently from *Aleteceras* but develops differently in that, in later (?) forms, the ventro-lateral tubercle becomes thin and elongated as in *F. flindersi* (McCoy). The variety of forms present is amazing, and the number of specimens seen by the writer is entirely insufficient to determine the specific limits among the host of forms that have been figured by Etheridge (42, 23, and 30). Those figures do not include all forms, for specimens seen by the writer belong to groups not depicted by Etheridge. The difficulty of making divisions within this assemblage was realised by Etheridge (30, p. 153), who grouped them all as *Crioceras flindersi* though pointing to several distinct types in the series.

The series requires separation; but all that is advisable to do here is to define several of the more distinct species, leaving a complete analysis for a further occasion when more specimens of the other forms are available.

FLINDERSITES BACCATUS sp. nov.

1909 *Crioceras flindersi* (pars) Etheridge Jr. (30), pl. 36, fig. 2; pl. 41, fig. 3; pl. 42, fig. 2; pl. 44, fig. 2.

Sp. Chars.—Coiling ancyloceratid; ventro-lateral tubercles hemispherical; costæ thin, sharply defined, in groups of two at the tubercle; whorl-section slightly compressed, subquadrate.

Remarks.—As holotype is taken a specimen figured by Etheridge (30, pl. 36, fig. 2; pl. 42, fig. 2; pl. 44, fig. 2). The early whorls are unknown. In its hemispherical tubercles this species is probably closer to *Aleteceras* than any other in the genus.

Localities.—Wellshot (G.S.Q. Coll., holotype); South Central Queensland (A.M. Coll.); west bank of Ward River, 23 miles S.W. of Tambo (F.W.W. Coll.).

⁴⁴ Named from its abundance in the Flinders River section. Since this paper was written Dr. Spath has shown the writer a species of *Myloceras* from Portuguese East Africa which has ancyloceratid coiling. Mode of coiling is therefore of questionable importance as a generic feature, and the name *Flindersites* may have to be abandoned. Differences in ribbing may, however, require it to be separated from *Aleteceras*; for the group seems natural from the point of view of ornamentation.

FLINDERSITES FLINDERSI (McCoy).

1867 *Ancyloceras flindersi* McCoy (60), p. 356.

1909 *Crioceras flindersi* (pars) Etheridge Jr. (30), pl. 39, fig. 1.

This holotype of this species was not figured by McCoy but has been figured by Etheridge. The ventral and apertural views, however, were not given. It is a gigantic species but still *very* imperfectly unknown.

Locality.—Head of Flinders River (N.M. Coll., holotype).

FLINDERSITES aff. FLINDERSI (McCoy).

1909 *Crioceras flindersi* (pars) Etheridge Jr. (30), pl. 39, figs. 2, 3.

This is a common type; but it is only known from fragments. Its relationship to *F. flindersi* cannot be determined until better specimens have been found. It has the same elongated tubercles and the same type of ribbing as *F. flindersi*.

Locality.—Flinders River (Q.M. Coll.).

FLINDERSITES aff. BACCATUS sp. nov.

1909 *Crioceras flindersi* (pars) Etheridge Jr. (30), pl. 40, fig. 4.

This form has similar tuberculation to *F. baccatus* but is rather wider and the costæ are bundled in groups of 3 or 4 at the tubercles.

Locality.—Saltern Creek (Q.M. Coll.).

FLINDERSITES INTERMEDIUS sp. nov.

1909 *Crioceras flindersi* (pars) Etheridge Jr. (30), pl. 40, figs. 1, 2.

Sp. Chars.—Coiling ancyloceratid; whorl-section subquadrate, equidimensional; venter very broad; costæ thin, flexed, prominently rursiradiate on approaching the ventro-lateral tubercles; tubercles blunt, elongate.

Remarks.—This species is peculiar in the course of the costæ. The tubercle is elongated as in *F. flindersi* but is intermediate in character between that of *F. baccatus* and *F. flindersi*. Certain other forms figured by Etheridge are closely connected (30, pl. 40, figs. 5, 6; pl. 51, fig. 1).

Localities.—Mount Cornish (Q.M. Coll., holotype); Longreach (Q.M. Coll.).

FLINDERSITES SP. NOV.

1905 *Crioceras flindersi* (pars) Etheridge Jr. (30, pl. 1, fig. 1; pl. 3, fig. 1).

This type with papillate tubercles is common but the writer has only seen fragments.

Localities.—Dalhousie Springs (G.S.S.A. Coll.); Beaconsfield (A.M. Coll.).

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Plate XXXIV.

(All figures natural size unless otherwise stated.)

1. *Aconeceras walshense* (Etheridge fil.). (a) Lateral, (b) apertural view of topotype. The arrow indicates the beginning of the body-chamber. (See Pl. XXXVII., fig. 3). Walsh River (Q.M. Coll.); Roma Series (Lower Gargasian).
2. *Australiceras jacki* (Etheridge fil.). Topotype. Walsh River (Q.M. Coll.); Roma Series (Upper Bedoulian).
3. *Australiceras transiente* sp. nov. Holotype; (a) lateral view, (b) whorl-section taken at \times . Walsh River (Q.M. Coll.); Roma Series (Upper Bedoulian).
4. *Australiceras gracile* (Sinzow). Small fragment with whorl-section perfectly circular. Walsh River (Q.M. Coll.); Roma Series (Upper Bedoulian).
5. *Toxoceratoides taylori* (Etheridge fil.). Lateral view of fragment. Walsh River (Q.M. Coll.); Roma Series (Upper Bedoulian).

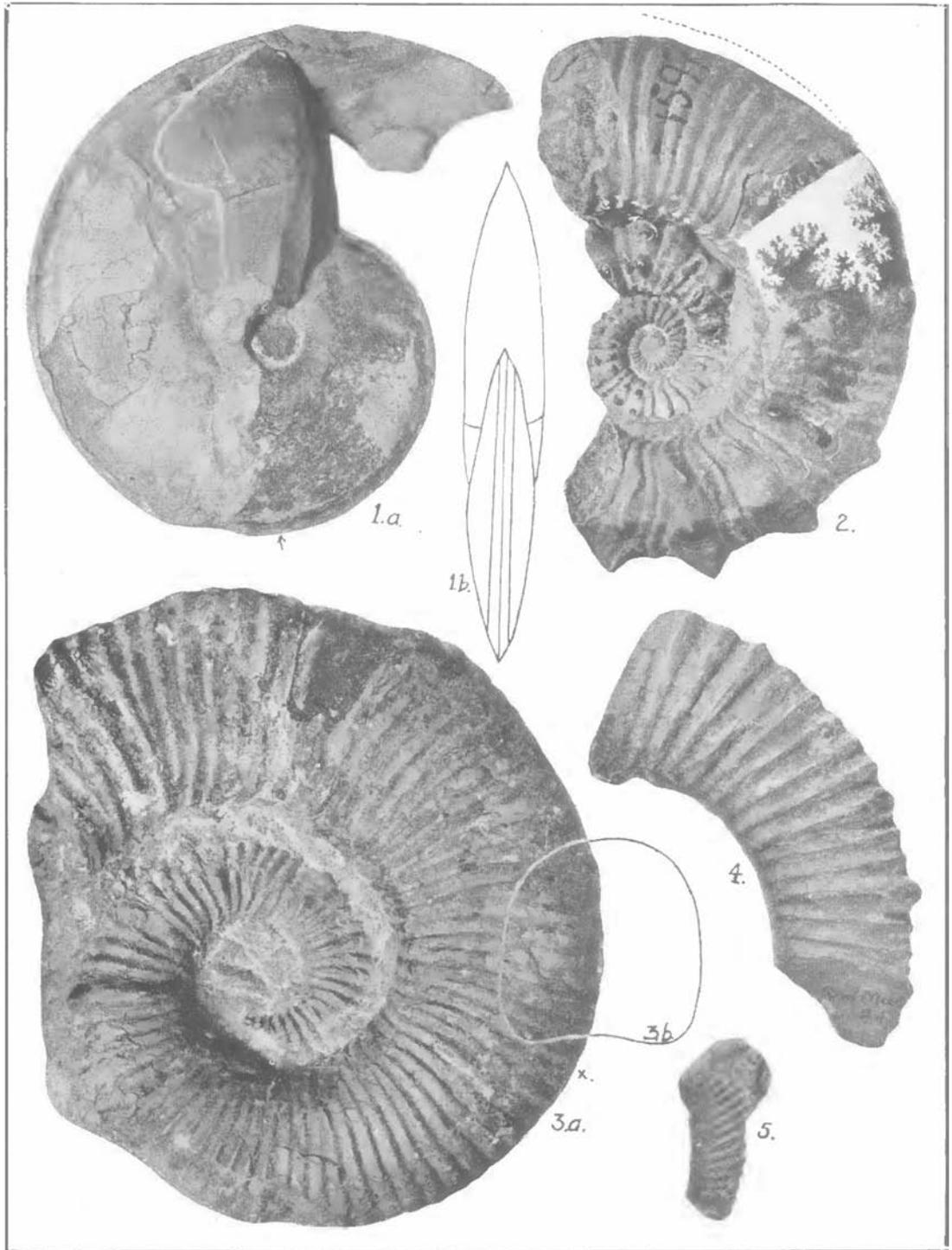
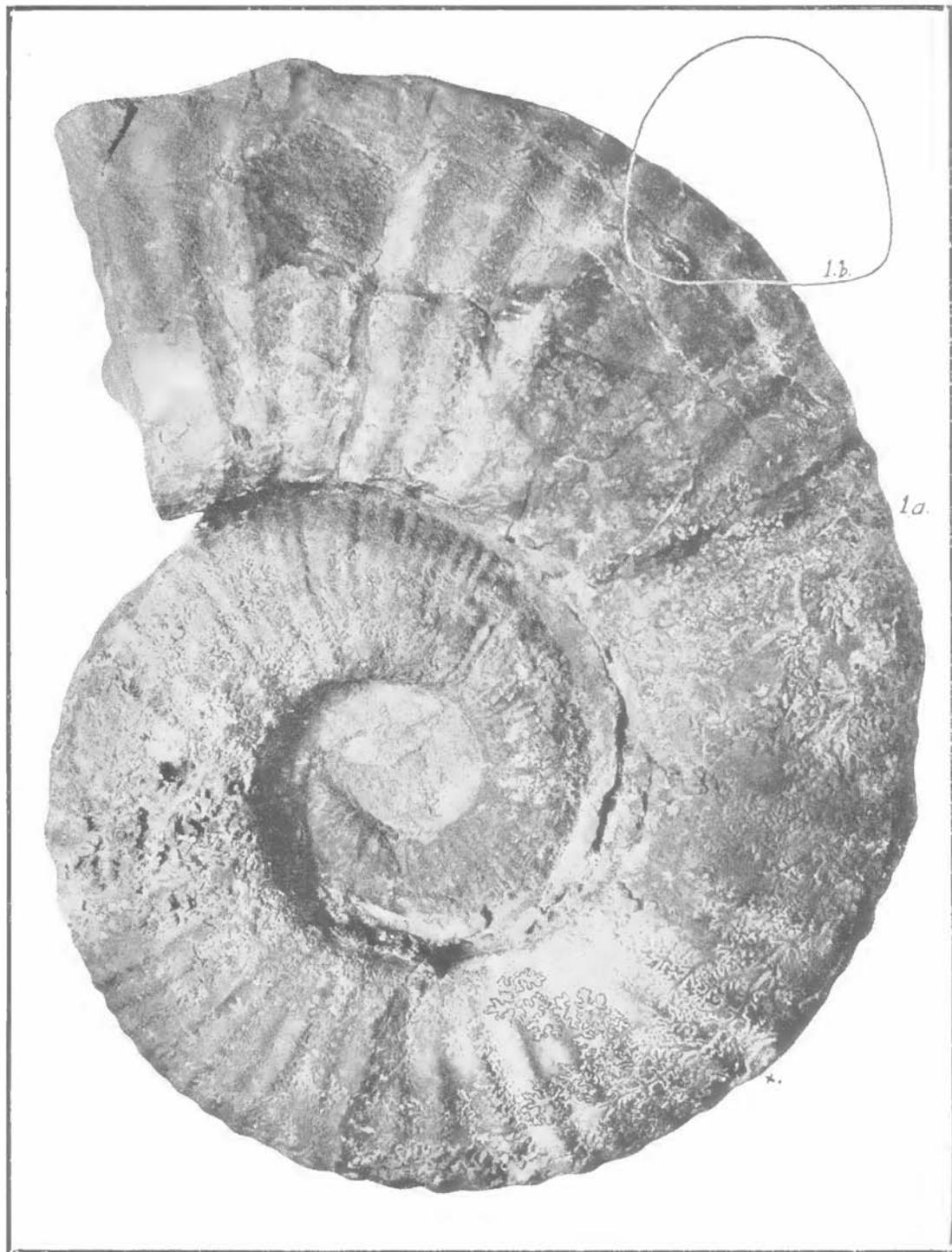


Plate XXXV.

(All figures natural size unless otherwise stated.)

1. *Tropæum lampros* (Etheridge fil.). (a) Lateral view, (b) whorl-section taken at \times . See also Pl. XXXVII., fig. 4. Glendower Station, Flinders River (B.M. Coll.); Roma Series (Lower Gargasian). $\times 0.5$.



W. Tams, Photo.

Plate XXXVI.

(All figures natural size unless otherwise stated.)

1. *Tropæum rarum* sp. nov. Holotype; (a) lateral view, (b) whorl-section taken at \times . Walsh River (Q.M. Coll.); Roma Series (Lower Gargasian). $\times 0.78$.
2. *Prohysterocheras richardsi* sp. nov. Septal suture of specimen from Ward River, 23 miles S.W. of Tambo (F.W.W. Coll.); Tambo Series (Upper Albian).
3. *Prohysterocheras richardsi* var. *nitidum* nov. Whorl-section of holotype. South-Central Queensland (A.M. Coll.); Tambo Series (Upper Albian).
4. *Labeceras papulatum* sp. nov. Septal suture of holotype (see Pl. XXXIX., fig. 3). $\times 2$.
5. *Labeceras compressum* sp. nov. Septal suture of holotype (see Pl. XXXIX., fig. 5). $\times 1.5$.
6. *Beudanticeras* cf. *flindersi* (McCoy). Septal suture of specimen from Hughenden (Q.M. Coll.). $\times 2$.

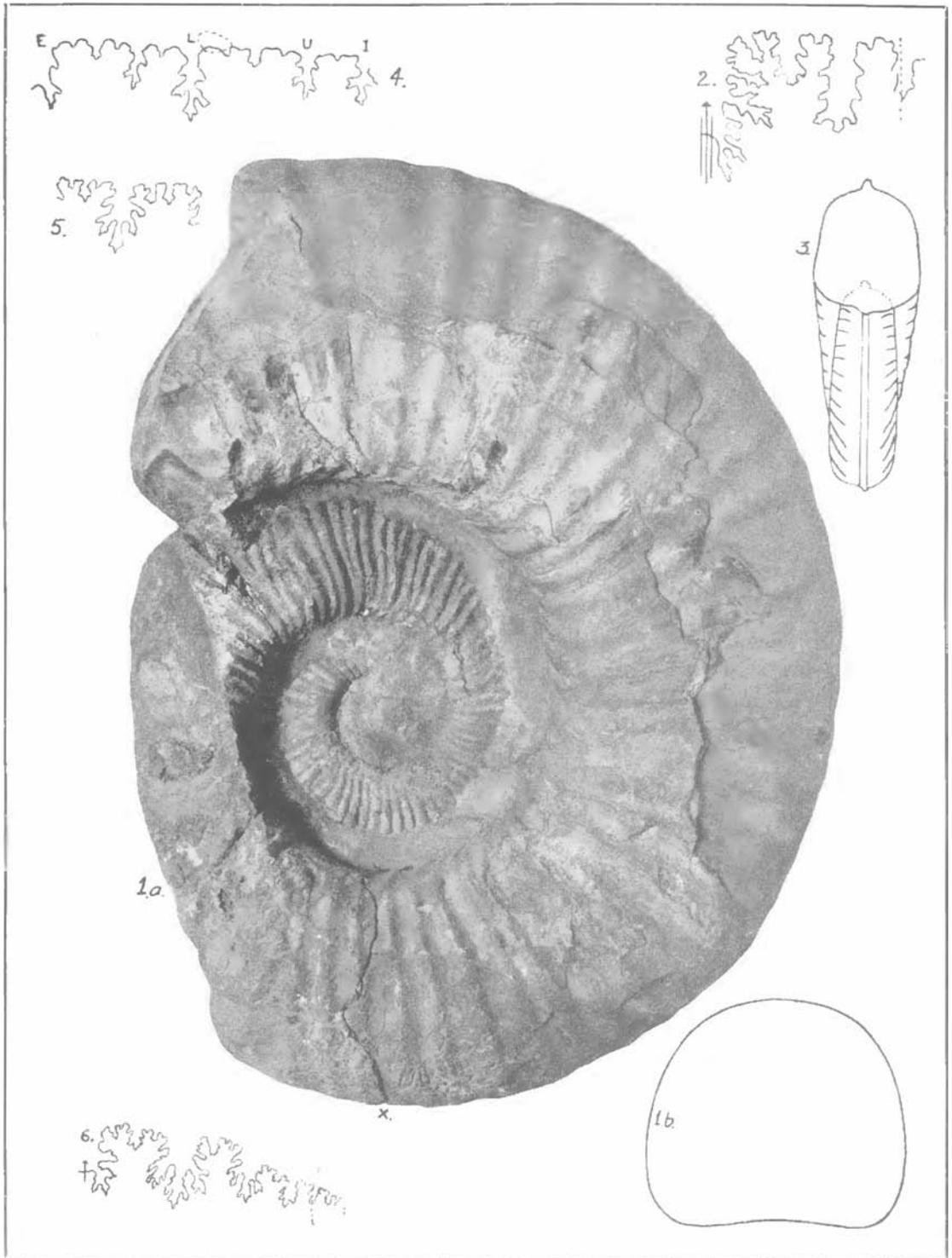


Plate XXXVII.

(All figures natural size unless otherwise stated.)

1. *Australiceras irregulare* (Tenison-Woods). (a) Lateral view, (b) whorl-section at \times . Walsh River (Q.M. Coll.); Roma Series (Upper Bodoulian).
2. *Myloceras davidi* sp. nov. Holotype; (a) lateral view, (b) whorl-section at \times , (c) septal suture. Bowen Downs, Thomson River (Q.M. Coll.); Tambo Series (Upper Albian).
3. *Aconeceras walshense* (Etheridge fil.). Septal suture of specimen figured on Pl. XXXIV., fig. 1. $\times 4$.
4. *Tropæum lampros* (Etheridge fil.). Septal suture of specimen figured on Pl. XXXV.
5. *Puzosia longmani* sp. nov. Septal suture of holotype. See Pl. XXXIX., fig. 1.

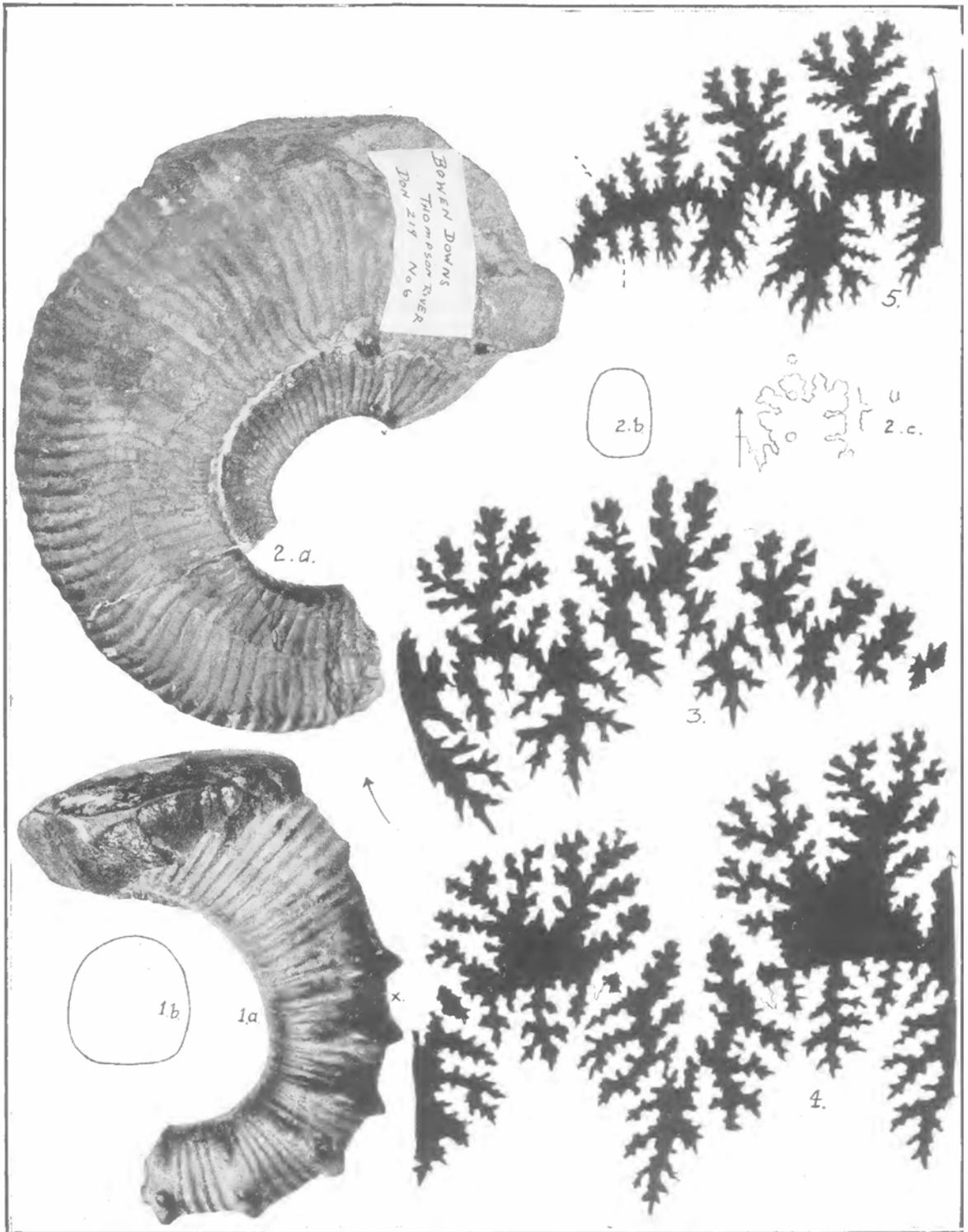
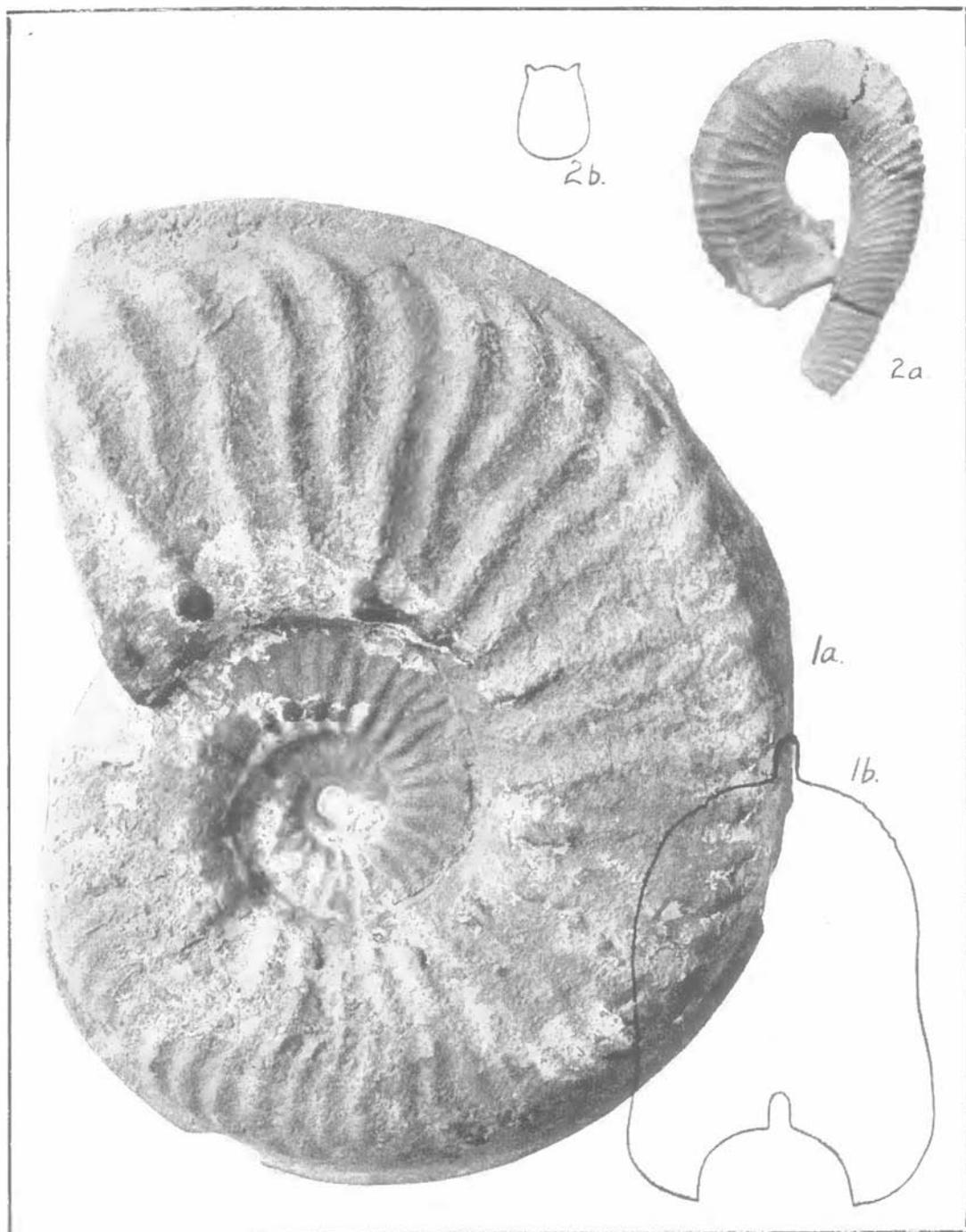


Plate XXXVIII.

(All figures natural size unless otherwise stated.)

1. *Prohysterocheras richardsi* sp. nov. Holotype; (a) lateral view, (b) whorl-section. Augathella (Q.M. Coll.); Tambo Series (Upper Albian).
2. *Appurdiceras etheridgei* sp. nov. Holotype; (a) lateral view, (b) cross-section. Kensington (N.M. Coll.); Tambo Series (Upper Albian).



W. Sanderson, Photo.

Plate XXXIX.

(All figures natural size unless otherwise stated.)

1. *Puzosia longmani* sp. nov. Holotype; (a) lateral view, (b) whorl-section \times . Beginning of body-chamber marked by arrow. Barcoo River (Q.M. Col.); Tambo Series (Upper Albian).
2. *Hamites* aff. *maximus* J. Sowerby. (a) Lateral view, (b) whorl-section at proximal end. Body-chamber. Ward River, head of Warrego (Q.M. Coll); Tambo Series (Upper Albian).
3. *Labeceras papulatum* sp. nov. Genotype, holotype; (a) lateral view, (b) ventral view. Longreach (B.M. Coll.); Tambo Series (Upper Albian).
4. *Labeceras bryani* sp. nov. Holotype, showing aperture. The impression of the dorsum of the spiral portion is preserved at the base of the specimen (not shown in the figure); (a) lateral view, (b) whorl-section at \times . South-Central Queensland (A.M. Coll.); Tambo Series (Upper Albian).
5. *Labeceras compressum* sp. nov. Holotype; (a) lateral view, (b) whorl-section at \times . Tower Hill, Muttaborra (Q.M. Coll.); Tambo Series (Upper Albian).

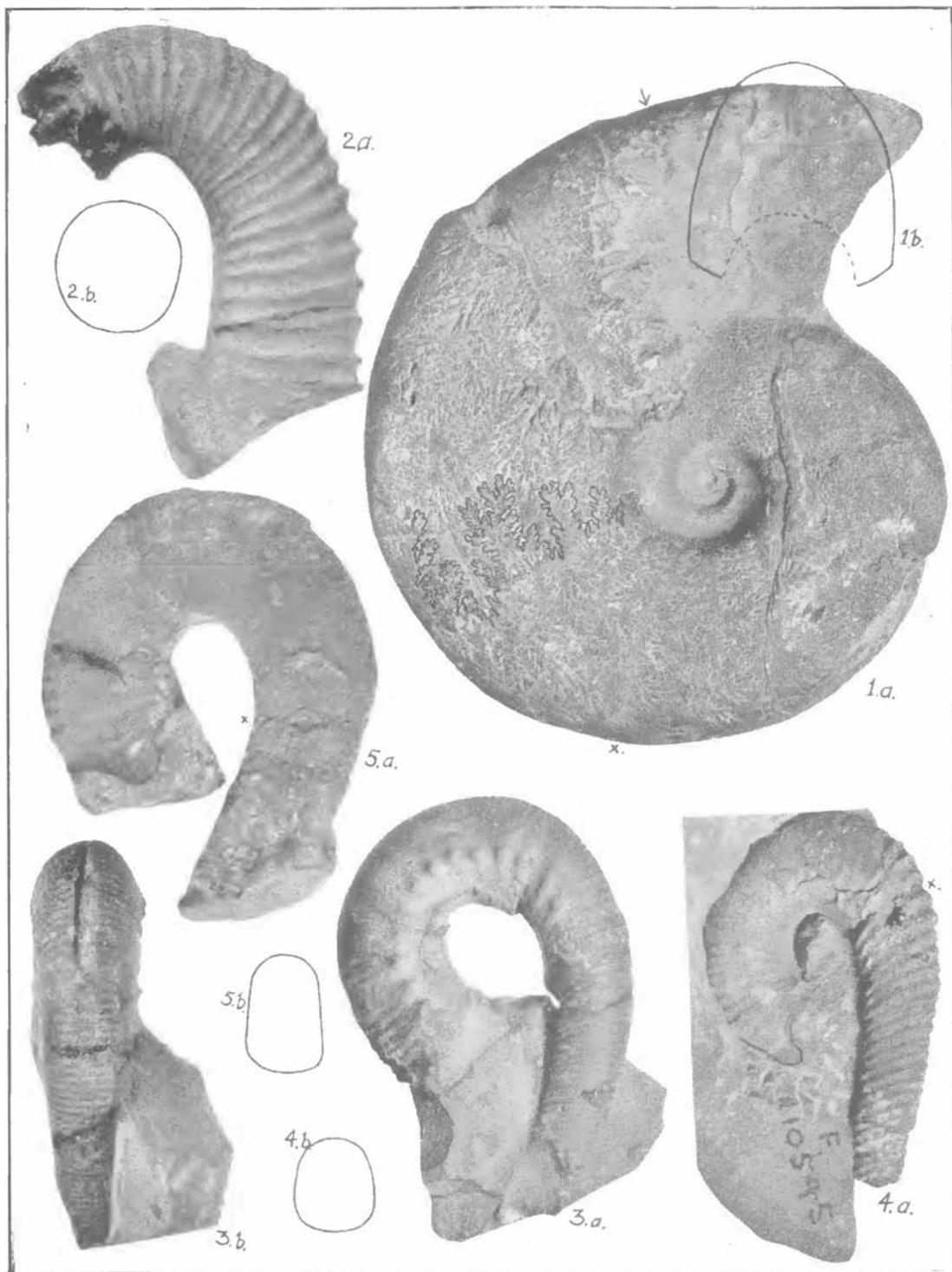
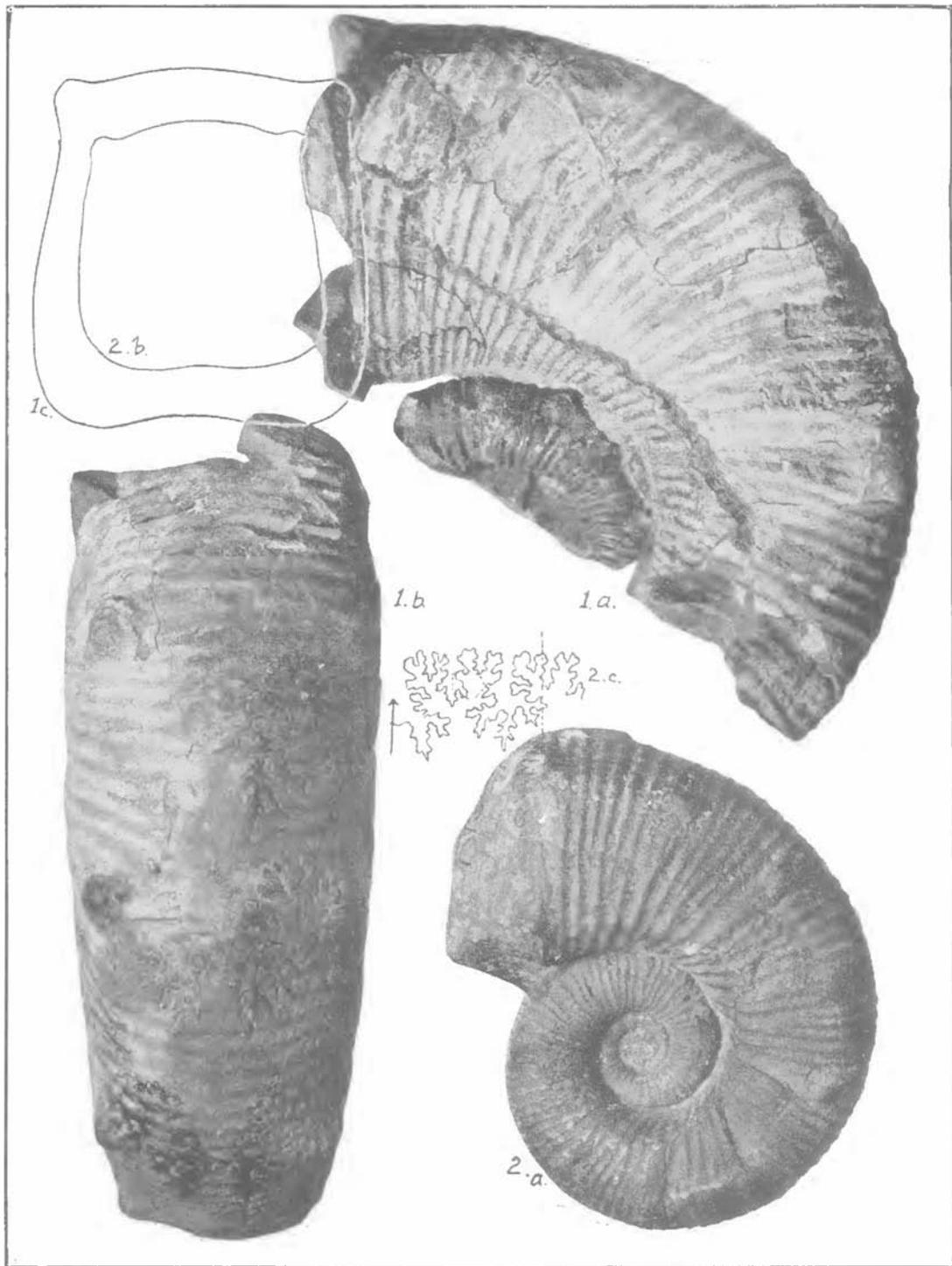


Plate XL.

(All figures natural size unless otherwise stated.)

1. *Aleteceras tardicostatum* sp. nov. Holotype; (a) lateral view, (b) ventral view, (c) whorl-section at the distal end. South-Central Queensland (A.M. Coll.); Tambo Series (Upper Albian).
2. *Aleteceras plectoides* (Etheridge fil.). Young specimen; (a) lateral view, (b) whorl-section at the distal end, (c) septal suture. Walsh River (Q.M. Coll.); Tambo Series (Upper Albian).



W. Tams, Photo.

Plate XLI.

(All figures natural size unless otherwise stated.)

1. *Myloceras orbiculus* sp. nov. Holotype; (a) lateral, (b) ventral view. Penultimate chamber shaded. Beaconsfield (A.M. Coll.); Tambo Series (Upper Albian).
2. *Myloceras ammonoides* (Etheridge fil.). (a) Lateral, (b) ventral view. Dalhousie Springs (A.M. Coll.); Tambo Series (Upper Albian).
3. *Sanmartinoceras olene* (Tenison-Woods). (a) Lateral view, (b) whorl-section. Walsh River (Q.M. Coll.); Roma Series (Upper Gargasian).

