REFERENCES.

1. Miyamoto, S., 1959: A Geological Interpretation of the Lunar Surface. Planet. Space Sci. Vol.2, pp.256-260.
2. Barabashov, N.P., 1961: Structure of the Moon's Surface and Investigation of the First Photographs of its Far Side. Int.Geol.Review, Vol.4,No.6, pp. 631-4.
3. Wilkins, H.P., 1958: Our Moon. Frederick Muller Ltd., London.
4. Hoyle, F., 1961: Frontiers of Astronomy. Mercury Books, London.

PRODROMUS OF A DETERMINATIVE SCHEME FOR AUSTRALIAN AMMONITES

G. Z. Foldvary

ABSTRACT

A determinative classificatory table is presented here in an abridged version, not going lower in the scale of categories than super-families (but there are a few exceptions). It is hoped that, in spite of its abridged nature, this determinative table will prove useful to palaeontologists.

INTRODUCTION

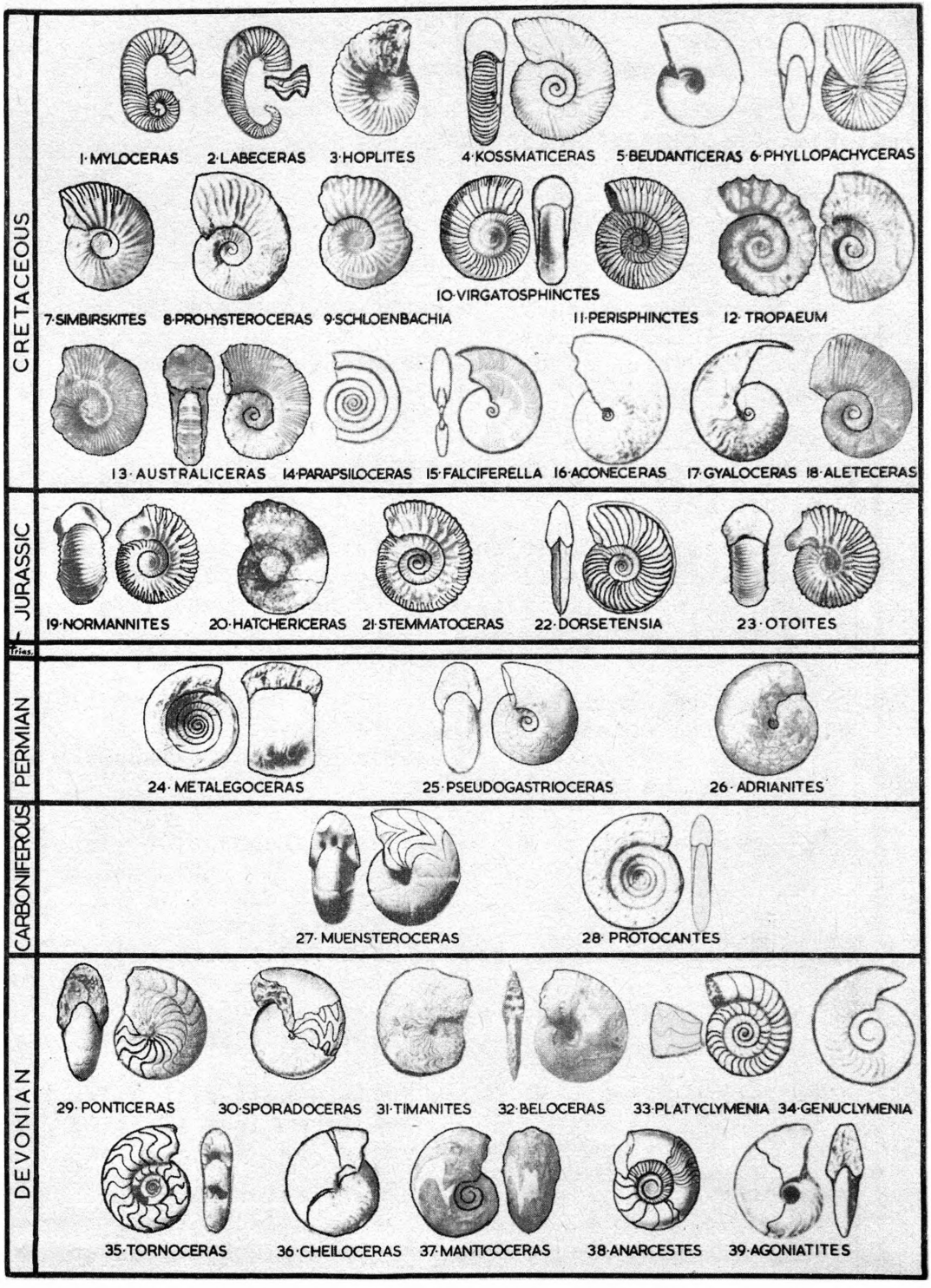
Ammonites are found in all parts of the Australian continent, representing all major groups of the Order Ammonoidea, except the Suborder Ceratitina, starting from the early groups of the Devonian Period to the strongly evolved or specialised Cretaceous superfamilies, alongside with some conservative, persistent groups of long temporal range.

The earliest, Devonian ammonites (Suborders: Clymeniina, Anarcestina, Goniatitina) are abundant at several localities in Western Australia (Glenister 1958), especially in the Fitzroy Basin, Kimberley district, where it forms the basis for 3 zones (Upper Devonian:

1. Manticoceras zone, 2. Cheiloceras zone, 3. Sporadoceras zone)which are also present in Europe (Stufe I,II,III) indicating a sea-link, and a rapid dispersal of genera and species, between the two areas at that time. Devonian Ammonites also occur in the Keepit area, near Tamworth, north-eastern N.S.W. In the subsequent Carboniferous Period ammonites are relatively rare: conditions could not have been favourable and a possible separation from the main centre of evolution might have taken place; also, the two oldest suborders (Anarcestina, Clymeniina) died out by the end of the Devonian Period. Permian ammonites are found in the Hunter Valley (Teichert 1954, Teichert & Fletcher 1943) in the Dalwood Group and Maitland Group; also in Western Australia (Teichert 1942, Teichert & Glenister 1952). The ammonite groups with goniatitic suture lines became extinct in Australia before the end of the Permian Period and this may be responsible for the curious lack of Triassic ammonites: the new suborders (with ammonitic suture lines) first reached Australia during the Jurassic Period. Triassic ammonites, which mostly belong to the Suborder Ceratitina, seem to be absent: though they are very abundant on the neighbouring island of Timor. Jurassic ammonites are abundant in Western Australia. The new ammonite groups (Ammonitina, Lytoceratina, Phylloceratine) probably first reached Australia during the Jurassic Period. The eastern edge of the Great Artesian Basin is especially abundant in Cretaceous ammonites, where the marine Roma Formation and Tambo Formation outcrop, forming part of the aquiclude above the Bundamba Group. (Whitehouse 1926, 1927, 1928, Etheridge jun. 1904, 1909). Also at the western periphery, in Central and South Australia, some ammonites have been recorded (Howchin and Whitehouse 1928).

This type of determinative table seems to prefer the morphological (typological) species concept, based on fossil morphotypes ("type species"): here species is a group of individuals, essentially indistinguishable from the selected group of individuals, essentially indistinguishable, from the selected standard specimen ("holotype" and all the "paratypes").

There is no great abundance of ammonites in Australia (compared with the abundance of English and European ones) and this inevitably renders the species definitions simpler by means of the morphological concept and more difficult by means of the biological concept, where a species is defined as a natural and statistical unit based on interbreeding populations.


CRETACEOUS
1·MYLOCERAS
2·LABECERAS
3·HOPLITES
4·KOSSMATICERAS
5·BEUDANTICERAS
6·PHYLLOPACHYCERAS
7·SIMBIRSKITES
8·PROHYSTEROCERAS
9·SCHLOENBACHIA
10·VIRGATOSPHINCTES
11·PERISPHINCTES
12·TROPAEUM
13·AUSTRALICERAS
14·PARAPSILOCERAS
15·FALCIFERELLA
16·ACONECERAS
17·GYALOCERAS
18·ALETECERAS
JURASSIC
19·NORMANNITES
20·HATCHERICERAS
21·STEMMATOCERAS
22·DORSETENSIA
23·OTOITES
Trias.
PERMIAN
24·METALEGOCERAS
25·PSEUDOGASTRIOCERAS
26·ADRIANITES
CARBONIFEROUS
27·MUENSTEROCERAS
28·PROTOCANTES
DEVONIAN
29·PONTICERAS
30·SPORADOCERAS
31·TIMANITES
32·BELOCERAS
33·PLATYCLYMENIA
34·GENUCLYMENIA
35·TORNOCERAS
36·CHEILOCERAS
37·MANTICOCERAS
38·ANARCESTES
39·AGONIATITES

Diagnostic characteristics for genera are given in one or two sentences, but species are merely listed. Stratigraphic occurrence, locality and age are also listed for genera, and sometimes for species.

Classification on the level of the higher categories is based, in order of importance, on:

1. suture lines,
2. position of siphuncle,
3. external form and ornamentation.

Uncertain genera have been omitted.

The determinative table is based on the Treatise on Invertebrate Palaeontology (ed. R.C. Moore), (L) Mollusca, 4: Ammonoidea, which is by now the standard work on ammonites.

THE DETERMINATIVE TABLE

(Note:) (S.L.) = see picture of suture-line in the back of this article.

I. Simple, goniatitic sutures (at least 3 or 4 lobes); ventral (external) siphuncle and retrochoanitic septal neck: Primitive gyrocones or convolute forms. Devonian.

Suborder Anarcestina

1. Sutures have small V-shaped ventral lobe; Only 3 or 4 lobes with rounded outline. Devonian.

Superfamily Anarcestaceae

Gyroceratites Meyer	L. Devon	
	M. Devon	S-E Austr. (S.L.22*)
- desideratus	M. Devon	Taravale Mudstone, Buchan distr. Vic. Disc-shaped, smooth shell, very simple suture.
Anarcestes Mojs.	L. Devon	Murrindal Limestone, Buchan distr. Vic.
	M. Devon	Disc-shaped shell with half-moon whorl section. (Fig. 38)
Agoniatites Meek.	M. Devon	Flat shell with 4-lobed suture lines (S.L. 23 and Fig. 39).

2. Sutures with large divided ventral (external) lobe. Also a median lobe. Disc. or lens-shaped conch, growth lines biconvex, no prominent sculpture. U. Devonian.

Superfamily Pharciceratacea

Manticoceras Hyatt.	U. Devon	Fitzroy Basin, W.A. (S.L. 19 and Fig. 37)

— cinctum		6 lobed sutures
— guppyi		Shell up to 2 ft. in
— lindneri		diameter.
Koenenites Wed.	U. Devon	W.A.
Ponticeras Mat.	U. Devon	Fitzroy Basin, W.A. (20 S.L. & Fig. 29)
— discoidale		4-lobed sutures, simpler
— retorquatum		but more divided.
Probeloceras Clarke	U. Devon	Fitzroy Basin, W.A.
— alveolatum		4-lobed sutures.
Timanites Mojs. (= Hoeninghausia)	U. Devon	Fitzroy Basin, W.A.
— angustus		(S.L. 21 and Fig. 31)
— pons		10 lobed sutures
Beloceras Hyatt	U. Devon	Fitzroy Basin, W.A.(Fig.22)
— sagittarium		Many adventitious lobes.
Neomanticoceras Schind.	U. Devon	Fitzroy Basin, W.A.
— erraticum		Pair of adventitious lobes inside ventral lobe.
Mesobeloceras Glen.	U. Devon	Fitzroy Basin, W.A. Up to 12 lobes; 3 pairs of ad-
— thomasi		ventitious lobes within ventral lobe.

II. Simply wavy suture line. Siphuncle on the internal (ventral) side, marginal. Septal necks cylindrical, retrochoanitic. Tightly coiled shell. U. Devonian.

Suborder Clymeniina.

Platyclymenia Hyatt.	U. Devon.	Keepit area, N.E.-N.S.W. (S.L. 17 and Fig. 33) Ribbed on smooth shell.
Cyrtoclymenia Hyatt.	U. Devon.	Keepit area, N.E.-B.S.W. Nearly spherical shell.
Genuclymenia Wed.	U. Devon.	Keepit area, N.E.-N.S.W. (S.L.18 & Fig. 34) Disc-shaped, densely ribbed shell.

III. Simply wavy, goniatitic sutures with basically 8 lobes. Siphuncle on dorsal side, prochoanitic septal neck. M. Devonian - U. Permian.

Suborder Goniatitina.

1. Adventitious ventral lobe. All together 6 lobes. Biconvex growth-lines. M. Devonian - M. Permian.

Superfamily Cheiloceratacea

Tornoceras Hyatt	M. Devon U. Devon	W.A. (Fitzroy Basin) (S.L. 15 and Fig.35)
— clausum		small flat shell.
— contracticum		
Posttornoceras Wed.	U. Devon	W.A. Subglobular shell.
Pseudoclymenia Frech.	U. Devon	W.A. Flat lens-like shell, evolute.
Cheiloceras Frech.	U. Devon	W.A. Subglobular shell, 6-10 lobes (Fig. 36)
Dimeroceras Hyatt.	U. Devon	W.A. Large lateral lobe, otherwise similar to Cheiloceras.
— clarkei		
Sporadoceras Hyatt.	U. Devon	W.A. (S.L. 16 & Fig. 30) Subglobular shell. 10-12 lobes (3 internal).
Imitoceras Schind.	U. Devon M. Perm.	Fitzroy Basin: Laurel Form., L. Carbonif. 8 distinct lobes.
— rotatorium		

2. Prominently bifid ventral lobe, undivided lateral lobe. Thinly discoidal or lenticular to globular conch. L. Carbonif. - U. Perm.

Superfamily Goniatitaceae

(a) Suture-lines with 8 lobes. No prominent sculpture. L. Carb. - L. Perm.

Family Goniatitidae

Muensteroceras Hyatt. Lowermost Carbonif. (S.L. 14 & Fig. 27). Discoidal to globular shell with nearly linear growth-lines.

(b) 8-lobed suture-lines. Prominently sculptured conch. L. Carb. - U. Perm.

Family Neoicoceratidae

Paragastrioceras Tsch. L. Perm.

— wandageense

Pseudogastrioceras Perm. Spath. — W.A. Hunter Valley, N.S.W. (S.L. 13 and Fig. 25)

— goochi — N.W. of W.A.

— pokolbinense — Hunter Valley, N.S.W. in Dalwood Gp.

(c) Goniatitic sutures with 12-14 lobes. Disc. to globe-shaped conch. L. Perm. - M. Perm.

Family Metalegoceratidae

Metalegoceras Schind. L. Perm & M. Perm. Irwin R. Valley (Fossil Cliff beds) W.A. (S.L. 12 & Fig. 24)

— campbelli

— clarkei ("Lower Ferruginous series". M. Perm.) 12 lobes; subglobular conch.

— jacksoni — Irwin R.Coalfield,N.W.of W.A.
— striatum — Kimberley distr.

Pseudoschistoceras Teich. L.Perm. W.A. Similar to Metalegoceras but additional lobe in umbilical region of suture line.

— simile Perm. W.A.

3. Sutures goniatitic to ammonitic with trifid lateral lobes, which produce 3 or 4 independent lobes in more advanced forms. Subdiscoidal to globular conch. U. Carbonif. - M. Perm.

Superfamily Agathiceratacea

Agathiceras Gemm. U.Carbonif. - M. Perm.

— micromphalum — Kimberley distr. W.A.;
— planorbiforme — Gympie Form. Q'ld.
— applanatum Perm. — W.A.

4. Goniatitic suture lines with 10-30 lobes. Discoidal to globular shell. U.Carbonif. - M. Perm.

Superfamily Adrianitaceae

Adrianites Gemm.(= Neocrimites Ruzh.) M. Permian (S.L. 11 and Fig. 26) Maitland Group, Hunter R. Valley, N.S.W. Sutures with 20-30 lobes. Inflated shell.

— meridionalis

5. Goniatitic sutures with large bifid ventral lobe and subdivided external lobes: serrate to digitate. Disc-shaped or lens-shaped shell. Carbonif.- M.Permian.

Superfamily Dimorphocerataceae

Thalassoceras Gemm. L. Perm. - M. Permian

— wadei "Lower Ferruginous Series"(M.Perm.) Kimberley distr. — Sutures with digitate external lobes.

IV. Goniatitic to ceratitic suture lines with auxiliary lobes. Siphuncle simple, with retrochoanitic septal neck. Conchs discoidal to thinly lenticular. U. Devon. - U. Trias.

Suborder Prolecanitina

Protocanites Schmidt L.Carb.S.E.Austr.(e.g. Keepit area, N.S.W.) (S.L. 9 and Fig.28).Disc-shaped conch, large umbilici.

Propinacoceras Gemm. M.Perm.N.W. of W.A.(S.L. 10)

— australe — Primitive sutures with bifid
— paucilobatum — auxiliary lobes and low, broad first lateral saddle. Discoidal shell.

V. Suture-lines have moss-like saddles and lobes. Siphuncle on dorsal side. Evolute, loosely coiled, round-whorled shell, ornamented with growth lines, only rarely ribbed.
Jurassic - Cretaceous E. Australia.
Suborder Lytoceratina

1. Uncoiled mostly, with hooked body-chambers.
Tithonian - L. Albian.
Superfamily Ancyloceratacea

Australiceras Whitehouse. Aptian. Roma Form. Great Artesian Basin, (Qld.,S.A.)
— gracile (Fig. 13)
— irregulare - Blackdown Form.(L.Apt.) Carpentaria Sub-basin.
— lampros - Upper Flinders River. 54 cm in diameter (for holotype)
— jacki (no final hook.
— robustum (alternate ribs with tubercles.
— transiente (Trituberculation on initial (and final stages of the shell.

Tropaeum Sow. Aptian. Roma Form.Gr.Art.Basin(Q'ld., S.A.) (S.L. 6 and Fig.12)
— australe
— arcticum Large shell, many costae. Complete loss of tubercles.
— imperator Cretaceous argill. limestone, 48m. S.W. of Oodnadatta, on the N.E. flanks of the Stuart Range (S.A.) The largest species of all.
— leptum
— rarum
— undatum

Hamiticeras Anderson Aptian. Roma Form.Gr.Art.Basin (Qld,S.A.) Small shell: plane open spiral,
— taylori followed by long shaft and final hook; fine ribe(oblique)

Leptoceras Uhlig Barremian Small shell with slight
— edkinsi spire, long shaft and massive hook. Ribs and tubercles increase towards hook.

Ancyloceras d'Orb. Aptian Roma Form.Gr.Art.Basin (Qld,S.A.).Similar to Hamiticeras, but larger shell and 2 rows of tubercles.

Ammonitoceras Dumas Aptian Roma Form.Gr.Art.Basin (Qld., S.A.)

2. Suture with no auxiliary element. Heteromorph coiling of many forms, with smooth, ribbed and tuberculate shell surfaces. Cretaceous.

Superfamily Turrilitaceae

Ptychoceras d'Orb. U-Aptian - L. Albian
E. Australia.
— closteroides — Long, straight, ribbed initial shaft, on which the longer second shaft (tapering into a point) is closely bent back.

Hamites Park. U.Aptian - U. Albian.
Tambo Form. Gr.Art.Basin (Qld., S.A.). 3 well-separated, nearly parallel shafts; strong ribs.

Anisoceras Pict. U. Alb. - U. Turon — Tambo Form.Gr.Art.Basin

Eubaculites Spath. — Maastrichtian, W.A.

Glyptoxoceras Spath. — Santonian - Maastr.

Diplomoceras Hyatt — Campanian - Maastr.

Bostrychoceras Hyatt — Cenomanian - L. Maastr.W.A.

— indicum — Strongly ribbed, tightly coiled, acute angled spire. Similar to Turrilites.

3. Suture lytoceratid in early forms, but there is much variation. Coiled in loose, tight plane spiral, with terminal hook on short or long shaft. U. Albian - Maastrichtian.

Superfamily Scaphitaceae

Scaphites Park. U.Alb. — Campanian,Qld. (S.L. 8)

— ericiformis — Irregularly sutures. Early whorls incontact. Shaft short. Ribs branching. 2 rows of tubercles.

Labeceras Spath. U. Alb. — Tambo Form of Gr.Art.Basin in Qld. and S.A. (S.L. 7 and Fig. 2)

(i) Labeceras (Labeceras)
— bryani
— compressum
— laqueum
— populatum
— trifidum
— small shell with open spire of few whorls followed by curved shaft and final hook. Fine ribs and some tubercles

(ii) Labeceras (Appurdiceras)
— corycepoides
— etheridgei

Myloceras Spath. L.-U.-Alb. — Tambo Form.Gr.Art.Basin (Qld., S.A.) (Figure I)

— ammonoides — Larger shell than Labeceras
— davidi — Spire more closely coiled.
— orbiculum

(i) Myloceras (Flindersites) Tambo Form. Gr. Art. Basin (Qld)
— baccatum
— flindersi
— intermedium

(ii) Myloceras (Aleteceras) (Fig. 18: a young specimen, with tuberculate ribs, no shaft or hook.)
— plectoides
— tardicostatum
— nautiloides
— axonoides

4. Lytoceratid suture lines, fully coiled shell, smooth or with ribs. Jurassic - Cretaceous.

Superfamily Lytoceraceae

Suture line with auxiliary elements. Lirate, striate, or smooth shell, Cretaceous.

Family Tetragonitidae

Pseudophyllites Kossm. — Campanian-Maastr. W. Australia. No constrictions on shell, involute; whorl-section rounded. Very finely divided, complex suture-line.

VI. Ammonitic sutures. Dorsal siphuncle. Thick test with strong ornamentation. Closed, planispiral shell. Jurassic - Cretaceous.

Suborder Ammonitina

1. Simple, rather phylloceratitic sutures; evolute shell with smooth or vaguely ribbed surface, rounded venter. L. Jurassic.

Superfamily Psiloceratacea

Parapsiloceras Hyatt (= Paraphylloceras Salfeld) (Fig. 14) — Hettangian, W.A. Evolute many-whorled shell; elliptical cross-section. Venter unkeeled.

2. Truly ammonitic sutures. Compressed or planulate or even oxycone shell, with keel and falcate or falcoid ribbing. L. Jur. - M. Jurassic.

Superfamily Hildocerataceae

Dorsetensia Buckm. M. Bajocian W. Australia (Fig. 22)
— clarkei — Falcoid ribs, but outer whorls smooth.

Sonninia Bayle M. Bajocian) Newmarracarra Limestone,
Witchellia Buckm. ") Geraldton District, N. of Perth, W.A.

3. Ammonitic sutures. Compressed, discoidal shell, with or without keel, smooth surface, falcoid or falcate ribbing. L. Bajocian - Albian.

Superfamily Haploceratacea

Sculpture and sutures in almost infinite variety. Ribbing usually S-shaped and forked. Bajocian - Albian

Family Oppeliidae

Aconeceras Hyatt L.Albian Roma Formation, Gr.Art.Basin
— austronisoides (Qld., S.A.)(S.L.5 & Fig.16)
— walshense Involute shell with flat sides.
— whitehousei Keel very finely serrate.

Falciferalla Casey M.Albian Tambo Formation Gr.Art.Basin
— breadeni (Qld., S.A.) (Fig.15)
— reymenti Flat-sided shell with venter varying from rounded to flat.

Eofalciferalla
— condoni

Sanmartinoceras Bona. W.A. and E. Austr.
M.Apt.-L.Alb. Roma Formation (Gr.Art.Basin, Qld. S.A.) (S.L.3)
— fontinale Falcate or falcoid ribs
— olene Aperture with long rostrum and lappets.

Gyaloceras Whiteh. U.Apt. - L.Alb.
Roma Formation, Qld. (Fig 17)
— smithi Smooth shell, not so involute as Aconeceras.

4. Sharply ribbed cadicones (evolute, thick), also can be sphaerocones, oxycones and planulates, with complex suture-lines. (Dominant 1st lateral lobe).
M. Jura - U. Jura

Superfamily Stephanocerataceae

Stemmatoceras Masc. M. Bajocian Greenough R. district, W.A. (Fig.21) Stout, involute shell

Zemistephanus McLearn. Greenough R. district, W.A.
M. Bajocian Coronate whorl cross-section.

Normannites Mun-Chal
M. Bajocian Greenough R. district, W.A. (Fig 19)
— australia Large lappets

Otoites Masc M. Bajocian Greenough R. district, W.A (Fig.23)

Pseudotoites Spath M. Bajocian
Greenough R. district, W.A.

5 Complex, differentiated sutures with dominant first lateral lobe. Evolute, predominantly planulate shell with strong and very variable ribbing, usually forked M. Bajocian - Valanginian.

Superfamily Perisphinctaceae

Simbirskites Pavlow L.Hauteriv.Qld.(S.L. 4 & Fig.7)
— morvenae — Involute shell with coronate cross-section. Forking of ribs starts about half-way outwards, branching point marked by tubercles.

Virgato-sphinctes Uhlig
— communis — Canning Desert, N.W.Australia. Alexander Form.(Kimmeridgian to early Tithonian). Also Langey Beds(Uppermost Jurassic) on Dampier Peninsula.(Fig 10). Large evolute shell, biplicate ribs.

Kossmatia Uhlig — Alexander Form.(Kimmeridg.L. Tithonian).Canning Desert, N.W.Aust. Also in Langey Beds. Fine,many-branched ribbing.

Perisphinctes Waag.U.Oxfordian Jarlemai siltstone (Canning Basin) W.A.(Fig.11)
— championensis — Also in Greenough R. district.
— kayseri

Hatchericeras Stanton L. Hauteriv. Lakefield (On Normanby R. N.Qld.)(Fig.20) Large, involute, flat shell.
— lakefieldense — Fine, branched ribbing. Simple sutures with wide lobes.

6. Phylloceratoid sutures (but folioles are not phylloid). Whorls predominantly rounded or oval in cross-section. Shell usually smooth and weakly ribbed. Derived from Phylloceratina. Valanginian - Maastrichtian.
Superfamily Desmoceratacea

Puzosia Bayle L.Albian Large, evolute shell;whorls
— longmani U.Turonian are flattened sideways, i.e. elliptical in cross-section. Weak, simple ribs. Very complex phylloceratoid suture lines.

Beudanticeras Hitzel(=?Boliterceras Whiteh)L.Alb.-U.Alb. Tambo Form.Qld.S.A.(S.L. 1 & Fig.5) Flat, involute shell, smooth surface with weak ribs. Suture lines simpler than in Puzosia
— daintreei
— flindersi
— ingente
— mitchelli
— perlatum
— sutherlandi

Beudantiella Breistr (= Cophinoceras Whiteh.)
— ogilviei — Sparse, nearly straight main ribs and short intermediate ribs.

Desmoceras Zittel U.Apt. - Cenoman. Qld., W.A. Involute shell, with circular whorl section.

Hauericeras de Gross.Coniacian - Maastricht. W.A.

Kossmaticeras de Gross. (Natalites) U.Turon. Campanian,W.A.(Fig.4) Evolute shell with dense, simply branched ribbing.

7. Simplified desmoceratoid suture-lines. Compressed shell with flat venter and strong ornamentation (branched ribs, tubercles). Hauterivian - Campanian.

Superfamily Hoplitaceae

Deshayesites Kazansky Aptian Qld. (= Parahoplitoides) Flat, evolute shell.

Aioloceras Whiteh. L.Alb. Qld.

— jonesi

Hoplites Neum. L.Neocomian,Jowlaenga Form.Dampier Peninsula,W.A.(Fig.3) Flat shell, with near rectangular whorl-section. Strong ribs,branching.

Schloenbachia Neum.U.Alb. - Cenomanian (Fig.9)

— rostrata Smooth shell with faint but wide ribs, and keel on the venter.

8. Suture-lines with squarish, symmetrical,deeply and sharply indented saddles. A polyphyletic group,derived from Desmoceratidae, possessing strong ribs and tubercles; also includes smooth oxycones. Ribs are simple or branched. Cretaceous.

Superfamily Acanthocerataceae

Prohysteroceras Spath. Lower Upper Albian, TamboForm., Qld. (Fig.8) Flat, evolute shell with keel. Dense, fine ribbing. Tubercles present.

— angolaense

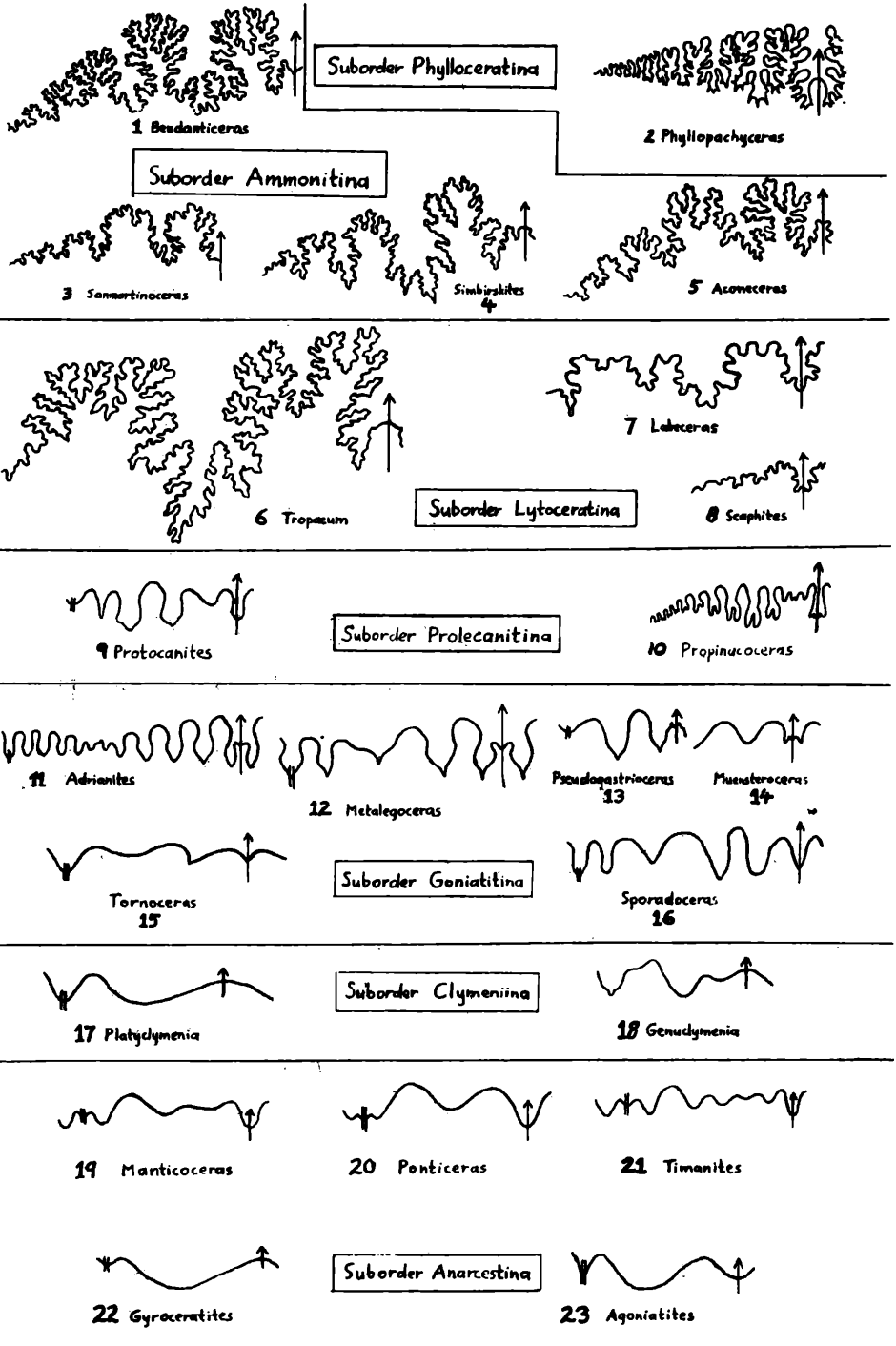
— richardsi

Mortoniceras Meek Upper M.Alb.- U.Alb. (= Pervinquieria Boehmi = Inflaticeras Stieler) Strongly ribbed evolute shell with tubercles.

VII. Phylloid (leaf-like) saddles on suture-lines. Smooth, weakly sculptured shell of thin test. Persistent, conservative group: Triassic - Cretaceous.

Suborder Phylloceratina

Phyllopachyceras Spath. Barremian-Maastr.W.A.(S.L.2 and Fig.6) Involute shell with strong outer ribs. Suture lines with 1st and 2nd lateral saddles.



Representative suture lines

In the seven suborders which occur in Australia

ACKNOWLEDGMENTS

The writer is indebted to Dr.A.N.Carter and Mr.H.O. Fletcher for their co-operation and help, and to Miss Valmai Peet for her kindly offered and excellent typing of the manuscript. Pictures have been taken from many sources: from Naumann's "Geognosie"(1850) to Glenister's article in Journ.Pal.1958 and many local publications like that of J.T. Woods, 1961. The bulk of the pictures are from Volume L of the Treatise on Invertebrate Paleontology (Ammonoid volume) 1957, University of Kansas Press.

REFERENCES (selected)

Burma, B.H. 1954 Reality, Existence and Classification. Madrono, Vol.12, p.193-224.

Etheridge, R.Jun.1904,1909. Lower Cretaceous fossils from South Central Qld., and Northern Territory. Rec.Austr.Mus.Vols.V, VII (No.3-4).

Glenister,B.F.,1958.Upper Devonian ammonoids from the Manticoceras zone, Fitzroy Basin, W.A. Journ.Pal.Vol.32, p.58-96.

Haas,O.,1942. Recurrence of morphologic types and evolutionary cycles in Mesozoic ammonites. Journ.Pal.Vol. 16, p.643-650.

Howchin & Whitehouse,1928. A new and very large crioceratid ammonoid from the Cretaceous of Central Aust. Rec.S.Austr.Mus.Vol.III No.4 p483-492.

Imbrie, J. 1957 The species problem with fossil animals in: The Species Problem (a symposium, ed.Mayr) Publ.No.50, Am.Ass.Adv.Sci.

Miller, A.K.1936 A new Permian ammonoid fauna from W.A. Journ.Pal. Vol.10, p. 684-688.

Simpson, G.G.1951 Species Concept.Evolution Vol.V.p.285-298

" " 1940 Types in modern taxonomy.Am.J.Sci. Vol.238, p. 413-31.

Teichert, C. 1942 Permian ammonites from W.A. Journ.Pal. Vol.16 p.221 -232.

" " 1941 Upper Devonian goniatite succession of W.A. Am.J.Sci. Vol. 241, p. 69-94. 167-184.

" " 1948 M.Devonian goniatites from the Buchan distr.Vic. J.Pal.Vol.22 p. 60-67.

" " 1949 Obs.on strat.and pal.of Devonian, western Kimberley. Bur. Mineral. Res.Report No.2.

" " 1952 A new ammonoid from the eastern Aust. Permian province. J.Roy.Soc.N.S.W. Vol. 87, p.46-50.

Teichert, C. & Fletcher, 1943. A Permian ammonoid from N.S.W. and the correlation of the Maitland Gp. Rec.Aust.Mus.Vol.21, p.156-163

Teichert, C. & Glenister. 1952. Lower Permian ammonites from W.A. J. Pal. Vol. 26 p. 12-23.

Whitehouse, F.W. 1926,1927,1928. The Cretaceous Ammonoidea of Eastern Australia. Mem.QldMus. Vol.viii, Pt.3, Vol.ix, Pts.1-2.

Woods, J.T. 1961 A new species of Hatchericeras from N. Queensland. J.Geol.Soc.Austr.Vol. p.239-243

SOME OBSERVATIONS ON QUARTZ CRYSTALS FROM THE NEW ENGLAND DISTRICT, NEW SOUTH WALES

J.H. Bryan[1]

ABSTRACT

Smoky quartz crystals from three types of ore deposits, associated with the late Permian granitic intrusions, in the New England district were examined.

The crystals from each deposit were found to have certain characteristic morphological features.

INTRODUCTION

The localities from which the crystals were collected are:
(a) Kingsgate - molybdenite bearing quartz pipes.
(b) Fielders' Hill - a wolframite bearing quartz - Topaz intrusion.
(c) Blatherarm - a complex Uranium bearing pegmatite.

The smoky quartz crystals observed in these deposits vary in size from $\frac{1}{8}$" to 1". The crystals all have a prismatic habit and the only forms developed are the first order prism (M), the positive rhombohedron (R) and the negative rhombohedron (Z). The crystals are singly terminated by a combination of the R and Z faces.

Contact twins, where the first order prism $(10\bar{1}0)$ is the twin symmetry and twin composition plane, are common. Poor cleavage parallel to the positive rhombohedron is rarely observed, but hackly to sub-conchoidal fractures develop along random crystallographic directions. Zoning was not observed in these crystals.

With respect to the features described above the crystals are similar, however with respect to certain features of the habit and crystal face markings, the crystals from each deposit are significantly different from those of the other deposits as follows:

---

1. Undergraduate, University of N.S.W.