SYSTEMATIC REVISION OF THE BAJOCIAN AMMONITE SUBFAMILY *SPHAEROCERATINAE*

By

C. F. Parsons

ABSTRACT

The classification of this Bajocian (Middle Jurassic) ammonite group is discussed, and it is here defined as a subfamily within the ammonite family *Otoitidae*; with three constituent genera (*Chondroceras*, *Labyrinthoceras* and *Sphaeroceras*) and five subgenera (*Sphaeroceras (S.), S. (Megasphaeroceras*), *Chondroceras (C.)*, *C. (Defonticeras) and C. (Praetulites)*. Six species and subspecies of *Sphaeroceras (S.)*; eight of *Chondroceras (C.)* including one new (*C. obornensis nov*.) and two subspecies of *Labyrinthoceras* are described. The evolution of the subfamily is discussed and its interesting exhibition of evolutionary size decrease described. The problems of sexual dimorphism in the *Sphaeroceratinae* are summarised and the stratigraphic distribution and significance of its members detailed.

CONTENTS

I. INTRODUCTION TO THE SPHAEROCERATINAE

The *Sphaeroceratidae* was erected as a family name for a diverse group of unrelated ammonite genera; *Sphaeroceras, Emileia, Otoites, Chondroceras, Docidoceras, Labyrinthoceras, Trilobiticeras, Morrisiceras and Macrocephalites* (Buckman, 1920 in 1909-30, p.22). This taxon was later restricted by Buckman (1921 in 1909-30), who removed *Morrisiceras* and *Macrocephalites* to the *Tulitidae* and *Macrocephalitidae* respectively. Roman (1938, p.197) further restricted his use of the *Sphaeroceratidae* to the genera*, Sphaeroceras* (including *Labyrinthoceras* & *Chondroceras*), *Platystomoceras, Emileia, Otoites* (including *Trilobiticeras*) and *Defonticeras*; whilst Arkell (1951-9; 1957), assigned most of these genera to other families and restricted the *Sphaeroceratidae* to *Sphaeroceras*, *Chondroceras*, *Labyrinthoceras* and *Oecoptychoceras* only. With the placing of this latter genus in the *Morphoceratidae* (Westermann, 1956a), the *Sphaeroceratidae* came to be represented solely by three genera, as are accepted here. The ammonite subfamily *Sphaeroceratinae*, so defined, consists of a well differentiated, Bajocian group, of small to medium sized, sphaeroconic ammonites, with fine sharp ribs and a low degree of morphological differentiation between sexual dimorphs.

There are several Bathonian/Callovian groups, such as *Bomburites, Bullatimorphites* and *Kheraiceras* (Arkell, 1951-9, pp. 86-90), which bear a strong, if perhaps only superficial resemblance to these Bajocian taxa. Many of the former were originally placed in *Sphaeroceras,* and thus were included in the *Sphaeroceratidae* (cf. Roman, 1938). The greatest similarity, as noticed at an early date by Waagen (1867, p.604), is between certain species of *Chondroceras*, particularly *evolvescens* (Waagen), and members of the *Bullatimorphite*s group (e.g. *B. suevicum* (Roemer), Quenstedt, 1845-9, Plate 15, fig. 5; Westermann & Getty, 1970, Plates 53-5). This has suggested a direct phylogenetic link between these two groups (Arkell, 1951-9, p.82). Whilst the latter must remain a possibility, there are several factors which suggest that this close similarity could be nothing more than another example of convergent evolution and homeomorphy. Notably there are considerable differences between these groups in the structure and organisation of their septal sutures. In particular the Bajocian taxa, such as *Chondroceras* possess a 'heterochronous, internal lateral lobe' (U), rather than the 'normal' U in *Bullatimorphites*, which is characteristic of the *Tulitidae* (i.e. the latter is 'eubullate', see Westermann, (1964a, p.996; 1967, pp.259-60); Westermann & Getty, (1970, pp.253, 263). Another important factor is the considerable stratigraphic break between the last Bajocian members of the *Sphaeroceratinae* in the upper *garantiana* Zone (= lower-most *parkinsoni* Zone of some authors), and the appearance of the Bathonian forms in the upper Zigzag Zone. In fact this stratigraphic gap is even larger, since the species of *Chondroceras*, which are commonly compared with *Bullatimorphites*, are restricted to the lower *humphriesianum* Zone. The younger Bajocian Sphaeroceraitids are far less comparable, since they are more involute, and much smaller. It has been suggested that members of the subgenus *Chondroceras (Praetulites)*, particularly "*G. (P.)" dalpiazi* Sturani 1964 (pp.24-5), might at least in part fill this gap, (*loc. cit.*). However, it has subsequently been shown that this latter taxon is a misplaced Callovian form (Sturani, 1968, pp.43- 49), and in fact there is little or no information available on the correct stratigraphic position of *Praetulites*, which might well originate from an horizon as low as the Sauzei Zone (Westermann, 1956, p.46).

Thus, whilst it is possible that the Bathonian *Bullatimorphites* may have originated from a long ranging, but as yet unknown Bajocian Sphaeroceratid, other origins, such as within the *Morphoceratidae*, cannot be ruled out. In these circumstances it would, seem best to restrict membership of the Sphaeroceratinae to those Bajocian taxa, which can be shown to be naturally related; that is the three genera discussed above.

Sphaeroceratid ammonites are most commonly found within the *humphriesianum* and *subfurcatum* Zones of the Bajocian, although they are more rarely encountered at horizons above and below these Zones. The absolute range of this subfamily depends on the definition of its contents, but as defined here, it "would appear to be from the upper *laeviuscula* Zone to the base of the *parkinsoni* Zone; see Table I for the zonal scheme used here. Whilst these ammonites have a relatively wide stratigraphic range, they would seem to have a restricted geographic distribution. The sphaeroconic shell shape appears to be linked with some form of 'facies control' of these ammonites, as with the Bathonian Tulitidae (Torrens, 1967, p.84; Hahn, 1971, pp.62-4). Thus the genus *Sphaeroceras* is particularly abundant in limestone deposits, which were laid down on shallow, current swept areas of the sea floor (Sturani, 1971, p.44). Some degree of palaeogeographic isolation undoubtedly increased their provinciality: thus some species of *Chondroceras*, including *C. schmidti* (Westermann) & *C. schindewolfi* (Westermann), are more relatively abundant in Germany and the Swiss Jura, where similarly restricted faunas of *Staufenia* are to be

ZONE	SUBZONE
Parkinsonia parkinsoni	*Parkinsonia bomfordi* *Strigoceras truellei*
Strenoceras(Garantiana)garantiana	*Parkinsonia acris* *Strenoceras(Pseudogarantiana)dichotoma*
Strenoceras (S.) subfurcatum	*S. (Garantiana) baculata* *Caumontisphinctes (C.) polygyralis* *Teloceras banksi*
Stephanoceras (S.) humphriesianum	*Teloceras blagdeni* *Stephanoceras (S.) humphriesianum* *Dorsetensia romani*
Emileia (Otoites) sauzei	
Witchellia (W.) laeviuscula	*Witchellia (W.) laeviuscula* *Sonninia ovalis*
Hyperlioceras (H.) discites	

Table 1.

Zones and Subzones of the Bajocian Stage (excl. Aalenian),
used here, and modified after Parsons, (1974 & 1976).

found in the Aalenian. This provinciality of the *Sphaeroceratinae* strongly contrasts with the occurrence of the *Stephanoceratidae* at the same horizons, most of which are truly cosmopolitan. In this work I am thus restricting myself to those members of this subfamily, which are known to occur in the British Isles.

In the recent past attempts have been made to undertake a systematic revision of this subfamily, (Westermann, 1956 and 1964). Both of these works suffered from a lack of knowledge of the stratigraphic distribution of the various 'species' and 'morpho-types', which resulted in dubious and often illogical conclusions. A more recent paper by Sturani (l97l) has described large and well localised collections of Sphaeroceratids from the Venetian Alps of Italy. However, the nature of these faunas, with their small physical size in this 'Coquina facies' makes comparisons with other areas difficult. It is also sad to note some glaring omissions in this otherwise fine work; notably the lack of any measurements or collection numbers for many specimens, including the holotypes of some new species, such as *Sphaeroceras tenuicostatum* Sturani.

Material

The following account is mainly based on over four hundred Sphaeroceratid ammonites, which I have collected *in situ* from various localities in the British Isles: south Dorset, Somerset, the Isle of Skye, but mostly from the Sherborne area of north Dorset. Use of museum specimens has, as far as possible been restricted to well localised and documented specimens. The latter overwhelmingly originate from Milborne Wick, Somerset, where the one thin bed which has yielded most of the Sphaeroceratid ammonites, has a highly distinctive matrix. Other, less well documented museum material has only been used either for comparative purposes, or to give a better knowledge of the range of variation in species, such as *C. grandiforme* Buckman, where only small *in situ* samples are available. Because of the very close affinity between the Normandy (France) and Dorset ammonite populations, and also because many of the type specimens of distinctive Sphaeroceratid species originate from Normandy, a few specimens from this region, in both my own and museum collections, are included here

Location of material.

Specimens, according to the prefix of their collection number, belong to the following collections:

BCM	Bristol City Museum, Bristol
NHM	The Natural History Museum, London.
BUGM	Bristol University, Geology Museum, Bristol.
CP	Author's collection, 26 Hengrave Road, London SE23 3NW.
BGS	Geological Survey, Keyworth, Nottingham.
LL	Manchester City Museum, Manchester.
OUM	Oxford University Museum, Oxford.
SM	Sedgwick Museum, Cambridge
TC	Taunton Castle Museum, Taunton
YM	Yorkshire Museum, York.

Note on synonymy lists

The synonymy lists, which are given here are in most cases not intended to be complete, as detailed lists for the bulk of the *Sphaeroceratinae* are to be found elsewhere (Westermann, 1956). The references which are mainly given, are either works which make a significant contribution to our knowledge of the relevant species, or to works which cite particular specimens, which are described here.

II. HIGHER LEVEL CLASSIFICATION OF THE *SPHAEROCERATINAE*

In deciding the limits of taxa above the species level, consideration must be given to the phylogeny of the groups concerned, as well as to their degree of morphological diversity and divergence. Various attempts at revising the classification of the *Sphaeroceratinae* have come to grief, either by ignoring or over stressing one or more of these criteria. Thus Westermann (1956) over stressed minute morphological differences, and produced a highly restricted family group, with an excessive number of genera and species. Westermann's more recent attempt to rationalise his previous over zealous 'splitting' by, reducing the *Sphaeroceratinae* to a subfamily, eliminating a number of species and reducing a number of genera to subgenera, (Westermann, 1964), whilst on the right lines, has failed to produce a more natural classification. This has been due to a lack of evidence on another important criteria; relative stratigraphic distribution. Hence, whilst it might seem logical, on the basis of previously published statements and following Buckman's work (Buckman, 1893 & 1909-30), to link together the genera *Frogdenites* and *Labyrinthoceras* as micro- and macroconch respectively; this would be untenable if these two genera were shown to be stratigraphically isolated; as is in fact the case (Parsons 1974, p.175). Before any attempt was made to revise the classification of the *Sphaeroceratinae*, a great deal more knowledge of the degree of variation and the stratigraphic distribution of this group was needed. The first aim of this work is thus to try to fulfil some of these needs.

Since its inception the *Sphaeroceratinae* has been considered as: -

1/a full family (Buckman, 1909-30)

2/ a subfamily within the *Stephanoceratidae* (Morton 1971)

3/ a subfamily within the *Otoitidae*, (Westermann, 1964)

Whilst a full family rank for this taxon could be considered, there is perhaps insufficient divergence from the *Otoitidae* root stock to warrant this status. There are good reasons for rejecting any close taxonomic link between the *Otoitidae/ Sphaeroceratinae* and the *Stephanoceratidae*, since these groups possibly evolved independently; the *Stephanoceratidae* from *Erycites sensu stricto* in the *scissum-murchisonae* Zones (Aalenian Stage) and the *Otoitidae* from *Abbasites* in the basal concavum Zone. The latter of these three groupings would thus appear the most suitable.

The morphological divergence, which separates the *Sphaeroceratinae* from the *Otoitinae,* is slight. *Frogdenites spiniger* S.Buckman and *Chondroceras obornensis nov*. are in many respects extremely alike; they have a similar size range, style of dimorphism and shell form and coiling; but they differ in one important feature, *C. obornensis* has lost all trace of any spines or tubercles. The *Otoitinae* are here characterised as a subfamily, by two important criteria; by their well developed sexual dimorphism, with the presence of relatively small, well lappeted microconchs, and by their different ornament with the occurrence of club shaped primary ribs, surmounted by sharp spines and/ or tubercles, on the microconchs. The differentiation of the *Sphaeroceratinae* is thus immediately apparent when the loss of spines in the earlier species is reinforced in later groups by the loss of lappets in the microconchs and a lower relative size ratio between dimorphs.

At the generic level there seems little need for the recognition of more than three genera and six subgenera within the *Sphaeroceratinae,* which are as follows-

1. The genus *Sphaeroceras* Bayle, 1878.

A series of small, globular ammonites, with a closed umbilicus. This generic name was preoccupied, but its use has been validated under the plenary powers of the International Commission of Zoological Nomenclature (Opinion 300, 1954).

i. The subgenus *Sphaeroceras (Sphaeroceras)*

As typified by its type species, *S. brongniarti* (J. Sow.), this group consists of a series of very small, globular ammonites, with wiry, sharp ribs, an occluded umbilicus and a very sharp contraction of the body-chamber

ii. The subgenus *Sphaeroceras (Megasphaeroceras)* Imlay, 1961.

This taxa is closely related to the nominate subgenus. The type species, *S. (M.) rotundum* (Imlay), differs only in its greater maximum size, from some typical members of *Sphaeroceras. s. str*. However, since members of this subgenus appear to be restricted to North and South America, this apparent similarity to *Sphaeroceras*, could be nothing more than another example of convergent evolution. Until it is possible to show that Megasphaeroceras did not evolve independently from the 'Old World' stocks, it is best kept separate.

2. The genus *Chondroceras* Mascke, 1907.

This genus comprises a group of relatively small, involute ammonites, with a deep, narrow, but open umbilicus.

i. The subgenus *Chondroceras (Chondroceras), syn. Schmidtoceras*, Westermann 1956.

A group of small, relatively involute ammonites, with an open umbilicus and fairly fine ribs, with a high primary rib density per whorl. The type species, *C. (C.) gervillei* (J. Sow,), is closer in gross morphology to the type species of *Schmidtoceras, S. schmidti* Westermann, than many species which have been assigned, to *Chondroceras, s. str,,* such as *C. (C.) evolvescens* (Waagen). There is thus no alternative but to consider *Schmidtoceras* as a junior subjective synonym *of Chondroceras (Chondroceras)*.

ii. The subgenus *Chondroceras (Defonticeras*) McLearn, 1927 *syn. Saxitoniceras*, McLearn,

There are no stratigraphic or morphological characters which would support the separation of *Defonticeras and Saxitoniceras* (Arkell, 1951-9, p78; Westermann, 1964). The type species of this submenus, *C. (D.) defontii* (McLearn), is extremely like certain members of *Chondroceras s. str*. such as *C. evolvescens*; although it, and its close relations, differ from most European Chondroceratids, by possessing, stronger, coarser and straighter primary ribs. However, like *Megasphaeroceras,* these taxa have only been found in America, and until such time as it can be proved to be directly connected with its European counterparts, and not merely another example of convergent evolution, it is best kept separate.

iii. The subgenus *Chondroceras (Praetulites)* Westermann, 1956.

This taxon is based on the isolated and unlocalised occurrence of its type species, *C. (P.) kruizingai* Westermann, in the Molluccas, of the East Indies. This very dubious group is retained here solely because one or two ammonites have been described, such as *C. (C.) boehmi* Westermann, which in general morphology may link it with the *C. (C.) grandiforme* Buckman group.

3. The genus *Labyrinthoceras* Buckman, 1921.

This genus consists of a group of medium to small sized, involute ammonites, with an open, narrow and very deep umbilicus, and with very fine prorsiradiate ribs. The type species, *perexpansum* (Buckman), is based on an inadequate, septate nucleus (Buckman, 1909-30, Plate 134A). Buckman's interpretation of the complete ammonite (*op. cit.,* Pl.134C), would suggest that this species should be considered as a junior subjective synonym of Waagen's *L. meniscum* (= *'Ammonites' gervillii* d'0rb, *non* Sow., d'Orbigny, 1842-51, Pl. 140, figs. 1 & 2). This group is the only subgenus within the *Sphaeroceratinae*, which exclusively possesses lappeted microconchs.

III. THE STRATIGRAPHIC DISTRIBUTION OF THE SPHAEROCERATINAE

The *Sphaeroceratinae* range in Great Britain from the upper *laeviuscula* Zone to the base of the *parkinsoni* Zone - see Table 1 for the zonal scheme used here. However, they are at their most abundant in the *humphriesianum/ subfurcatum* Zones of the Sherborne district of north Dorset. The detailed stratigraphy of this area has recently been revised (Parsons, 1976), and for further details of these ammonite faunas, the latter work should be consulted. The earliest members of this subfamily are found to intergrade with the genus *Frogdenites,* (*Otoitinae s. str.*), in the 'green-grained marl' bed of Oborne, north Dorset (= bed 3, Oborne Wood; ST648188; Parsons, 1976, p.132). From this earliest member of the genus *Chondroceras (C. obornensis nov*.), all subsequent Sphaeroceratids seem to have evolved. The successive faunas, within which various lineages may be separated are as follows: -

l/ *laeviuscula* Zone and subzone

C. obornensis nov, which shows some transitional features to *Frogdenites,* is occasionally found at this horizon, at Oborne Wood (bed 3) and on Dundry Hill, Avon (= bed 5, South Main-road quarry;' Buckman & Wilson, 1896, p,69l).

2/ *sauzei* Zone

A more varied fauna has been found at this horizon, although Sphaeroceratids are still exceedingly rare. *Labyrinthoceras meniscum* and *Sphaeroceras manseli* (J. Buckman) have been found in the top of the Sandford Lane 'fossil-bed' (Parsons, 1974, p. 166), at Sandford Lane, near Sherborne (ST628179) and in its equivalents in the Clatcombe area (Clatcombe Farm; ST636104; Parsons, 1976, p.124, bed 4), whilst at Dundry specimens of *Labyrinthoceras* have been found in the topmost part of the 'Brown iron-shot' (= bed 4, South Main-road).

3/ *humphriesianum* Zone, *romani* subzone

This horizon is characterised by the most abundant and varied occurrence of the *Sphaeroceratinae;* particularly *C. evolvescens*, with less common specimens of *C. gervillei* (J. Sow.), *C. grandiforme* S. Buckman, *C. polypleurum* (Westermann) , *C. polypleurum crassicostatum* (Westermann) and *Sphaeroceras brongniarti* (J. Sow,). These species have been found in the basal part of the 'Oborne Road-stone' (beds 4a/b, Oborne Wood; Parsons, 1976, pp.131-2), at Milborne Wick lane section (ST663205; Parsons, 1976, p.134, bed 5), in the 'Irony bed' to the west of Sherborne (Parsons, 1976, p.122), at Louse Hill (ST608152), and in the 'Red conglomerate' (*1oc. cit*.), at Upton Manor farm (SY512936), Loders Cross (SY506929), Stony Head cutting (SY496927), Bonscombe Hill (SY488919) and Burton Bradstock (SY487891), south Dorset. *C. evolvescens* is also not uncommon in the middle of the Rigg Sandstones of the Isle of Skye (Morton, 1971).

4/ *humphriesianum* Zone and subzone

This horizon has yielded only rare specimens of *C. evolvescens*, *C. polypleurum C. polypleurum crassicostatum* and *S. brongniarti* in the Oborne area of north Dorset (= bed 4c, Oborne Wood).

5/ *subfurcatum* Zone, *banksi* sub zone

Only very rare specimens of *G. sp. nov. aff. C. tenue* (Westermann) have come from this horizon at Frogden quarry (ST642185; Parsons, 1976, p.127, bed 5b).

6/ *subfurcatum* Zone, *polygyralis* and. *baculata* subzones

Specimens of *Sphaeroceras auritum* (Parona) and *Chondroceras canovense* (de Gregorio) are moderately common throughout the '*cadomensis* beds' of the Oborne area, which are of this age (Oborne Wood & Frogden quarry; Parsons, 1976, beds 6b-d). This is also the "claimed" type horizon of *S globus* S. Buckman, although it has been impossible to confirm this by the location of *in situ topotypes*.

7/ *garantiana* Zone, *dichotoma* and *acris* subzones

The basal part of the Sherborne Building-stone, which is to be correlated with the *dichotoma* subzone of the *garantiana* Zone, has yielded one specimen of *S. aff, globus*, at Castle View, Sherborne (ST646173). The '*Astarte* bed' of south Dorset (Parsons, 1975, p.9), which is of *acris* subzone age, has yielded *Chondroceras canovense, Sphaeroceras tenuicostatum* Sturani and *S. auritum tutthum* (S. Buckman), from Horn Park quarry (ST458022), Upton Manor farm, Loders Cross, Stony Head and Bonscombe. This latter horizon has been placed at the base of the *parkinsoni* Zone by some authors (Pavia & Sturani 1968), but by original definition (Buckman, 1893), it must be considered an integral part of the *garantiana* Zone (Parsons, 1976a, p,48)

IV. SEXUAL DIMORPHISM IN THE SPHAEROCERATINAE

During the resurgence of interest in the problems of sexual dimorphism in Jurassic ammonites, the *Sphaeroceratinae* were one of the first groups to receive attention, (Makowski, 1963). Whilst most members of the *Stephanoceratacea* possess marked morphological differences between micro- and macroconchs, which has resulted in some being placed in different families (e.g., *Stephanoceras* in the *Stephanoceratidae* and *Normannites* in the *Otoitidae*), the *Sphaeroceratinae* are characterised by a low level of differentiation between dimorphs. In most species of *Chondroceras* and *Sphaeroceras* the dimorphism may be considered in taxonomic terms as being of infra-specific rank, rather than subgeneric (*q.v.* Callomon, 1963, p.50), since the only difference between the two dimorphs is often one of size. Even this difference may not be all that marked, as ratios in size of less than l:2 between micro- and macroconchs are not uncommon (e.g. *C. evolvescens*). Thus large samples of any one species may be needed in order to demonstrate the bi-modal size distribution of its population (see Text fig. 1). On the other hand, where the sample size is very small, as with *C. gervillei*, it may be impossible to establish the presence of both dimorphs, one of which may either still be separate as a different species (or subspecies), or may still remain to be discovered.

The microconchs of the earliest members of the *Sphaeroceratinae* retain, although much reduced, the lappets of their Otoitid progenitors. Thus *C. obornensis nov. and Labyrinthoceras meniscum* have lappeted microconchs, whilst *Sphaeroceras manseli* has evolved a microconch, which has retained only a slight prolongation of the mouth-border (see Plate 1, fig. 10c). Many subsequent species, such as S*phaeroceras brongniarti*, have microconchs, which show no modifications to the mouth-border, and have only plain lips (see Plate 1, fig. 8). Some later Sphaeroceratids, such as *S, auritum* show the development of other secondary, sexual modifications. These include, terminal constrictions, flared collars and hoods, bilobate or 'two pronged' flared collars and lateral, lappet

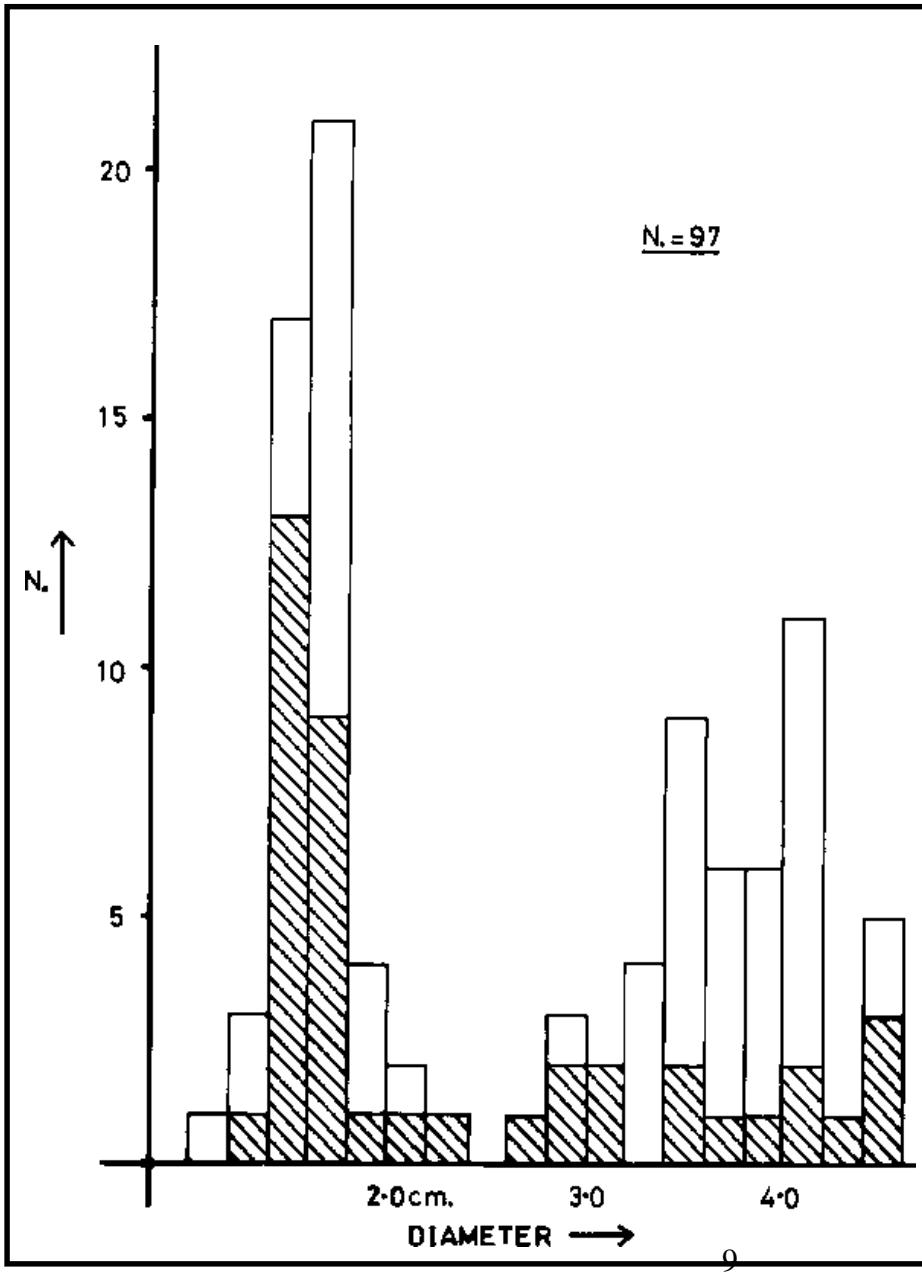


Figure 1:

A histogram of the distribution of maximum. mature diameter in *Chondroceras (C.) evolvescens* (Waagen). The shaded section is based on *in situ* material, the rest on museum specimens. All come from Milborne Wick.

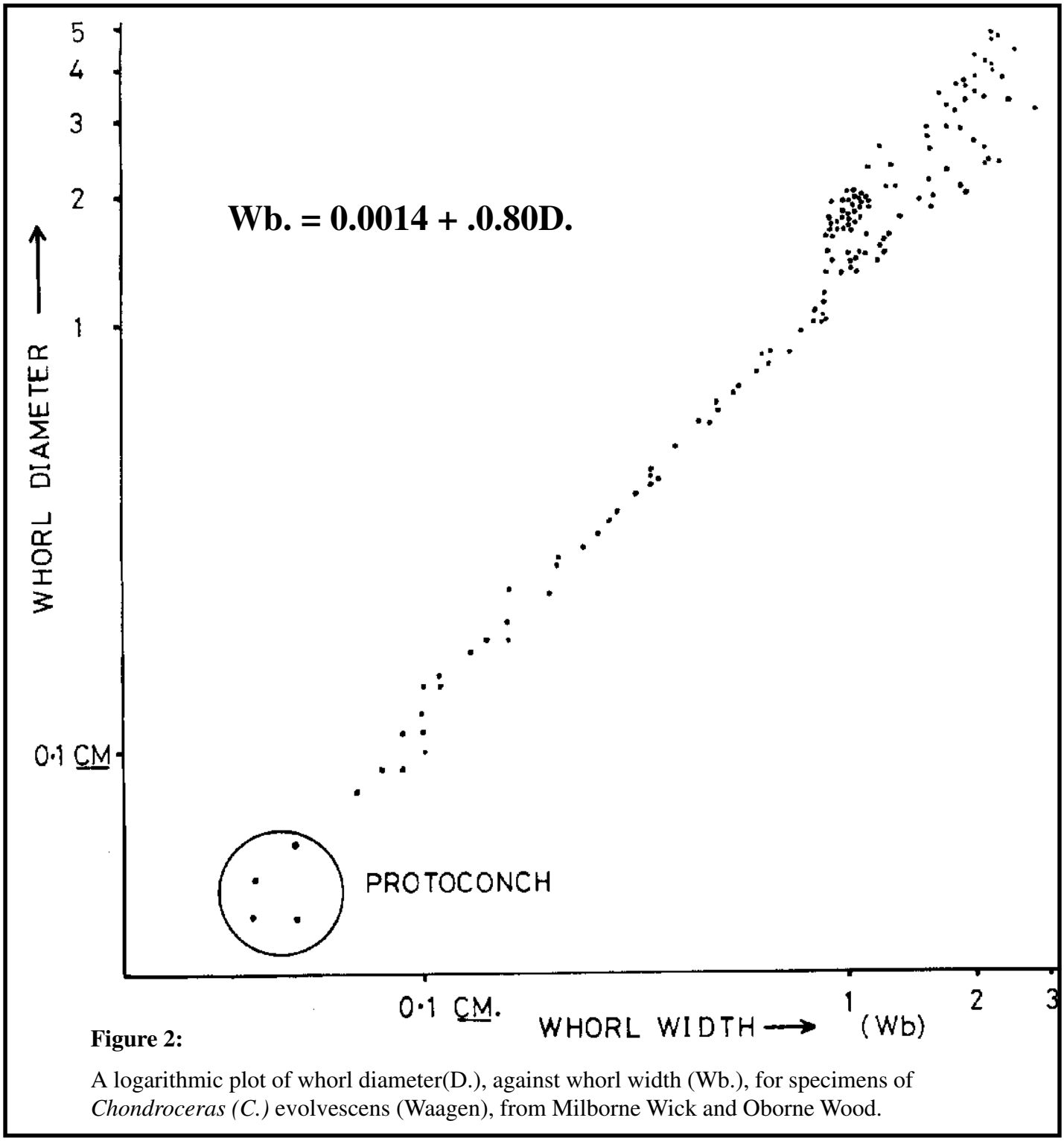


Figure 2:

A logarithmic plot of whorl diameter(D.), against whorl width (Wb.), for specimens of *Chondroceras (C.)* evolvescens (Waagen), from Milborne Wick and Oborne Wood.

like projections from the side of the mouth-border, rather than forward, as with true lappets. All of these modifications are well illustrated by Sturani (1971, text fig. 42) and Westermann (1956., text figs, 13-17) and need no further description here. The evolution and development of dimorphism in the *Sphaeroceratinae* thus follows a straightforward course; the microconchs first loose their lappets and attain a plain mouth-band, subsequent species then develop a series of different apertural modifications.

The ontogenetic development of dimorphism follows the normal pattern. Studies of the inner whorls of numerous specimens belonging to the Sphaeroceratinae shows that, up to the maximum diameter represented by the penultimate whorl of the microconch, both micro- and macroconchs are identical, in shell form, ornament and dimensions, differentiation only occurs in the last whorl. This is clearly shown in the graph, (Text fig, 2), which shows a logarithmic plot of diameter against whorl breadth for specimens of *Chondroceras evolvescens*. The measurements of whorl breadth and diameter were made from cross-sections of the ammonites, which were measured under a microscope, using a vernier mechanical stage. This allowed a high degree of accuracy to be obtained in measuring the smallest whorls and protoconchs. The style of ontogenetic development shown in this graph is the

same as that displayed in other groups, such as *Taramelliceras/ Creniceras*, (Palframan, 1966). In its essentials this graph consists of a growth curve, constructed from the measurements taken from the inner whorls, surmounted by two clusters of points which represent measurements taken from the body-chambers, of more than 80 mature micro- and macroconchs. The divergence of these two clusters from an essentially logarithmic growth curve is due to the uncoiling and contraction of the body-chamber, as seen in both mature dimorphs. The separation of these two clusters along the diameter ordinate is a reflection of the bi-modal size distribution, which is more clearly seen in the histogram representing the size distribution in *C. evolvescens*, from Milborne Wick, (Parsons, 1976, bed 5), (Text fig. 1). Whilst the development of *C. evolvescens* is illustrated here, other groups, such as *C. canovense* (de Greg.), have a similar size distribution (Text fig. 20), and growth curves.

One other feature which serves to separate the two dimorphs in the *Sphaeroceratinae;* apart from size and certain apertural modifications; is the tendency for some microconchs to be slightly more coarsely ribbed than the corresponding macroconchs. This is particularly true of *C. canovense* and *S. auritum.*

V. SYSTEMATIC DESCRIPTIONS

Genus *Sphaeroceras* Bayle 1878

Type species: "by subsequent designation *S. brongniarti* (J, Sow.) - Douville 1879.

Subgenus: *Sphaeroceras* Bayle 1878

Diagnosis

A group of very small, globular ammonites, with fine, wiry, often superficial ribs. The inner whorls are tightly coiled, leading to the development of an occluded umbilicus. The rapid contraction of the body-chamber, leads to a sharp uncoiling of the umbilical seam. In some species, such *as S. brongniarti*, this uncoiling is so pronounced, as to have produced a straight umbilical seam on the last half whorl, which in turn has produced a 'scaphitoid' shell form. The sutures are complex; finely divided and interdigitating; and this together with the small size of the ammonites, makes their interpretation difficult. The micro- and macroconchs fall into a size ratio of approximately 1:2, with the former being slightly more coarsely ribbed. The modification of the mouth-border varies, with plain lips, residual lappets and flared hoods all having their adherents. This subgenus ranges from the *sauzei* Zone to the base of the *parkinsoni* Zone.

Subgenus group

Whilst numerous species have been, described under the generic name *Sphaeroceras*, only the following are accepted here as members of the restricted subgenus: -

1/ *Sphaeroceras brongniarti* (J. Sowerby, 1817)
syn S. brongniarti sub sp. terpartitum Westermann, 1956.

2/ *S. manseli* J. Buckman, 1881.

3/ *S. auritum auritum* Parona 1896.
syn. S. disputabile Parona 1896.
S. Pilula Parona 1896.

4/ *S. auritum sub sp. tutthum* S. Buckman, 1921.
syn. S. renzi (Christ 1960)

5/ *S. globus* S. Buckman, 1927

6/ *S. tenuicostatum* Sturani 1971
syn. S. tenuicostatum sub. sp. glabrum Sturani 1971

7/ *S,. pusillum* Sturani, 1971

8/ *?S. talkeetnanum* Imlay 1962.

Of these species, *S. pusillum* has yet to be recorded, from Great Britain, whilst *S. talkeetnanum* is a very large, American form, probably better assigned to *Megasphaeroceras*. *S. tenuicostatum* perhaps has a doubtful status since the only feature serving to separate it from *the S. auritum/ tutthum* group is the presence of a continuous rather than a bilobate, 'two pronged' flared hood. There is strong evidence to suggest that the remaining five species and subspecies form part of a continuous evolutionary lineage or chronocline, which stretches from the *sauzei* Zone to the upper *garantiana* Zone, - see below for further details.

1, *Sphaeroceras (Sphaeroceras) brongniarti* (J. Sowerby)

Plate 1 , figs. 1-6 & 8 Text figs. 3 & 4.

1817 *Ammonites brongniarti nov*. J. Sowerby (in J. & J. de C. Sowerby, 1812-46, p.190, Plate 184A, fig.2).

1846 *Ammonites gervilii* ; d'Orbigny, 1842-5l) *non* Sowerby; pp. 409-10, Plate 140, figs. 3-8 *non* 1 & 2.

non 1846 *Ammonites brongniarti* ; d'Orbigny (1842-5l) *non* Sowerby, pp. 403-5, Plate 137.

1847 *Ammonites brongniarti* ; Quenstedt (1845-9), p.186, Plate 15, fig. 9.

1856 *Ammonites brongniarti*; Oppel, p.375.

1867 *Ammonites brongniarti*; Sowerby; Waagen, p.602.

1877 *Stephanoceras brongniarti*; Hyatt, p. 394.

1878 *Sphaeroceras brongniarti* Sowerby; Bayle, Plate 53, figs. 3-5.

1879 *Sphaeroceras (Am. brongniarti*. Sow.); Douville p.91.

non 1881 *Ammonites brongniarti* Sow.; J. Buckman, p.64, fig.5.

1881 *Sphaeroceras brongniarti* (Sow.); S.S. Buckman, p.597, (*Partim*).

1886 Ammonites brongniarti; Quenstedt (1886-7), P.509, Plate 64, figs. 1 & 2.

1907 *Sphaeroceras (Ammonites brongniarti*. Sow.); Mascke, p. 19.

1952 *Sphaeroceras brongniarti* (J. Sow.); Arkell (1951-9), p. 77, text fig. 20, 2a -b, (holotype), *non* la & b.

1956 *Sphaeroceras brongniarti* (Sow.); Westermann, pp. 28-35, Plate 14, figs.1-7, text figs. 3-8, including sub. sp, *S. brongniarti terpartitum* Westermann, *cum syn. exclud. S. globus S. tutthum* Buckman.

1957 *Sphaeroceras (Am. brongiarti J. Sowerby*); Arkell (in Arkell, Kummel & Wright 1957), p. L292, fig.347, la & b, (*holotype*).

non 1963 *Sphaeroceras brongniarti* (Sow.); Makowski, pp.46-48 + 81, text fig.XI, 1 & 2.

1967 *Sphaeroceras brongiarti* (Sowerby); Westermann, p.55,

non 1968 *Sphaeroceras brongniarti* (J. Sowerby); Senior, p.45.

1971 *Sphaeroceras brongniarti* (Sowerby); Sturani, pp.137-141, text figs. 42/8-9, 43 & 44/3, Plate 10, figs. 2, 6-10 & ?12.

1975 *Sphaeroceras brongniarti* (J, Sow.); Parsons, p.11.

Material:

The following specimens have all been collected *in situ* by the authors one *topotype* from the Bayeux Conglomerate, St. Honorine-des-Pertes Normandy, France, NHM. C80317; two specimens from bed 4a, Oborne Wood, NHM. C80318-9; six specimens from bed 4b Oborne Wood, NHM. C80320-5; one specimen from bed 4c Oborne Wood, NHM. C80326; two specimens from the 'Irony bed' of Louse Hill near Sherborne, NHM. C80327-8 and three specimens from the 'Red Conglomerate' of Upton Manor Farm near Bridport, NHM. C80329-80331; a total of fifteen ammonites.

Dimensions:

Holotype (BMNH.C36734), (m.).

Diameter	Umbilical diameter	Number of Primary ribs	Whorl height	Whorl breadth
D.	Ud,	Pn	Wh.	Wb.
1.92	0.34 (18%)	28	0.87 (45%)	c.1.25(65%)
1.60	0.08 (5)	-	1.06 (66)	1.44 (90)
NHM. C80317, (M.),				
2.32	0.49 (21%)	-	1.18 (51%)	1.46 (63%)
NHM. C80318, (m.),				
1.87	0.32 (17)	30	0.88 (47)	1.27 (68)
1.59	0.13 (8)	-	0.9 (57)	1.31 (82)
NHM. C.80319, (m.)				
1.54	0.13 (8)	-	0.9 (58)	1.05 (68)
NHM. C80320, (M.),				
2.5	0.45 (18)	25	1.13 (45)	1.5 (60)
2.0	0.1 (5)	-	l.34 (67)	c1.6 (80)
NHM. C80321, (M.),				
2.44	0.5 (21)	26	1.12 (46)	1.4 (57)
1.95	0.16 (8)	-	1.2 (62)	1.62 (83)
NHM. C.80322, (m.),				
1.84	0.3 (16)	27	0.9 (49)	1.1 (60)
1.46	0.16 (11)	-	0.9 (62)	l.l8 (8l)
NHM. C.80323, (m.),				
1.7	0,43 (25)	c24	0.8 (47)	1.03 (61)
1.35	0.11(8)	-	0.89 (66)	1.17 (87)
NHM. C.80324 (m.),				
1.94	0.38 (20)	28	0.88 (45)	1.19 (61)
1.57	0.1 (6)	-	0.98 (62)	1.27 (8l)
NHM. C.80325, (m.),				
1.76	0.31 (18)	34	0.84 (48)	1.1 (63)
1.39	0.09 (7)	-	94 (68)	1.15 (83)
NHM. C80329, (M.),				
2.9	0.62 (21)	29	c1.27 (44)	1.79 (62)
1.48	0.47 (32)	26	1.32 (89)	1.76 (119)
NHM. C80330, (M.),				
2.5	0.42 (17)	28	1.25 (50)	1.6 (64)
2.1	0.12 (6)	-	1.3 (62)	-
NHM. C80331, (m.),				
1.13	0.25 (22)	c24	0.51 (45)	0.88 (78)
0.96	0.09 (9)	-	0.63 (66)	0.89 (93)
BMMH. C80327, (m.),				
1.98	0.32 (16)	-	0.95 (48)	1.16 (59)
1.6	0.19 (12)	-	1.0 (63)	1.24 (78)

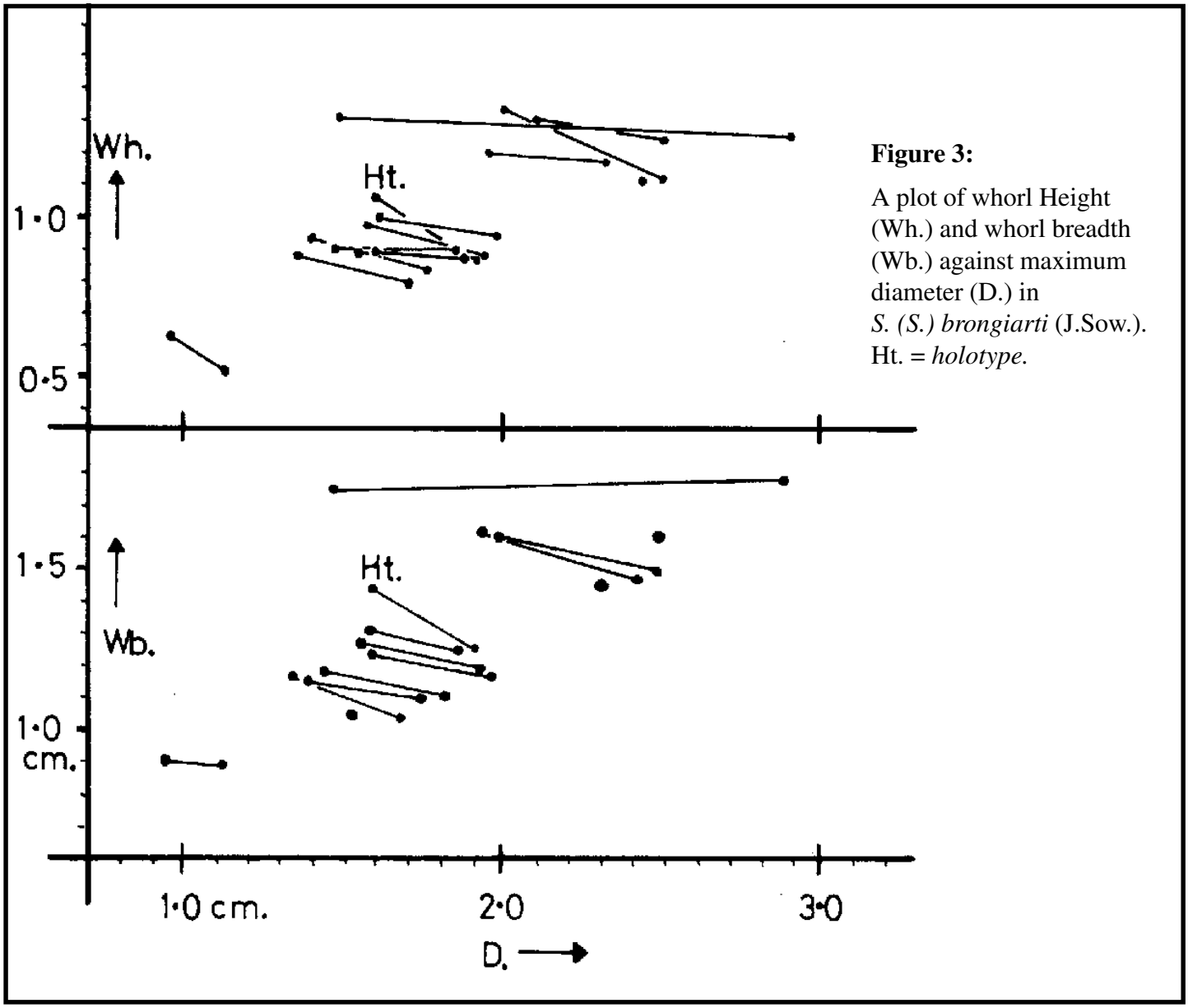


Figure 3:

A plot of whorl Height (Wh.) and whorl breadth (Wb.) against maximum diameter (D.) in *S. (S.) brongiarti* (J.Sow.). Ht. = *holotype.*

Description

A small, (average macroconch size = 2.5 cm.), globose or sphaeroconic ammonite, with tightly coiled inner whorls and a rapid retraction of the umbilical seam over the last half-whorl. The inner whorls are relatively depressed, with a whorl height/width ratio in the order of 0.87 : 1, whilst the last half whorl has a more rounded cross-section; - see Text fig. 3 . This change in cross-section is linked to the sudden contraction of the body-chamber, which spans almost exactly one whorl. The umbilical seam on the last half whorl is almost straight, whilst prior to this the umbilicus is totally occluded. The primary ribs are sharp, slightly curved, prosiradiate and are fairly dense; the primary rib density for the final whorl varies between 24 and- 34 per whorl. The secondary ribs are about the same length as the primaries, and they sweep forward gently over the rounded venter. These secondaries are very fine, sharp and often superficial, since they leave no impression on the internal cast. Although the secondaries are fine, with 3-4 per primary on the inner whorls, towards the mouth-border they become coarser, with only 2-3 per primary. The modification of the mouth-border is simple, with a prosiradiate, narrow flare, followed by a constriction and then a smooth lip or mouth band - see Plate 1, fig. 8.

Sexual dimorphism

The small sample size creates some difficulties in determining the style of sexual dimorphism in *S. brongniarti*, which previous authors (Westermann, 1964, p.55; Sturani, 1971, pp. 138-9) have regarded as intra-specific. Sturani (*op. cit.*), when dealing with a large sample (although very depleted in macroconchs), considered that there were little or no differences between dimorphs, except that of size, the macroconchs having a diameter greater than 2.0 cm., the microconchs a maximum diameter less than 1.5 cm. The size distribution of the Dorset specimens (see

Text fig .4) , tends towards a similar bi-modality, although more material is needed to give a more convincing distribution. If this style of dimorphism is accepted, then there is indeed little morphological differentiation between dimorphs, apart from size, macroconch average maximum diameter = 2.5cm., microconch average diameter = 1.7 cm., a size ratio of 1 : 1.47.

Discussion

Sphaeroceras brongniarti differs from *S. manseli*, by its slightly smaller size, sparser primary ribs, stronger contraction of the body-chamber and by its more rounded cross-section on the last whorl. *S. auritum* is the closest in gross morphology, but this differs by its smaller size, and by its more differentiated mouth border, which is characterised by its bilobate, two pronged flared hood. These three species, together with *S. globus*, *S. tutthum* and *S. tenuicostatum* form a chronocline, or continuously evolving lineage, within which it would be difficult to distinguish any single species, if stratigraphic breaks had not dislocated the sequence. As noted by Sturani (1971, p.140) there is no basis for the separation of the subspecies *S. brongniarti torpartitum* Westermann, as there is a wide variation in the number of ribs in S. brongniarti s. str. The holotype of. this species (Plate 1 , fig. 5), shows the presence of a weak, narrow, flared hood, followed by a constriction and then a narrow, smooth lip. This form of mouth-border is typical of all the specimens of this species collected from the *romani* Subzone in England and in the Venetian Alps of Italy, (Sturani, 1971, p.138). Some specimens collected from the upper *subfurcatum* Zone of the Oborne district, showing signs of a ventral interruption in the flared hood, (Plate 1, fig. 11) have been included in *S. auritum*, in spite of an otherwise close similarity to some smaller specimens of *S. brongniarti*, (Sturani, 1971, p.143). *S. globus* Buckman, considered by Sturani (l971, p.138) as a subspecies of *S. brongniarti* is here kept as a distinct species, since it is the possible macroconch dimorph of the *S. auritum* (m.) group.

Stratigraphic distribution

The holotype of *S. brongniarti* came frora the 'Bayeux Conglomerate' of the Bayeux district of Normandy (France). The ammonite assemblage from this horizon includes:- *Chondroccras gervillei, C. evolvescens, Phaulostephanus paululum* Buckman, *Dorsetensia eduardiana* (d'Orb.) etc., which indicates a *romani* Subzone, *humphriesianum* Zone, age for this bed, A *topotype*, collected *in situ* froim the 'Bayeux Con- glomerate' of St. Honorine-des-Pertes, Normandy, NHM, C80317, confirms this as the type horizon. All the specimens of this species from southern England described here have come either from beds 4a-c of Oborne Wood, which are mainly *romani* Subzone in age, or from highly condensed equivalents of this horizon; the 'Irony bed' and 'Red Conglomerate' (Parsons, 1975). There is no evidence for a higher stratigraphic occurrence of this species in England, than this fauna from the lower/middle *humphriesianum* Zone, (*Contra*, Westermann, 1964, p. 55).

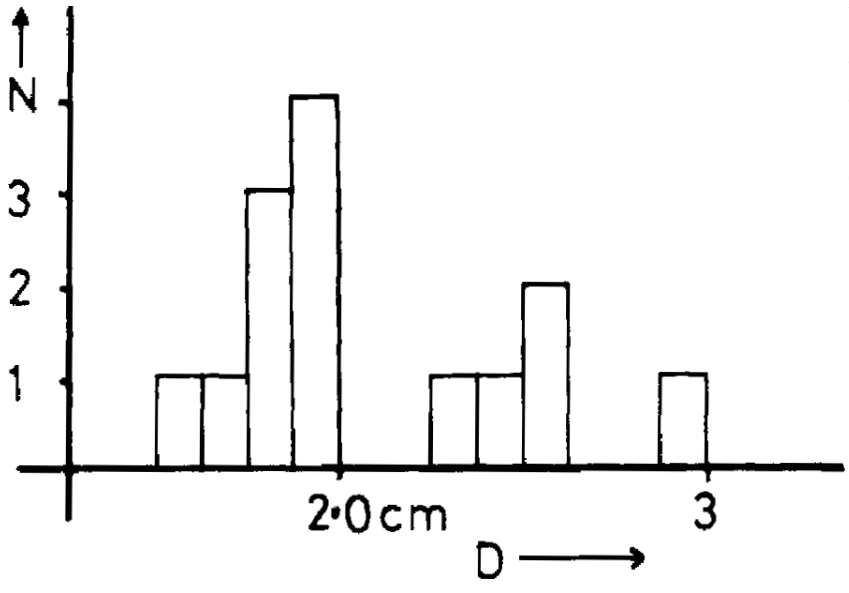


Figure 4:

A histogram showing the distribution in maximum diameter in the Dorset specimens of
S. (S.) brongiarti (J.Sow.)

2. Sphaeroceras (Sphaeroceras) manseli (J. Buckman)

Plate 1 , figs. 7 &9-10; Text figs. 5 & 6.

1881, Ammonites manselii Buckman, n. sp. ; J, Buckman, p.64.

1881, Sphaeroceras manselii (J. Buckman); S. Buckman, p.597.

1882, Sphaeroceras manselii J. Buckman; S, Buckman, p.141, Pl. II, figs. 3a & 3b.

1939, Sphaeroceras manselii J. Buckman; Roché p. 226.

1974, Sphaeroceras manselii (J. Buckman); Parsons, p.l66,

Material:

Three specimens from the top half of the Sand-ford Lane 'Fossil-bed', Sandford Lane, (Bed 6b) near Sherborne, Dorset, from the author's collection and now NHM, C80332-4, One specimen from the 'Sherborne area', SM, J24529; and one specimen from Yorkshire Museum, ex. Reed Collection, 216, also from the 'Sherborne area'.

Dimensions:

Buckman's figured specimen (S. Buckman, 1881, p.597), (M.),				
D.	Ud	Pn.	Wh.	Wb.
4.45 cm.	0.83 (19%)	c.34	2.23 (50%)	3.05 (69%)
NHM. C80333, (M.).				
2.9	0.65 (22)	37	1.33 (46)	1.84 (63)
2.18	0.35 (11)	-	1.32 (61)	1.74(80)
NHM. C80332, (M.),				
2.73	0.54 (20)	38	1.4 (51)	1.76 (66)
2.05	0.26 (13)	-	1.35 (66)	1.64 (80)
NHM. C80334 (m.),				
1.91	0.36 (19.)	39	0.92 (48)	1.2 (63)
1.49	0.25 (17)	-	0.81 (54)	1.06 (71)
J24529, (M.),				
3.42	0.75 (22)	38	1.65(48)	2.32 (68)
2.6	0.43 (17)	-	1.5 (58)	2.05 (79)
YM. Reed col. 2l6, (?M.),				
2.3	0.50 (22)	40	1.18 (51)	1.57 (68)
1.77	0.24 (14)	-	1.06 (60)	1.47 (83)

Description

A small (average size of macroconch = 3.4cm.), involute, sphaeroconic ammonite, with three quarters of a whorl of body-chamber. The inner whorls are tightly coiled, producing a deep, very narrow umbilicus, whilst the gradual uncoiling of the umbilical seam on the last third to half whorl, gives a more open umbilicus. There is a progressive change in the whorl cross-section, with the rounded. inner whorls, giving way to a more square cross-section on the last half whorl - see Plate 1 , fig. 9c . This is mainly due to the decline in the whorl height, relative to whorl width, as may be seen in Text fig. 5 . Although there is a fairly strong contraction of the body-chamber, the whorl height and whorl width, immediately prior to the mouth-border, are still greater than on any part of the preceding whorls. This is a direct contrast to several other members of the *Sphaeroceratinae,* where the greatest values for these dimensions are to be found approximately half a whorl prior to the mouth-border, (e.g. *S. brongniarti*, Text

fig. 3). The primary ribs are relatively short, sharp, slightly curved, prosiradiate and dense; there are 34-40 on the last whorl. The secondary ribs are fairly coarse for the *Sphaeroceratinae*, and they branch from the umbilical edge, with 2-3 per primary on the inner whorls, and 2 per primary on the outer whorl. The mouth-border is characterised by a deep terminal constriction, followed by a smooth expanded lip, which on the microconch shows a residual lappet like projection along the line of the umbilical edge, - see Plate 1 , fig. 10c.

Sexual dimorphism

Buckman's figure (here reproduced as Text fig. 6), shows a mature ammonite, with a mouth-border consisting of a deep constriction, followed by a smooth lip. The relatively large size of this specimen, (as with J24529 & NHM. C80333) compared to the specimen figured here showing residual lappets, (Plate 1, fig. 10 , NHM. C80334), would suggest that the former is a macroconch, the smaller specimen, with the 'lappets', being the corresponding microconch. If this is so, then the size ratio between the dimorphs is in the region of 1 : 1.6.

Discussion

James Buckman's original description of this species is rather nebulous …..'related to the *Ammonites brocchii* group; but the fineness of its ribs and the absence of tubercles is a sufficient distinction, [The mouth-border has] .. the usual deep depression before the terminal semicircular depression. We possess several examples of this shell from Bradford (Abbas), Chalcombe (sic) and other places.' … (J. Buckman, 1881, p. 64). On its own this abbreviated diagnosis would be insufficient to determine the true identity of this species. Fortunately J. Buckman's son, S. S .Buckman, gave a more detailed and restricted description of *S. manseli* (S. Buckman, 1881, p,597; 1882, p.141, Plate II, figs 3a-b). However, Buckman (1881, p.597) listed only two specimens as belonging to this spe-

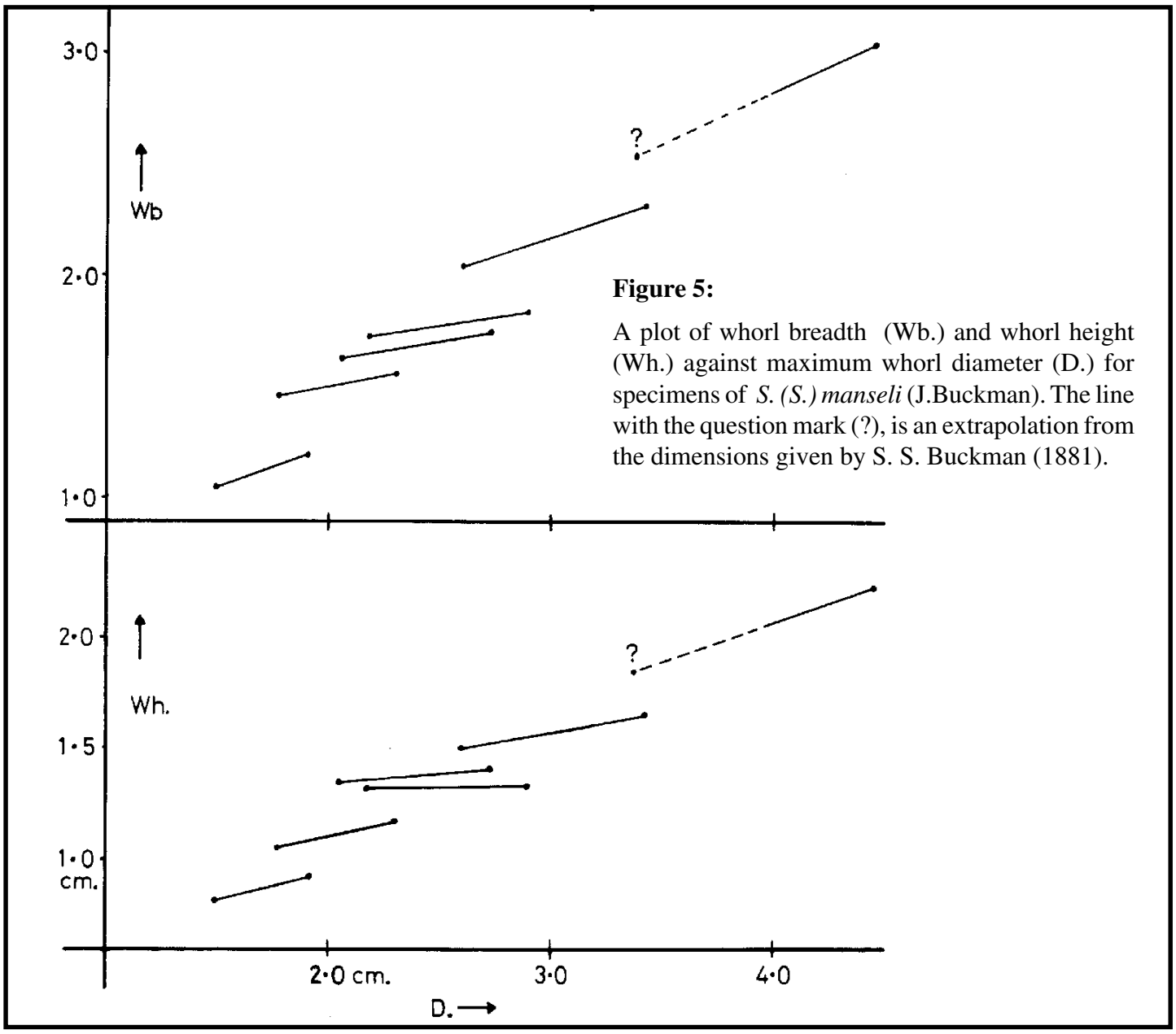


Figure 5:

A plot of whorl breadth (Wb.) and whorl height (Wh.) against maximum whorl diameter (D.) for specimens of *S. (S.) manseli* (J.Buckman). The line with the question mark (?), is an extrapolation from the dimensions given by S. S. Buckman (1881).

cies; both from the Clatcombe area of Sherborne and from the T.C. Maggs collection. It is thus certain that S. Buckman was using this specific name in a much more restricted sense than originally intended by his father. This was due to S. Buckman's subsequent introduction of a new species *'Sphaeroceras' (Labyrinthoceras) perexpansum*, in which he included specimens previously considered by his father to belong to *S. manseli,* (S. Buckman, 1882, Plate II, fig.3). No type specimen of *S. manseli* has been designated, thus the two specimens cited by S. Buckman (1881, p.597; 1882, p.14l), must be considered the only recognizable syntype members of the more extensive type series cited by J, Buckman (1881). If the use of this specific name is to be continued, for what is in fact a highly distinctive and stratigraphically useful ammonite species, then S. Buckman's interpretation of the species must be accepted. The dimensions taken from S. Buckman's figure of this species (S. Buckman, 1882 - reproduced here as Text fig. 6), appear very similar, if not identical, to those which Buckman had previously cited (S, Buckman, 1881, p.598). There thus can be little doubt, that both of these records were based on the same specimen. A search for the two known syntypes from the T.C. Maggs collection, revealed the presence of one specimen in the British Museum, in the Buckman collection. Unfortunately this specimen (S.S.B. collection number 478), looks very different to Buckman's figure, and also has very different relative proportions. It is in fact a large specimen of *S. brongniarti*. This ammonite obviously should not be selected as *lectotype*, as it would make *S. manseli* a junior subjective synonym of the latter species. In the present absence of Buckman's figured specimen, it seems inadvisable to make any decision concerning the selection of a *lectotype*. This need not however effect the inter- pretation of this taxon, since in this connection, the dimensions given by S. Buckman, taken together with his figure, make identification of this species relatively easy. The species which are closest in gross morphology are significantly those which are in close stratigraphic proximity. With its relatively large size and inflated shell shape, *S. manseli* is closely related *to Chondroceras obornensis nov*., whilst its strongly contracted body-chamber, and poorly differentiated dimorphs show some similarity with *S. brongniarti*. Taking into account its stratigraphic position, *S. manseli* makes a good evolutionary link between these two latter species. The intermediate nature *of S. manseli*, with its 'mosaic' of morphological features characteristic of *Chondroceras, Sphaeroceras* and *Labyrinthoceras*, makes it difficult to place in any one genus. The less well developed sexual dimorphism, with the presence of only residual lappets, would however point to the inclusion of this taxon in *Sphaeroceras.*

Stratigraphic distribution

The two specimens cited by S. Buckman (1881), came from the 'iron-shot' limestones of the Clatcombe area of Sherborne, which are either *humphriesianum* or *sauzei* Zone in age, according to their exact horizon. The three specimens which I have found *in situ*, came from the top half of the Sandford Lane 'fossil-bed', Sandford Lane quarry, near Sherborne (-0.20m. below the top). This horizon is the stratigraphic equivalent to bed 4 at Clatcombe Farm (Parsons, 1974, p. 164, fig.2), which is the probable type horizon for Buckman's figured specimen. Both of these beds are *sauzei* Zone in age. The other two specimens described here, from the York and Sedgwick museums, both show the characteristic matrix of the upper Sandford Lane 'fossil-bed', thus all the existing specimens

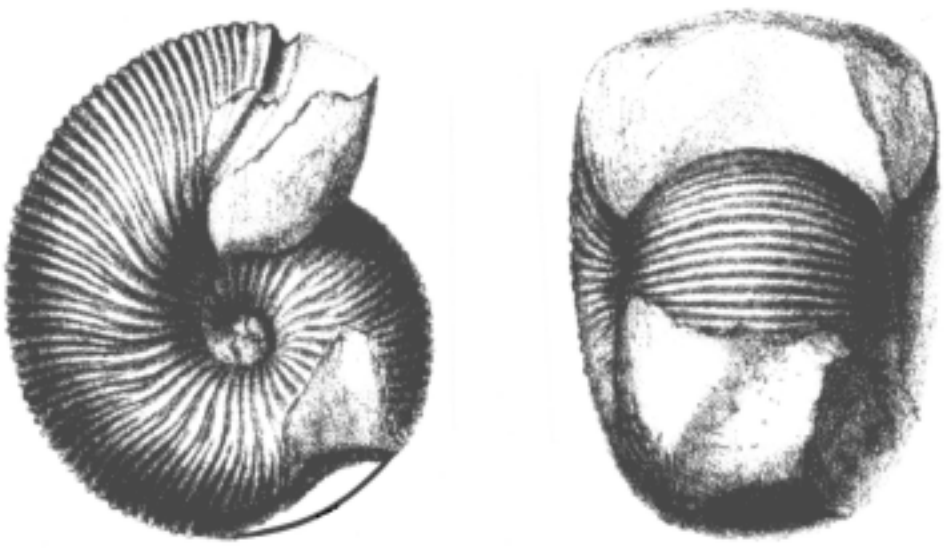


Figure 6:

S. (S.) manseli (J. Buckman), a copy of S.S. Buckman's original figure (1882, pl. 2, fig. 3).

of this species probably originate from *sauzei* Zone beds

3. *Sphaeroceras (Sphaeroceras) auritum cf. sub, sp. auritum* Parona

Plate 1. figs. 11a-b; Plate 2, figs. 1-3; Text figs. 7.

1894 *Sphaeroceras brongniarti*; Parona *non* Sowerby, p. 377.

?1896 *Sphaeroceras pilula nov*.; Parona, p. 16, Plate I, figs. 14 & 15.

1896 *Sphaeroceras auritum nov*.; Parona, p.16, Plate I, fig.16,

1896 Sphaeroceras disputabile nov.; Parona, p.17, Plate I, fig. 17.

1897 Sphaeroceras auritum Parona; Glangeaud, p.104, Plate III, figs. 4 & 5, (*holotype*).

1971 *Sphaeroceras auritum* Parona; Sturani, pp.141-3; text figs. 42/1 and 43; Plate 10, figs. 17, 19, 21 & 23; *cum. syn. exclud*. S. tutthum Buckman and ?S. renzi (Christ).

Material:

The following specimens have been collected *in situ*, from the '*cadomensis* bed' of the Oborne district, near Sherborne, Dorset; three specimens from bed 6d, Frogdcn Quarry, BMNH. C80374-6; three specimens from bed 6d Oborne Wood, BMNH. C80339, C80341 and C80342, and one specimen from bed 6c Oborne Wood, BMHH, C80340.

Dimensions:

Lectotype, (m.),

D	Ud	Pn	Wh	Wb
1.3	0.29 (22)	-	0.59 (45)	0.72 (55)
NHM. C80340, (m.),				
1.42	0.29 (21)	c28	0.69 (49)	0.86(6l)
1.15	0.1(9)	-	0.7(61)	0.98(85)
NHM. C80341, (m.),				
1.46	0.3(21)	29	0.69(41)	0.97 (67)
1.17	0.14(12)	-	0.78 (67)	1.05 (90)
NHM. C80339, (m.),				
1.38	0.23 (17)	30	0.69(50)	0.88 (64)
1.12	0.08 (7)	-	0.73 (65)	0.97 (87)
NHM. C80374, Max. D, over flare = 1.23, (m.),				
1.15	0.28 (24)	26	0.58 (51)	0.87 (76)
0.97	0.06 (6)	-	0.61 (63)	0.91 (94)
NHM.. C80375, (m.),				
0.99	0.3 (30)	24	0.45 (46)	0.7 (71)
0.85	0.08 (10)	-	0.55 (65)	0.78 (92)
NHM.. C80376, (m.),				
1.02	0.23 (23)	-	0.55 (54)	0.74 (73)
0.87	-	-	0.58 (67)	0.77 (89)

Description

A small (average size = 1.26 cm.), globose ammonite, with tightly coiled, inner whorls and. a rapid contraction of both the body-chamber and, the umbilicas over the last half whorl. The whorl cross- section is rounded, but depressed, the whorl breadth (Wb) being consistently greater than the whorl height (Wh), (Wh /Wb= 0.73). The whorl section does not change much over the last whorl, since both the whorl height and.breadth decrease at a similar rate, (see Text fig. 7). Over the last half whorl the umbilical seam is so retracted as to be almost straight, (see Plate 1, fig. 11b), as is also true of *S. brongniarti.* The primary ribs are fine, dense (27 per whorl), sharp, prosiradiate and mainly divide into fine, sharp secondaries, often with one extra secondary interdigitating. These secondary ribs swing forward over the venter, although there say be a slight backward flexure along the mid ventral line of the last quarter whorl, - see Plate 1, fig. 11a. All the ribs have a tendency to be superficial, leaving a smooth internal cast. The mouth-border is well differentiated, and shows a complex structure, of which the thin, high, flared hood is the most evident. This hood is not bilobate, but shows signs of a slight ventral interruption - Plate 1 , fig. 11a. Forward of this hood there is a deep constriction, followed by a wide, triangular shaped, expanded lip, with a large, blunt node in the mid, ventral position: well preserved specimens also show the presence of two lateral, lappet like extensions of the lip, (Plate 2 , fig. 3b), as is so well seen in the lectotype of the *S. auritum s. str.*, (Sturani, 1971, p.142, Text fig. 42/1).

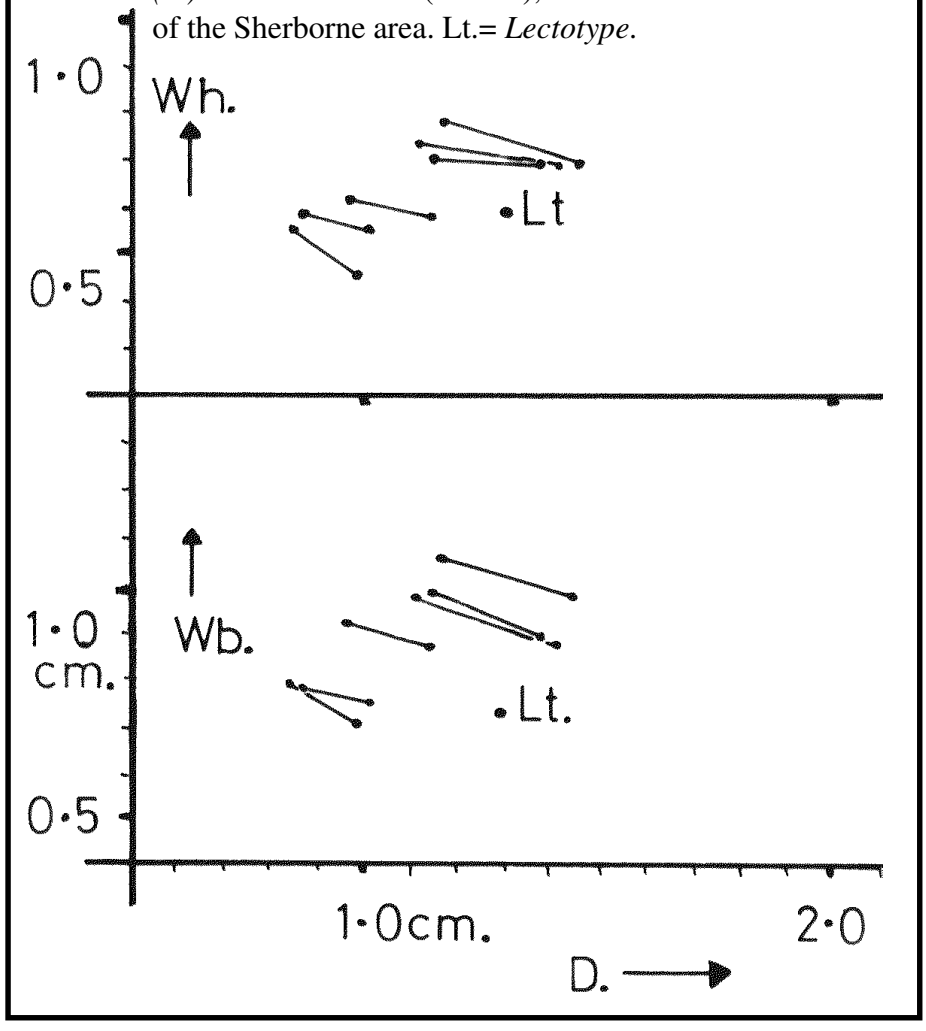


Figure 7: A plot of whorl height (Wh.) and whorl breadth (Wb.) against maximum diameter (D.) for specimens of *S. (S.) auritum auritum* (Parona), from the '*cadomensis* beds' of the Sherborne area. Lt.= *Lectotype*.

Sexual dimorphism

The specimens described here, taking into account their small size and highly differentiated mouth-border, are probably microconchs. I suspect that the corresponding macroconch partner may be *S. globus*, since this its the only macroconch sphacroceratid ammonite so far recorded from this horizon in southern England.

Discussion

The lectotype of *S. auritum auritum* Parona, (selected Sturani, 1971, p.142), from Monte Meletta (Venetian Alps, N. Italy) is upper *subfurcatum* Zone in age (*schroederi* Subzone *sensu* Sturani, 1971 = upper *baculata* Subzone herein). It differs from the specimens described here by having a better developed, 'two pronged' flared hood, (Sturani 1971, Text fig. 42/1 and Plate 10, fig. 19). This hood is the major feature, which serves to separate this species from the older *S. brongniarti*. Those specimens found in the 'cadomensis beds' of the Oborne district, have a much more prominent hood than *S. brongniarti*, with some signs of the beginning of a ventral interruption, They are thus similar to the 'primitive morphotypes' of *S. auritum* described by Sturani (1971, p. 143) and are hence included within this taxon, under 'open nomenclature'.

Stratigraphic distribution

All bar one of the specimens described here have come from bed 6d of Oborne Wood and Frogden, which is lower *baculata* Subzone in age. A single specimen has come from bed 6c at Oborne Wood, which is upper *polygyralis* Subzone, *subfurcatum* Zone in age. The range of this species in England, is thus similar to that in its type area, (*polygyralis - schroederi* Subzones, Sturani, 197l).

4/ *Sphaeroceras (Sphaeroceras) auritum sub, sp. tutthum* (S, Buckman)

Plate 2 , figs. 4-6 ; Text figs. 8 & 9.

1881 *Sphaeroceras brongiarti* (Sow.); S. Buckman, p. 597, (*partim*)

1921 *Sphaeroceras tutthum nov*.; S, Buckman, (1909-30), Pl. 259.

1937 *Sphaeroceras tutthum* Buck.; Wetzel, p.78, Pl. 10, fig. 1.

1939 *Sphaeroceras tutthum* Buck.; Roché, p.225,

1956 *Sphaeroceras brongniarti* (Sow.); Westermann non Sow. pp. 28-30, (*partim*).

1960 *Oecoptychius renzi nov.;* Christ, pp. 91-2, Pl. 5, fig. 8a-b.

1963 *Sphaeroceras tutthum* Buckman; Rioult, p,245.

1964 *Sphaeroceras brongniarti* (Sowerby); Westermann, p.55, (*partim*).

1965 *Sphaeroceras brongniarti tutthum,* Buckman; Wendt, p,301.

1970 *Sphaeroceras tutthum* S. Buckman; Senior, Parsons & Torrens, pp.116-8.

1971 *Sphaeroceras auritum* Parona; Sturani, pp. 141-3, (*partim*)

1975 *Sphaeroceras tutthum* S. Buckman; Parsons, p. 9.

Material:

Four specimens from the '*Astarte* bed' equivalent at Horn Park quarry, near Beaminster (Dorset), (Senior, Parsons & Torrens, 1970, p. 118, bed 8), NHM. C80362-5; one specimen from the '*Astarte* bed' of Stony Head cutting, near Bridport, Dorset (Parsons, 1975, bed 13), NHM, C803565 one specimen from the '*Astarte* bed' of Bonscombe Hill, near Bridport, (Senior *et al*., 1970, p. 116, bed 30), NHM. C80361; and five specimens from the 'Oolithe Ferrugineuse de Bayeux', Port en Bessin, Nornandy, France, NHM. 080366-803705, a total of eleven specimens, all collected *in situ* by the author.

Dimensions:

Holotype, ex. Buckman.collection (S.B.3502) BGS 32060. Max, diameter over flare=1.0 cm., (m.),

D.	Ud.	Pn.	Wb,	Wh.
0.89	0.11 (12)	-	0.5 (56)	0.69(78)
0.73	?0.0	-	0.51 (70)	0.71(97)
BMNH. C80362, (m.),				
0.79	0.21 (27)	-	0.39 (49)	0.56 (71)
0.64	0.01 (2)	-	0.41 (64)	0.6(94)
BMNH. C80363, (m.)				
0.89	0.18	-	0.44 (50)	0.63 (71)
0.73	0.06(8)	-	0.46 (63)	0.64 (88)
BMNH. C80364, (m.)?				
0.83	0.2(24)	28	0.4(48)	0.58 (70)
0.7	0.05 (7)	-	0.44(63)	0.6(86)

NHM. C80365, (m.),

0.74	0.2(27)	0	0.33(45)	0.53 (72)
0,63	0.03(5)	-	0.34 (54)	0.54 (86)

NHM. C80356, (m.),

1.16	0.34 (29)	28	0.5 (43)	0,76 (66)
0.91	0.11 (12)	-	0.61(67)	0.83 (91)

NHM. C80361, incomplete, (m.),

0.67	-	-	0.52 (78)	0.62 (93)
0.58	-	-	0.41 (71)	0.59 (102)

NHM. C80366, (m.),

0.94	0.3 (32)	27	0.46 (49)	0.66 (70)
0.76	0.03(4)	-	0.51 (67)	0.73 (96)

NHM. 080367, incomplete, (m.),

0.88	0.08 (9)	-	0.59 (67)	0.81 (92)
0.7	-	-	0.5 (72)	0.78 (112)

NHM. C80368, nucleus, (m.),

0.72	-	-	0.52 (72)	0.71 (99)
0.6	-	-	0.48 (80)	0.56 (93)

NHM. C80369, (m.),

0.95	0.21 (22)	21	0.47 (50)	0.66 (70)
0.78	0.04 (5)	-	0.5(64)	0.73 (94)

NHM. C80370, (m.),

0.81	0.2 (25)	-	0.42(61)	0.58 (72)
0.73	0.15 (21)	-	49 (67)	0.6 (82)

Description

A very small, (average size=0.87cm.), globose ammonite, with tightly coiled inner whorls and a strongly contracted body-chamber. The whorl section is rounded, but depressed (average Wh:Wb= 0.72), and although both of these dimensions decrease rapidly over the last half whorl, they keep approximately to the same relative proportion, (see Text fig. 9). The primary ribs are very faint, strongly prosiradiate, dense (average 26 per whorl) and branch into two-three very faint secondary ribs which gently swing forward over the venter, often with a slight backward deflection along the mid ventral line. All the ribs, except innermost parts of some of the later primaries, are superficial giving a totally smooth internal cast, particularly on the inner whorls, where all ribs are absent. The umbilical seam is strongly retracted, and flexed, rather than straight as in *S. brongniarti* and *S. auritum auritum* (see Plate 2 , fig. 5b , and Text fig. 8). The mouth-border, as in *S. auritum s. str*. is well differentiated, with the presence of a prominent bilobate, 'two pronged', flared hood, (see Plate 1 fig. 11.), followed by a deep constriction and a triangular shaped expanded lip with lateral, lappet like, extensions.

Sexual dimorphism

The small size and highly differentiated mouth-border of this species, point to it being a microconch ammonite. Unfortunately there is at present very little evidence of the nature of its macroconch partner. At first sight *S.*

tenuicostatum would make a good choice for the latter, but it is excluded by the presence of its own, obvious microconch counterpart, with a continuous, rather than bilobate flared hood, (e.g. NHM. C80359).

Discussion

The type specimen of *S. tutthum* Buckman, (1909-30, Pl. 258), (BGS 32060) was not collected by S. Buckman, but came from his father's collection, with no more information than a provenance from the 'Sherborne district'. The citing of a *niortensis* hemera age (= *baculata* Subzone, *subfurcatum* Zone herein) for this specimen, by S. Buckman was thus nothing more than an inspired guess, based on its 'iron-shot' matrix. Recent detailed collecting, by several workers, of the 'cadomensis beds' of the Sherborne district, has revealed no trace of this subspecies. On the other hand it does appear to be relatively common at a higher horizon; the '*Astarte* bed' of north and south Dorset, (upper *garantiana* Zone). Whilst the specimens of this subspecies, described here come from the '*Astarte* bed' of south Dorset and its equivalents in Normandy, ('Oolithe Ferrugineuse de Bayeux'), it has been recorded from the '*Astarte* bed' equivalent of north Dorset; Half-way House, near. Sherborne, (Whicher, 1969, p. 327). There is thus no reason to doubt the Sherborne district as the type area for this taxon. However considerable doubts must be expressed over the supposed subfurcatum Zone age of the *holotype*, since all available evidence, including its matrix, would point to a higher, *garantiana* Zone, type horizon.

S. tutthum was considered as a junior subjective synonym of *S. auritum* by Sturani, (l971, p. 143), since he wrongly considered it was also of upper *subfurcatum* Zone age. Whilst it is true that some members of the *auritum, s. str*. group do have superficial ribs, with a smooth internal cast, this is not the predominant morphotype. Thus the consistently smooth nature of *S. tutthum*, taken together with its finer ribs, higher stratigraphic position and different shaped umbilical seam, all serve to separate it from *S. auritum s. str.* (*contra* Sturani, 1971, p.143). However, taking into account the features it has in common with *S. auritum,* such as the form of the mouth-border, *S. tutthum* is best considered as a chronological subspecies of the former, both of these taxa being microconchs.

Stratigraphic distribution

There is no evidence of *S. auritum tutthum* in the *subfurcatum* Zone. The specimens described here come from the '*Astarte* bed' of south Dorset and from the 'Oolithe ferrugineuse de Bayeux' of St. Honorine-des-Pertes, Normandy, both of which are upper *garantiana* Zone, *acris* subzone in age. Similar specimens have been collected from the '*Astarte* bed' equivalent of north Dorset, which is of a similar age, (Whicher, 1969, p.327).

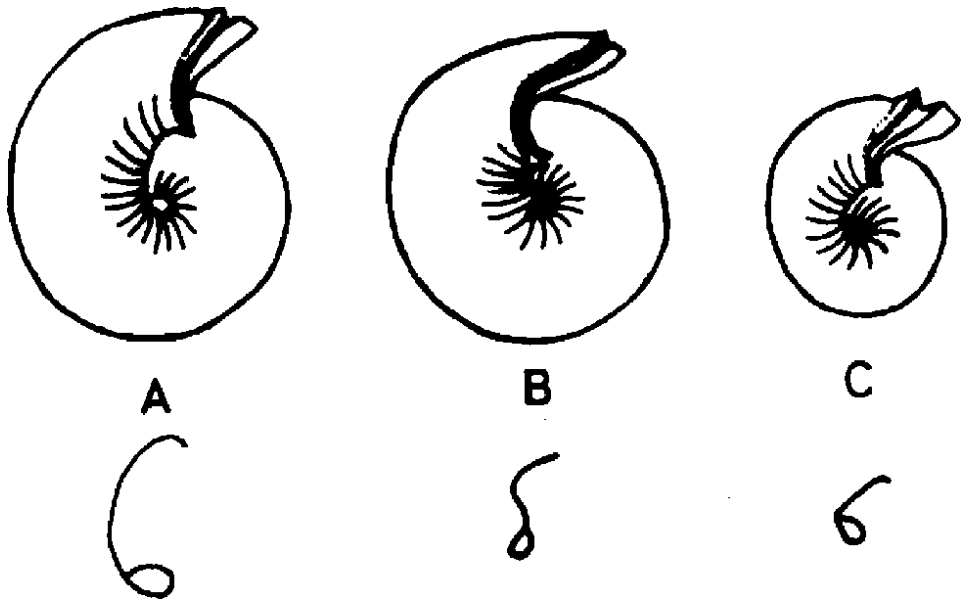


Figure 8:

Outline sketches of; A/ *S. (S.) brongiarti*, B/ *S.(S.) tenuicostatum* and C/ *S.(S.) auritum tutthum,* with enlarged, skeletal outlines of their umbilical seams.

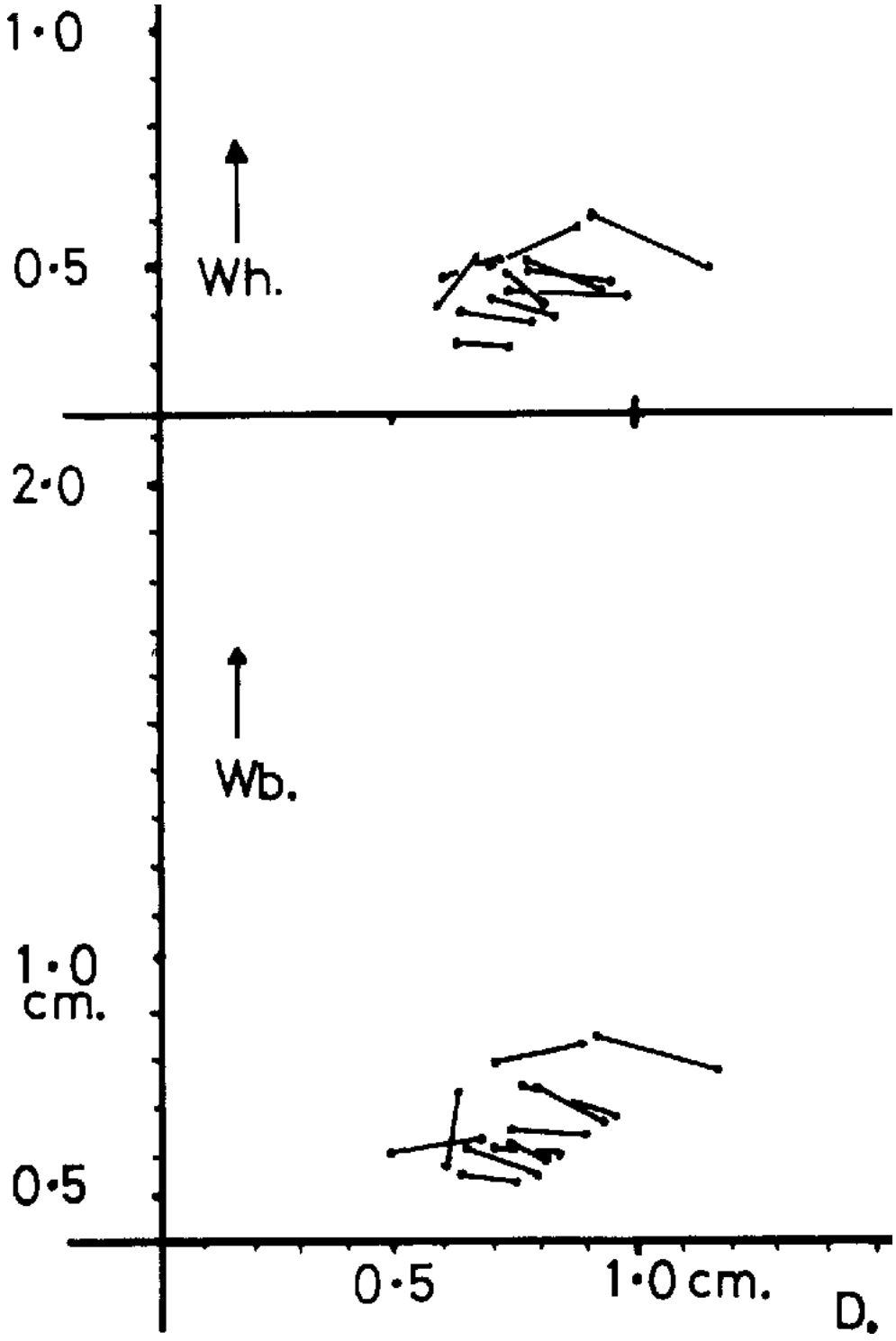


Figure 9:

A plot of whorl breadth (Wb.) and whorl height (Wh.) against maximum diameter (D.), fo*r S.(S.) auritum tutthum* (S.S.Buckman).

5, *Sphaeroceras (Sphaeroceras) aff. globus* S. Buckman

Plate 2 , figs. 7a-b;, Text figs. 10,

1927 *Sphaeroceras globus nov*.; S. Buckman (1909-30), Pl,725.

?1932 *Sphaeroceras sp. nov*., Richardson, p.76.

1939 *Sphaeroceras globus* Buckman; Roché, p.225.

1956 *Sphaeroceras brongniarti* (Sow.); Westermann *non* Sow. pp. 28-9, (*partim*).

1964 *Sphaeroceras brongniarti* (Sowerby); Westermann *non* Sow., p.55, (partim).

1971 *Sphaeroceras brongniarti sub, sp. globus* (S. Buckman); Sturani, pp.137-141, *non* Pl.10, fig. 12.

Material:

One specimen from the 'Rubbly beds' of the Sherborne Building stone series, Castle View, Sherborne, Dorset (ST646173), NHM. C80371.

Dimensions:

Holotype, BGS.49315, (ex. S.S.B. 4762), (M.)

D	Ud	Pn	Wh	Wb,
4.0cm.	?0.24(6%)	-	2.30(58)	3.1(78)
3.62	?0	-	2.23 (62)	3.10 (86)
NHM. C80371, (M.),				
2.7	0.55(20)	-	1.24 (46)	2.02 (75)
2.33	0.18(8)	-	1.44 (62)	2.03 (87)

Description

A small ammonite, with just over three-quarters of a whorl of' body-chamber. The inner whorls are tightly coiled to give an occluded umbilicus, whilst the rapid but uneven uncoiling of the body-chamber produces a flexed 'S' shaped umbilical seam (see Plate2, fig, 7b). The inner whorls are relatively depressed (Wh:Wb=0.71) and this becomes more accentuated on the last half whorl, where the relative height decreases at a greater rate than the breadth. The primary ribs are prosiradiate and very weak, whilst the secondary ribs are totally superficial on the internal cast. The mouth-border shows the development of a prosiradiate, weak flare, followed by a constriction and the beginning of a narrow, smooth lip.

Sexual dimorphism

As it is a relatively large, smooth ammonite, with a poorly differentiated mouth-border, *S. globus* is probably a macroconch. The corresponding microconch, may well be *S. auritum cf. sub, sp. auritum*, although this would have to be confirmed by more extensive material.

Discussion

The *holotype* of *S. globus* is purported to have come from the middle part of the '*cadomensis* beds' of Frogden Quarry, Oborne (S. Buckman, 1909-30, Plate 725), which is equivalent to bed 6c at Oborne Wood. However, it has been impossible to confirm this by the location of *in situ topotypes*. The specimen described here comes from a higher stratigraphic position and shows various differences in gross morphology. It is smaller than the *holotype*,

although still within the range of a 10% standard deviation, and shows coarser ribbing and a stronger retraction of the umbilical seam. The *holotype* does have the same inflated, shell shape and until more is known of this species the described specimen is included in *S. globus* under open nomenclature.

Stratigraphic distribution

The *holotype*, if its cited horizon is correct, is *subfurcatum* Zone, *polygyralis* Subzone in age, whilst the specimen described here from the 'Rubbly Beds' of the Sherborne Building Stone series, is *garantiana* Zone in age.

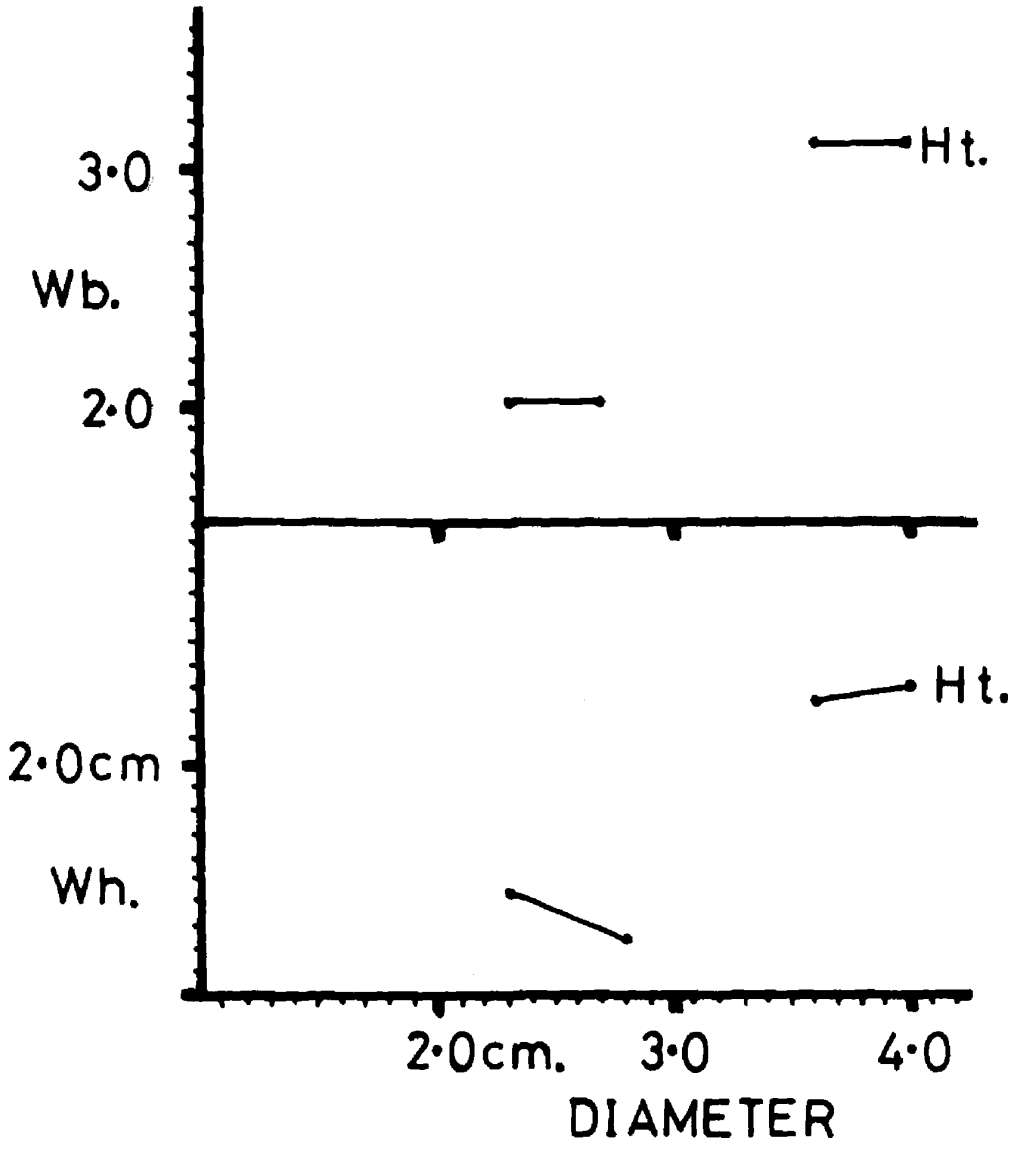


Figure 10:

A plot of whorl breadth (Wb.) and whorl height (Wh.) against maximum diameter (D.) for *S. (S.) aff. globus* S. Buckman. Ht. = *Holotype*.

6. *Sphaeroceras (Sphaeroceras) tenuicostatum* Sturani

Plate 2, figs. 8-10; Text figs. 8 & 11.

?1935 *Sphaeroceras brongniarti* (Sowerby); Roman *non* Sow., p.28, Plate III, fig. 10.

1952 *Sphaeroceras brongniarti* (J. Sow.); Arkell (1951-9) *non* Sow., text fig. 20/ la-b only.

1970 *Sphaeroceras brongniarti* (J, Sow.); Senior, Parsons & Torrens, p.117, *non* Sow.

1971 *Sphaeroceras tenuicostatum nov.*; Sturani, pp.143-4, Plate 10, fig.24 and Text fig. 42/4.

1971 *Sphaeroceras tenuicostatum sub sp. glabrum nov*,; Sturani p. 144, Plate 10, figs.20, 22 and Text figs. 42/ 2 & 5.

1975 *Sphaeroceras tenuicostatum* Sturani; Parsons, p. 9.

Material:

One specimen from the 'Astarte Bed' of Upton Manor Farm, near Bridport, Dorset (Senior et al. 1970, p. 117, bed 7a), NHM. C80359, two specimens from the 'Astarte Bed' of Stony Head Cutting, near Bridport, Dorset, (Parsons, 1975, p. 9, bed 13), NHM. C80357-8, and one specimen from the Sherborne Building Stone Series, Clatcombe (S. Buckman, 1893, p. 496, Section 12), near Sherborne, NHM. C73591.

Dimensions

NHM. C80359, Max. diameter on flare 1.16cm., (m.),

D.	Ud.	Pn.	Wh.	Wb.
1.1	0.14 (12)	c.29	0.6 (55)	0.79 (72)
0.94	0.05 (5)	-	0.62 (66)	0.8 (85)

NHM. C80357, (M.),

2.53	0.44 (17)	38	1.24 (49)	2.02 (80)
2.0	0.07 (4)	-	1.44 (72)	2.03 (102)

NHM. C80358, (M.),

2.3	-	-	1.15 (50)	1.68 (73)
1.96	c.0.1(5)	-	1.27 (65).	-

NHM. C78591, maximum diameter on flare - 314 cm, (M.),

2.88	0.46 (l6)	-	1.53 (53)	2.08 (72)

Description

A small (average macroconch diameter = 2.7 cm.), highly globose ammonite, with tightly coiled inner whorls, a rapid uncoiling of the umbilical seam but with a less marked contraction of the body-chamber over the last half whorl. The whorl section is well rounded, but the whorl width is consistently greater than the whorl height (Wh/ Wb=0.72), The whorl height decreases relative to the width over the last quarter whorl (see Text fig. 11), which leads to the development of a very wide but depressed aperture (see Plate 2 , fig. 10c). The umbilical seam retracts at an uneven rate, which leads to the production of the highly characteristic, sinuous, 'S' shape (Text fig. 8 , B). The primary ribs are extremely fine, sharp, wiry, prorsiradiate, very dense (28-38/whorl) and divide on the outer part of the whorl flank into two and often on the inner whorls, three secondary ribs. These secondaries are also very fine, sharp, and swing forward smoothly over the venter, with the hint of a slight backward deflection along the mid ventral line. All the ribs are partly superficial but leave a slight impression on the internal cast.

The mouth-border is well differentiated, with a very thin, but high flared hood, which is strongly prorsiradiate (see Plate 2 , fig. 10a). The hood is followed by a narrow, deep constriction and then a narrow, smooth lip, which has a mid-ventral node. The flare is unusual, in that it shows the presence of numerous secondary ribs on its adapical surface (Plate 2 , fig. 9).

Sexual dimorphism

The three larger specimens (average diameter = 2.7cm.) are very similar to Sturani's (1971, p.144) material in relative proportions, ribbing style, mouth-border and shape of umbilical seam; but differ by being much larger. They are probably thus macroconchs. The specimen from Upton Farm (NHM. C80359), is much smaller (1.16 cm.) and is of the same order of magnitude as the larger end members of the Italian fauna (loc. cit., 10-11 mm.); they are thus the ideal microconch partners for the larger English specimens. Although based on a very small sample, the size ratio between dimorphs is in the order of 1:2.3.

Discussion

The *holotype* of this species (Sturani, 1971, Plate 10, fig. 24) comes from the *garantiana* Zone of the Venetian Alps. The specimens described here conform to those figured by Sturani in most characters, both groups having similar mouth-borders, very fine ribs and sinuous umbilical seams; however, exact comparisons are made difficult by Sturani's unfortunate omission of any measurements for the holotype and paratypes. This species is easily separated from *S. brongniarti* by its thinner, sharper hood and by its more occluded umbilicus (see Text fig. 8), whilst its continuous rather than bilobate hood distinguishes *S. tenuicostatum* from the *S. auritum/tutthum* group, which otherwise has very similar relative proportions.

Stratigraphic distribution

The *holotype* of this species is *garantiana* Zone in age, whilst the specimens described here come from the '*Astarte* bed' of south Dorset, which is to be correlated with the *acris* subzone of the *garantiana* Zone, and from the Sherborne Building Stone Series, which is probably, at least in part, of the same age.

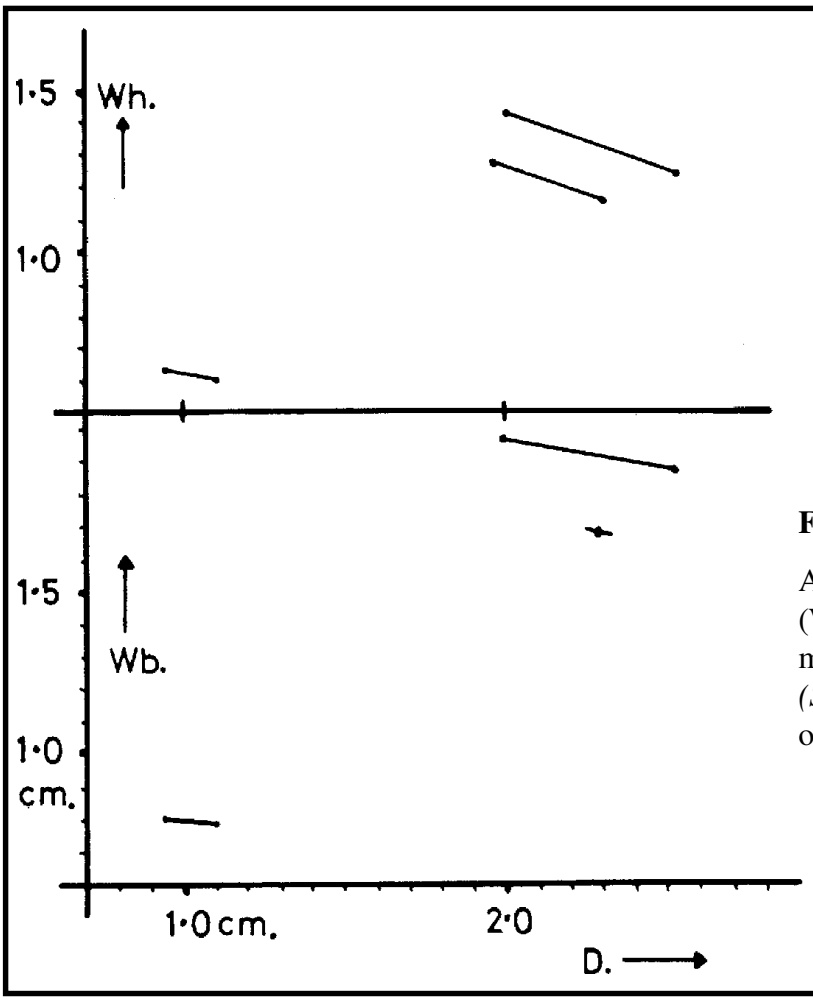


Figure 11:

A plot of whorl height (Wh.) and whorl breadth (Wb.) against maximum diameter (D.), for macroconch and one microconch specimen of *S. (S.) tenuicostatum* Sturani, from the *Astarte* bed of south Dorset.

Genus *Chondroceras* Mascke 1907

Type species, by original designation: – *C. gervillei* (J. Sowerby 1817)

Subgenus *Chondroceras* Mascke 1907 Including *Schmidtoceras* Westermann, 1956.

Diagnosis

A group of small, sphaeroconic ammonites, with relatively fine, sharp ribs. The inner whorls are closely coiled leading to the development of a deep, narrow, but open umbilicus. There is a moderate uncoiling of the umbilical seam associated with the contraction of the body-chamber; this contraction however, is never as marked as in *Sphaeroceras*. The sutures are complex and interdigitating. Macro- and microconchs have a size ratio of approximately 2:1, both showing modifications to the mouth-border, usually a constriction, followed by a smooth lip. This subgenus ranges from the upper *laeviuscula* Zone to the base of the *parkinsoni* Zone.

Subgenus group

Numerous species have been described under the generic name *Chondroceras*, but only the following are accepted here as members of the restricted subgenus.

1/ *C. gervillei* (J. Sowerby, 1817)
syn. *C. orbignyanum* (Wright, 1860 *non* Geinitz)

2/ *C. evolvescens* (Waagen 1867)
syn. *C. wrightii* (Buckman, 1881),
C. wrightii sub. sp. minor, Westermann, 1956
C. (Schmidtoceras) schindewolfi sub. sp. hispanicum Westermann, 1956,
?C. (S. ibericum Westermann, 1956,
C. (Defonticeras) parvumbillicum Westermann, 1956,
??C. densicostatum Westermann, 1956,

3/ *C. canovense* (de Gregorio, 1886)

4/ *C. grandiforme* S. Buckman, 1922,
syn. *C. delphinus* S. Buckman 1923
? C. polytomum Westermann, 1956.

5/ *C. polypleurum* (Westermann, 1956)
syn. *C. gracile* (Westermann, 1956)

6/ *C. polypleurum sub. sp. crassicostatum* (Westermann, 1956),

7/ *C. obornensis nov.*

8/ *C. sp. nov. aff, C. tenue*

9/ *C. schmidti* (Westermann, 1956), group including
syn./
sub. sp.
C. schmidti multicostatum (Westermann, 1956).
?C. arkelli (Westermann, 1956).
?C. arkelli gerzense (Westermann, 1956)
?? C. crassum (Westermann, 1956)
C. evolutum (Westermann, 1956)

10/ *C. antiquum* (Westermann, 1956)

11/ *C. tenue* (Westermann, 1956)

12/ *C. boehmi* Westermann, 1956

13/ *C. flexuosum* Sturani, 1971
syn./ sub. sp. C. fasciculatum Sturani, 1971.

14/ *C. callomoni* Sturani, 1971.

Of these species, *C. boehmi* has only been recorded from New Guinea, whilst *C. callomoni* and *C. flexuousum* have not yet been recognised outside of northern Italy. The most problematic group consists of those 'species' here included in *C. schmidti*, which are members of Westermann's subgenus *Schmidtoceras*. There is little or no stratigraphic basis for most of the species erected by Westermann in this subgenus. Only two (*C. antiquum* & *C. tenue)* were recorded from any horizon other than the lower *humphriesianum* Zone. It is solely because of their distinct stratigraphic ranges in the *sauzei* and upper *humphriesianum* Zones respectively, that these latter two species are retained here.

Since there is at present insufficient stratigraphic and morphological criteria to separate them, any future attempts at a revision of the members of the *C. schmidti* group must be based on a greater appreciation of both their relative stratigraphic distribution and intra-specific variation. The *C. schmidti* group is largely restricted to the German/ Swiss Jura area, and a study of large collections from Luphen, Schwabian Albe, south Germany (U. Bayer collection, Stuttgart), would suggest that most of the so called 'species' of *Schmidtoceras* are merely morphotypic variants, within a single highly variable biospecies, centred on *C. schmidti*.

1. *Chondroceras (Chondroceras) gervillei* (J. Sowerby)

Plate 2, figs. 11-13. Plate 3, figs. 1;, Text figs, 12 & 25.

1817 Ammonites gervillii nov. J. Sowerby (in J. & J. de C. Sowerby, 1812-46), p.189, Plate 184A, fig. 3.

non 1846 Ammonites gervillii Sow.; d'Orbigny (1842-51) non Sowerby, pp.409-410, Plate 140, figs.1-8.

non 1849 Ammonites gervillii; Quenstedt (l845-9), p. 187, Plate 15, fig. 11.

1856 Ammonites gervillii Sow.; Oppel, p.375

non 1867 Ammonites gervilli Sowerby; Waagen, p,605.

1877 Stephanoceras gervilii ; Hyatt, pp. 393-4.

non 1878 Sphaeroceras gervillii Sowerby; Bayle, Plate 53. figs, 6 & 1.

non l88l Ammonites gervillii Sow.; J, Buckman, p. 63 fig.4.

non l88l Sphaeroceras gervillii (Sow.); S. Buckman, p. 597.

non 1886 Ammonites gervillii; Quenstedt (l886-7), p.510, Plate 64, figs.3, 14 & 15.

? 1893 Sphaeroceras gervillii (Sow,); S. Buckman, p. 501.

1907 Chondroceras gervillei Sow.; Mascke, p. 33.

non 1927 Chondroceras gervillii (J, Sowerby); S, Buckman (1909-30), Plate 724.

non 1951 Sphaeroceras gervillei (Quenstedt), Maubeuge, 1951, p. 81, Plate 12, fig,. 5.

1952 Chondroceras gervillii (J. Sowerby); Arkell (1951-9), p. 78, Text fig. 20/a & b. (holotype). 1956 Chondroceras gervillii (J. Sowerby); Westermann, pp. 50-3, Text figs. 25 & 31, Plate 1, figs.l (holotype), 3 & 4 non 2.

? 1956 Chondroceras russelli Crickmay; Westermann, pp. 53-5, Plate 1, figs. 5 & 6, non Crickray.

1956 Chondroceras (Schmidtoceras) orbibnyanum orbignyanum (Wright); Westermann, pp.74-7, Text figs. 39 & 45, Plate 5, fig.6 non 7; & non Plate 6, figs. 1 & 2.

1957 Chondroceras gervillii (Sow.), Arkell (in Arkell, Kummel & Wright 1957), p. L292, Figure 347/3a-b. (holotype).

1961 Chondroceras gervillii Sowerby; Maubeuge, p.146 (with figure).

1964 Chondroceras gervillii (J. de C. Sowerby); Westermann, p. 54.

1971 Sphaeroceras (Chondroceras) gervillii (Sow.); Sturani, p.146.

1971 Chondroceras gervillii (Sowerby); Morton, p. 287.

1971 Chondroceras gervillii (J. Sowerby); Whicher & Palmer, p. 117.

Material:

Four specimens from Oborne Wood; two collected in situ from bed 4b, NHM. C80380-1, and two probably from this horizon, NHM. C80382-3 and one specimen from the 'Irony bed' of Louse Hill quarry, near Sherborne, Dorset (ST 608163), NHM. C80379.

Dimensions:

Holotype, NHM. C36735, maximum diameter on flare - 2.85cm,

D.	Ud.	Pn.	Wh.	Wb.
2.60	0.60(23%)	38	1.30(50)	1.90 (73)
c.2.35	0.5 (21)	37	1.14 (49)	1.74 (74)
NHM. C80380,. diameter on flare - 2,9 cm.				
2.83	0.7 (25)	26	1.39(49)	1.93 (68)
2.36	0.51 (22)	25	1.23 (52)	1.78 (75)
NHM. C80382,				
2.6	0.62 (24)	26	1.23 (47)	1.84 (71)
2.05	0.43 (21)	-	1.22 (59)	1.84 (90)
NHM. C80383,				
2.57	0.77 (30)	28	1.2 (47)	1.8 (70)
2.12	-	-	1.18 (56)	1.67 (79)
NHM. C80381,				
2.94	0.72 (24)	39	1.41 (48)	1.94 (66)
2.44	0.58 (24)	-	1.23 (50)	1.88 (77)
NHM. C80379, (incomplete),				
1.78	0.40 (22)	23	0.92 (52)	1.44 (81)
1.51	0.32 (21)	-	0.82 (54)	1.23 (81)

Description

A small (average size = 2.8cm.), globose species, with a narrow, deep, but open umbilicus, and with a rounded but relatively depressed whorl section (Wh/Wb=0.69). There is a very slight uncoiling of the umbilical seam over the last quarter whorl, but this produces little or no change in the relative whorl height and breadth of the body-chamber, compared to the earlier whorls - see Text fig. 12 . The ribbing is sharp and well marked. The primary ribs are curved, prorsiradiate, dense (26-39 on the outer whorl) and divide just above the whorl shoulder into two secondaries, with the occasional third interdigitated. The secondary ribs sweep forward gently over the relatively flat venter, and tend to become slightly coarser just before the aperture. The body-chamber stretches for four-fifths of a whorl and it is terminated by a well developed mouth-border. This consists of a slight flare, followed by a deep constriction and a smooth expanded lip - see Plate 2, fig. 11.

Sexual dimorphism

There is a problem in determining the identity of the dimorphic partner of *C. gervillei*. In relative proportions, ribbing style and shape of mouth-border, this species is very close to *C. grandiforme*. This might suggest *C. gervillei* as the microconch counterpart of this much larger species. The only factor against this is the higher proportion of secondary to primary ribs on the inner whorls of *C. grandiforme*; as a ratio closer to 3:l, rather than the 2:1 of *C. gervillei* is evident. Another possibility is that *C. gervillei* is the macroconch of a smaller, and as yet un-recognised group. It is however certain that *C. wrighti minor* (= *C. evolvescens*, (m,)), cannot be considered as the microconch of this species (*contra* Sturani, 1971 p.146), since its relative proportions and the shape of its mouth-border are very different, (see the later discussion of *C. evolvescens*). The last possibility is that *C. gervillei* is the microconch of an as yet undescribed macroconch, which would have the appearance of a more inflated form of *C. polypleurum* (Westermann), M., but with a more depressed whorl cross-section. The only solution to this problem rests in the collection of larger *in situ* samples.

Discussion

As can be seen from the synonymy list, this species has been the subject of much past confusion, which at least in part has originated from d' Orbigny's interpretation of this taxon (d' Orbigny, 1842-51, Plate 140). This confusion was augmented by Quenstedt's erroneous and broad interpretation of this species, which he used as the basis for several invalid trinomens (Quenstedt, 1886, Plate 64). Other authors who have mis-identified this group include Buckman, whose figured specimen (Buckman, 1909-30, Plate 724; BGS. 49314); is too compressed and umbilicate for this species, and Westermann (l956); at least one of whose specimens is a member of the *C. evolvescens* group (*op. cit*. Plate 1, figs. 2a-b), since it shows the presence of a smooth mouth-band and a highly contracted body-chamber. In connection with the latter work, it is possible that the specimens figured by Westermann as *C. russelli* Crickmay, (*op. cit*. Plate 1, figs. 5a-b & 6a-b), are coarser ribbed, morpho-types of *C. gervillei*, since there is a wide range of variation in primary rib density in the latter species. In any event these specimens cannot be referred to *C. russelli*, as this species is based on an inadequate nucleus of relatively large size, which from the associated ammonite fauna is *sauzei* Zone in age (Crickmay, 1933, p.913, Plate 27, figs. 6-8). Similarly Westermann's '*lectotype*' of C. orbignyanum (Wright) is undoubtedly synonymous with *C. gervillei*. They both come from the same horizon, the 'Bayeux Conglomerate', Normandy, show a similar gross morphology, depressed whorl cross-section and rib style, particularly the prevalence of biplicate secondary ribs. In any case *'Ammonites' orbignyianus* (Wright, 1860) is a junior objective homonym *of 'A.' orbignyanus* Geinitz (1850) (Waagen, 1867, p.605), in spite of the one letter difference, (int. Code Zoo. Nomen., Article 58(2)).

The specimens which are here referred to this species are both rare compared to other *romani* subzone sphaeroceratids and relatively variable. The specimen closest to the *holotype* (Plate 2, figs, 11a-b) is NHM. C 80380 (Plate 2 , figs, 12 a-b), which has very similar relative proportions and whorl shape, but which is coarser ribbed. However the range of rib density and relative proportions exhibited by this, and the other specimens, is well within that shown by larger samples of other more clearly defined species, such as *C. evolvescens* (see below). This species may be easily confused with *C. polypleurum crassicostatum* which is very similar in many respects, However, they may be separated by their very different whorl proportions, as is clearly brought out in Text fig, 25.

Stratigraphic distribution

The type horizon of this taxon, the 'Bayeux Conglomerate', is romani subzone, humphriesianum Zone in age, as are all the English specimens, which have been collected *in situ*.

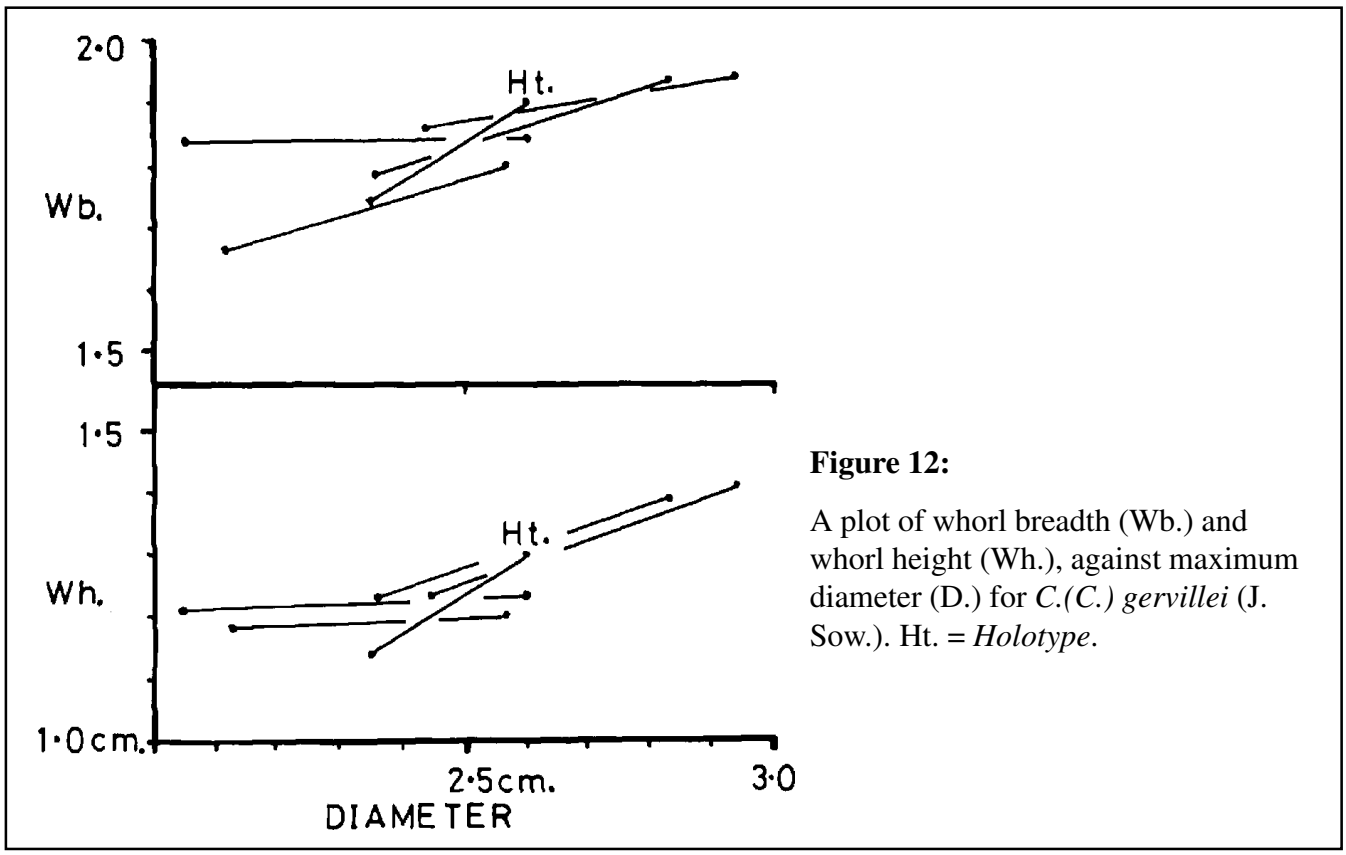


Figure 12:

A plot of whorl breadth (Wb.) and whorl height (Wh.), against maximum diameter (D.) for *C.(C.) gervillei* (J. Sow.). Ht. = *Holotype*.

2, *Chondroceras (Chondroceras) evolvescens* (Waagen)

Plate 3 , figs. 2-9, Text figs. 1,2 & 13-9.

non 1849 *Ammonites gervillii* Sow,; Quenstedt (1845-9), p,l87, Plate 15, fig.11.

1867 *Ammonites evolvescens n. sp*.; Waagen, pp. 604-5.

non 188l *Ammonites gervillii* Sow.; J. Buckman, pp.63-4, fig. 4.

1881 *Sphaeroceras wrightii n. sp*.; S.S. Buckman, p.599.

non 1886 *Ammonites gervillii* Sow.; Quenstedt (l886-7), p.510, Plate 64, fig.3.

1893 *Sphaeroceras wrighti* ; S. Buckman, p. 501.

1923 *Chondroceras wrighti* S.Buckman; S. Buckman (1909-30), Plate 415.

1939 *Chondroceras wrighti* Buck.; Roché, p.225.

1939 *Sphaeroceras evolvescens* Waagen; Roché, p.226.

1943 *Sphaeroceras evolvescens* Waagen; Roché, pp.20-2, Plate 1, figs, 5) 6, (lectotype) & 7.

? 1951 *Sphaeroceras gervillei* (Quenstedt); Maubeuge, p,81, Plate 12, figs, 5a-c.

1952 *Sphaeroceras wrighti* S, Buckman; Jackson, p,139.

1956 *Chondroceras (Chondroceras) evolvescens* (Waag.); Westermann, pp. 55-8 *(pars*), Plate 1, figs, 7a-b, *non* 8, *non* Plate 2, figs. la-b.

1956 *Chondroceras (Chondroceras) wrighti wrighti* Buckm,; Westermann, pp. 58-61, Plate 2, figs. 3 & 4, Plate 3, fig, 1.

1956 *Chondroceras (Chondroceras) wrighti minor n. subsp*.; Westerinann, p.61, Plate 3. figs. 2 & 3.

1956 *Chondroceras (Chondroceras) gervillii* (Sow.); Westermann, Plate 1, fig, 2a-b, *non* 1, 3-4. 1956 *Chondroceras (Schmidtoceras) schindewolfi hispanicum n. subsp*.; Westermann, pp.82-4, Plate 8, figs, la-b, non 2 & 3.

1956 *Chondroceras (Defonticeras?) parvumbilicum n. sp.;* Westermann, pp.104-6, Plate 12, figs..1 & 2.

?1963 *Chondroceras wrighti wrighti* Buckm.; Makowski, pp. 50 & 81, Text fig. XII, 1 & 2.

1964 *Chondroceras evolvescens* (Waagen); Westermann, p.54.

1964 *Chondroceras parvumbilicum* (Westermann); Westermann, p.54.

1971 *Sphaeroceras (Chondroceras) wrighti* (Buckm.) minor (Westermann); Sturani, pp.145-6, Plate 11, figs. 1-3, 5 & 6.

1971 *Chondroceras wrighti* S. Buckman; Whicher & Palmer, p. 117.

1971 *Chondroceras evolvescens* (Waagen); Morton, pp. 286-7, Plate 51, figs. 4-7.

Material:

The following have been collected in situ: 41 from bed 5, Milborne Wick, NHM. C80400-2, CP2178-2190, CP2192-.2200, CP2202-2213, CP2280-3; 39 from bed 4, Oborne Wood, NHM. C80384-8, CP2226-8, CP2230-6, CP2238-2248, CP2250-2, CP2254-2261, CP2726-7; 2 from bed 5b, Clatcombe Farm, NHM. C80372-3 and two from the Rigg Sandstone, Rigg, Isle of Skye (NG521567), CP2262-3. In addition 20 specimens from the Manchester Museum (ex. Earwaker coll.), from Milborne Wick, LL4252A-I & N-X; and 38 from Milborne Wick, OUM.J10800, J10812-9, J10821-4, J10826-42 and 8 on a collective number J10847, have been utilised, since they have a highly characteristic matrix, and thus can be well localised. The following topotype material of *C. evolvescens*, from Le Mesnil-Louvigny, Normandy, France has also been included; OUM.Jz1465 & NHM. C78324-5. A total of 145 specimens.

Dimensions:

Jz1465, (M.),

D.	Ud.	Pn	Wh.	Wb.
4.0cm.	1.25 (31.3%)	26	1.76 (44)	2.25 (56.3)
3.2	-	-	1.7 (53.1)	2.23 (69.7)

NHM. C78324, maximum diameter 3.74cm., (M.),

3.53	0.96 (27)	-	1.6 (45)	2.03 (53)
3.05	0.70 (23)	-	1.54 (51)	2.11 (69)

NHM.. 078325, maximum diameter 4.13 cm., (M.)

,3.83	1.05 (27)	-	1.62 (42)	2.28 (60)
3.34	0.85 (26)	-	1.7 (51)	2.37 (71)

NHM. C80372, maximum diameter, 4.24 cm., (M.),

4.16	1.2 (29)	37	1.85 (45)	2.35 (57)
3.32	0.64 (19)	-	1.67 (50)	2.44 (74)

NHM. c80400, maximum diameter, 4.8 cm. (M.),

4.72	1.5 (32)	26	1.93 (41)	2.28 (48)
3.84	0.75 (20)	24	1.84 (48)	2.25 (59)

NHM. C80401, maximum diameter, 1.74 cm., (m..),

1,64	0.44 (27)	27	0.70 (43)	0.94 (57)
1.43	0.30 (21)	-	0.71 (50)	0.94 (66)

NHM. C80384, maximum diameter, 4.0cm., (M.),

3.76	0.95 (25)	29	1.54 (41)	2.2 (59)
3.2	0.58 (18)	28	1.65 (52)	2.25 (70)

NHM. C803855 maximum diameter, 1.76cm., (m.),

1.68	0.40 (24	29	0.76 (45)	1.00 (60)
1.33	0.3 (23)	-	0.74(56)	1.05(65)

Dimensions of only a small representative sample of the total material are given above, and the majority are recorded in an appendix.

Description

A small (average size, Oborne Wood microconch = 1.90 cm., macroconch =4.01, Milborne Wick microconch = 1.87, macroconch = 3.98), globose, involute ammonite, with a deep and very narrow umbilicus (see Text fig.13). There is a marked uncoiling of the umbilical seam (hence Waagen's name), associated with the contraction of the body-chamber, which stretches for between three-quarters and one whorl. This contraction is caused by the reduc-

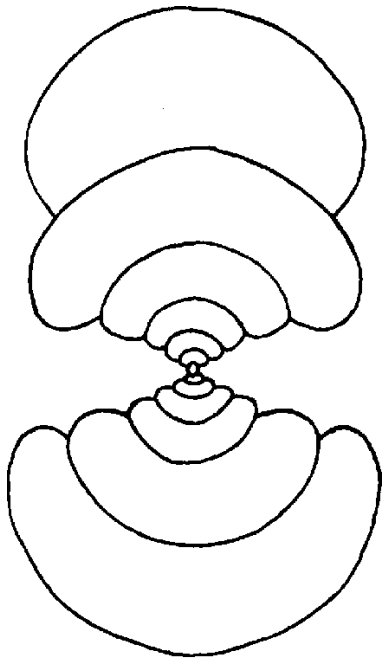


Figure 13:

A median cross-section of a specimen of *Chondroceras (C.) evolvescens* (Waagen), from bed 4b, Oborne Wood, Dorset, x 1.5.

tion in whorl breadth relative to whorl height (see Text figs. 14 & 15), which results in the highly depressed inner whorls becoming more rounded towards the aperture (see Text fig. 13). The ribbing is well marked and strong, although with a tendency to be slightly superficial on the inner whorls. The primary ribs are almost straight, slightly prorsiradiate, dense (modal values = 26-7 per last whorl) and divide well up the whorl flank into two to three secondaries. The latter are coarser on the last half whorl and sweep forward very gently over the arched venter. The mouth-border is characterised by a constriction, followed by a faint flare and a broad, smooth lip. The sutures of some specimens from Milborne Wick (CP2224, 2280, 2239 & 2291), are more easily visible, than is the case with many other British sphaeroceratids. Although they are still complex and difficult to delineate, the larger size of these sutures has enabled a detailed comparison to be made with previous figured specimens. Whilst there is a considerable degree of individual variation, these sutures agree in general terns with that figured "by Westermann (1956, Text fig.33), of *Chondroceras wrighti*. The only clear difference from this figure, would appear to be a tendency for the second umbilical lobe (U_{II}) to be narrower and more divided on the Milborne Wick specimens, compared to Westermann's.

Sexual dimorphism

Both of the larger samples from Oborne Wood. and Milborne Wick, clearly show bi-modal size distributions (Text figs.1 & 16). It is evident from the examination of both the inner whorls of numerous complete specimens, as well as more fragmentary material, that the micro-, and macroconchs are identical in relative proportions and ribbing style, up to a diameter of approximately 1.25cm. It is only with the appearance of the mature body-chamber, that sexual differentiation becomes apparent. The size ratio between dimorphs is fairly constant, as both the Milborne Wick and Oborne Wood samples, yielded ratios of average microconch diameter to average macroconch diameter of 1: 2,1. The microconchs, apart from their smaller size, tend to be slightly coarser ribbed and to have a more modified mouth-border, than their macroconch counterparts. Whilst the majority of the microconchs have a slightly sinuous edge to their apertures, a few show additional modifications, including mild flares preceding the constriction, mid-ventral nodes on the lip and the presence of residual lappets, (e.g. NHM. C80402). The latter are extremely similar to those exhibited "by *Sphaeroceras manselli and Labyrinthoceras meniscum* (see Plate 1 , fig. 10c ; Plate 3, fig. 4). However, these additional modifications of the mouth-border are both relatively rare and highly variable in their developments

	At aperture	Half whorl before
Relative whorl height %	**39-52%**	**45-63%**
" " breadth %	**48-69%**	**53-87%**
Number of primary ribs per whorl	**20-37**	**——**
Relative umbilical width	**20-34%**	**15-26%**

Table II

Variation in relative proportions for *C. evolvescens* (Waagen), based on *in situ* material from Oborne Wood and Milborne Wick, Dorset.

Morphological variation

There is a considerable range of morphological variation inherent in this group (see Table II). The sample from Oborne Wood has the most even distribution between the two dimorphs, and hence this was used for a study of the variation in relative proportions. This showed that the variation of both whorl height and of the number of primary ribs per whorl, follows an approximately gaussian distribution (see Text fig.17), whilst whorl breadth has a more widely spread, non-gaussian distribution. The variation in relative dimensions of the Milborne Wick sample show similar trends, with a wide spread in the whorl breadth distribution, and well developed gaussian distributions in the rest, particularly the primary rib density (see Text fig. 18). Although they have similar relative whorl proportions, the Milborne Wick and Oborne Wood samples do not show identical ranges of variation. An examination of the plots of relative whorl height and breadth (Text figs. 14 & 15), shows that the macroconchs from Milborne Wick are consistently less inflated, with a lower whorl height, than the Oborne Wood macroconchs at identical diameters. This variation is not however discontinuous, as there is a considerable overlap of these two groupings, (see Text fig. 19). A similar style of variation appears to be inherent in the small sample from the Clatcombe Farm section, Sherborne (ST628l79). These specimens have a much higher primary rib density than most members of the other collections (30-37 per whorl) However, this again overlaps with the range of variation of the larger samples.

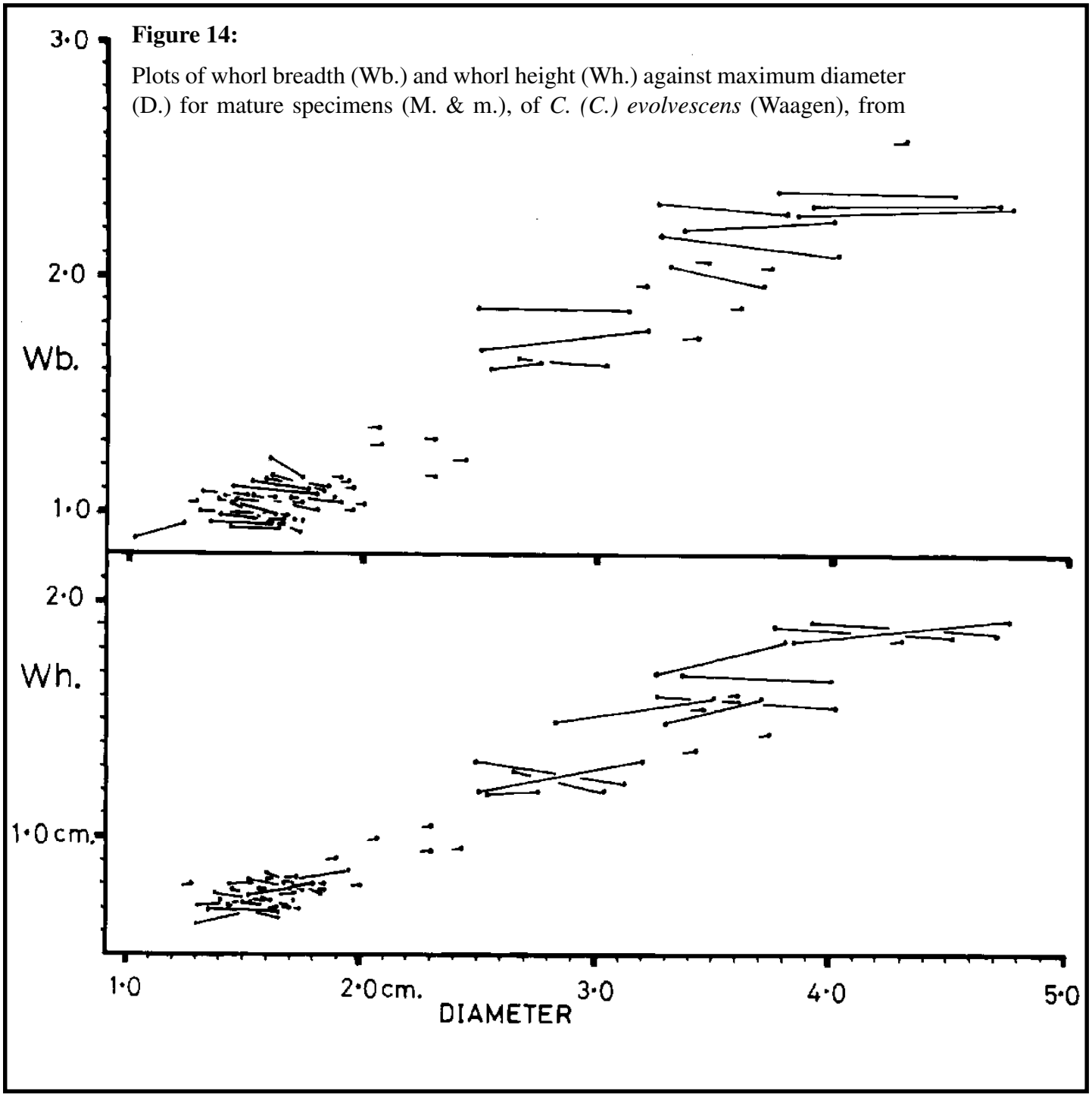


Figure 14:

Plots of whorl breadth (Wb.) and whorl height (Wh.) against maximum diameter (D.) for mature specimens (M. & m.), of *C. (C.) evolvescens* (Waagen), from

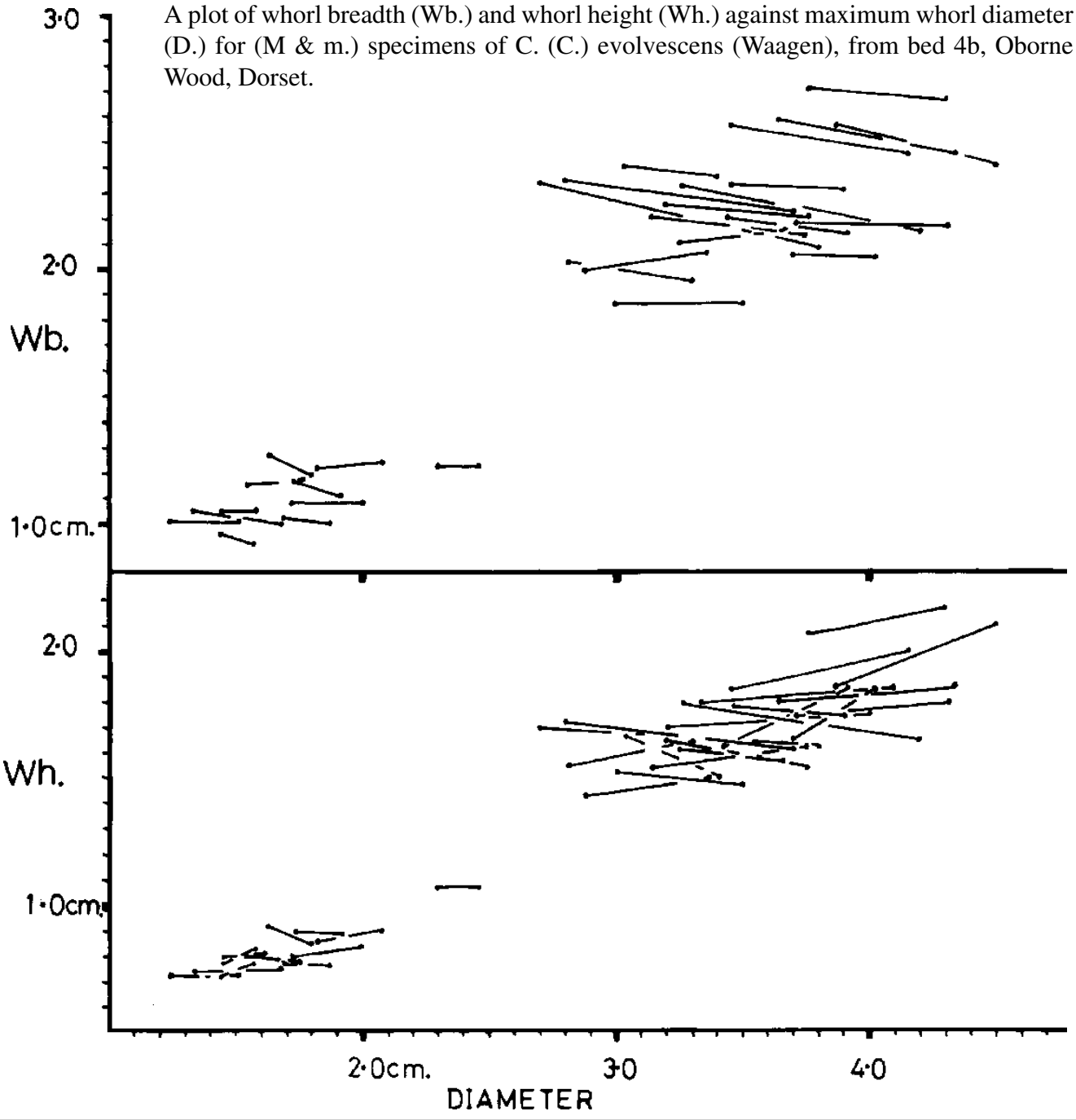
Discussion

The type series of *C. evolvescens* (Waagen), contains specimens from at least two localities; Le Mesnil-Louvigny and Les Moutiers, Normandy (Waagen, 1867, p. 605), hence the figuring of only one of these specimens as 'holotype' (Roché, 1943, Plate 1, figs. 6a-b), may be considered as a *lectotype* designation. This specimen, together with the three *topotypes* from Le Mesnil, fall in the centre of the range of morphological variation of the Dorset populations, particularly that from Milborne Wick (bed 5). Thus *C. evolvescens* is undoubtedly the oldest available specific name for this latter population of ammonites.

The synonymy of this species is fairly involved, but its interpretation has been simplified by the large size of the available samples. *C. wrightii* (S. Buckman) is the senior, junior subjective synonym, Buckman (188l, p.599), included in his type series of this species a figure by Quenstedt (1845-49, Pl. 15, fig. 6) and an unknown number of specimens from the Oborne and Sherborne districts of north Dorset (Buckman, 188l, p.599). It is important to note at this juncture, the presence of a misprint in Buckman's description. It is evident from a correction made in Buckman's own copy of his 1881 paper, that the Quenstedt figure which he intended to cite was fig. 5, rather than fig.6 (Quenstedt, l845-9, Pl.15). Figure 5, a Callovian form, is, as noticed by Waagen (1867, p. 604), very like the

Figure 15:

A plot of whorl breadth (Wb.) and whorl height (Wh.) against maximum whorl diameter (D.) for (M & m.) specimens of C. (C.) evolvescens (Waagen), from bed 4b, Oborne Wood, Dorset.



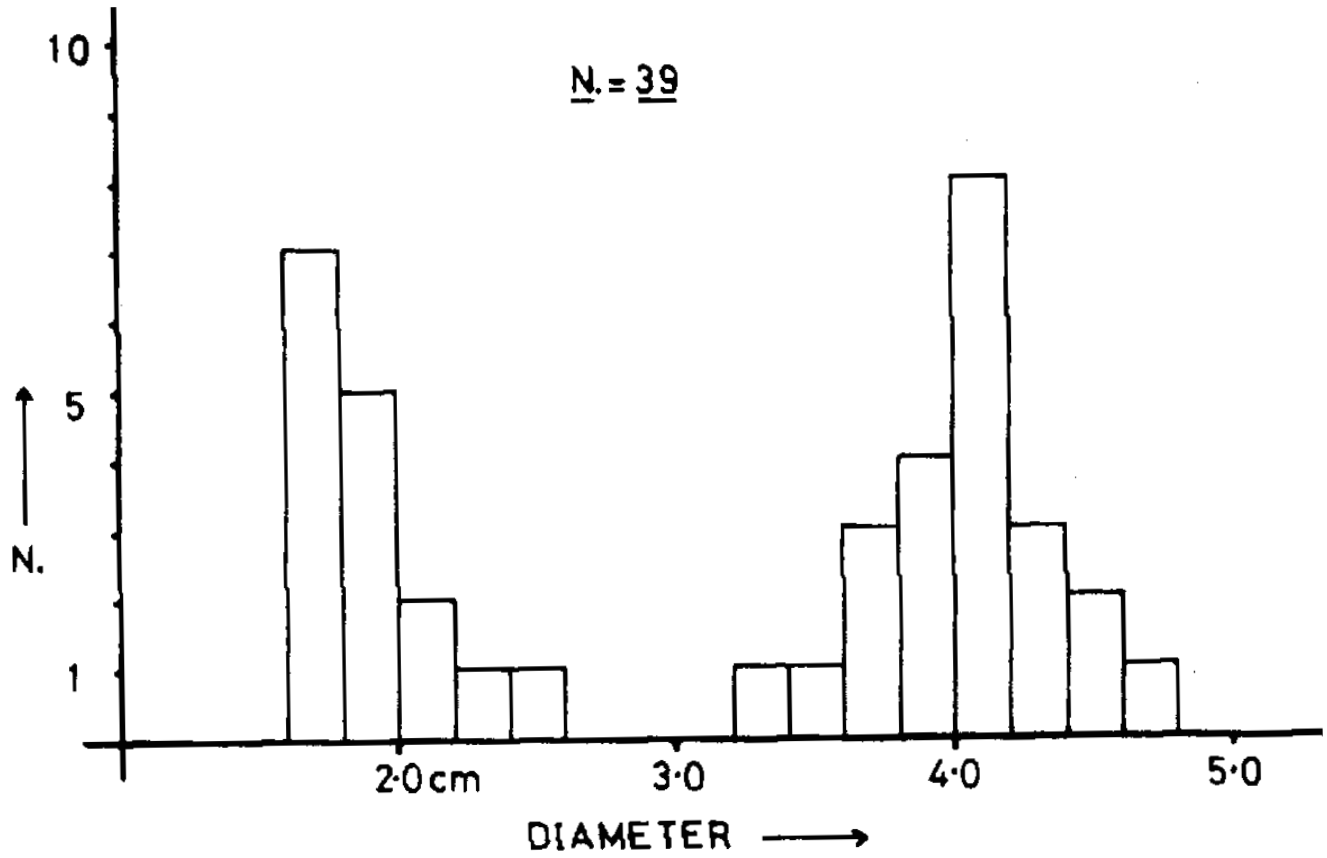


Figure 16:

A histogram of the distribution of maximum mature diameter in specimens of *C.(C.) evolvescens* (Waagen), from Oborne Wood.

Bajocian taxon. Since both of these Quenstedt figures have subsequently become types of new species (fig.5, *Ammonites microstoma* = *'Sphaeroceras' suevicum* Roemer, 1911, p. 43; fig. 6, *A. microstoma impressae* = *A. chapuisi* Oppel, 1856-8, p. 605), the selection of a *lectotype* for *'Sphaeroceras' wrightii* should be restricted to the Dorset specimens. As Buckman designated no *holotype* in his original description, the later figuration of one of the *syntypes* as the 'holotype' of *C. wrightii* Buckman (1909-30, Pl. 415), can be considered as a *lectotype* designation of *'Sphaeroceras' wrightii* Buckman, 1881; particularly since this *syntype* is undoubtedly the same specimen as that which provided the dimensions cited in 1881 (Jackson, 1952, p.139).

This confused taxonomic situation has been made chaotic by Westermann (1956). He claimed that the Quenstedt figure cited by Buckman was the *holotype* of *'Sphaeroceras' wrightii*, and this led him to consider Buckman's species as a Callovian *Bullatimorphites.* Whilst this action is understandable, although incorrect, Westermann's subsequent recognition of a second *homonymic* Buckman species based on the figure in 'Type Ammonites' (Buckman, 1909-30, Pl. 415), is totally unforgivable. It is evident both from the text of this plate, and from the catalogue of type material in the Manchester museum (Jackson, 1952), that the specimen figured in 'Type Ammonites' is the same one as that cited by Buckman in 1881. This same specimen cannot be divided into two homonymic species; *Bullatimorphites wrightii* Buckman l88l and *Chondroceras wrightii* Buckman 1923; as suggested by Westermann (l956, p. 58). Fortunately this situation is easily rectified by the re-interpretation of Buckman's 1923 selection of a type specimen, as a lectotype designation. for *'Sphaeroceras' wrightii*, as discussed above.This *lectotype*, which came from Frogden quarry, Oborne, is now preserved in the Manchester museum (L11420), and it proves to be identical in dimensions and ornament to numerous *topotypes* of this species from bed 4b, Oborne Wood. There is thus no reason for separating this species from *C. evolvescens,* which is morphologically identical. Of the other taxa included in the synonymy, *C. wrightii sub, sp. minor* Westermann (1956, P1. 3, fig.2), is identical in size, ornament and relative dimensions, to the smaller specimens in both the Oborne and Milborne Wick samples, and is clearly the microconch counterpart of *C. evolvescens s. str.* Since there is very little morphological differentiation between the two dimorphs, there would appear to be no reason for keeping them as two distinct taxa. The *holotype* of *C. (Defonticeras) parvumbillcum* Westermann, (1956, Plate 12, fig. l), originates from Dorset. The only morphological feature which Westermann utilised, in first recognising this group as a distinct

species, and second in placing it in the subgenus *Defonticeras,* would appear to be its rather coarse primary ribbing (22-3 per whorl). As a high degree of variation is now recognised in this character (Text figs, 17 & 18), *C. parvumbilicum* need be nothing more than a coarsely ribbed variant of *C. evolvescens*, since it falls well within the range of variation of this latter species. Similarly the *holotype of C. (Schmidtoceras) schindewolfi hispanicum* Westermann (1956, Plate 8, fig. l), seems nothing more than an evolute variant of *C. evolvescens*, as has been confirmed by the study of topotypes of this taxon from the Burgos district of north Spain (R. Sykes personal collection), *C. evolvescens* is clearly separated from, *C. gervillei and C. polypleurum* by its narrower umbilicus, from *C. grandiforme*, by its smaller size and greater contraction of the body-chamber, and from *C. obornensis nov*., by its coarser ribs and narrower whorl cross-section. Some mention must be made of the interesting degree of morphological variation shown by the Dorset collections of *C. evolvescens*; in particular the anomalous, non-gaussian distribution of the whorl breadth measurements, in comparison with the other dimensions. This latter feature is similar to that shown by *Poecilomorphus cycloides* (d'Orb.) and *C. canovense* (de Gregorio), (Sturani, 1971, pp.102-3 & 148 respectively). In future descriptions of new taxa, some account must be taken of the possible presence of this style of variation, if any attempt is to be made at establishing true bio-species. Similarly the degree of variation evident in the form of the mouth border would tend to preclude the use of this character as the sole arbiter in the establishment of new Sphaeroceratid species (*contra* Sturani, 1971, p.137). This character is merely one amongst many other morphological features useful in taxonomic description,

Stratigraphic distribution

The most abundant members of this species were found in bed 4b. at Oborne Wood, which is *humphriesianum* Zone*, romani* subzone in age, as is the type horizon in Normandy; the 'Bayeux' Conglomerate'. Rare specimens of this taxon have however been found in the base of bed 4c, Oborne Wood, which is *humphriesianum* subzone in age. The specimens recorded from the Rigg Sandstone of the Isle of Skye, Scotland, both here, and by Morton (1971, p.286), are also fromtheir associated fauna *romani* subzone in age.

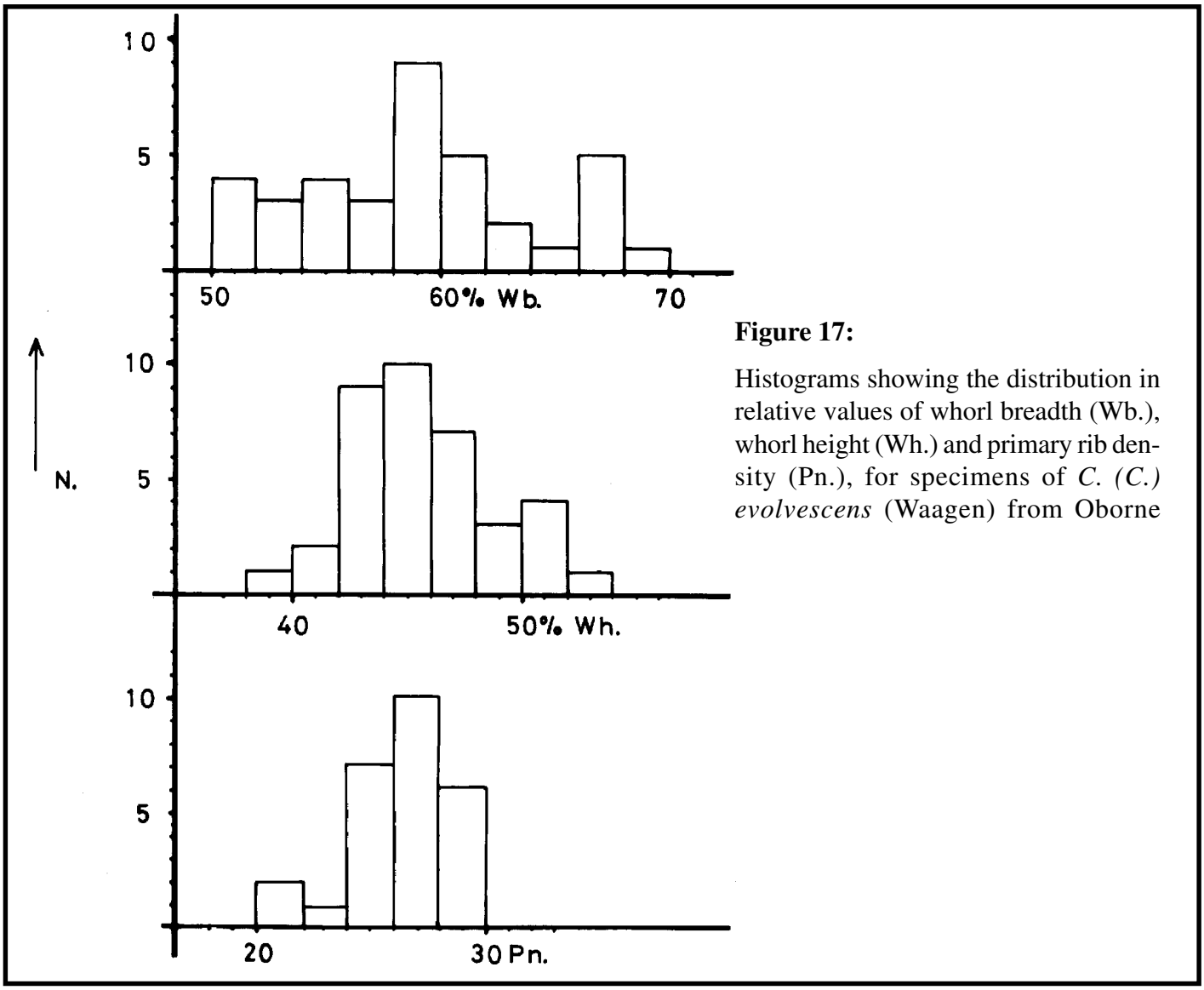


Figure 17:

Histograms showing the distribution in relative values of whorl breadth (Wb.), whorl height (Wh.) and primary rib density (Pn.), for specimens of *C. (C.) evolvescens* (Waagen) from Oborne

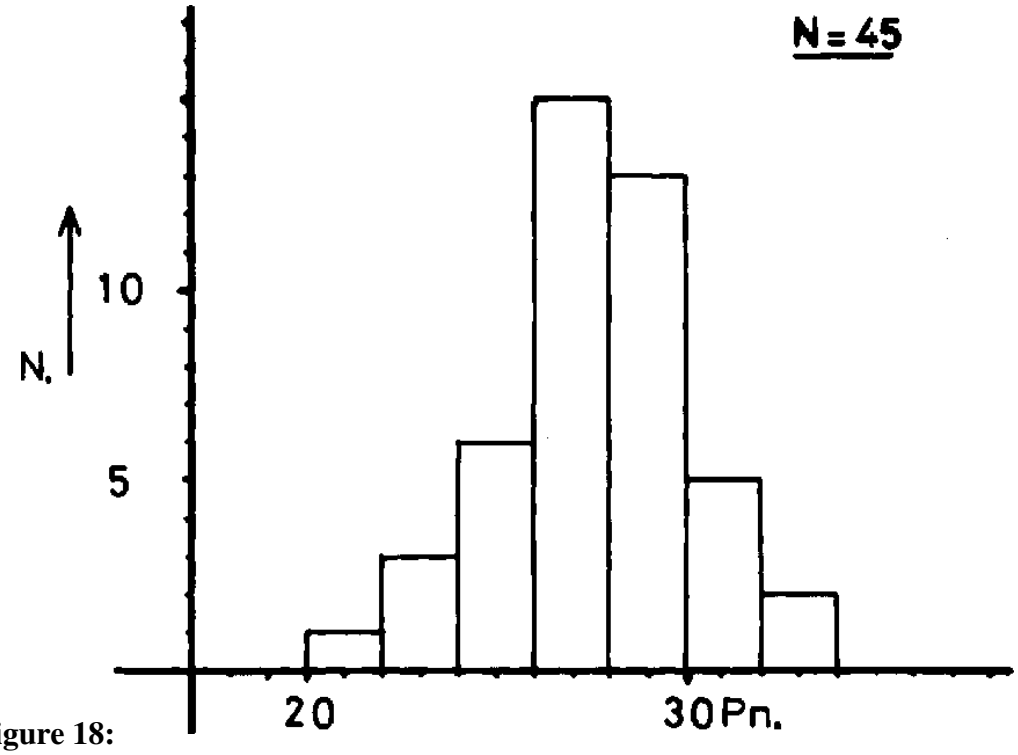


Figure 18:

A histogram showing the distribution in values of primary rib density (Pn.) in *C.(C.) evolvescens* (Waagen), from Milborne Wick, bed 5.

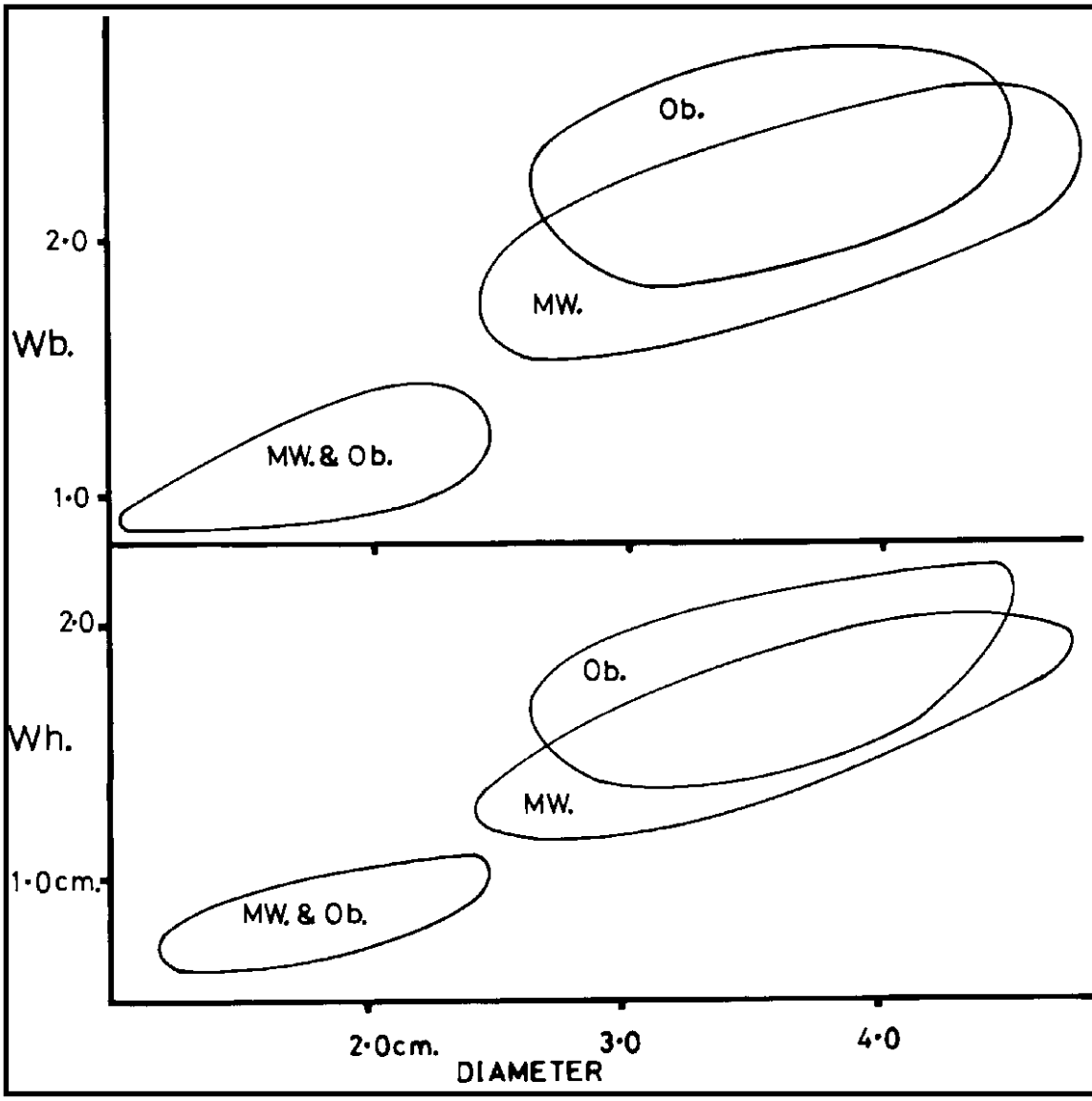


Figure 19:

The range of variation in whorl breadth (Wb.) and whorl height (Wh.), plotted against overall diameter in *C. (C.) evolvescens* (Waagen). Ob. = Oborne Wood macroconchs; MW. = Milborne Wick macroconchs; MW. & Ob. = joint plot of microconch data

3. *Chondroceras (Chondroceras) canovense* (de Gregorio)

Plate 3 , figs. 10-17; Text figs. 20A &B.

1886 *Stephanoceras (Sphaeroceras) brongniarti Sow. mut. canovensis*; de Gregorio, p. ll, Plate 1, figs. 3c-e, *non* 3a-b, & f.

1971 *Sphaeroceras (Chondroceras) canovense* (de Gregorio); Sturani, pp. 146-9 Plate 10, figs. 14-17, Pl.11, fig.10, Text figs. 42/3 & 6, 44 & 45.

1975 *Chondroceras canovense* (de Gregorio); Parsons, p.9.

Material:

Fifty-three specimens from bed 6d, Oborne Wood; NHM. C80392-3, C80397-9, CP2323, CP2366, CP2368-2371, CP2373-2396, CP2813-2831; four from bed 6b, Oborne Wood, NHM. C80394-6 & CP2339; four from bed 6d, Frogden quarry, CP2331, 2342-3 & 2832; three from bed 6b, Frogden quarry, NHM. C80377, CP2341 & 2344; three from the '*Astarte* Bed' of south Dorset, from Bonscombe Hill NHM. C80360, Loders Cross (SY506929), NHM. C803549 and Stony Head Gutting, NHM. C80355; and finally three specimens from the Reed collection, in the Yorkshire Museum, from the 'Loders district' (2) and Burton Bradstock (l) : a total of seventy specimens,

Dimensions:

D.	Ud.	Pn.	Wh.	Wb.
NHM. C80392, maximum diameter - 1.65 cm., (M.),				
1.52	0,26 (17)	37	0.78 (51)	1.1 (72)
1.33	0.20 (15)	-	0.79 (59)	1.1 (83)
NHM. C80393, maximum diameter - 1.4 cm., (M.),				
1.38	0.33 (24)	-	0.72 (52)	0.97 (70)
1.12	-	-	0.67 (60)	0.93 (83)
NHM. C80397, maximum diameter 1.24 cm., (M.),				
1.17	0.25 (21)	-	0.54 (46)	0.82 (70)
1.00	0.16 (16)	-	0.57 (57)	0.81 (81)
NHM. C80398, maximum diameter 1.16 cm., (M.),				
1.10	0.23 (21)	-	0.63 (57)	0.73 (66)
0.94	0.13 (14)	-	0.51 (54)	0.70 (74)
NHM. C80399, maximum diameter, 0.64, (m.),				
0.61	0.14 (23)	-	0.35 (57)	0.44 (72)
0.52	0.10 (19)	-	0.31 (60)	0.42 (81)
NHM. C80377, maximum diameter 1.51 cm., (M.),				
1.47	0.33 (22)	-	0.8 (54)	0.92 (63)
1.20	0.18 (15)	-	0.75 (63)	0.91 (76)
NHM. C80354, maximum diameter 2.01 cm., (M.),				
1.96	0.38 (19)	c.34	0.95 (49)	1.36 (69)
1.46	0.18 (12)	-	0.96 (66)	1.39 (95)
NHM. C80360, maximum diameter, 0.77 cm., (m.),				
0.73	0.17 (23)	c.21-2	0.36 (49)	0.46 (63)
0.60	0.09 (15)	-	0.36 (60)	0.48 (80)
YM. maximum diameter - 2.18 cm., (M.),				
2.00	0.41 (21)	41	0.91 (46)	1.40 (70)
1.80	0.30 (17)	-	1.17 (65)	1.61 (89)

Dimensions of only a small proportion of the material are given here, as the rest are to be found in an appendix.

Description

A very small (Oborne Wood, bed 6d, average macroconch diameter = 1.20 cm., microconch. diameter = 0.67 cm.), globose, involute ammonite, with a deep, very narrow, but open umbilicus. The whorl breadth increases at a greater relative rate than the whorl height on the inner whorls, leading to the development of a very depressed whorl cross-section - see Text fig 20B, There is a minor uncoiling of the umbilical seam associated with the slight retraction of the body-chamber, the latter stretching for just under one whorl. This contraction is not uniform to all specimens, as some show a marked relative decrease in whorl height, as well as breadth, (see Text fig. 20B). The ribbing is extremely fine, dense, and superficial, The primary ribs are long, highly curved and prorsiradiate. The primary ribs divide well up the whorl flank into two secondary ribs, which sweep forward over an arched venter, and become coarser towards the aperture.

Sexual dimorphism

All of the samples collected show a marked division into micro- and macroconchs, but only the collection from Oborne Wood, bed 6d, is large enough to show the bimodal size distribution (see Text fig. 20A). The microconchs, apart from their smaller size, also show coarser ribbing and a greater modification of the mouth-border, including a thin flare behind the constriction, and lateral, lappet like extensions from the lip; than the macroconchs, which are finer ribbed, with a simpler mouth-border. The latter consists of nothing more than a faint constriction, followed by a lip with a sinuous edge.

Morphological variation

As noticed by Sturani (1971, p.148), there is a high degree of morphological variation inherent in this species. The large sample from Oborne Wood, bed. 6d, came from the top-most 0.03 m. of this horizon. The specimens in this sample are consistently of a smaller size, with finer ribbing, than the other samples from beds 6b-d, at Oborne Wood and Frogden. The specimens from the '*Astarte* bed' of south Dorset are on the whole slightly larger than the *subfurcatum* Zone forms. These *garantiana* Zone forms also show a greater modification of the mouth-border, particularly in the development of flares preceding the constriction on the macroconch specimens. However, both the smaller macroconchs and the microconch from this horizon, are identical in size and morphology to their *subfurcatum* Zone equivalents.

Discussion

This species is here interpreted in a very broad sense. With the sole exception of the sample from the top of bed 6d, Oborne Wood, insufficient specimens have been collected to enable an accurate picture of the phenotypic variation of this group to be established. It is thus likely that more than one species is represented in this highly variable material. This is particularly true when the extended stratigraphic range of this group is taken into account, The specimens from bed 6b Oborne Wood and beds 6b-d, Frogden quarry, are the closest in size and morphology to the topotypes figured by Sturani (l971, Pl.10, figs, 14-16 & 18). The south Dorset microconch specimen from Bonscombe Hill (BMNH. C30360) and the 2 smaller macro-conchs from Loders Cross (BMNH. C80354; and York, mus., Reed Col, 475) which are upper *garantiana* Zone in age, are also very similar to Sturani's material. However, the other material from the '*Astarte* bed' is of much larger size, with a more prominent flared mouth-border, than is exhibited by the topotypes. On the other hand the specimens from bed 6d, Oborne Wood are all finer ribbed and smaller than the topotype material. The microconchs from this Oborne sample are without doubt the smallest mature ammonites yet recorded from the British Jurassic. This Oborne population possibly intergrades with the larger and more typical forms found in the 'cadomensis beds', since there is little difference in size or morphology between the end members of the former group, such as NHM. C80393, and the latter, larger specimens, such as NHM. C80377. Further material is thus needed before a definite decision can be made on the taxonomic position of either the *garantiana* Zone, or Oborne Wood, bed 6d material. It is certain that groups closely related to *C. canovense*, are represented by the specimens described here as *C. sp. nov. aff C. tenue* and by Sturani's species *C. flexuosum*. Both these groups are undoubted members of the genus *Chondroceras* since they possess an open umbilicus. Whilst *C. canovense* has an umbilicus which often varies in width, it is never occluded or completely closed, there thus seems little difficulty in also accepting this species as a member of the same subgenus (*contra*, Sturani, 1971, p. 149). All the *subfurcatum* Zone members of *Sphaeroceras s. str.* fortu-

nately have an highly occluded umbilicus, which precludes generic confusion. In any event, the variation in relative proportions of the umbilicus *in C. canovense* is little different to that exhibited by *C. evolvescens*, a typical member of the subgenus *Chondroceras.*

Stratigraphic distribution

The type horizon of *C. canovense* is either *banksi* or *polygyralis* subzone, *subfurcatum* Zone in age (Sturani, 1971, p. 146). The material described, here comes from the *polygyralis* and *baculata* subzones of the *subfurcatum* Zone, and from the *acris* subzone of the *garantiana* Zone.

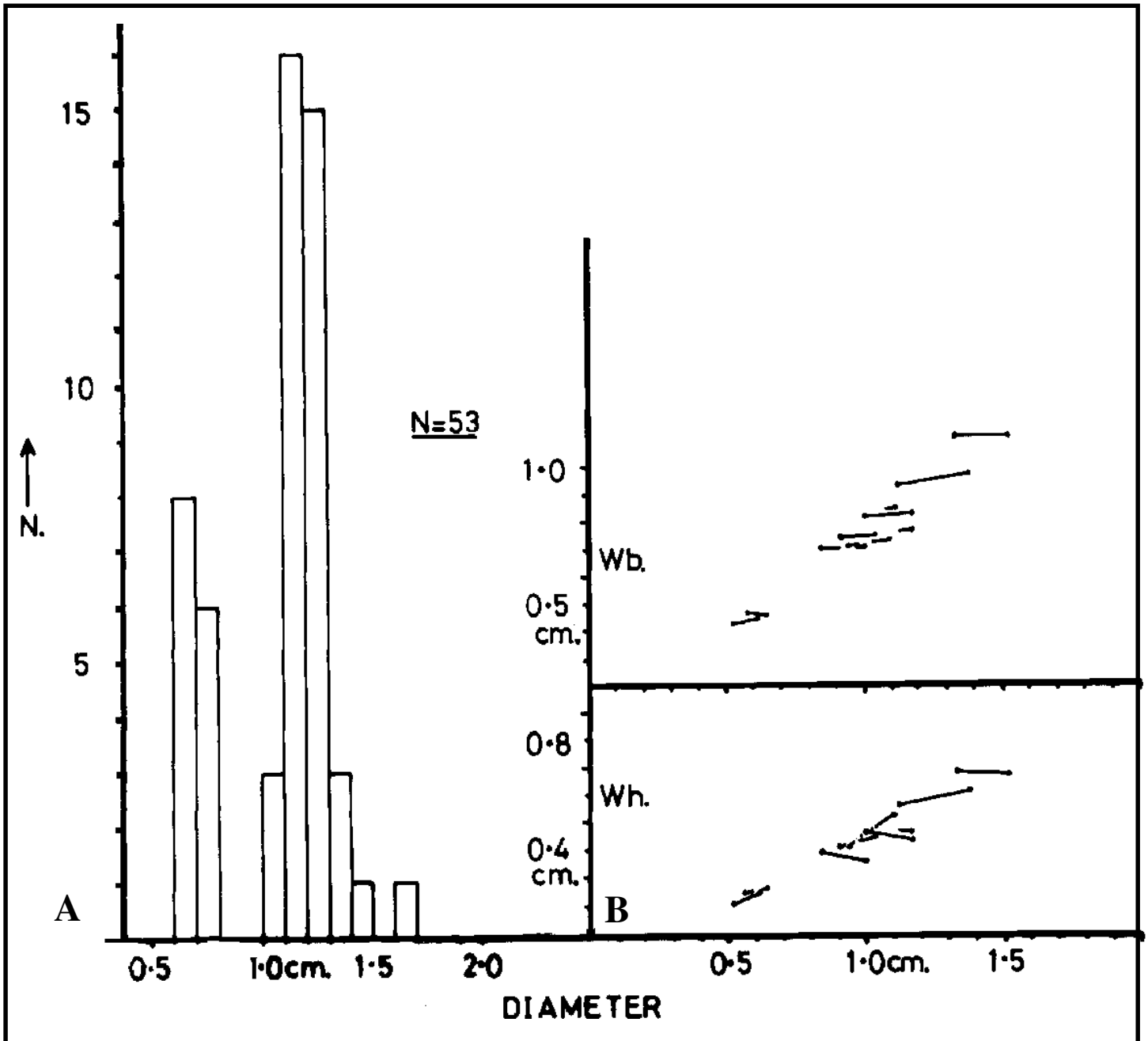


Figure 20:

A. a histogram of the distribution of maximun diameter of *C. (C.) canovense* (de Gregorio), from bed 6d, Oborne Wood, Dorset

B. a plot of whorl height (Wh.) and whorl breadth (Wb.) against whorl diameter, for some of the above specimens, showing microconch and macroconch clusters.

4. *Chondroceras (Chondroceras) grandiforme* S. Buckman

Plate 4 , figs, 1-4 ; Text figs. 21-3.

? 1849 *Ammonites gervilli* Sowerby; Quenstedt (1845-9) p.187, Plate 15, fig.11.

1878 *Sphaeroceras gervillii* Sow.; Bayle, Plate 53, fig. 7, *non* 6.

1881 *Ammonites gervilli* Sow.; J. Buckman, p.63 (excluding synonomy), fig.4.

1881 *Sphaeroceras gervillii* (Sow.); S, Buckman, p. 597, (*pars)*

? 1886 *Ammonites gervillii* Sow.; Quenstedt (1886-7), p. 510, Plate 64, fig. 3 *non* 14 & 15.

1922 *Chondroceras grandiforme nov.* ; S. Buckman (1909-30), Plate 357.

1923 *Chondroceras delphinus nov*,; S. Buckman (1909-30), Plate 431.

1952 *Chondroceras sp.;* Jackson, p.85.

1952 *Chondroceras grandiforme* S. Buckman; Arkell (1951-9), Text fig. 20/5a-b.

1956 *Chondroceras evolvescens* (Waagen); Westermann, p. 55-8, (*pars*), Pl. 1, fig. 8 *non* 7, Pl. 2, fig. 1 *non* 2.

? 1956 *Chondroceras polytomum n. sp.;* Westermann, pp.62-3, Plate 3, fig. 4, Text figs, 34 & 35.

? 1961 *Chondroceras sp. cf. C. delphinus* Buckman; Maubeuge, pp.144-5.

1964 *Chondroceras grandiforme* Buckman; Westermann, p.54.

Material:

One specimen from bed 4a., NHM. C80343 and three from bed 4b., NHM. C80344-6, Oborne Wood; four specimens from Milborne Wick, BGS.37293 (*holotype* of *C. delphinus*), TC.1731, BGS.25286 and OUM. J10787; one from the 'Red Conglomerate' of Burton Bradstock, Dorset, NHM. C2768; and one from the 'Bayeux Conglomerate', of Bayeux, Normandy, NHM. 37264. In addition the following less well localised specimens from the 'Sherborne district': BGS.47157 (*holotype*), SM. J57746; MM. L11160; NHM. C3223, C80286-9, C80290-8. A total of 27 specimens.

Dimensions:

BGS. 47157, holotype C. grandiforme, maximum diameter over flare = 7.7 cm., (M.),

D.	Ud.	Pn.	Wh.	Wb.
7.32	l.93 (26)	-	3.43 (47)	4.66 (64)
6.04	1.2 (20)	c.29	2.83 (47)	4.72 (78)

BGS. 37293, holotype of C. delphinus, maximum diameter over flare = 4.7 cm., (M.),

4.14	0.87 (21)	26	2.0 (48)	2.78 (67)
3.68	0.6 (16)	-	1.9 (52)	2.6 (71)

NHM. C80345, diameter 5.1cm. on flare, (M.),

4.45	1.1 (25)	27	2.32 (52)	3.1 (70)
3.87	0.7 (18)	-	2.12 (55)	2.95 (76)

NHM. C80343, diameter 3.96 cm. on flare, (?M.),

3.71	1.0 (27)	31	1.83 (49)	2.43 (66)
3.13	0.65 (21)	-	1.65 (5-3)	2.34 (75)

NHM. C80344, incomplete, (M.),

4.24	1.0 (24)	30	2.15 (51)	2.91 (69)
3.59	0.75 (21)	-	1.93 (54)	2.70 (75)

BGS.25286, diameter 7.76 cm. on flare, (M.),

7.50	1.97 (26)	24	3.33 (44)	4.69 (63)
6.08	0.79 (13)	25	3.0 (49)	4.7 (77)

OUM. J10787, (M.),

5.5	1.48 (27)	26	2.45 (45)	3.25 (59)
4.3	0.84 (20)	-	2.17 (51)	3.1 (72)

Description

A relatively large (average size = 5.0 cm., range 3.52 - 7.76 cm.), globose ammonite, with a narrow, deep, but open umbilicus. There is a marked uncoiling of the umbilical seam over the last third of a whorl, usually associated with a relative reduction of whorl breadth compared to whorl height - see Text fig. 21. This produces a more rounded whorl cross-section at the aperture, compared to the highly depressed form of the inner whorls. However, this contraction is purely relative, as the maximum value for the whorl breadth is to be found directly behind the aperture. The ribbing is sharp and well marked. The primary ribs are strong, curved, prorsiradiate and relatively coarse, with 24-35 per outer whorl. The primaries, which become much coarser and straighter on the last half whorl, divide just above the whorl shoulder into predominantly three secondaries, although there are more rarely two, often with an additional free secondary intercalated. These secondaries, which become much coarser and more rounded just before the aperture, sweep forward very gently over a flatly arched venter. The mouth-border is highly distinctive. It consists of a faint flare, followed by a deep constriction, then a very strong, 'delphinulate' flare (J. Buckman, 1881, fig. 4), then another deep constriction, followed by a smooth, expanded lip.

Sexual dimorphism

There are considerable difficulties in determining this group's dimorphic partner. The size frequency distribution shown in Text fig, 22 , illustrates this problem. If only the well localised specimens (shaded on this figure) are taken into account there is no evidence of bimodality. The addition of sixteen specimens from Buckman collection, of which nothing is known but a provenance from the 'Sherborne district', produces a hint of bimodality. This might suggest the presence of a microconch group centred on the size range 4.0 - 4.2cm., with a macroconch group between 5.0 – 8.0cm., (cf. Westermann, 1964, p. 54). If this is correct, it would suggest a ratio between dimorphs in the order of 1 : 1.4, which is rather low. On the other hand the strong similarity in morphology between this group and C. gervillei suggests the latter as a possible microconch partner. In this light a broader regrouping of the size grades in the size frequency distribution, (Text Fig. 23), produces a highly skewed, but unimodal distribution, which could represent a single macroconch group. Unfortunately it is impossible on the present evidence to eliminate either of these possibilities, and again more *in situ* material is needed.

Discussion

This is a highly distinctive group, which is characterised by its large size and its superbly developed 'delphinulate' mouth- border. One of the specimens which is figured here, is the same as that exhibited to the Geological Society of London by J. Buckman, (1881, fig. 4). This specimen shows that S. Buckman's restoration of the flare on the holotype of *C. grandiforme* (Buckman, 1909-30, Pl. 357) is not as excessive, as has been suggested by Westermann (1956, p. 57*). C. delphinus* is identical to *C. grandiforme* in its relative whorl proportions, and in its style of mouth-border and ribbing; they differ only in size. As can be seen in Text fig.22 , the present sample shows a highly discontinuous size frequency distribution, which makes separation of these two 'species' solely on this basis highly unlikely. *C. grandiforme* having priority by one year, is hence here used as the specific name for the whole group. What can be certain is that *C. grandiforme* cannot be considered synonymous with *C. evolvescens* (*contra* Westermann, 1956, pp. 56-7). Apart from the obvious difference of the mouth-border, *C. grandiforme* is consistently larger, with coarse primary ribs on a more inflated body-chamber, than *C. evolvescens*, which has a plain mouth band and a more contracted body-chamber. On the other hand, *C. polytomum* Westermann (l956. pp. 62-3, Plate 3, figs. 4a-c.) is very similar, as the fragmentary *holotype* is of a similar size and gross proportions to the *holotype* of *C. grandiforme*. It differs by having very slightly coarser ribs (23 per whorl). This however is well within the possible range of variation of *C. grandiforme* and it is thus here considered conspecific with this latter species. Apart from Westermann's species, there are no other European, *humphriesianum* Zone sphaeroceratids with which this taxon could be confused; they are all of much smaller size.

Stratigraphic distribution

The specimens, which I have collected *in situ*, originate from the *romani* subzone beds of Oborne Wood. The specimens from Milborne Wick, including the holotype of *C. delphinus*, show a matrix, which is typical of beds 4-5, which again are *romani* subzone, *humphriesianum* Zone in age. The material from the 'Sherborne district', have a grey matrix, with brown, shiny ooliths, which is characteristic of bed 4b., Oborne Wood. Thus all available evidence would suggest that this taxon is dominantly or totally restricted to the *romani* subzone.

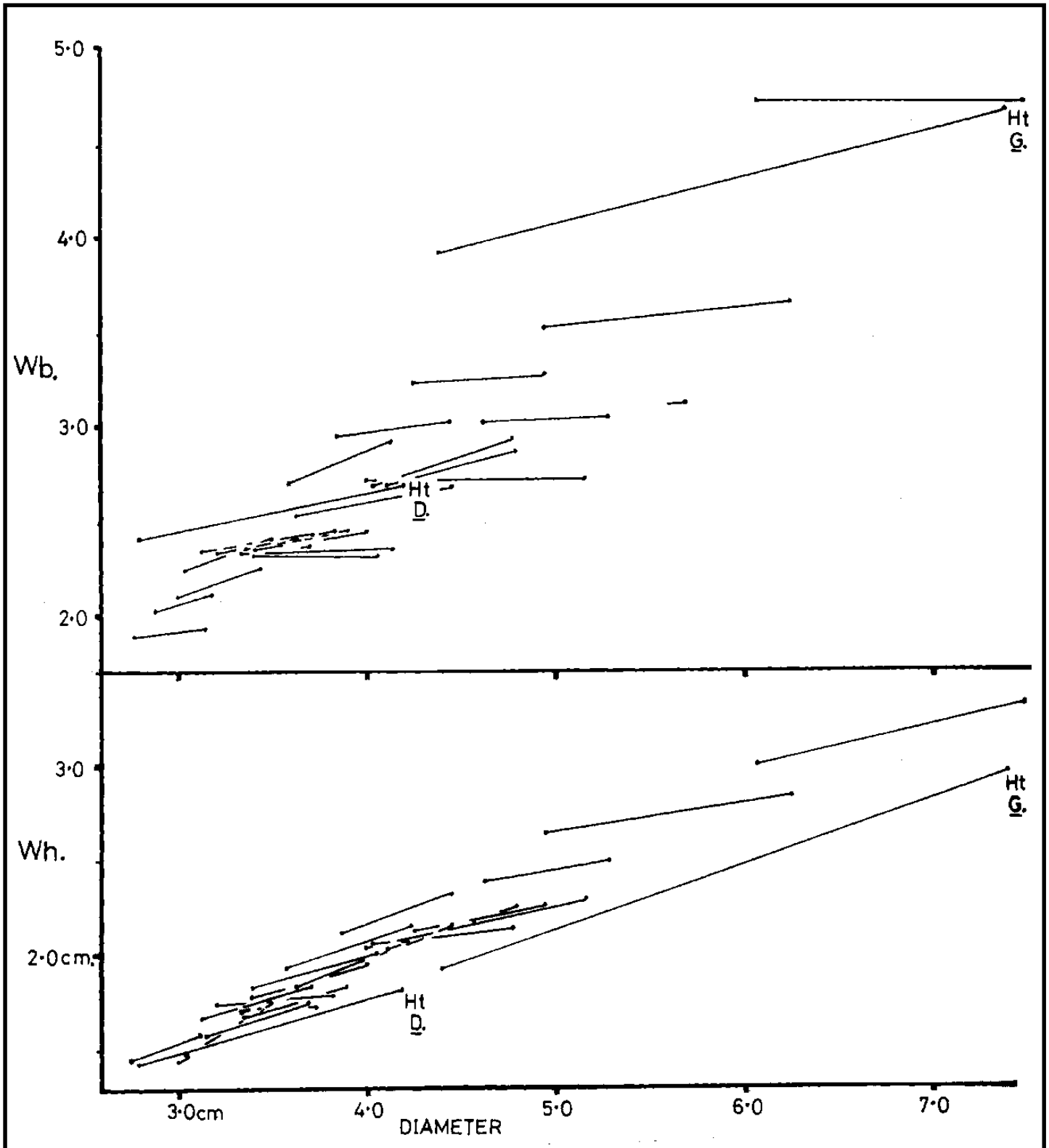


Figure 21:

A plot of whorl breadth (Wb.) and whorl height (Wh.) against maximum whorl diameter for specimens of *C. (C.) grandiforme* S. Buckman, from the Sherborne area. HT.G. *holotype* of *C grandiforme*, Ht. D. *holotype* of *C. delphinus* S. Buckman.

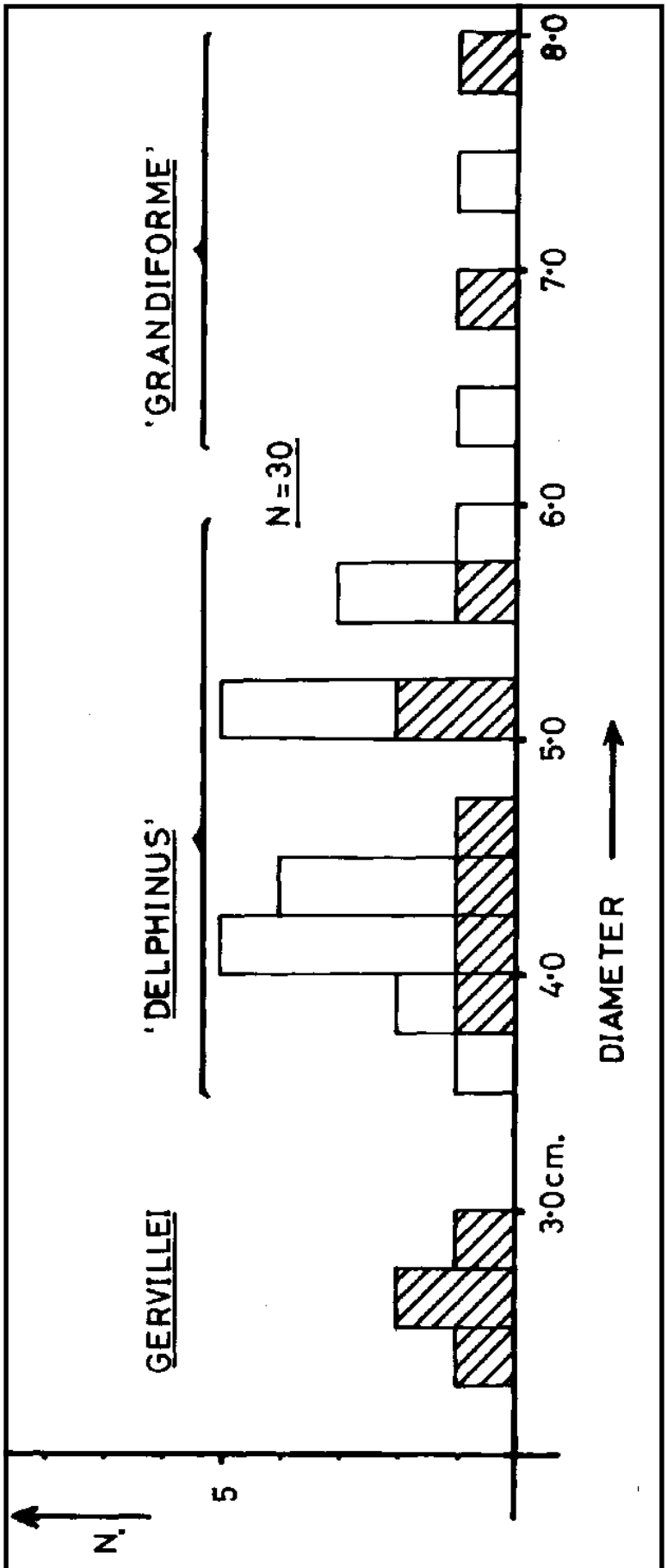


Figure 22:

A histogram of the distribution of maximum mature diameter in *C. (C.) grandiforme* S.Buckman, as compared to *C. (C.) gervillei* (J. Sow,). The shaded portions are based on *in situ* material

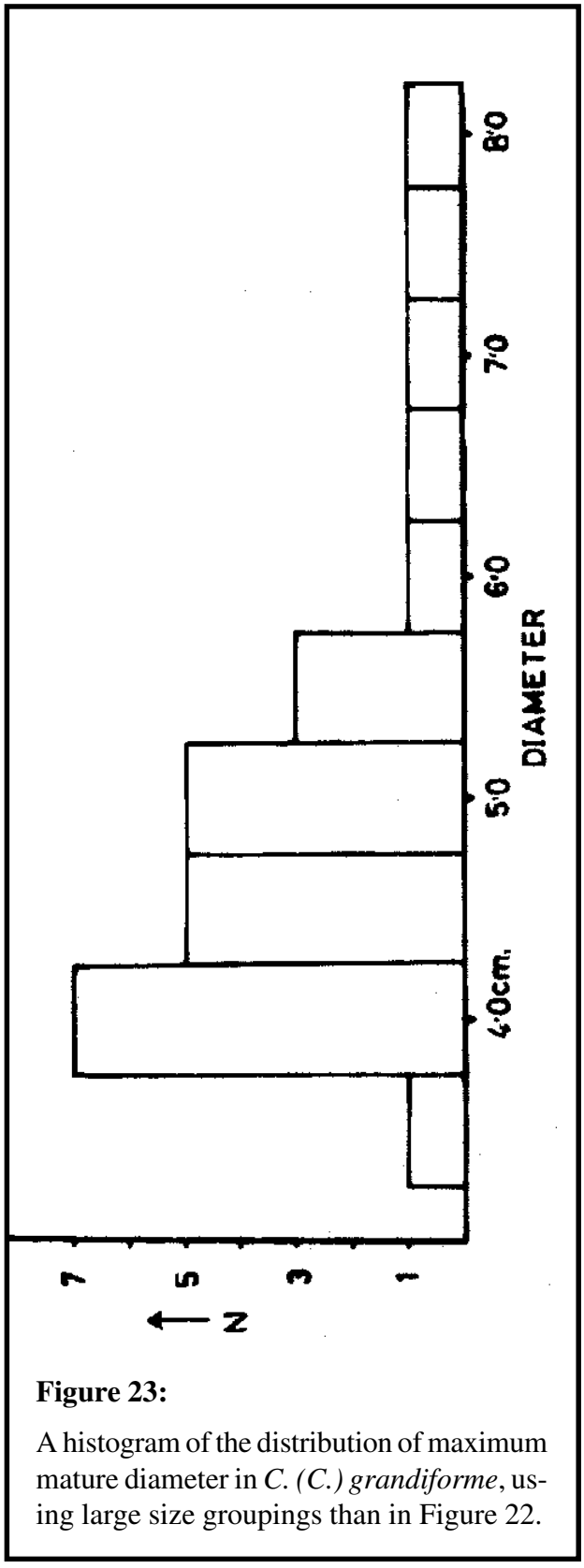


Figure 23:

A histogram of the distribution of maximum mature diameter in *C. (C.) grandiforme*, using large size groupings than in Figure 22.

5. *Chondroceras (Chondroceras) polypleurum* (Westermann)

Plate 4 , figs. 4-5 & 7; , Text figs. 24-5.

1846 *Ammonites brongniarti* Sow.; d' Orbigny (l842-5l), Plate 137, fig. 5.

1878 *Sphaeroceras brocchii* Sow.; Bayle, Plate 52, fig.2.

1927 *Chondroceraa gervillii* (Sow.); Buckman (1909-30), Plate 724.

1956 *Chondroceras (Schmidtoceras) orbignyianum polypleurum n. sub. sp.*; Westerrnann, pp. 19 & 77-8, Plate 6, figs. 6a-d.

1956 *Chondroceras (Schmidtoceras?) gracile n.sp.*; Westermann, pp.96-7, Plate 10, figs.8a-c.

1964 *Chondroceras (Schmidtoceras) evolutum* Westermann; Westermann, p.55 (pars).

1968 *Sphaeroceras brongniarti* (Sow,); Senior, p.45.

1971 *Sphaeroceras (Chondroceras) gracile* (Westermann); Sturani, p.150.

Material:

One specimen, NHM. C80347 from bed 4b, and one, NHM. C80348, from bed 4c Oborne Wood; two, NHM. C80349, 80350, from bed 4, Oborne Wood, one from the 'Red Conglomerate', of Loders Cross (SY506929), near Bridport, Dorset, NHM. C80353, (ex. Senior collection), one from the 'Sherborne district', of Dorset, SM. J24525, (ex. Monk coll.), and one from the 'Oborne district' of Dorset, YM, (ex.Reed coll, 216).

Dimensions:

D.	Ud.	Pn.	Wh.	Wb.
NHM. C 30348, (m.),				
2.26	0.64(28)	31	1.0(44)	1.27(56)
1.73	0.44(25)	-	0.84(49)	1.2(69)
NHM. C80349, (m.),				
.5	0.44(21)	34	0.98(48)	1.18(58)
1.48	0.35(24)	-	0.76(51)	1.04(70)
NHM. C80350, (m.),				
2.35	0.61(26)	31	1.0(43)	1.35(57)
1.84	0.44(24	30	0.85(46)	1.23(67)
NHM. C80348, slightly incomplete, (m.),				
2.13	0.54(25)	35	1.0(47)	1.30(61)
1.60	0.39(24)	-	0.78(49)	1.17(73)
SM. J24525, maximum diameter over flare.- 4.19 cm., (M.),				
4.0	1.2 (30)	34	1.73(43)	2.20(55)
3.27	0.95(29)	-	1.5(46)	2.1(64)
NHM. C80353, incomplete, (M.),				
c.4.0	1.11 (23)	-	1.59(40)	2.26(57)

Description

A small (average microconch size = 2.2 cm.), relatively evolute ammonite, with a deep umbilicus. It shows a marked change in the relative whorl height compared to the whorl breadth (see Text fig. 24), which leads to the slightly depressed inner whorls becoming more rounded on the last quarter whorl. There is a slight uncoiling of the umbilical seam on the last fifth of a whorl, but little or no contraction of the body-chamber, as the maximum values of both whorl height and breadth are found at the very end of the body-chamber, which stretches for four-fifths of a whorl. Both primary and secondary ribs are fine and sharp on the inner whorls, but become gradually

coarser on the last half whorl. The primary ribs are curved, prorsiradiate, very dense (31-35 per outer whorl), and divide well up the relatively flat whorl flank, into two-three secondary ribs. These secondaries sweep forward gently over the arched venter. The mouth-border is marked by a slight flare, produced by an expanded secondary rib, followed by a deep constriction and a smooth, narrow, flared lip.

Sexual dimorphism

The style of dimorphism and the ratio between micro- and macroconchs are similar to those of the subspecies *C. polypleurum crassicostatum*, the probable macroconch of the nominate subspecies, from the 'Red conglomerate' of Loders Cross, south Dorset, (NHM. C 30353), although fragmentary, is virtually identical to a more complete specimen from the 'Sherborne district' in the Sedgwick Museum (SM. J24525). These two are identical in all but size to *C. polypleurum s. str.,* and would suggest a ratio of approximately 1 : 1.86 between dimorphs; although this would have to be confirmed by larger collections.

Discussion

As already mentioned in the discussion of *C. gervillei*, *C. orbignyanum* is an invalid homonym, and must be replaced by the oldest valid name among the included co-ordinate taxa (I.C.Z.N, article 23, e, iii), since *C. orbignyanum polypleurum* (Westermann, 1956, pp. & 77-8, Pl. 6, figs.6a-d), has clear page priority, it thus becomes the nominate subspecies (I.C.Z.N., article 47b). The only real difference between the *holotype* of *C. polypleurum* (*loc. cit.*), and *C. gracile* (Westermann, 1956 Pl.10, figs. 8a-c), would appear to be relative primary rib density, since in style of ribbing, relative whorl proportions and in the form of the mouth-border, they are identical. Considering the wide range of variation in primary rib density which is found in the Sphaeroceratids (cf. *C. evolvescens*), this would appear to be an inadequate basis for separating these taxa. Hence *C. gracile* is here considered conspecific with *C. polypleurum*, which in turn has page priority.

C. polypleurum, a relatively rare form, is distinguished from the other *humphriesianum* Zone Sphaeroceratids, by its higher primary rib density, its more open umbilicus, and by its characteristic change in relative whorl proportions over the last half whorl. Of the other *romani* subzone groups, with which *C. polypleurum* might be confused, its subspecies *C. polypleurum crassicostatum* has slightly rounder, less compressed whorls and is coarser ribbed, whilst *C. gervillei* has a far more inflated whorl cross-section (see Text fig.25). The only other comparable forms are the microconch members of *C. evolvescens*, which are clearly distinguished by their strongly contracted body-chambers.

Stratigraphic distribution:

There is no evidence as to the exact horizon of the type material of *C. polypleurum*, within the *humphriesianum* Zone. The specimens described here originate from beds 4b/c, Oborne Wood, which span the *romani* and *humphriesianum* subzones of the *humphriesianum* Zone.

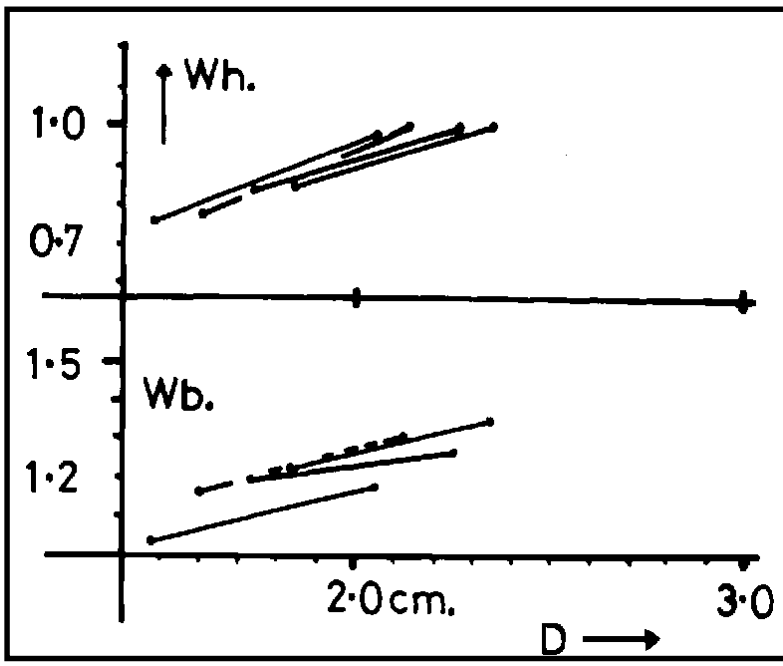


Figure 24:

A plot of whorl height (Wh.) and whorl breadth (Wb.) against maximum diameter (D., for microconch specimens of *C. (C.) polypleurum polypleurum* (Westermann).

6. *Chondroceras (Chondroceras} polypleurum. sub. sp. crassicostatum* (Westermann)

Plate 4, figs. 8, Plate 5, figs. 1-2;, Text figs. 25-6.

1878 *Sphaeroccras gervillii* Sow.; Bayle, PI.53, fig.6.

1907 *Chondroceras crassicostatum n. f.;* Mascke, p.33.

1956 *Chondroceras (Schmidtoceras) orbignyanum orbignyanum* (Wright); Westermann, Plate 5, figs. 7a-c, *non* 6a-c.

1956 *Chondroceras (Schmidtoceras) orbignyanum crassicostatum n. sub. sp.*; Westermann, pp.79-80, Plate 5, figs. 8a-d, *non* Pl.6., figs. 3 & 4.

1964 *Chondroceras orbignyanum* (Wright); Westermann, p.54, (pars).

Material:

One specimen from bed 4c, NHm. C80389) and one from bed 4b, NHm.C80390, Wood; and one from the 'Irony' bed, of Louse Hill quarry, near Sherborne, NHm.C80378, all the above specimens having been collected *in situ* by the author. In addition four specimens from Milborne Wick (ST663205), (ex. Earwaker collection), in the Manchester City Museum, LL4252J-M, and one from the 'Bayeux Conglomerate', Bayeux, Normandy, ex. Tesson collection, NHm. 37263.

Dimensions:

NHM. C80378, maximum diameter on flare - 2.35cm. (m.),

D.	Ud.	Pn.	Wh.	Wb.
2.22	0.63(23%)	27	0.96(43)	1.36(61)
1.89	0.50(26)	-	0.92(49)	1.31(69)

NHM. C80389, diameter over flare - 2.47, (m.),

2.44	0.70(29)	c.28	0.95(39)	1.43(59)
2.00	0.46(23)	-	0.90(45)	-

NHM. C80390, diameter over flare - 2.53, (m.),

2.33	0.68(29)	c.27	1.0 (43)	1.50(64)
2.00	0.50(25)	-	1.01 (51)	1.49 (75)

LL4252J, (m.),

2.5	0.65(26)	32	1.22(49)	1.5(60)

LL4252K, (m.),

2.57	0.67(26)	28	1.2(47)	1.53(60)

LL4252L, (m.),

2.6	0.65(25)	30	1.18(45)	1.6(62)

LL4252M, (m.),

2.6	0.7(27)	28	1.12(43)	1.53(59)

NHM. 37263, diameter over flare – 4.28 cm., (M.),

3.86	1.0 (26)	29	1.82 (47)	2.28(59)
3.20	0.78(24)	28	1.55(48)	2.12(66)

Description:

A small (average microconch size = 2.52 cm.), involute ammonite, with a deep, narrow, but open umbilicus, and with a rounded whorl cross-section. There is a slight uncoiling of the umbilical seam associated with the retraction of the body-chamber, which reaches its maximum breadth a quarter of a whorl before the aperture. There is little relative change between the whorl height and breadth (see Text fig. 26) and thus there is no change in whorl cross-section, over the last whorl. The ribbing is coarse and well marked. The primary ribs are slightly curved, prorsiradiate, relatively dense (32-27/whorl on the body-chamber), and branch just above the whorl flank into two secondary

ribs. These secondaries, of which there are rarely more than two per primary, become coarser just before the aperture, and sweep forward very gently over the flatly arched venter. The body-chamber, which stretches for one whorl, is terminated by a well developed mouth-border. This consists of a faint flare, followed by a deep constriction, then a smooth, expanded lip, which shows signs of the development of lateral projections, out from the mid-whorl position..

Sexual dimorphism

This species is probably a microconch, since a possible macroconch counterpart has been figured by Bayle (1878, P1.53, fig.6). A specimen similar to the latter, and also from the 'Bayeux Conglomerate' of Normandy, is now preserved in the Tesson collection, (NHM.37263). This has an identical style of ribbing and relative proportions to *C. polypleurum crassicostatum*, but is of much larger size (4.28 cm,). If this specimen is in fact the authentic macroconch, a size ratio of approximately 1 : 1.7 between dimorphs is indicated. It is possible that this macroconch is conspecific with *C. schindewolfi* (Westermann, 1956), but this suggestion (Westermann, 1964, p. 54) needs to be confirmed by the collection of further material.

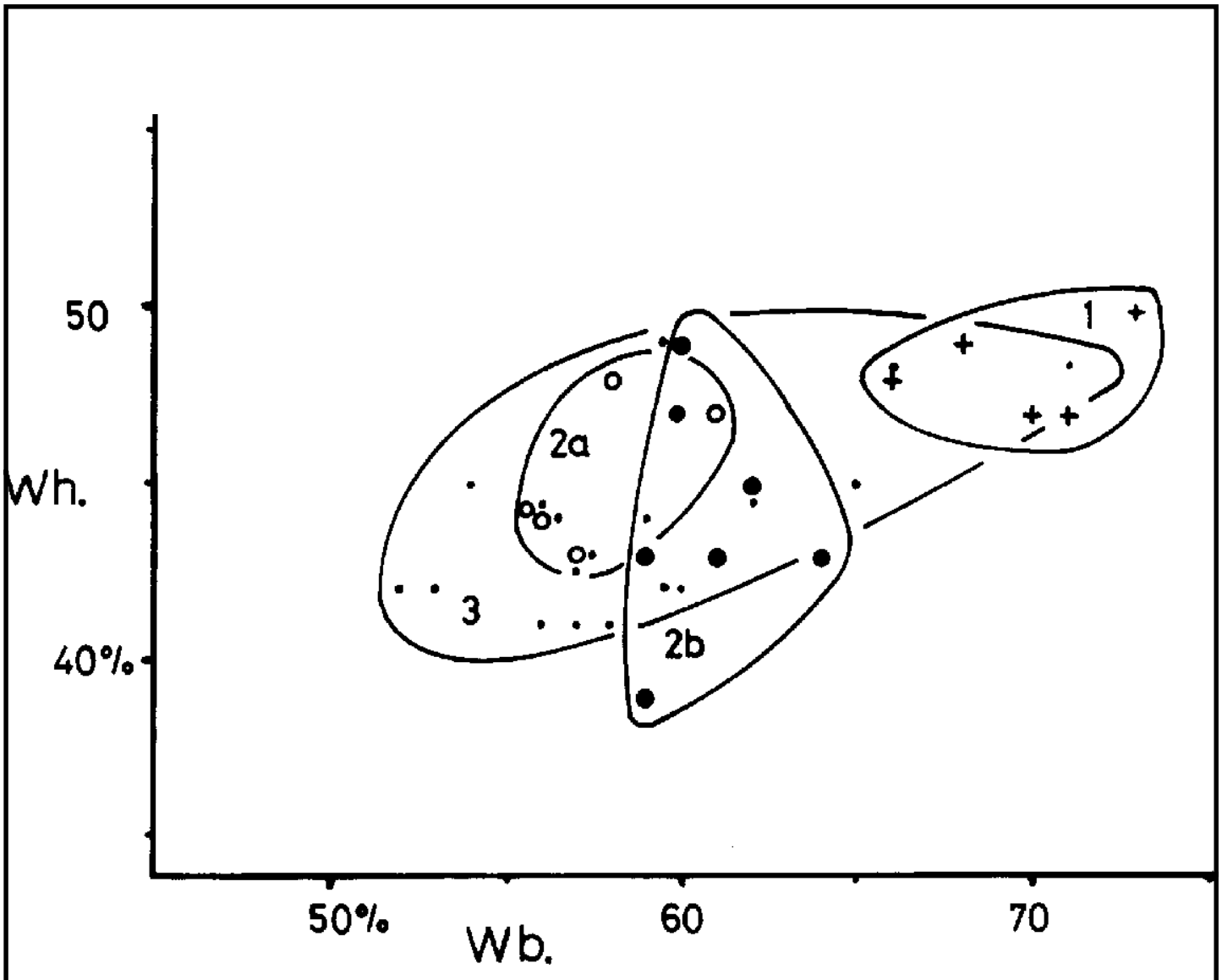


Figure 25:

A plot of whorl height (Wh.) against whorl breadth (Wb.) for specimens of *C. (C.) gervillei* (1), *C. (C.) polypleurum polypleurum* (2a), *C. (C.) polypleurum crassicostatum* (2b.) and microconch and macroconch specimens of *C. (C.) evolvescens* (3.)

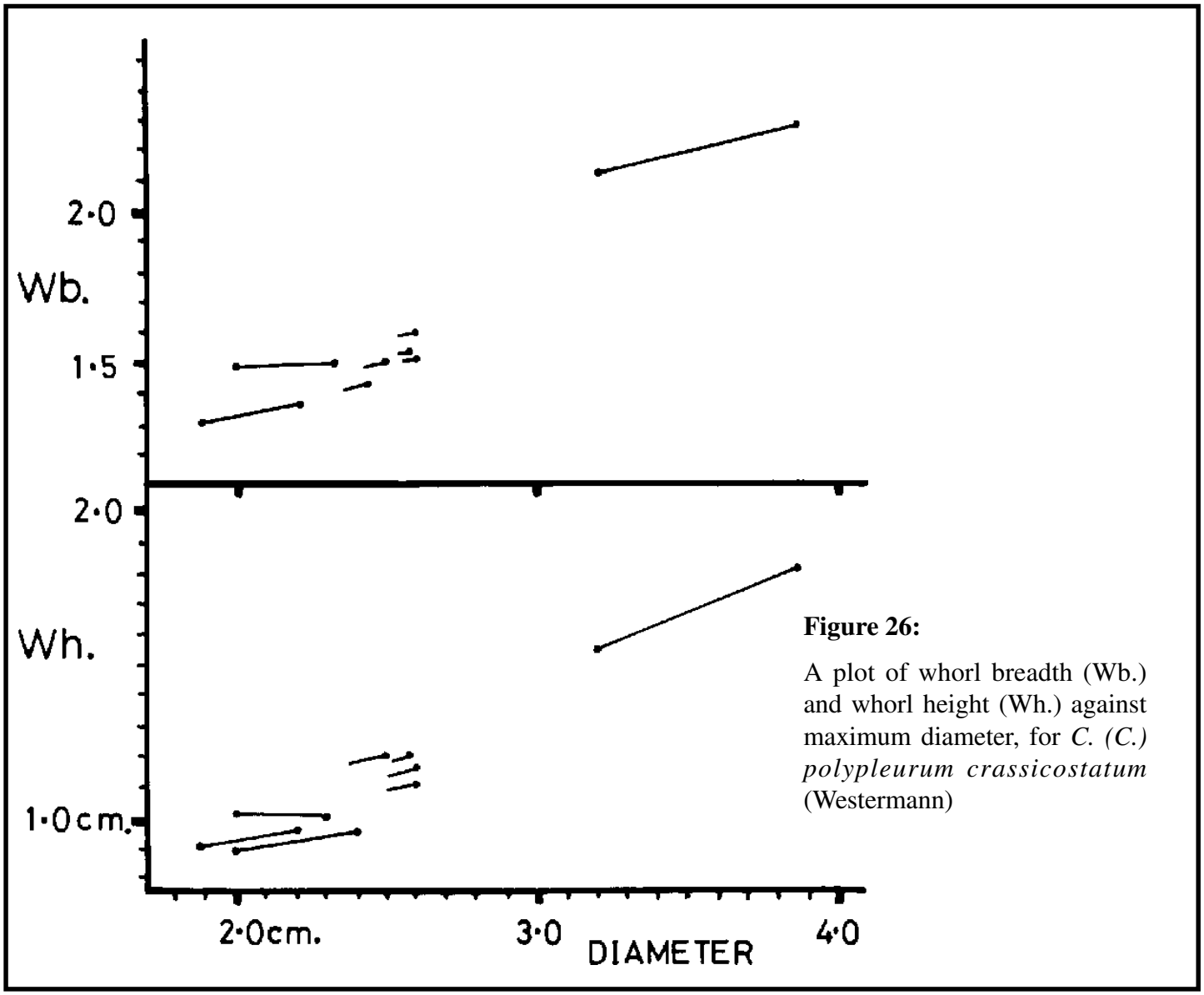


Figure 26:

A plot of whorl breadth (Wb.) and whorl height (Wh.) against maximum diameter, for *C. (C.) polypleurum crassicostatum* (Westermann)

Discussion

Chondroceras crassicostatum Mascke (1907, p. 33) is a *nomen nudum*, it thus takes the date and authorship of the first person to satisfy I.C.Z.N. Articles 11-14, which in this case is Westermann (1956, p. 79). Westernann established this taxon as a subspecies of *C. orbignyanum*, it is thus here transferred to *C. polypleurum*. Amongst the specimens figured by Westermann (1956), under the name *C. (Schmidtoceras) orbignyanum orbignyanum*, there is one which is less inflated and with a more rounded whorl cross-section than that of the *'neo-lectotype'* (*sic*). This specimen (*loc. cit.* P1.5, figs. 7a-c), is virtually identical in all features except size, to the *holotype* of *C. polypleurum crassicostatum* (*op. cit*., Pl. 5, figs. 8a-d). On the other hand the *paratypes* of the latter taxon, figured by Westermann (1956, Pl. 6, figs. 3-5), are rather more evolute, and look closer to *C. crassum* (*op. cit*., Pl. 9, figs. 4a-c).

The relationship of this subspecies to other *romani* subzone sphaeroceratids is clear. In style of ribbing, size and shape of mouth-border, this taxon is very similar to *C. gervillei*, which however, has a different whorl cross-section (see Text fig. 25). The specimens here included in *C. polypleurum s.str.* are also very similar, but they differ by having finer, more prorsiradiate ribs, and by being slightly less inflated, with flatter whorl flanks and a more arched venter. However, all three of these taxa are undoubtedly closely related, and must have arisen from a common ancestor. There are in fact insufficient morphological differences to warrant separating this taxon from *C. polyuleurum,* and Westermann's sub-specific rank is probably the most satisfactory. Although more material is needed, there is a suggestion that these are chronological subspecies, with the finer ribbed, nominate subspecies being more common at the higher horizons, the *humphriesianum* subzone.

Stratigrahic distribution

There is no evidence of the exact horizon of the German and Swiss type material, but the specimens described here originate from the *romani* and *humphriesianum* subzones of the *humphriesianum* zone.

7. *Chondroceras (Chondroceras) obornensis n.sp.*

Plate 5, figs, 4-8 &11; Text-fig.. 27.

1971 *Chondroceras sp*.; Whicher & Palmer, p.117.

1974 *Chondroceras sp. nov*.; Parsons, p.167.

Material:

Four specimens *in situ* from, bed 3, Oborne Wood, Dorset, NHM. C80313-6; one specimen from "Miller's quarry", Sherborne, Dorset (ex. Monk collection), SM.J20154; one from the 'Sherborne district', SM. J24526, and one from Dundry Hill, near Bristol, BUGM.3325, a total of seven specimens.

Dimensions:

Holotype, NHM. C80313, with over three-quarters of a whorl of body- chamber, (M.),

D.	Ud.	Pn.	Wh.	Wb.
4.04 cm.	1.25 (31%)	56	1.93 (48)	2.73 (68)
3.32	0.71 (21)	50	1.76 (53)	2.64 (80)

1st. Paratype, NHM. C80314, with over 1 whorl of body-chamber, (M.),

c.4.1	1.25 (31)	43	-	-
3.36	0.59 (18)	39	1.88 (56)	c.2.40 (71)

2nd. Paratype, NHM. C80316, with ¾ of a whorl of body-chamber, (m.),

2.3	0.49(21)	36	1.03(45)	1.58(69)
1.75	0.23 (13)	28	c.1.0 (57)	1.49 (85)

3rd. Paratype, NHM. C80315, with just over 1 whorl of body-chamber, (M.),

3.8	1.13 (30)	47		
3.1	0.8(26)	45	1.6(52)	2.39(77)
2.6	0.58(22)	42	1.56(60)	2.33(90)

4th. Paratype, SM. J24526, with the edge of the mouth-border preserved, and approximately 1 whorl of body-chamber, (M.),

4.14	1.4(34)	63	1.8 (44)	2.58 (62)
3.25	0.8(25)	62	1.72 (53)	2.52 (78)

SM. J20154, with 1¼ whorls of body-chamber, (M.),

c.4.05	1.23 (30)	c.53	-	-
3.24	0.74 (23)	c.55	1.71 (53)	2.58 (80)

BUGM.3325, with one whorl of body-chamber, original diameter = 4.0cm.+, (M.),

3-34	1.03 (31)	51	1.48 (44)	2.18 (65)
2.9	0.73 (25)	52	1.54 (53)	2.23 (77)

Description

A small (average macroconch size = 4.1cm.), globose ammonite, with a deep, narrow umbilicus. There is a marked uncoiling of the umbilical seam associated with the slight contraction of the body-chamber, which stretches for just over one whorl. The inner whorls are relatively depressed, and this shell form is only slightly modified by a minor decrease in whorl breadth relative to whorl height over the last half whorl, (see Text fig. 27). The ribbing is extremely fine and dense (63-43 primary ribs/outer whorl). The primary ribs are short, curved, prorsiradiate and often show a slight backward deflection on the whorl shoulder, above which point they divide into two secondaries. A small proportion of the ribs are simple, and pass straight over the venter. The sharp secondary ribs, which become coarser and blunter towards the mouth-border, sweep forward very gently over a broad, flatly arched

venter. One specimen (NHM. C80315), shows -the presence of slight node like swellings of the primary ribs at the point of division into the secondaries. None of the macroconch specimens are wholly complete and only one (SM. J24526) shows a fragment of the mouth-border, consisting of the base of a constriction, followed by a lip. One complete microconch has been found (NHM.C803l6), which shows the presence of a relatively deep constriction, followed by a lip. The base of a lappet was preserved on this latter specimen, but unfortunately it disintegrated during extraction.

Sexual dimorphism

The small specimen, with the lappets is an undoubted microconch. The larger specimens, although little is known.of the shape of their mouth-border, are likely to be its macroconch partners. Taking into account the very small sample, a size ratio between dimorphs in the region of 1 : 1.8 is suggested.

The type series: (5 specimens)

The *holotype*, (NHM. C80313) is an almost complete macroconch specimen, collected in situ from bed 3, Oborne Wood, Dorset.

The *1st paratype*, NHM. C80314, is a more evolute, coarsely ribbed macroconch variant, from bed 3, Oborne Wood.

The *2nd paratype*, NHM. C80316, is a complete microconch specimen from bed 3 Oborne Wood.

The *3rd. paratype,* NHM. C80315, is an incomplete, macroconch specimen from bed 3 Oborne Wood, showing the presence of faint tubercles or node like swellings at the top of the primary ribs.

The *4th paratype,* SM. J24526, is the most complete macroconch specimen, showing part of the mouth-border and comes from the Sherborne district of Dorset.

Discussion

Although only very rarely found in the 'green-grained marl bed' of the Oborne district of north Dorset (= bed 3 Oborne Wood), where it forms less than 2% of the total ammonite fauna, this taxon is interesting, as it is the oldest recorded sphaeroceratid and as it shows features which are transitional to the Otoitid genus *Frogdenites.* Thus *F. spiniger* S. Buckman, is very similar to this species in its size range, style of dimorphism and general whorl proportions and coiling, but it differs by having sharp spines or tubercles situated on the relatively acute ventrolateral angle of the whorl. It is clear from some specimens that these tubercles have a tendency both to migrate ventrally and to become less pronounced. This results in the umbilical angle becoming more obtuse, which thus produces a more rounded whorl cross-section. This trend is illustrated by two microconch specimens, of *Frogdenites* (Plate 5, figs. 9-10), where one (NHM. C75252) has its spines situated directly on the sharp ventrolateral angle, whilst the second (NHM. C80391) has its tubercles situated ventrally of a more rounded umbilical shoulder. The location of one specimen of *C. obrnensis* retaining some relict tubercles well up the whorl flank, (C80315), confirms the origin of this species as nothing but the straightforward result of the continuation of the above trend. Thus the total loss of tubercles has produced a smoothly rounded whorl cross-section.

It is difficult to determine the precise generic position of this species, since its phylogenetic position as progenitor of all the succeeding sphaeroccratid ammonites is reflected in the hybrid nature of its morphological features. In particular it combines the very fine, sharp ribbing of *Labyrinthoceras*, with the smaller size and open, evenly coiled umbilicus of *Chondroceras*. Comparison of this taxon with closely related Sphaeroceratids reveals the greatest similarity with members of the C. evolvescens group and in particular the finely-ribbed variants of this species from Clatcombe Farm, near Sherborne, Dorset (NHM. C 80372). The latter differ only in being slightly coarser ribbed and less inflated. Taking this similarity into account *C. obornensis* is best included in the genus *Chondroceras*. The existing species of *Labyrinthoceras* are on the whole of much larger size and exhibit a more contracted body-chamber. However, the existence of smaller specimens of *Labyrinthoceras*, such as *L. "intricatum"* S. Buckman (1909-30, Plate 135A), which are transitional in size and general morphology between *C. obornensis* and *L. meniscum s.str.*, confirms the close relationship which exists between these two groups. The only other stratigraphically similar species, *Sphaeroceras manselli* also shows transitional feature; in this case between *C.*

obornensis and *Sphaeroceras s. str.* (such as *S. brongniarti*). This *sauzei* Zone species differs from *C. obornensis* by having a more occluded umbilicus and a squarer whorl cross-section. There thus can be little doubt that this close morphological similarity between all the early Sphaeroceratids confirms *C. obornensis* in its position as the earliest, root stock of this subfamily. In these circumstances strong doubts must be expressed concerning the supposed critical phylogenetic position of *C. antiquum* (Westermann, 1956, p. 94). Westermann (1956, p.95, text fig. 23), considered that this species was the oldest european representative of the genus, and thus was a probable root stock for the bulk post-*sauzei* Zone Sphaeroceratids. In fact this 'species' is probably nothing more than an extreme morphotype of *the C. schmidti* group

Stratigraphic distribution

The specimens which have been collected *in situ* have come from bed 3, Oborne Wood, which is to be correlated with topmost part of the *laeviuscula* subzone of the *laeviscula* Zone. Of the museum material, the specimens from the Sherborne district of Dorset, also appear from their matrix to have come from this same bed, whilst the one specimen from Dundry Hill, near Bristol has the matrix of the 'White Iron-shot bed', (= bed 4a. South Main-road Quarry), and is presumably also *laeviuscula* subzone in age.

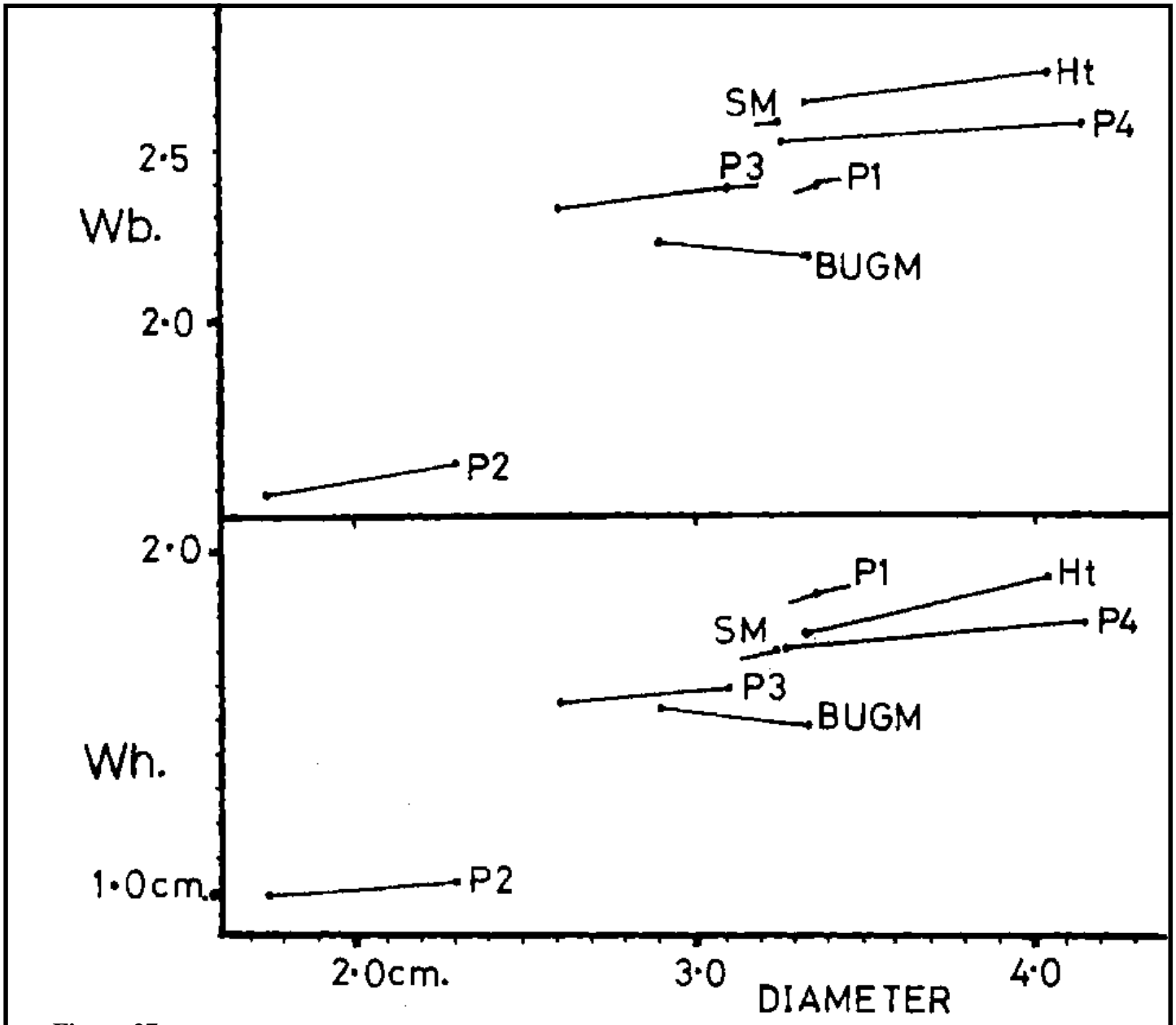


Figure 27:

A plot of whorl breadth (Wb.) and whorl height (Wh.) against maximum diameter for *C. (C.) obornensis sp. nov*. P. = *Paratype*, Ht. = *Holotype.*

8. *Chondroceras (Chondroceras) sp. nov. aff. C. tenue* (Westermann)

Plate 5 , Figs. 3a-b; Text fig.. 28 .

? 1956 *Chondroceras (Schmidtoceras) tenue n.sp.*; Westermann, pp.91-3, Text-figs. 11-12, 22, 51, 55, Plate 10

? 1964 *Chondroceras (Schmidtoceras) tenue* Westermann; Westermann, p.55.

1971 *Sphaeroceras (Chondroceras) flexuosum n. sp.*; Sturani, pp.149-150, Plate 11, fig.18, *non* Plate l6, figs.17. 18, 20-21.

Material:

Two specimens from bed 5b, Frogden quarry, Oborne, Dorset, BMNH. C80351-2.

Dimensions:

NHM. C80351, incomplete, with ¼ whorl of body-chamber,

D.	Ud.	Pn.	Wh.	Wb.
0.96cm.	0.26(27)	-	0.44(46)	0.61(64)
0.82	0.21(26)	-	0.36 (44)	0.55(67)

NHM. C80352, with ¾ whorl body-chamber, maximum size 1.86 cm.,

1.74	0.53(31)	45+	0.71(41)	0.91(52)
1.48	0.40 (27)	-	0.69(47)	0.84 (57)

4th. Para type, C. flexuosum, Ponte sul Ghelpach, N. Italy, Pisa museum,

0.81	0.21(26)	-	0.36(44.6)	0.47(58)

Description

A small, relatively evolute (Ud. = 24-31%) ammonite, with a rounded-ovate whorl cross-section, and with a relatively sharp angle between the whorl flank and the umbilical wall. There is a slight uncoiling of the umbilical seam associated with the retraction of the body-chamber, which stretches for three-quarters of a whorl. As can be seen in Text fig. 28 , there is little relative change in the whorl breadth over the last whorl, but a sharp decline in the relative whorl height. The ribbing is extremely fine, with a tendency to be superficial on the inner whorls, and in the case of the primary ribs, on the last half whorl. The rib density is high, but it is difficult to exactly determine, as the larger specimen is slightly damaged; it must however be in excess of 44 primary ribs per whorl. The primary ribs are strongly prorsiradiate and bend forward sharply from the umbilical shoulder, from just above which point they divide into two, or more commonly three secondary ribs. These secondaries, which become coarser just before the aperture, sweep forward gently over a tightly arched venter.

Sexual dimorphism

Only the edge of the mouth-border is preserved on the larger specimen, and this together with the small number of specimens, precludes any discussion of the style of dimorphism.

Discussion

These two specimens represent members of a very rare species; no equivalent material was found in the much larger collections from the banksi subzone beds at Oborne Wood. The larger specimen is one of the most evolute and almost platycone sphaeroceratids found in the British Bajocian. The most closely comparable groups consist of *C. polypleurum* from the *humphriesianum* subzone of Oborne Wood, which is larger and coarser ribbed, and *C. canovense* from the upper *subfurcatum* Zone, which is smaller, with a more occluded umbilicus. *C. tenue* (Westermann, 1956, Plate 10, figs.1a-d), from the upper *humphriesianum* Zone, Gerzen, N.W. Germany (Westermann, 1954, p. 25), is of a similar size and has a similar style of coiling, However, this species differs from

the specimens described here, by having a more rounded whorl cross-section and less well marked, straighter and sparser ribbing. The most strictly comparable specimen, described in the previous literature, is undoubtedly the fourth *paratype* of *C. flexuosum* (Sturani, 1971, Plate 11, fig. 18). This specimen is the only one of the type series to have come from the *banksi* rather than the *polygyralis* subzone of the *subfurcatum* Zone. It differs from the other *paratypes* and the *holotype,* by being more evolute and less inflated. As can be seen from the dimensions given above, it has very similar relative proportions to the specimens recorded here, as well as showing an identical style of very fine, prorsiradiate ribbing. It is likely that the specimens from Frogden quarry represent a new species, but further material is needed before an adequate description of this taxon can be made.

Stratigraphic distribution

These specimens were found in bed 5b, Frogden quarry, which is *banksi* subzone*, subfurcatum* Zone in age.

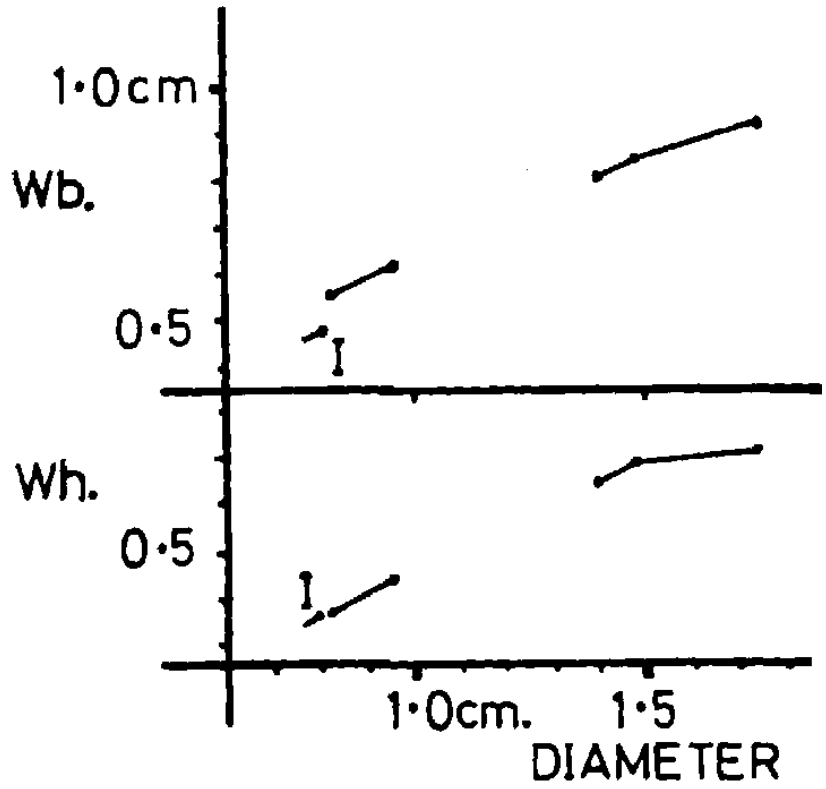


Figure 28:

A plot of whorl breadth (Wb.) and whorl height (Wh.) against maximum diameter for specimens of *C. (C.) sp. nov. A. aff. C. (C.) tenue* (Westermann). I = Italian specimen of *C. (C.) flexuosum* (Sturani).

The genus Labyrinthoceras S.S. Buckman, 1919

Type species: by original designation - *L. perexpansum* (S. Buckman, 1882)
= subjective *syn. L. meniscum* (Waagen, 1867)

Diagnosis

A group of relatively large Sphaeroceratid ammonites, with round whorls, a contracted body-chamber, and a narrow, deep umbilicus. The ribbing is very fine and dense, the dimorphism well marked, and there are no spines or tubercles present (*contra*, Westermann, 1956, p. 13). The microconch is relatively small in comparison to other members of the subfamily, and bears lappets, whilst the macroconch has a mouth- border made up of a deep constriction, followed by an expanded, smooth lip.

Stratigraphic distribution

All the described species are apparently restricted to the sauzei Zone.

Genus group

Only the following is here recognised as a member of the restricted genus:-

1. *L. meniscum* (Waagen, 186?)
   syn. *L. perexpansum* (Buckman, 1882)
   L. intricatum S. Buckman, (1919)

2. *L. meniscum sub. sp. amphilaphes* (S. Buckman, 1922).

The other two 'species', which Buckman assigned to this genus; *'L.' extensum*, Buckman, 1921, & *'L.' gibberulum* Buckman, 1922; show the presence of an acutely angled umbilical shoulder, surmounted by sharp tubercles or spines, they are thus better included in the genus *Frogdenites*.

1. *Labyrinthoceras meniscum* (Waagen)

Plate 5 , figs. 12-14, Plate 6,figs. 1-6; Text fig. 29.

1845 *Ammonites gervillii* Sow.; d'Orbigny (1842-51), Plate 140, figs. 1 & 2, *non* 3-8.

? 1856 Ammonites brongniarti Sow.; Oppel (1856-8), p.375.

1867 *Ammonites meniscus n, sp*.; Waagen, pp.602-3.

1881 *Sphaeroceras meniscus* (Waagen); S. Buckman, p.597.

1882 *Sphaeroceras perexpansum* S. Buckman, p. 142, Plate II, figs. 4a-b.

1891 *Sphaeroceras meniscus* Waag.; Haug. p.68.

1900 *Sphaeroceras meniscus* (Waagen); Bigot, p.47.

1919 *Labyrinthoceras perexpansum* (S. Buckman); S. Buckman (1909-30), Plates 134A-D.

1919 *Labyrinthoceras intricatum nov*; S. Buckman (1909-30), Plate 135.

1927 *Labyrinthoceras intricatum* Buckman; S. Buckman (1909-30), Plate 135A.

1938 *Sphaeroceras perexpansum* Buck.; Roman, pp. 197-8.

1939 *Sphaerocerag meniscus* Waagen; Roche, p. 226.

? 1952 *Sphaeroceras (Labyrinthoceras) intricatum*; Kumm, p. 383.

1957 *Labyrinthoceras perexpansum* (Buckman) ; Arkell (in Arkell, Kummel & Wright, 1957), p. 292, fig. 347/4a-b.

1964 *Labyrinthoceras (Labyrinthoceras) meniscum* (Waagen); Westermann, p .54.

1968 *Labyrinthoceras perexpansum* Buckm.; Pavia & Sturani, p. 311.

1974 *Labyrinthoceras meniscum* (Waag.); Parsons, pp.159 & 166.

Material:

Three specimens *in situ*, from the top 0.20m. of the Sandford Lane 'fossil-bed', NHM. C80335-7, and one from the top 0.06m. of the Dundry, 'Brown Iron-shot' bed, NHM. C80338, from the 'South-Main-road' quarry, Dundry Hill. Five specimens from Dundry Hill, nr. Bristol; NHM. C78582-5, BCM,Cb4969; one specimen from Rackledown quarry, Dundry (ST572654), BUGM.3324/1; two specimens from 'South-Main-road' quarry, Dundry, (ST567655), BUGM. 3289 & 3324/2: seven specimens from the 'Sherborne district', north Dorset, NHM. C80300 (ex. S.S.B. 475), C80304 (ex. S.S.B. 1248), C80301 (ex S.S.B. 2968), C78581, BGS. 32001, 32041, 49296; one specimen from the 'Yeovil district', south Somerset/north Dorset, NHM. C75263; three specimens from 'Clatcombe', near Sherborne, Dorset, NHM. C80803 (ex. S.S.B. 2969), C3282, BGS.3649; two specimens from Sandford Lane, near Sherborne, Dorset, NHM. C78580, C80302 (ex. S.S.B. 1245); one specimen from Chideock Quarry hill (SY434931), south Dorset, NHM. C80299 (ex. S.S.B. coll.) and three specimens from Normandy, north-west France, St.Vigor, NHM.37268 (ex. Tesson), Bayeux, NHM.37269 (ex. Tesson) & NHM.74307: a total of 29 specimens.

Dimensions:

NHM.C80300 (*ex*.S.S.B.475),*paralectotype* of *L. perexpansum* (S. Buckman 1882),septate phragmacone,(M.)

D.	Ud.	Pn,	Wh.	Wb.
4.36cm.	0.75(17%)	-	2.5(57)	3.68(84)
3.27	0.62 (19)	-	1.8(55)	2.6 (80)

BGS.32041 (*ex.* S.S.B. 1249), *metatype* of *L. perexpansum* (Buckman, 1909-30, PI 134, C-D), (M.), mD.= 13.55

12.6	4.04(32)	-	5.35(43)	6.95(55)
10.36	2.8(27)	-	5.07(55)	6.90(67)

BGS.32001 (ex. S.S.B. 476), *holotype* of *L. intricatum* Buckman (l930, Pl. 135), incomplete specimen, with start of body-chamber, (M.)

4.2	0.88(21)	-	2.16(51)	c.3.8(91)
3.52	0.72(21)	-	1.96(56)	-

BGS.49296 (ex. S.S.B.-1264), paratype of L. intricatum Buckman (1909-30, P1. 135A), (M.), mD. = 7.25

6.8	2.18(32)	67	2.75(40)	-
5.83	1.61(28)	63	2.68(46)	-

NHM. C80302 (ex S.S.B. 1245), complete with mouth-border, (M.), mD. = 10.85cm.

10.3	3.05 (30)	c.46	4.44(43)	6.1(59)
8.65	2.07(24)	-	3.42(40)	6.1(71)

NHM. C78582 (ex S.S.B. coll.), complete with flared mouth-border and one whorl of body-chamber, (M.),

3.57	1.14(32)	67	1.4(39)	1.8(50)
2.78	0.71(26)	-	1.33(48)	1.78(64)

NHM. C78531 (ex, Darell-Stephens, via S.S.B. coll.), complete with flared mouth-border and one whorl of body-chamber, (M.), maxD. = 4.34.

4.03	1.3(32)	61	1.68(42)	2.12(53)
3.40	0.87(26)	54	1.66(49)	2.26(67)

BUGM. 3289, fragmentary, but with edge of mouth-border and one whorl of body-chamber, (M.)

9.08	2.6(29)	-	3.8(42)	-
-	1.75	45	-	5.08
6.8	1.32(19)	41	3.49(51)	5.06(74)

NHM. 37268 (ex. Tesson coll.), *topotype* of *L. meniscum* (Waagen), complete with flared mouth-border and one whorl of body-chamber, (M.), mD=6.98,

5.66	1.4(25)	54	2.7(48)	3.61(64)
4.95	0.97(20)	50	2.66(54)	3.58(72)

NHM. C78585 (ex. S.S.B. coll.), complete with three-quarters of a whorl of body-chamber and small lappets, (m.)

2.4	0.53(22)	-	1.13(47)	1.46(61)
1.98	0.31(16)	-	1.12(57)	1.45(73)

BUGM. 3324/1 (ex, Underhill coll.), complete with three-quarters of a whorl of body-chamber and the base of lappets, (m.),

2.41	0.60(25)	31	1.2(50)	1.4(58)
2.0	0.28(14)	27-28	1.08(54)	1.37(69)

Dimensions of further material are to be found in an appendix.

Description

A relatively large (average macroconch diameter, from 14 specimens = 6.74 cm., range 3.3 – 13.55; average microconch diameter from five specimens = 2.45), globose ammonite species, with a deep and very narrow umbilicus. There is a pronounced contraction of the body-chamber, particularly in the macroconchs, associated with the decrease in whorl breadth relative to whorl height (see Text fig. 29). Thus the highly depressed inner whorls become more rounded on the body-chamber, which spans one whorl of the macroconchs and three-quarters of a whorl in the microconchs. The contraction of the body- chamber on the last half whorl is also marked by a rapid retraction of the umbilical seam. Although there is a reduction of the rate of increase of both whorl height and breadth over the last three-quarters of a whorl, the maximum values for these dimensions are still found just before the mouth-border. The ribbing is extremely fine and sharp, with a tendency to be superficial. The primary ribs are curved, prorsiradiate, extremely dense (44-76/ outer whorl of macroconchs; 27-33 outer whorl of microconchs), and divide well up past the whorl shoulder into two, or more rarely, three secondary ribs. These secondaries are also fine and sharp, and sweep forward gently over the arched venter, often with a slight backward deflection along the mid-ventral line. Although almost superficial on the inner whorls, the secondaries tend to become coarser and blunter just before the mouth-border. The latter is characterised by a very strong constriction (particularly on the internal cast), followed by a slight flare and a smooth lip, which on the microconchs shows the presence of a pair of wide, forward projecting lappets (see Plate5 , figs. 13b & 14b).

Sexual dimorphism

It is evident that the majority of the specimens of *L meniscum*; with their relatively large size and mouth-borders, with smooth lips; are macroconchs (cf. Westermann, 1964, p. 54). Westermann (*loc. cit.*), suggested the genus *Frogdenites* as the corresponding microconch, However, it is now certain that this latter taxon is *laeviuscula* rather than *sauzei* Zone in age (Parsons, 1974, p. 175), and in any case has a very different morphology, with the presence of spines and/or tubercles (Parsons, 1977). This apparent problem is solved by the presence in the *sauzei* Zone beds of obvious microconchs, which are identical to *L. meniscun* in relative proportions and ornament, but are much smaller, and bear lappeted mouth-borders (e.g. BMNH. C78585). The size ratio between these two dimorphic groups is in the order of 1 : 2.75. This is perhaps a trifle low, as it has been biassed by the relatively large number of complete small macroconchs in the sample; many of the larger macroconchs are incomplete, and thus could not be taken into account.

Discussion

The type series of *'Ammonites' meniscus* Waagen 1867 is made up of an unknown number of specimens, including those discussed by d'Orbigny (1846 in 1842-51, PI.140, figs. 1 & 2, *non* 3-8) and Oppel (1856 in 1856-8, p. 375 *pars*), as well as the specimens collected by Waagen himself (l867, p. 603), from the top of the Malière (La Couche verte) at Sully, near Bayeux, Normandy. No *holotype* as such was designated, hence a *lectotype* must be chosen. The mere casual citing of d'Orbigny's 1846 figure (P1.140, figs. 1 & 2 only), as the 'holotype' or 'type' (e.g. Westermann, 1964, p. 63) on its own does not fulfil this need. Whilst it is admissible to designate a figure as lectotype, it must be treated as a designation of the specimen represented by the figure, (I.C.Z.N., Art. 74b). In d' Orbigny's case so many of his figures are blatant synthetographs (cf. d' Orbigny, 1842- 51, Pls. 133, 136 etc.), that it is impossible to be certain in many cases that any one figure was based on a single specimen. Thus, any such lectotype designation can only be considered valid, if a single specimen can be found in the d' Orbigny collection, which closely matches the relevant figure. Unfortunately the specimen in question of L. meniscum, has yet to be found in the d' Orbigny collection. However, this need not effect the interpretation of this taxon, since the d' Orbigny figure is more than adequate, especially since it is supported by abundant *topotype* material, including specimens in the Tesson collection (BMNH.37268-9), which are themselves of considerable historic importance. Specimens extremely close, both to d' Orbigny's figure, and to the *topotypes* have been found fairly commonly in the *sauzei* Zone beds at Sandford Lane and Clatcombe, north Dorset, and at Dundry Hill, near Bristol, These specimens are undoubtedly conspecific with Waagen's taxon.

Sphaeroceras perexpansum S. Buckman 1882 was based on "a few", but unknown number of specimens from the 'Sherborne district', collected by J. Buckman (S. Buckman, 1882, p.142). No *holotype* was designated in the original description (*loc. cit*.), hence Buckman's later re-description (S.-Buckman, 1909-30, Pl.134A-B), of' the figured *syntype* (S. Buckman, 1882, PI. 2, figs. 4a-b), as 'holotype', may be taken as a *lectotype* designation. Unfortunately this specimen (Buckman collection number: 474), appears to have been lost, since it is not with the rest of the material figured in 'Type Ammonites' (Buckman,1909-30), and now in the British Geological Survey Museum. Neither does it seem to be in any of the other Buckman collections in, the British Museum (the bulk of his collection is here), Oxford University Museum, Manchester City Museum or Liverpool University geology department collections. However, several *paralectotypes* still exist, including S.S.B. 476 (= the subsequently designated *holotype* of *L. intricatum* S. Buckman, now BGS.32001) and S.S.B. 475, now in the Buckman collection at the Natural History Museum; C80300. This latter specimen is very similar to the lectotype, which was well figured by Buckman (*loc. cit*.). Although this 'species' thus appears relatively well defined, its interpretation is made difficult by the fact that all the original type material appears to have been based on fragmentary specimens which are mainly only septate inner whorls. This makes any comparison with larger, complete specimens rather difficult. Most, if not all, the type series seem to have had an 'iron-shot' matrix. In the Sherborne area this virtually restricts their type horizon to either the *sauzei* or *humphriesianum* Zones (see the previous discussion of *Sphaeroceras manseli*). The original diameter of the lectotype, when complete, must have been in excess of 10cm., and luckily there are very few comparable ammonite groups in the rocks of these ages, which reach this size. In the *humphriesianum* Zone, only *Chondroceras grandiforme* is large enough, and this species has a very different whorl cross-section and ornament. In the *sauzei* Zone there are several species of *Emileia,* which are the correct size, but have a different ornament, with 'club' shaped primary ribs. Only *Emileia multifida* S. Buckman has a comparable ribbing style and this differs by being far more evolute. There thus can be little doubt that the specimen later figured by Buckman (1909-30, Pl. 134C-D), does represent the only group which could have provided the inner whorls, that are the lectotype of *L. perexpansum*. If this is the case, then this latter taxon must be considered as a junior subjective synonym of *L. meniscum,* since Buckman's complete specimen (IGS.32041), is virtually identical to d' Orbigny's figure. This is confirmed by the fact that the more extensive collections of Buckman's 'species' now available, show a complete morphological intergradation with the topotypes of Waagen's species from the 'Couche verte', of Normandy.

The taxonomic status *of Labyrinthoceras intricatum* S. Buckman, is almost identical to that *of L. perexpansum.* It is based on a similarly incomplete type specimen, which is also a *paralectotype* of *L. perexpansum* (Buckman, 1909-30, PI. 135 - IGS.32001). However, this specimen has a small part of its body-chamber preserved, its original diameter, when complete, was thus considerably less than *L. perexpansum*. Buckman's interpretation of the complete *L. intricatum* (Buckman, 1909-30, Pl. 135A), is probably correct. However, this specimen (BGS. 49296) is almost identical to the figured *metatype* of *L. perexpansum* in almost every character, except size. The available specimens of *L. meniscum* show a wide size range (3.3 – 13.5cm.), Although this collection is anything-but a statistically homogenous sample (it is made up of mainly poorly localised material, from a variety of localities and horizons), its size range is not incompatible with a standard deviation for the diameter of about 10% (see Callomon, 1963, pp.26-8, for a fuller discussion). Taking into consideration that the *paratype* of *L. intricatum* is slightly larger than the average of this 'sample', size alone would appear to be an inadequate basis for separating this taxon from *L. perexpansum*, and thus *L. meniscum*.

However, the detailed stratigraphy of this group is still rather poorly known. If at some future time it could thus be shown that the younger populations of L. meniscum are of a larger average size, than the older specimens, which in turn are transitional to C. obornensis nov.; then a case could be made for resurrecting *L. intricatum* as a chronological subspecies of *L. meniscum*.

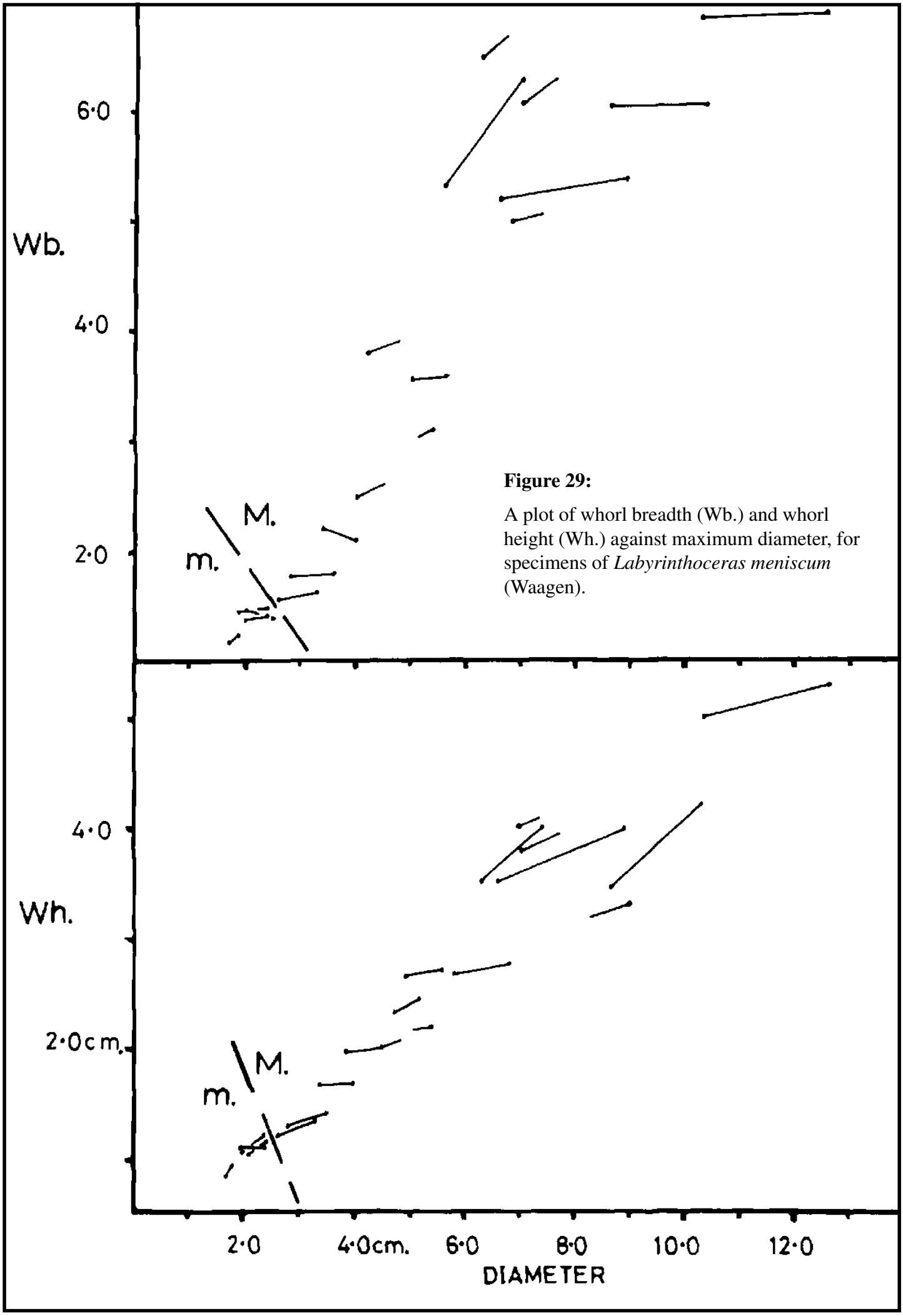


Figure 29:

A plot of whorl breadth (Wb.) and whorl height (Wh.) against maximum diameter, for specimens of *Labyrinthoceras meniscum* (Waagen).

'Labyrinthoceras' gibberulum Buckman has been considered conspecific with *L. meniscum* (Westermann, 1964, p. 54). However, this taxon is characterised by having faint tubercles/spines, it is hence best transferred to the genus *Frogdenites*, under no circumstances should it be included in *L. meniscum.*

Stratigraphic distribution

The type horizon of *L. meniscum* is 'La Couche verte' of Normandy, which is *sauzei* Zone in age (Parsons, 1974). The well localised English material has come either from the top half of the Sandford Lane 'fossil-bed' (Parsons, 1974, p. 166), or the top-most part of the 'Brown iron-shot' bed on Dundry Hill, both of which are also *sauzei* Zone in age (*op. cit*.). The other English material includes a specimen from the 'Red beds' of Chideock Quarry Hill (NHM. C80299), which are at least in part of *sauzei* Zone age; and several from the 'iron-shot' beds at Clatcombe, which are also of this age (Parsons, 1974, p. 165, bed 6). All available evidence would thus suggest that *L. meniscum* is restricted to the *sauzei* Zone.

2. *Labyrinthoceras meniscum sub. sp. amphilaphes* (S. Buckman)

Text fig. 30.

1922 *Labyrinthoceras amphilaphes nov.;* S. Buckman (1909-30), Plate 279.

1964 *Labyrinthoceras meniscum* (Waagen) Westermann, pp. 54 & 63*, pars*.

Material:

Two specimens from Dundry Hill, near Bristol; BGS.47114 (the holotype, ex S.S.B. 3315) & BCM. Cb4970; and one specimen from Oborne Wood, a derived specimen, found in the base of bed 4a. CP1208.

Dimensions:

BGS.47114, (holotype), septate nucleus. (M.),

D.	Ud	Pn.	Wh.	Wb.
4.7cm.	0.65(14%)	-	2.80(60)	c.4.9(104)

BCM. CB.4970, septate nucleus, with a diameter of 7.0cm. (M.),

6.22	0.92(15)	-	3.84(62)	6.2(100)

CP1208, septate nucleus, (M.),

3.0	0.61(20)	42	1.62(54)	+2.91(97)
2.63	0.52(20)	-	1.4 (53)	+2.6 (99)

Description

This taxon is very like *L. meniscum s. str*. It is a relatively large, involute ammonite group, with a deep, narrow umbilicus. The ribbing is fine, sharp, dense, and with a tendency to be superficial. The whorl section is extremely depressed, with very high values for whorl breadth (Wb. = 98-105%). Little more can be added to this description, particularly concerning the nature of the body-chamber and aperture, as all the material described here consists of septate inner whorls.

Sexual dimorphism

The specimens described here, taking into account their relatively largo size, are probably macroconchs. The corresponding microconchs are still unknown,

Discussion

All the available material, including the *holotype*, is totally septate, which prevents any really detailed comparisons with related taxa. However, the specimens described here are extremely similar to the inner whorls of *L. meniscum*, in almost every detail, except whorl breadth. *L. amphilaphes* seems to be consistently more inflated than the latter, with a more depressed whorl cross-section. Taking into account both the small size of the sample and the wide range of variation in whorl breadth, which has been observed in some ammonite populations (e.g. *Chondroceras evolvescens*), it would seem inadvisable to retain *L. amphilaphes* as a distinct species. In these circumstances, the best solution would appear to be relegating it to a subspecies of *L. meniscum*.

Stratigraphic distribution

Both the Dundry specimens have a highly 'iron-shot' matrix, which would suggest that they are sauzei Zone in age. The Oborne specimen came from a derived pebble at the base of the *humphriesianum* Zone beds. Its matrix is a soft, grey, 'iron-shot' limestone, which militates against an origin from the subjacent 'green-grained marl' (Parsons, 1974, p. 165, bed 9). A more likely source would, be a thin, lower sauzei Zone age bed, which has been broken up by pre-humphriesianum Zone erosion. This would be an equivalent horizon to bed 4 at Lower Clatcombe (loc. cit.).

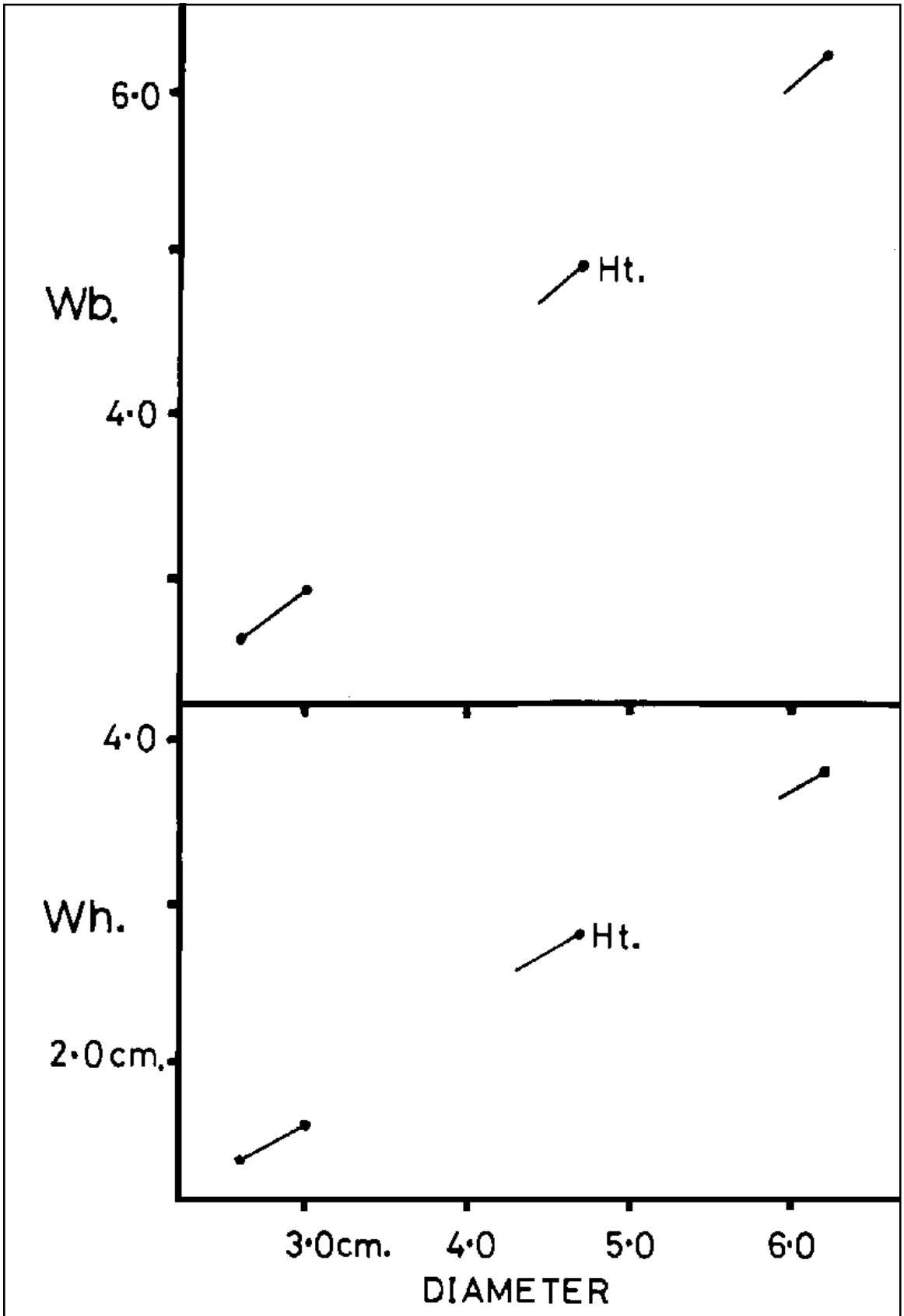


Figure 30:

A plot of whorl breadth (Wb.) and whorl height (Wh.) against maximum diameter for *Labyrinthoceras meniscum sub. sp. amphilaphes* (S.Buckman).

VI. EVOLUTION OF THE *SPHAEROCERATINAE*

The evolution of the ammonite subfamily *Sphaeroceratinae* exhibits some interesting features, which have come to light during the course of this work. Early attempts at elucidating the phylogeny of this group were severely hampered by a lack of information relating to the stratigraphic distribution of its constituent para-taxa. Thus Westermann (l956, Text fig. 23:1964, Text fig.14), suggested that *Sphaeroceras* was an offshoot of *Chondroceras,* which appeared at the base of the *subfurcatum* Zone. However, it has since been shown (here & Sturani, 1971), that the type species of *Sphaeroceras*, (*S. brongniarti*), is *humphriesianum* Zone in age, and indeed is at its most abundant in the basal third of this Zone. The origins of *Sphaeroceras* should thus be sought at an even lower horizon. The *sauzei* Zone, *S. manseli*, which is discussed, above, is the earliest taxon, which can be reliably assigned to *Sphaeroceras*, and it shows morphological features which are transitional between *Sphaeroceras s. str*. (i.e. *S. brongniarti*), and the earliest known Sphaeroceratid, *C. obornensis nov.,* of the upper *laeviuscula* Zone. It would thus seem that *Sphaeroceras* is indeed an offshoot of *Chondroceras*, but that it split off at a much earlier date than was previously thought; that is at the base of the *sauzei* Zone. The genus *Labyrinthoceras* appears to have a similar relationship *to Chondroceras*, since, *like S. manseli*, it is very similar to *C. obornensis nov*. in most features, except size. There is thus little reason to doubt that *Labyrinthoceras* also evolved from *C. obornensis* at the base of the *sauzei* Zone. With its close relationship to both *Sphaeroceras* and *Labyrinthoceras*, *Chondroceras* thus seems to be the conservative root stem for all the Bajocian *Sphaeroceratinae*.

At lower taxonomic levels, the *Sphaeroceratinae* exhibit some interesting phylogenetic trends, particularly in relation to evolutionary size changes. A relatively common phenomenon in lineages of Jurassic molluscs, is a slow, but progressive size increase within successive populations, (Hallam, 1975) and the Sphaeroceratinae, Labyrinthoceras and the early members of the genus Chondroceras show this tend. Thus *C. grandiforme* is x l.5 - 2.0 and *Labyrinthoceras* up to x 3.0 times the size of their direct ancestor; *C. obornensis*. However, this trend is atypical of the subfamily, which as a whole exhibits a very unusual, progressive evolutionary size decrease. Thus within the Chondroceras *lineage C. polypleurum/C. sp. nov. cf. C. tenue/C. flexuosum/C. canovense*, the microconchs (and macroconchs, although there is less material), show a decrease from an average maximum diameter in the *romani* subzone of 2.2cm., to 0.67cm. at the top of the *subfurcatum* Zone. The genus *Sphaeroceras* shows an even better documented pattern of size decrease. Here the lineage *S. manseli/S. brongniarti/S. auritum/S. auritum tutthum*, shows an overlap in general morphology between individual populations (see Text fig. 31), linked with progressive changes in the form of the aperture (the appearance of bilobate hoods) and flexing of the umbilical seam (see Text fig.8). Within this phyletic lineage, with its morphological intergradation (i.e. a chronocline), it would be impossible to separate distinct species, if stratigraphic discontinuities had not broken up the sequence. Perhaps the most striking feature of this chronocline, concerns the associated size changes. Again taking the more abundant microconch material, this group shows a decrease from an average maximum diameter of 1.7 cm, *in S. brongniarti*, to 0.87cm, in *S. auritum tutthum*. The most likely mechanism to account for this unusual case of evolutionary size decrease, would be a strong over all selection pressure in favour of the smaller forms, in successive Sphaeroceratid populations. This could take the form of either positive selection in favour of the smaller forms, or negative pressure, in the shape of increased predation of the larger size grades. Taking into account the Sphaeroceratid's preferred environment, with their predeliction for condensed sequences, associated with algal horizons (Sturani, 1971), the former, positive selection would seem the most likely. Thus, this particular case of evolutionary size decrease, could be a positive adaption to life in a micro-environment, associated with 'algal-meadows' (Sturani, 1971, p.46).

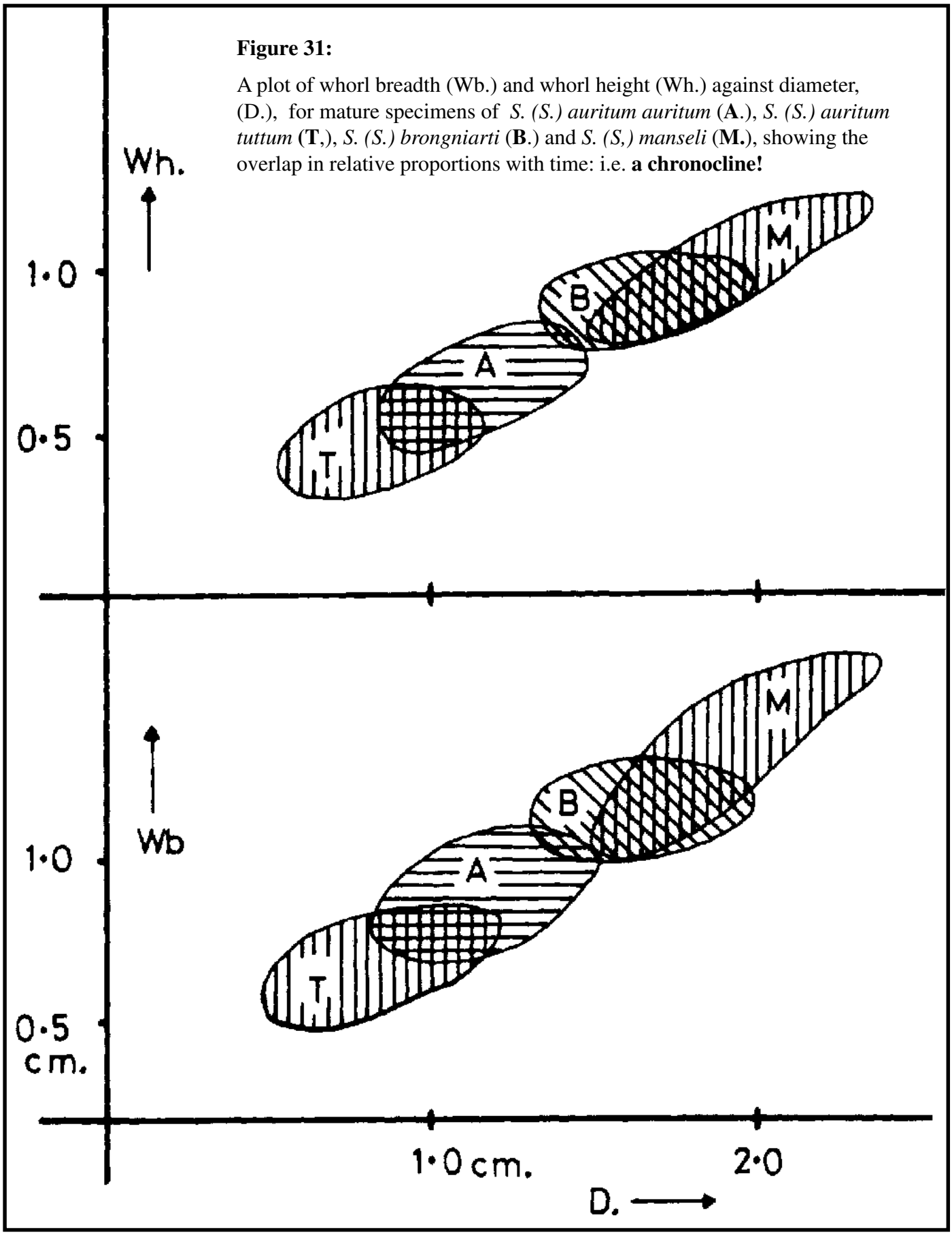
Apart from size, there are several other gradual changes in morphology, within the *Sphaeroceratinae*, which taken together aid our understanding of this group's phylogeny, (see Text fig. 32). In particular there are gradual evolutionary changes related to the shape of the mouth-border and umbilical region. In the early members of *Sphaeroceras* and *Chondroceras*, there is a gradual loss of the microconch's lappets, which at an earlier date were characteristic of their Otoitid progenitors. Consequently the *romani* subzone members of these genera have attained plain and simple mouth-bands, with no prolongations of the mouth-border. Subsequently the genus *Sphaeroceras* acquired a series of increasingly complex modifications to the mouth-border. These include prominent, thin, flared hoods, which in *the S. auritum/tutthum* group, acquire mid-ventral interruptions, leading to the development of the characteristic 'two prongs' of *S. auritum tutthum*. Both *Sphaeroceras* and *Chondroceras* show progressive modifications of the umbilicus. In the *C. polypleurun/canovense* lineage, this results in a gradual decrease in relative

umbilical diameter, until later members have an almost, but not quite occluded umbilicus. In *Sphaeroceras* the umbilicus is all but occluded from the beginning, and the evolutionary changes relate to the retraction of the umbilical seam, which is only slightly curved in *S. brongniarti*, but which becomes increasingly retracted and flexed in the younger populations (see Text fig.8).

Taken together, all the gradual evolutionary changes detailed above, on the one hand, facilitate fine divisions of the various phyletic lineages, which are thus of considerable stratigraphic significance; whilst on the other hand they

Figure 31:

A plot of whorl breadth (Wb.) and whorl height (Wh.) against diameter, (D.), for mature specimens of *S. (S.) auritum auritum* (**A**.), *S. (S.) auritum tuttum* (**T**,), *S. (S.) brongniarti* (**B**.) and *S. (S,) manseli* (**M.**), showing the overlap in relative proportions with time: i.e. **a chronocline!**



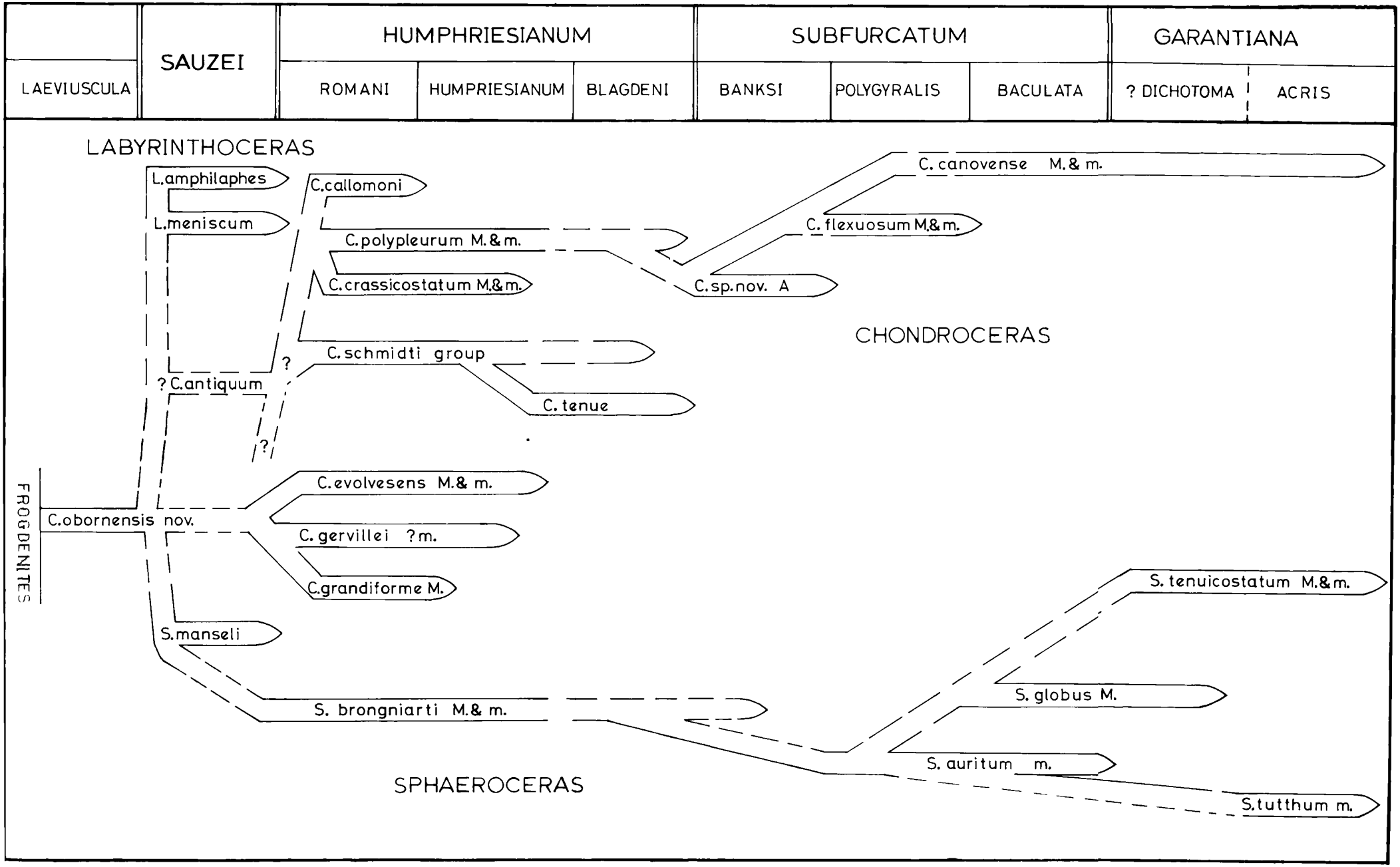
demonstrate the close inter-relationship of all the Bajocian *Sphaeroceratinae*, which in consequence can thus be safely described as a 'natural grouping'.

Explanation of Figure 32 (overleaf)

The stratigraphic distribution and probable phylogenetic relationships of the main european members of the *Sphaeroceratinae*. The un-broken lines represent known stratigraphic ranges, whilst the broken show probable extensions of stratigraphic ranges and/or suggested phylogenetic relationships,

It is evident from this figure, that there were several evolutionary bursts in this Subfamily. The primary radiation appears to have been in the *sauzei* Zone, when although still relatively rare, all the european constituent subgenera make their appearance. There is a strong secondary radiation in the lower *humphriesianum* Zone, which coincides with the greatest relative abundance of members of the Subfamily. Finally there is a late radiation in the *subfurcatum*, Zone where again several new species appear, whilst simultaneously showing an increase in their relative abundance.

Figure 32.


LAEVIUSCULA
SAUZEI
HUMPHRIESIANUM
ROMANI
HUMPHRIESIANUM
BLAGDENI
SUBFURCATUM
BANKSI
POLYGYRALIS
BACULATA
GARANTIANA
? DICHOTOMA
ACRIS
LABYRINTHOCERAS
L.amphilaphes
L.meniscum
C.callomoni
C.polypleurum M.& m.
C.crassicostatum M.& m.
C. canovense M.& m.
C. flexuosum M.& m.
C.sp.nov. A
CHONDROCERAS
C. schmidti group
C. tenue
? C.antiquum
?
?
FROGDENITES
C.obornensis nov.
C. evolvesens M.& m.
C. gervillei ?m.
C.grandiforme M.
S.manseli
S. brongniarti M.& m.
S. tenuicostatum M.& m.
S. globus M.
S. auritum m.
S.tutthum m.
SPHAEROCERAS

PLATES 1 - 6:

All specimens on this and the following Plates, unless otherwise stated, are coated with Ammonium chloride.

EXPLANATION OF PLATE 1

Figure 1. *Sphaeroceras (Sphaeroceras) brongniarti* (J.Sowerby), (M.), NHM. C80330, 'Red conglomerate' (bed 6, Senior *et al*., 1970, p.117), Upton Manor farm, near Bridport, Dorset, side view, xl.0

Fig. 2a-c. *S. (S.) brongniarti* (m.) NHM. C80325, bed 4b, 0borne Wood (Parsons, 1976, p, 131), near Sherborne, Dorset: 2a side view, x20; 2b ventral view, x 2.0; 2c side view, x l.5.

Fig. 3a-b. *S. (S.) bronniarti* (M,), NHM. C803201, bed 4b, Oborne Wood, near Sherborne, Dorset: 3a Ventral view, x 1.5; 3b side view, x 1.5.

Fig. 4a-b. *S. (S.) brongniarti* (M.) NHM. C80329. 'Red conglomerate', Upton Manor farm, near Bridport, Dorset; 4a side view; 4b ventral view, x 1.0.

Fig, 5a-b. *S. (S.) brongniarti* (m,), NHM. C36734, holotype, Bayeux, Normandy, France; 5a side view, x 1.0; ventral view of mouth-border, x 1.0.

Fig. 6a-b. *S.(S.) brongniarti* (m.), NHM. c80327, the 'Irony bed', Louse Hill, near Sherborne, Dorset (not coated); 6a ventral view, xl,.5; 6b side view, x1.0.

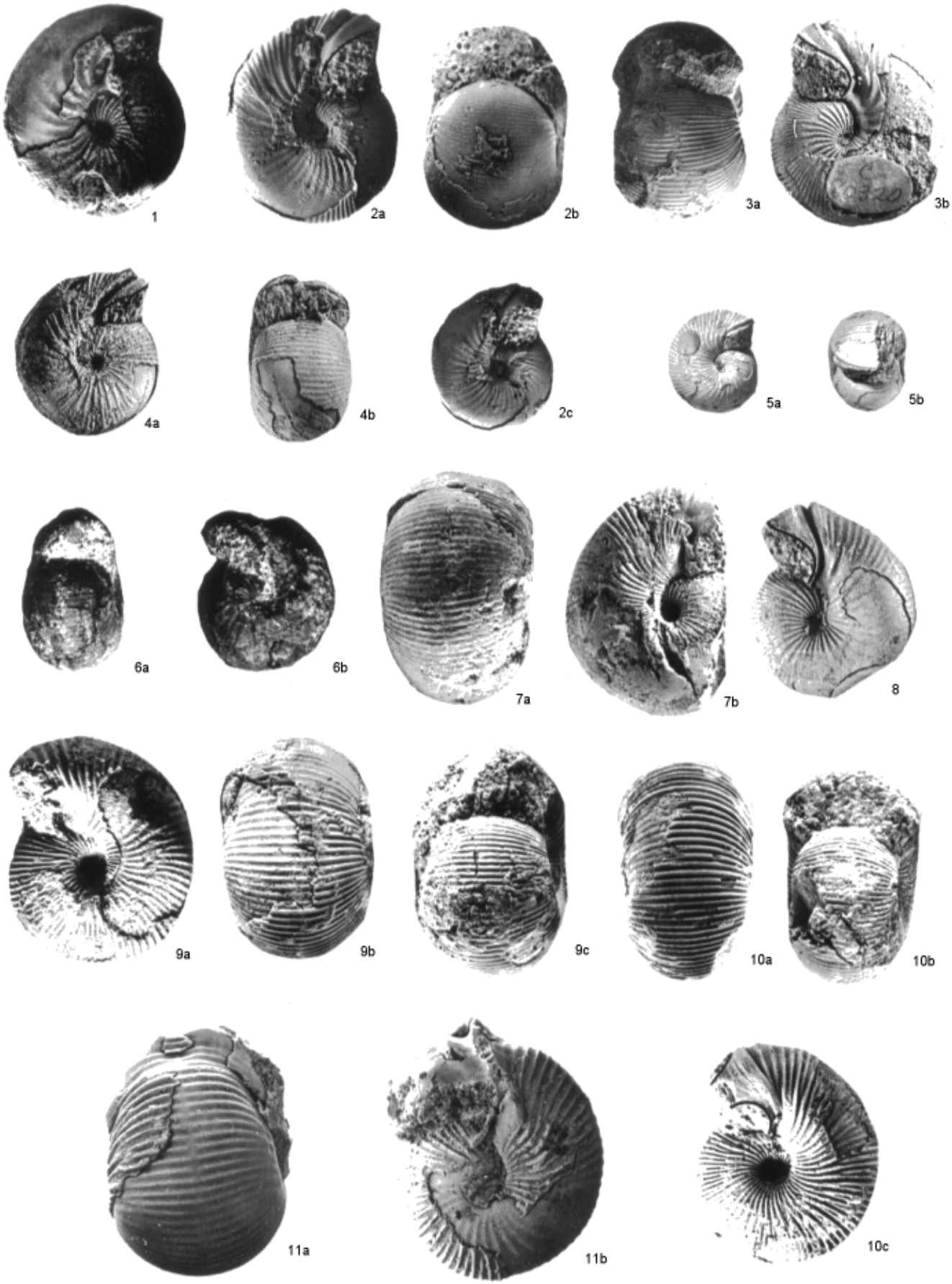
Fig. 7a-b. *S. (S.) manseli* (J. Buckman), (M.) NHM. C80332, 0.20m. from the top of the 'fossil-bed', Sandford Lane, near Sherborne, Dorset; 7a ventral view, x 1.5; 7b side view, x l.5.

Fig. 8. *S. (S.) brongniarti* (m.). bed 4a, 0borne Wood, near Sherborne, Dorset, x2.0.

Fig. 9a-c. *S. (S.) manseli* (M.), NHM. C80333, top half of the 'fossil-bed', Sandford Lane, near Sherborne, Dorset, 9a side view, x 1.5; 9b ventral view, x 1.5; 9c, apertural view, x 1.5.

Fig. 10a-c. *S.(S.) manseli* (m.).NHM. C80334, 0.20m. from the top of the 'fossil-bed' , Sandford Lane, near Sherborne, Dorset; 10a. ventral view, x2.0) 10b. apertural view. X 2.0; l0c. side view, showing small residual lappet, x2.0.

Fig. 11a-b. *S. (S.) auritum auritum* (Parona), (m.), NHM. C80341, bed 6d., Oborne Wood, near Sherborne, Dorset ; lla. Ventral view, showing the mid-ventral interruption to the flare, x3.0; 11b. side view, x 3,0.


1
2a
2b
3a
3b
4a
4b
2c
5a
5b
6a
6b
7a
7b
8
9a
9b
9c
10a
10b
11a
11b
10c

EXPLANATION OF PLATE 2

Figure la-b, *Sphaeroceras (Sphaeroceras) auritum auritum* (Parona), (m.), NHM. C80340, bed 6c, (Parsons, 1976), Oborne Wood, near Sherborne, Dorset; 1a side view, x2.0; 1b. apertural view, x 2.0.

Fig. 2a-b. *S. (S.) auritum auritum*, (m.), NHM. C80375, bed 6d, (Parsons, 1976, p. 126), Frogden quarry, near Sherborne; 2a side view, x 2.0; 2b apertural view, x 2.0.

Fig. 3a-b. *S.(S.) auritum auritum* (m.) , CP2344, bed 6b, Frogden quarry, near Sherborne, Dorset; 5a. side view, x 2.0; 3b. apertural view, showing lateral extensions, x 3.0.

Fig. 4. *S. (S.) auritum tutthum* (S. Buckman), (m.), NHM. C80356, the '*Astarte* bed' , Stony Head cutting, near Bridport, Dorset; side view, x 2.0.

Fig, 5a-b. *S.(S,) auritum tutthum*, (m.), NHM. C80369, 'Oolithe ferrugineuse de Bayeux', Les Hachettes, Port-en-Bessin, Normandy, France; 5a. view of 'two pronged' aperture, x2.0; 5b., side, view, x 2.5.

Fig. 6a. *S. (S.) auritum tutthum* (m.), NHM. C80363, bed 8, (Senior *et al*. 1970, p. 118), Horn Park quarry, near Beaminster, Dorset; 6a side view, x 3.0; 6b. view of aperture, x 2.3; 6c. side view, x 2.0.

Fig, 7a-b. *S.(S.) cf. globus* S,Buckman, (M.), NHM. C80371, the Sherborne Building-stone 'series', Castle View, Sherborne, Dorset; 7a. apertural view, x 1.5; 7b. side view, x 1.5.

Fig. 8a-b. *S. (S.) tenuicostatum* Sturani, (m.), NHM. C80339, the 'Astarte bed' (Senior, et al. 1970, p. 117, bed 7a). Upton Manor farm, near Bridport, Dorset; 8a apertural view, x 2.0; 8b side view, x 2.0.

Fig. 9. *S.(S.) tenuicostatum* (M.) NHM. C80358, 'Astarte bed', Stony Head cutting, near-Bridport, Dorset; ventral view, x 1.5, showing at the top the ribs on the adapical surface of the flare.

Fig. 10a-d. *S. (S.) tenuicostatum* (M.), NHM. C80357, 'Astarte bed', Stony Head cutting, near Bridport, Dorset; 10a. side view, x 1.5 ;10b. ventral view, x1.5; 10c. apertural view, x l.5; 10d. side view, x l.0.

Fig. 1la-b. *Chondroceras (Chondroceras) gervillei* (J. Sow.), (?m.), BMNH. C36735, holotype, Bayeux district, Normandy, France; 11a. apertural view, x 1.0; 11b. side view, x 1.0.

Fig. 12a-b. *C. (C.) gervillei*, (m.), NHM. C80380, bed 4b, Oborne Wood, near Sherborne, Dorset; 12a. side view, x 1.5; 12b. apertural view, x 1.5.

Fig. 13a-b. *C. (C.) gervillei* (?m.), NHM. C80382, a coarse ribbed variant from bed 4, Oborne Wood, near Sherborne, Dorset; l3a. side view, x 1.5; 15b. ventral view, x 1.5.


1a
1b
2a
2b
3a
3b
4
5a
5b
6a
6b
6c
7a
7b
8a
8b
9
10a
10b
10c
10d
11a
11b
12a
12b
13a
13b

EXPLANATION FOR PLATE 3

Figure 1. *Chondroceras (Chondroceras) gervillei* (?m.),CP2271, a fine ribbed, typical form, bed 4, Oborne Wood, near Sherborne, Dorset ; side view, x 1.5.

Fig.2a-b. *C. (C,) evolvescens* (Waagen), (M.), NHM. C80386, bed 4b, Oborne Wood, near Sherborne, Dorset; 2a. side view, x 1.0; 2b. apertural view, x 1.0.

Fig. 3a-b. *C. (C.) evolvescens* (m.), NHM.C80388, bed 4b,Oborne Wood, near Sherborne, Dorset; 3a. side view, x 1.5;3b. apertural view, x 1.5.

Fig,4. *C. (C.) evolvescens* (m.), NHM. C80402, bed 5, (Parsons, 1976, p. 134), Milborne Wick Lane section, Somerset; ventral view showing lappet like extensions of the mouth-border, x 1.5.

Fig.5. *C. (C.) evolvescens* (m.), CP2205, bed 5, Milborne Wick Lane section, Somerset; ventral view, showing the mouth-border, with a smooth, wide, expanded lip, x 1.5.

Fig. 6a-b. *C. (C.) evolvescens* ,(m.), NHM. C80401, bed 5, Milborne Wick Lane section, Somerset; 6a. side view, x l.5; 6b. apertural view, x 1.5.

Fig. 7a-c. *C. (C.) evolvescens*, (m.), NHM. C80387, bed 4b, Oborne Wood, near Sherborne, Dorset; 7a. side view, x1.0; 7b. side view, x 1.5; 7c. apertural view, x 1.5.

Fig. 8a-b. *C (C.) evolvescens*, (M.), NHM. C80372, bed 5b, (Parsons, 1976, p.124), Clatcombe farm section, near Sherborne, Dorset; 8a. side view, x 1.2 ; 8b. apertural view, x 1.2.

Fig.9a-b. *C. (C.) evolvescens*, (M.), NHM. C80400, bed 5,Milborne Wick lane section, Somerset; 9a. side view, x 1.0; 9b. apertural view, x 1.0.

Fig.10. *Chondroceras (Chondroceras) canovense* (de Gregorio), (m.), NHM. C80395, bed 6b, Oborne Wood, near Sherborne, Dorset; side view, x 2.5.

Fig. 11. *C. (C.) canovense*, (m.), CP 2342, bed 6d, Frogden quarry, Sherborne, Dorset; side view, x 2.0.

Fig. 12. *C. (C.) canovense*, (M.), NHM. C80394, bed 6b, Oborne Wood, near Sherborne, Dorset ; side view, x 1.5.

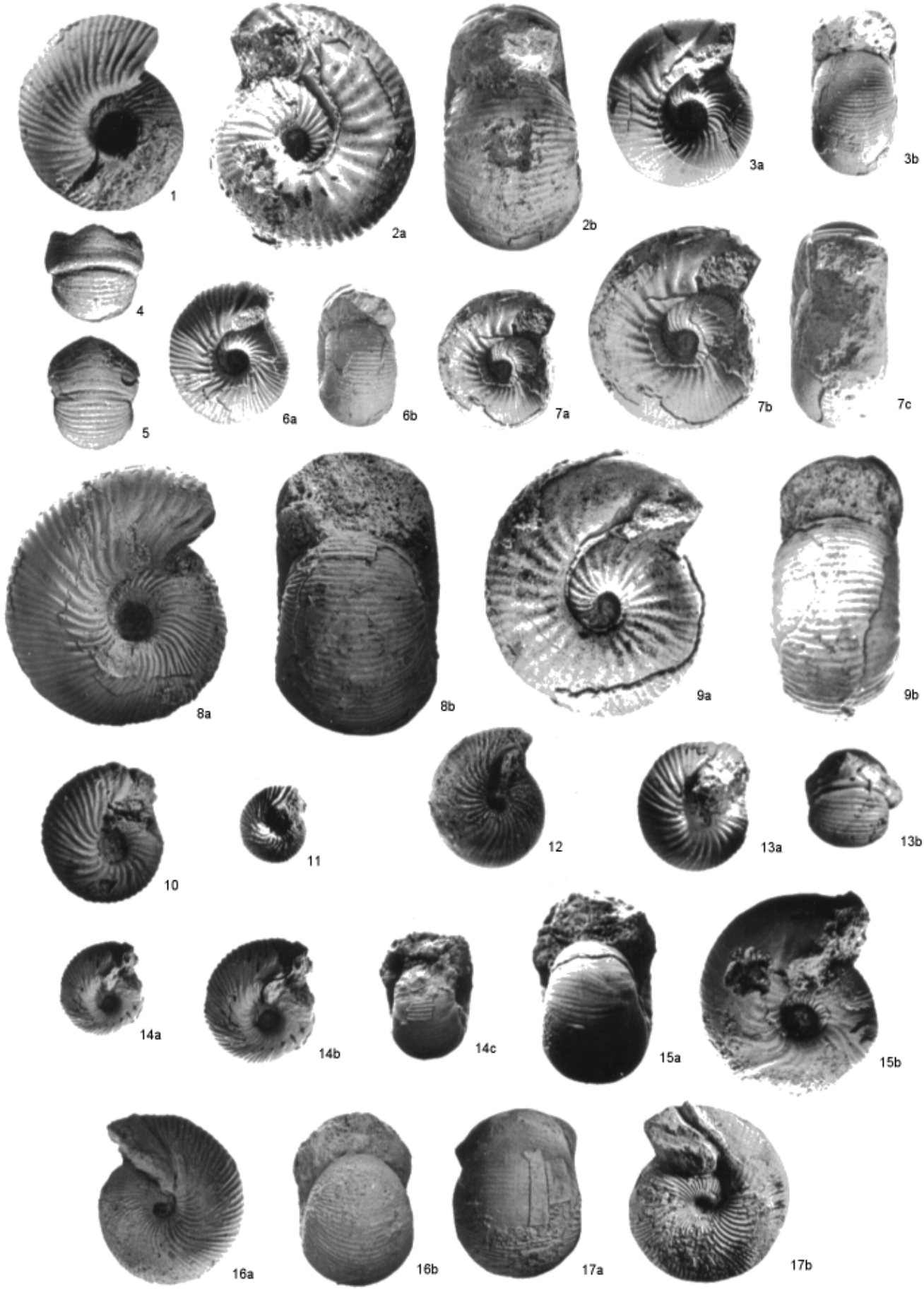
Fig.13a-b. *C. (C.) canovense*, (m.), NHM. C80396, bed 6b, Oborne Wood, near Sherborne, Dorset; 13a. side view, x 2.5; 13b. ventral view of aperture, showing lateral extensions and mid-ventral node, x 2.0.

Fig. 14a-c. *C. (C.) canovense*, (m.), NHM. C80399, bed 6d, Oborne Wood, near Sherborne, Dorset; 14a. side view, x 2.5; 14b. side view, showing the sinuous outline to the mouth-border x 4.0; 14c apertural view, x 4.0.

Fig. 15a-b. *C. (C.) canovense*, (M.) NHM. C80398, bed 6d, Oborne Wood, near Sherborne, Dorset; 15a apertural view, x 3.0; 15b. side view, x 3.0.

Fig, 16a-b. *C. (C.) canovense*, (M.), NHM. C80392, bed 6d, Oborne Wood, near Sherborne, Dorset; 16a. side view, x 2.0; 16b apertural view, x2.0.

Fig. 17a-b. *C. (C.) canovense* (M.), Yorkshire Museum, ex. Reed collection, 'Loders' , i.e. Loders Cross, near Bridport, Dorset, with a matrix of the 'Astarte-bed'; l7a. ventral View, x 1.5; 17b. side view, x l.5.


1
2a
2b
3a
3b
4
5
6a
6b
7a
7b
7c
8a
8b
9a
9b
10
11
12
13a
13b
14a
14b
14c
15a
15b
16a
16b
17a
17b

EXPLANATION FOR PLATE 4

Figure 1a-c. *Chondroceras (Chondroceras) grandiforme* S.Buckman, (M.), BGS.25286, Milborne Wick, Somerset; 1a apertural view, x 1.0; 1b. side view, x 1.0; 1c. ventral view, x 1.0.

Fig.2a-b. *C. (C.) grandiforme*, (M.), MM. LL11160, the 'Sherborne district', Dorset, cited by J.Buckman (1881), not coated; 2a. apertural view, x 1.0; 2b. side view, x1.0.

Fig. 3a-b. *C. (C.) grandiforme*, (M.), NHM. C80345, bed 4b. Oborne Wood, near Sherborne, Dorset; 3a. side view, x 1.0; 3b apertural view, x l.0.

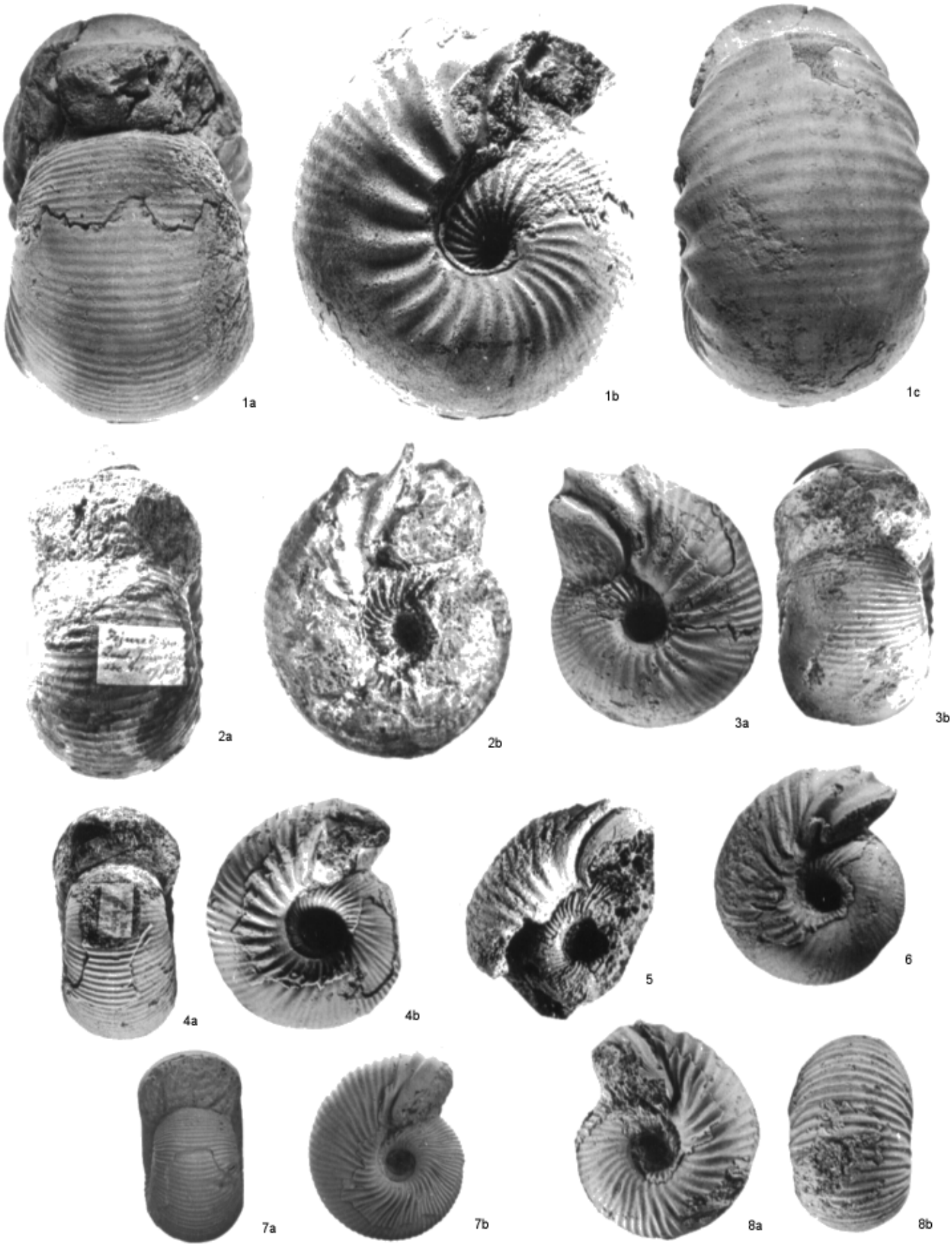
Fig. 4a-b. *C. (C.) polypleurum polypleurum* (Westermann), (M.), SM. J24525, 'Oborne', near Sherborne, Dorset; 4a. apertural view, x 1.0; 4b. side view, x 1.0.

Fig. 5. *C. (C .) polypleurum polypleurum*, (M.), NHM. C80353, the 'Red Congloinerate', Bomford's exposure, Loder's Cross, near Bridport, Dorset; side view, x 1.0.

Fig, 6. *C. (C.) grandiforme* (?M. or ?m.), NHM. C80343 , bed 4a, Oborne Wood, near Sherborne, Dorset; side view, x 1.0.

Fig. 7a-b. *C. (C.) polypleurum polypleurum,* (m.), NHM.C80348, bed 4c, Oborne Wood, near Sherborne, Dorset; 7a. apertural view, x 1.5; 7b. side view, x 1.5. .

Fig. 8a-b. *C. (C.) polypleurum crassicostatum* (Westermann), (m.) NHM. C80390, bed 4b,Oborne Wood, near Sherborne, Dorset; 8a, side view, x 1.5; 8b. ventral view, x 1.5.


1a
1b
1c
2a
2b
3a
3b
4a
4b
5
6
7a
7b
8a
8b

EXPLANATION FOR PLATE 5

Figure 1a-b. *Chondroceras (Chondroceras polypleurum crassicostatum* (Westermann), (m.), MM. LL42521 , Milborne Wick, Somerset, 1a. side view, x 1.5; 1b. apertural view, x 1.5.

Fig. 2. *C. (C.) polypleurum crassicostatum*, (m.) NHM. C80378, the 'Irony bed', Louse Hill quarry, near Sherborne, Dorset, not coated; Side view, x 1.0.

Fig. 3a-b. *C. (C.) sp, nov. A. aff . C. (C.) tenue* (Westermann), (?M.), NHM. C80351, bed 5b, Frogden quarry, near Sherborne, Dorset; 3a. side view, x 2.0; 3b. apertural view, x 2.0.

Fig. 4a-c. *C. (C.) obornensis sp.nov*., (M.), NHM. C80313, *holotype,* bed 3, Oborne Wood, near Sherborne, Dorset; 4a. apertural view, x 1.0; 4b. side view, x 1.0; 4c. ventral view, x 1.0.

Fig. 5. *C. (C.) obornensis sp. nov.,* (M.), NHM. C80314, 1st. *paratype*, bed 3,Oborne Wood, near Sherborne, Dorset ; side view, x l.4.

Fig.6. *C. (C.) obornensis sp. nov*., (M.), BUGM. 3325, Dundry Hill, near Bristol, Avon ; side view, x 1.0.

Fig.7a-b. *C. (C.) obornensis sp . nov.* (M.), SM. J24526 4th *paratype*, the 'Sherborne district', Dorset; 7a. side view, x 1.0 ; 7b. side view (opposite to 7a), showing the base of the mouth-border , x 1.0.

Fig. 8a-b. *C. (C.) obornensis sp. nov.,* (M.), NHM. C80315. 3rd *paratype*, bed 3, Oborne Wood, near Sherborne, Dorset; 8a. ventral view, x 1.0; 8b. side view, showing faint, relict tubercles, x 1.0.

Fig,9. *Frogdenites sp.* (m.), NHM. C75252, 'green grained marl' matrix, 'Sherborne district' , Dorset; side view, x 1.0.

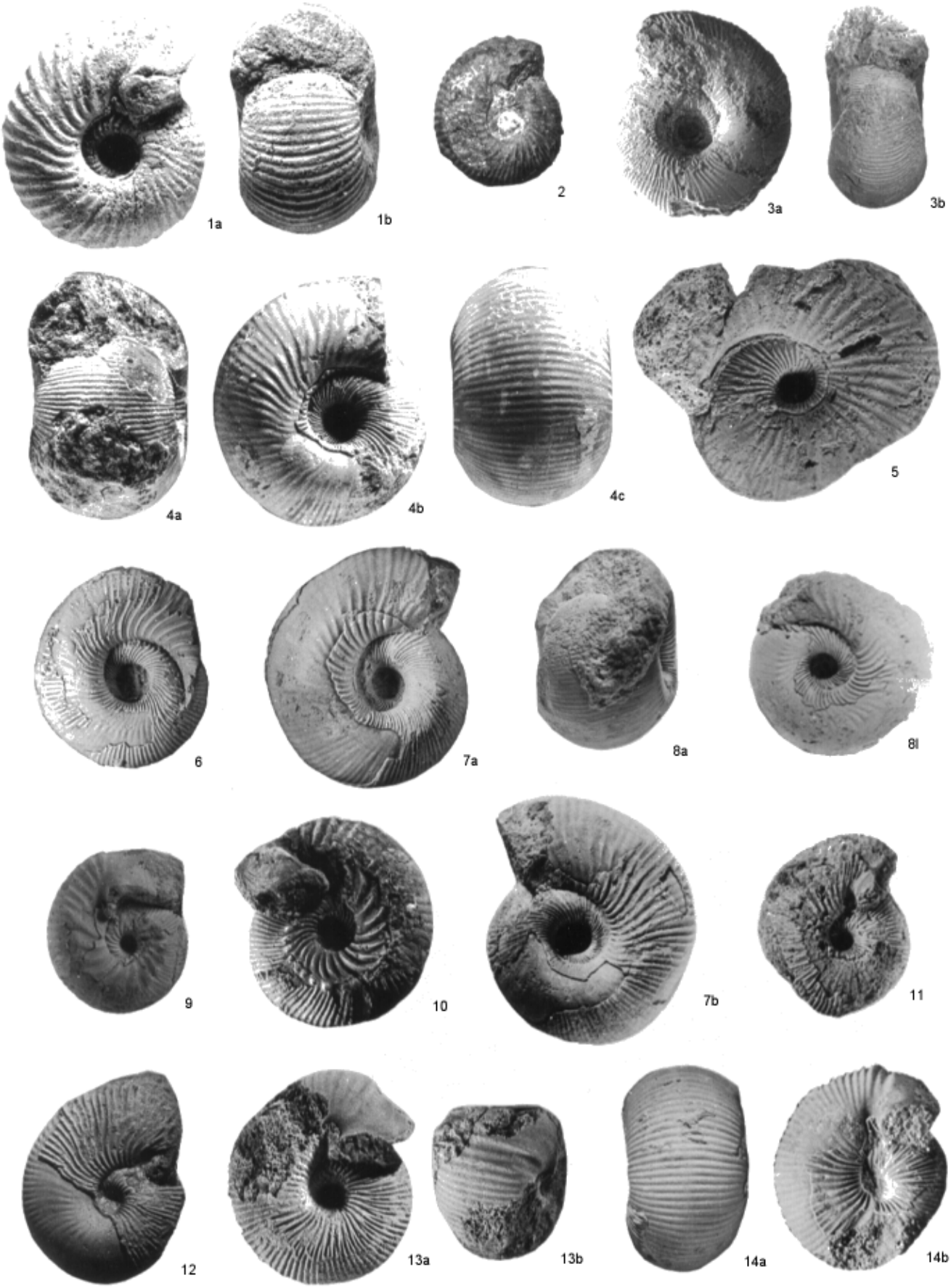
Fig.10. *Frogdenites spiniger* S. Buckman , (m.); NHM. C80391, derived from bed 3, at base of bed 4a, Oborne Wood, near Sherborne, Dorset; side view, x 1.5.

Fig. 11. *C. (C.) obornensis sp.nov*., (m.), BMNH. C803l6, bed 3, Oborne Wood, near Sherborne, Dorset; side view, x 1.5.

Fig. 12. *Labyrinthoceras mensicum* (Waagen),(m.), BUGM, 3324/2, South Main-road quarry, Dundry Hill, near Bristol, Avon; side view, x 1.5.

Fig. 13a-b. *L. meniscum* (m.), NHM. C78584 (ex.S.S.B. col.), Dundry Hill, near Bristol, Avon ; 13a. side view, x 1.5; 13b. oblique view of lappet , x 1.5.

Fig. 14a-b. *L. meniscum* (m.), BUGM. 3324/1, Rackledown quarry, Dundry Hill, near Bristol, Avon; 14a. ventral view, x 1.5; 14b. side view, x 1.5.


1a
1b
2
3a
3b
4a
4b
4c
5
6
7a
8a
8l
9
10
7b
11
12
13a
13b
14a
14b

EXPLANATION FOR PLATE 6

Figure 1a-b. *Labyrintboceras meniscum* (Waagen) , (M.), NHM. 37268*, topotype* (ex. Tesson col), St. Vigor, near Bayeux, Normandy, France; 1a. side view, x 1.0; 1b. apertural view, x 1.0.

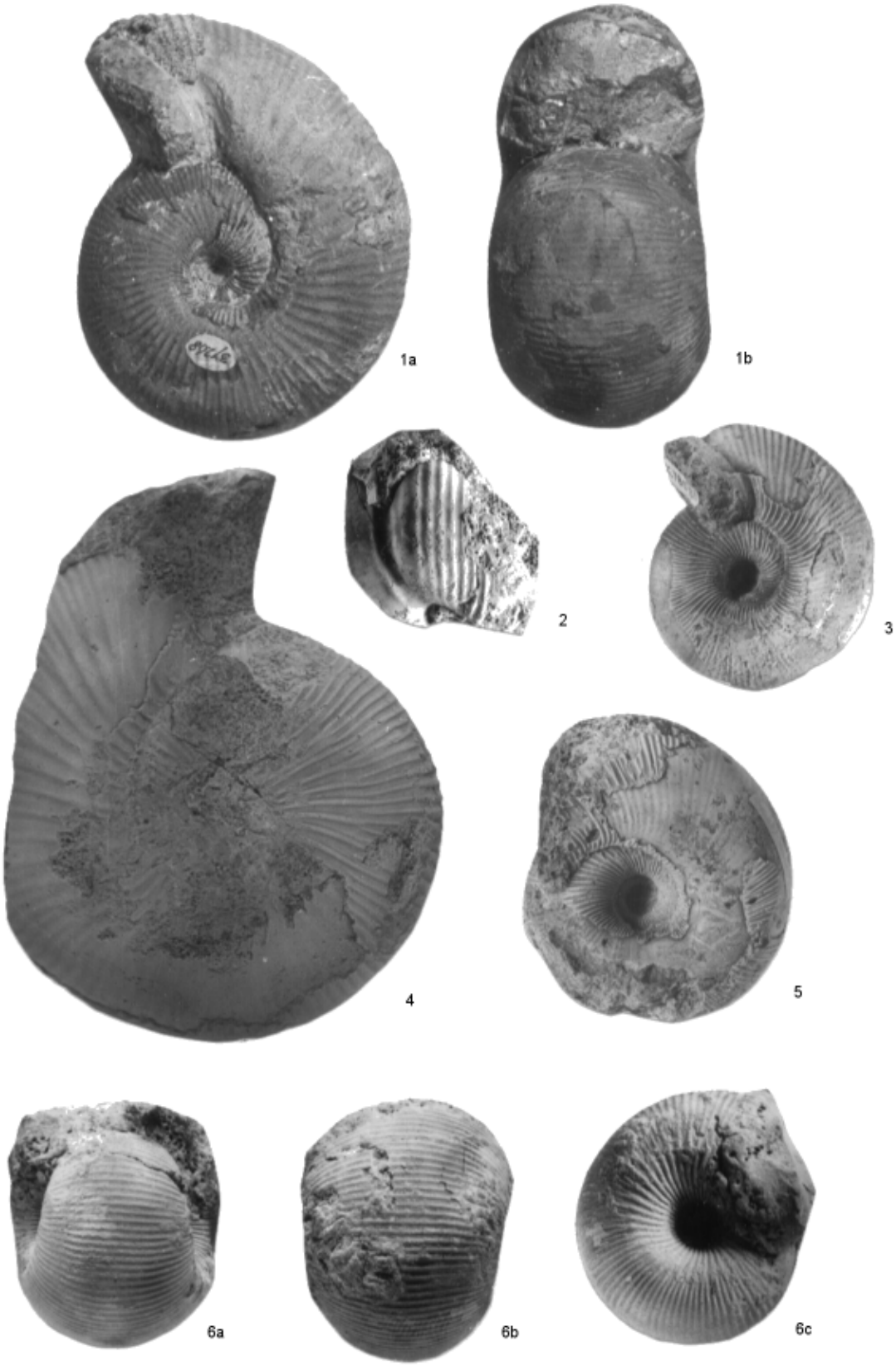
Fig. 2. *L. meniscum*, (M.), NHM. C80336, 0.20m. from the top of the, 'fossil-bed', Sandford Lane quarry, near Sherborne, Dorset; view of mouth-border, x 1.0.

Fig. 3. *L. meniscum*, (M.), NHM. C78581, (ex. S. S. B), 'Sherborne district' (matrix of Sandford Lane 'fossil-bed'), Dorset; side view, x 1.0.

Fig, 4. *L. meniscum*, (M.), BUGM. 3289, South Main-road quarry, Dundry Hill, near Bristol, Avon; side view, x 1.0.

Fig. 5. *L. meniscum*, (M.), NHM. C78580, (ex. S.S.B.), Sandford Lane, near Sherborne, Dorset; side view , x 1.0.

Fig. 6a-c. *L. meniscum*, (?M.), NHM. C.80335, top 0.20m. of the 'fossil-bed' , Sandford Lane quarry, near Sherborne, Dorset, septate inner whorls; 6a. apertural view, x 1.5; 6b. ventral view, x 1.5; 6c. side view, x 1.5.


1a
1b
2
3
4
5
6a
6b
6c

VII. REFERENCES

ARKELL, W.J. 1951-9. A Monograph of English Bathonian Ammonites.
Palaeontogr. Soc. 264pp., 33 pls.

,& KUMMEL, B. & WRIGHT, C.W., 1957, 'Mesozoic Ammonoidea" in:
MOORE, R.C. (Editor), Treatise on Invertebrate Palaeontology. Part L,
Mollusca (4). Univ. Kansas Press; 492 pp., 558 figs.

BAYLE, E. 1878, Explication de la carte géolgique de la France.
iv. Atlas pls. i-clviii.

BIGOT, A., 1900, Normandie. Livret Guide des excursions du VIII Congès Géologique International, Paris,33 ppp. 13 figs.

BUCKMAN, J, 1881, On the Terminations of some Amonites from the Inferio Oolite of Dorset and Somerset.
Q. Jl. geol. Soc. Lond. 37, 5-66.

BUCKMAN, S.S. 1881. A descriptive catalogue of some species of ammnonites from the Inferior Oolite of Dorset.*Q. Jl. geol. Soc. Lond. 37, 588-608.*

,1882. Some new species of anmonites from the Inferior Oolite. Proc.
Dorset Nat. Hist. Arch. Soc. 4, 137—146, pls.1-4.

,1887-1907. A Monograph of the Ammonites from the Inferior Oolite Series.
Palaeontogr. Soc. cclxii + 456 pp., 127 pls

,1893. The Bajocian of the Sherborne district; its relation to subjacent and superjacent strata.
Jl. geol. Soc. Lond. 49, 479-522.

,1909-30. Yorkshire Type Ammonites, continued as Type Ammonites,
London and Thame, Vols. 1—7, 790 pls.

,& WILSON, E., 1896, Dundry Hill: its upper portion, or beds marked as Inferior Oolite in the maps of the Geological Survey.
Q. Jl. geol. Soc. Lond. 52, 669-72.

CALLOMON, J. H., 1963, Sexual dimorphism in Jurassic ammonites.
Trans. Leicester Lit. Phil. Soc., 57: 21-56.

CHRIST, H. A., 1961, Beitrage zur Stratigraphie und Palaontologie des Malm von Westsizilien *Mem. Swiss. Pal., 77: 141 pp, 9 pls.*

CRICKMAY, G.H., 1933, Mount Jura investigation,
Bul. geol. Soc, Amer., 44: 895-926, pls. 23-34.

DOUVILLÉ, H., 1885, Sur quelques fossiles de la zone a Ammonites sowerbyi des environs de Toulon. *Bul. Soc. geol. Fr. (3): 12-44, 3 pls.*

GEINITZ, E. B., 1850, Charakteristik der Schichten und Petrefacten des sachsischbohmischen Kreidebirges.
Leipzig (Arnold), xxii, 1-116 & xxii, 1-19 pp. 31 pls.

GLANGEAUD, P.L., 1897, Sur la forme de l'ouverture de quelques ammonites.
Bul. Soc. geol. Fr., (3), 25: 99-106, 1 pl.

GREGORIO, A., de, 1886, Iconografia della fauna dell'orizonte Alpiniano.
Palermo (Pedone Lauriel ed.).

HAHN, W., 1971, Die Tulitidae S. BUCKMAN, Sphaeroceratidae S. BUCKMAN, Clydoniceratidae S. BUCKMAN (Ammonoidea) des Bathoniums; (Brauner Jura å) im südwestdeutschen Jura. *Jb. geol. Landesamt Baden-Württemberg, 13: 55-122, 9 pls.*

HALLAM, A., 1975, Evolutionary size increase and longevity in Jurassic bivalves and ammonites. Nature, 258, (5535): 493-496.

HAUG, E. 1891, Les Chaines Subalpines entre Gap et Digne
Bul. Serv. Carte. geol. Fr.(III) 21: 199 pp.

HYATT, A., 1877, Genetic relations of Stephanoceras.
Proc, Boston Soc. N.H, 18, 360-400.

IMLAY R.W., 1961, New genera and subgenera of Jurassic (Bajocian) ammonites from *Alaska. Jour. Palaeont. 35: 467-74, 2 pls.*

,1962, Late Bajocian Ammonites from the Cook Islet Region, Alaska,
U.S. Geol. Surv. Prof, Paper, 418-A, 14 pp. 5 pls.

JACKSON, J.W., 1952, Catalogue of Types and Figured Specimens in the Geological department of the Manchester Museum.
Manchester Museum Publication No. 6, 170 pp.

KUMM, A. 1952. Das Mesozoikum in Niedersachsen : Der Dogger.
Geol. u. Lagerstätten Niedersachsens. 2 (2), 329-509.

MAKOWSKI, H., 1963, Problems of sexual dimorphism in ammonites,
Pal. Polon., 12: 92 pp., 20 pls.

MASCKE, E. 1907. Die Stephanoceras-Verwandten in den Coronatenschichten von Norddeutschland. *Inaug. Dissert. Univ. Göttingen. 38pp.*

MAUBEUGE P.L., 1951, Les Ammonites du Bajocien de la region frontiere Franco-Belge,
Mem. Inst. Roy. Sci. Nat. Belg., (2), 42: 104 pp., 16 pls,

,1961, Catalogue des ammonites du Jurassique inferieur et moyen (Hettangien a Bathonien) du Musee cantonal de Bale-Campagne.
Tatigkeitsber, Naturforsch. Ger. Baselland (1958-1960), 22: 25-164.

McCLEARN, F. H., 1927, Some Canadian Jurassic faunas.
Trans. Roy. Soc. Canada, (3), 21:61-73, 1 pl.

MORTON, N. 1971. Some Bajocian ammonites from western Scotland.
Palaeontology. 14, 266—293, pls. 40-51.

NEUMAYR, M., 1875,Die Ammoniten der Kreide und Systematik der Amonitiden.
Zeit. Deutsch. Geol. Ges., 27: 854-892.

OPPEL, A. 1856-8. Die Juraformation Englands, Frankreiche and des südwestlichen Deutschlands.
Jb. Ver. vaterländ. Naturkde. Wurtt. 12-14, 1-837.

ORBIGNY, A. de., 1842-51, Paléontologie Française, Terrain Jurassique. *i Céphalopodes, 642 pp. 234 pls.*

PALFRAMAN, D.F.B., 1966,Variation and Ontogeny of some Oxfordian ammonites: *Tarmelliceras richei* (de Loriol) and *Creniceras renggeri* (Oppel), from Woodham, Buckinghamshire.
Palaeontology, 9: 290-311, pls. 48-52

PARONA, C.F., 1894, La fauna fossille (Calloviana) di Acque Fredde sulla sponda veronese del Lago di Garda.
Mem. Acc. Linncei. (4), 7: 365-96, 1 pl.

,1896 Nuove osservazioni sopra la fauna a l'eta degli strati con Posidonomya alpina nei Sette Communi. *Pal. Ital. 1:1-41, 2 pls.*

PARSONS, C.F. 1974. The sauzei and so called' sowerbyi Zones of the Lower Bajocian.
Newsl. Stratigr. 3, 153-180.

,1975a. The Stratigraphy of the Stony Head Cutting.
Proc. Dorset Nat. Hist. Arch. Soc. 96, 8-13.

,1976a. A stratigraphic revision of the humphriesianum/ subfurcatun) Zone rocks (Bajocian Stage, Middle Jurassic) of Southern England.
Newsl. Stratigr. 5, 114-142.

,1976b. Ammonite evidence for dating some Inferior Oolite sections in the north Cotswolds.
Proc. Geol. Ass. 87, 45—63, pls.1-2.

PAVIA, G. and STURANI, C. 1968. Étude biostratigraphique du Bajocien des Chaines Subalpines aux environs de Digne (Basse-Alpes).
Boll. Soc. Geol. Ital. 87, 305-316.

QUENSTEDT, F.A. 1845-9, Petrefactenkunde Deutschlands, die Cephalopoden.
Stuttgart, 300pp. 36 pls.

,1886, in 1886-7. Die Ammoniten des Schwäbischen Jura. 2. Der Braune Jura.
Schweizerbart, *Stuttgart, pp. 441-815, pls. 55-90.*

RICHARDSON, L.R. 1932. The Inferior Oolite and contiguous deposits of the Sherborne district, Dorset.
Proc. Cottes. Nat. F.C. 24, 35-85, pls. 6-11.

RIOULT, M., 1964, Le Stratotype du Bajocien. Coll. Jurassique Luxembourg, 1962.
Publ. Inst. Grand-Ducal Luxembourg, Sect. Sci. Nat. Phys. Math., pp. 239-258.

ROCHÉ, P., 1939, Aalénien et Bajoccien du Maconnais et de quelques régions voisines.
Trav. Lab. Geol. Fac. Sci. Lyon, Fasc.35. mem. 29: 355 pp. 113 pls.

,1943, Sur les couches dites à Ammonites Blageni du Monnt d'Or, Lyonnaise.
Idem. Mem. 30: 35 pp., 2 pls.

ROEMER, J., 1911, Die Fauuna der Aspidoides-Schichten von Lechstedt bei Hildesheim. Göttingen, 64 pp., 12 pls.

ROMAN, F., 1935, La Faune des Minerais de Fer des environs de Privas. *Trav. Lab. Geol. Fac. Sci. Lyon, Fasc.27. mem. 23: 52 pp. 8 pls.*

, 1938, Les ammonites jurassiques et crétacées. *Paris, 554 pp. , 53 pls.*

SENIOR, J.R, 1968, Ammonite finds of Stratigraphical importance in the Inferior Oolite of *Dorset. Proc. Dorset Nat. Hist. Arch. Soc. 89:45.*

SENIOR, J.R, PARSONS, C.F. and TORRENS, H.S. 1970. New *sections in* the Inferior Oolite of south Dorset. Proc. Dorset Nat. Hist. Arch. Soc. 91, 114—119.

SOWERBY, J & J. de J. 1812-46, The Mineral Conchology of Great Britain. *London, 1287 pp., 648 pls.*

STURANI, C. 1964. Ammoniti Mediogiurassiche del Veneto *:* Faune del Bajociana terminale (zone a Garantiana e a Parkinsoni). *Mem. Ist. Geol. Mineral. Univ. Padova. 24, 43pp. 4pls.*

,1968. Segnapazione di faune calloviane nel "rosso ammonitico" dei Lessini Veronesi. *Boll. Soc. Geol. Ital. 87, 43-9.*

,1971. Ammonites and stratigraphy of the "Posidonia alpina" Beds of the Venetian Alps. *Mem.Ist. Geol.Mineral.Univ. Padova. 28,1-190, pls.1-16.*

TORRENS, H.S. 1967, The Great Oolite Limestone of the Midlands. *Trans. Leicester Lit. Phil. Soc., 61: 65-90.*

WAAGEN, W., 1867, Über die Zone des Ammonites sowerbyi. *Geogn.-Palaont., 1:511-607, pls. 24-9.*

WENDT, J.,1965 Synsedimentare Bruchtektonik im Jura Westsiziliens. *N. Jb. Geol. Pal. Mh, 5:286-311.*

WESTERMANN, G.E.G., 1956, Monographie der Bajocien-Gattungen Sphaeroceras und Chondroceras (Ammonoidea). *Beih. Geol. Jb., 24:125 pp., 14 pls.*

,1956a, Phylogenie der Stephanoceratacea und Perisphinctacea des Dogger. *N. Jb. Geol. Palaont. Abh.,103: 233-79.*

,1964, Sexual-Dimorphismus bei Ammonoideen und seine Bedeutung für die Taxionomie der Otoitidae. *Palaeontographica (A), 124:33-73, pls. 6-9.*

,1964a, The terminology of the ammonoid septal suture. *Jour. Palaont., 38: 993-8.*

,1967, The umbilical lobes of Stephanoceratean ammonites. *Idem., 4: 259-261.*

& T.A. GETTY, 1970, New Middle Jurassic Amraonitina from New Guinea. *Bul. Amer. Paleont., 57,(256): 231-321, pls. 40-62.*

WETZEL, W., 1937, Studien zur Palaontologie des nordwesteuropaishen Bathonien.
Palaontographica (A),87: 77-157, pls.10-15.

WHICHER, J. 1969. New sections in the Inferior Golite, near Halfway House, Sherborne, *Dorset. Proc. Geol. ASS. 80, 324-330.*

& C. PALMER, Preliminary description of a temporary exposure in the Middle Inferior Oolite, near Sherborne, Dorset.
Proc. Dorset Nat. Hist. Arch. Soc., 92: 110-9

WRIGHT, T. 1860, On the subdivisions of the Inferior Oolite in the South of England, compared with the Equivalent beds of that Formation in Yorkshire. *Quart. J. geol. Soc. Lond., 16:1-48.*

© Dr. Colin F. Parsons,

26 Hengrave Road,
Forest Hill,
London, UK.
SE23 3NW

colinfparsons@bethere.co.uk