AN UNUSUAL AGGLUTINATING FORAMINIFER FROM THE UPPER CRETACEOUS OF ENGLAND

by C. G. ADAMS, R. H. KNIGHT, *and* R. L. HODGKINSON

ABSTRACT. *Labyrinthidoma dumptonensis* gen. et sp. nov., belonging to the Superfamily Lituolacea, is described from the Chalk of southern England. It has a distinctive mode of growth, chambers with labyrinthic interiors, and cannot be fitted into any of the existing families of the Lituolacea as presently defined.

THE species described in this paper was first found by one of us (R. H. K.) in the Chalk of Dumpton Bay, Broadstairs, Kent. An intensive search subsequently led to the discovery of numerous additional specimens within the *Micraster coranguinum* Zone in the coastal sections between the Western Undercliff, Ramsgate, and Kingsgate Bay, Broadstairs (text-fig. 1). For details of the local stratigraphy see Peake (1967*a*, *b*).

The morphological characters of this species do not conform with those of any previously described genus, and the generic characters are such that the species cannot be fitted readily into the subfamilies of the Lituolidae as presently defined. However, since this merely reflects the imperfection of the existing classification, which is based on genera and species described mainly on their external form, a new family or subfamily is not erected here.

It may, perhaps, be thought curious that this relatively large foraminifer should have passed unnoticed in Europe where so much attention has been paid to faunas of Senonian age. However, it has been found in old, undescribed collections in the British Museum (Natural History) under the name *Lituola nautiloidea* (Lamarck), a species to which it bears a superficial resemblance, and we have no doubt that it will also be found in similar collections elsewhere.

All type, described and figured specimens (except Pl. 78, fig. 8) are deposited in the collections of the British Museum (Natural History).

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Superfamily LITUOLACEA de Blainville 1825
Genus LABYRINTHIDOMA nov.

Type species. Labyrinthidoma dumptonensis nov.

Derivation of name. From the Greek, meaning a labyrinthic house.

Diagnosis. Test free, agglutinating. Initially coiled streptospirally in the megalospheric form, later becoming uncoiled. Microspheric form similar, but with a trochospiral

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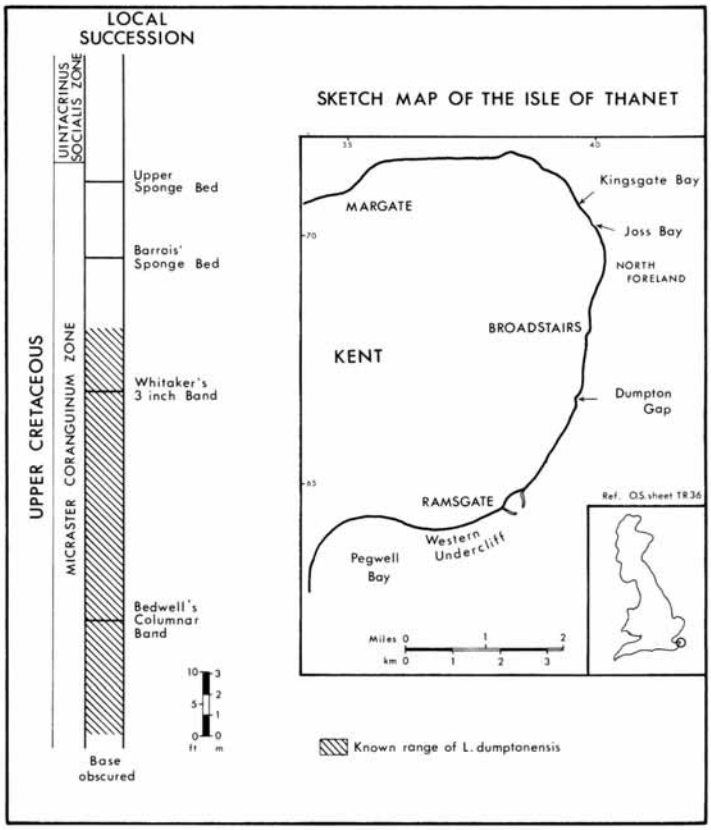


TEXT-FIG. 1. Stratigraphy and locality-map, Isle of Thanet.

and/or biserial stage prior to becoming streptospiral. Most chambers labyrinthic; wall canaliculate but non-labyrinthic, not composed of a distinct epidermis and hypodermis. Aperture cribrate.

Remarks. The labyrinthic interior, 'non-labyrinthic walls' (see below), streptospiral coil, and non-adherent habit distinguish this genus from all other described lituolaceans.

Labyrinthidoma dumptonensis sp. nov.

Plate 78, figs. 1–12; text-figs. 2 and 3

Material. More than 300 specimens, of which three are known to be microspheric.

Diagnosis. As for the genus.

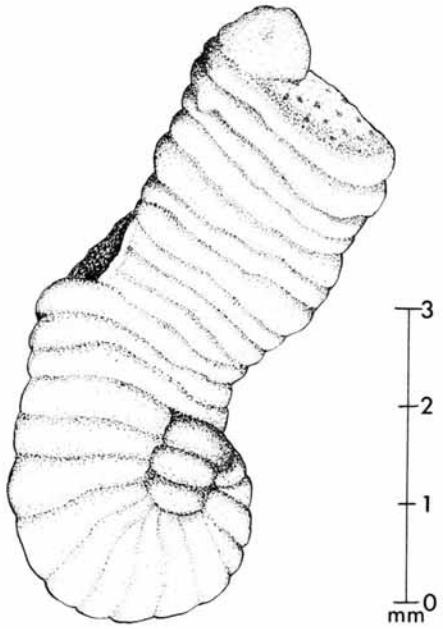
Holotype. P. 48623 (Pl. 78, fig. 3); a megalospheric form.

Horizon. Senonian (Upper Coniacian or Lower Santonian: see Barr 1966). Upper *Micraster coranguinum* Zone, Bedwell's Columnar Band (see Peake 1967*a*).

Locality. North of Dumpton Gap, Dumpton Bay, Isle of Thanet, Kent (exact position unknown).

Description.

Megalospheric form. Test finely agglutinating, with a prominent involute streptospiral initial coil comprising numerous chambers, and a rectilinear portion with up to fifteen chambers; all chambers much wider than high, chambers of uncoiled portion usually subcircular in cross-section. Sutures slightly depressed. Chamber walls thick, composed of agglutinated chalk grains, shell debris and other microfossils,

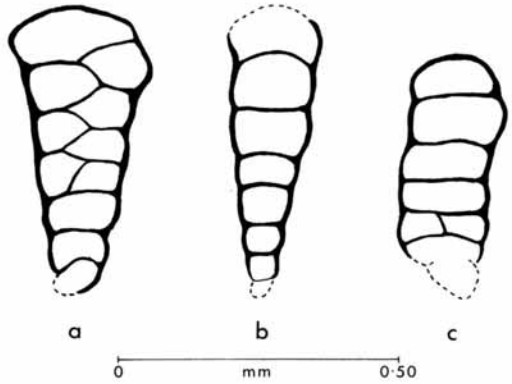


TEXT-FIG. 2. Typical external appearance of *Labyrinthidoma dumptonensis* gen. et sp. nov.

and characterized by the presence of numerous randomly arranged cytoplasmic canals. These do not open to the exterior except in slightly abraded specimens. Proloculus followed by up to eight simple chambers; all later chambers have labyrinthic interiors. In the rectilinear part of the test, short, stout, irregular vertical partitions project inwards from the wall. The lumen of each chamber is partly occluded with pillars and sinuous partitions of irregular width (Pl. 78, fig. 8). Both pillars and partitions are often perforated by coarse pores. Coil streptospiral, very difficult to see clearly owing to the labyrinthic nature of the chambers. Aperture cribrate with numerous circular or elongate pores, usually on a slightly convex apertural face.

Dimensions of holotype.

Length 4·0 mm.
Width of rectilinear portion 2·2 × 2·8 mm.
Width of coiled portion 2·7 × 2·0 mm.
Height of chambers in rectilinear portion up to 0·50 mm.



TEXT-FIG. 3. Semi-diagrammatic representations of the initial stages of three microspheric individuals. (*a*) Specimen with a clear trochospiral or biserial stage; (*b* and *c*) Two dissected specimens showing some of the early chambers. The uniserial appearance is believed to be an accident of dissection.

Microspheric form. Externally similar to the megalospheric form. Proloculus followed by a high trochospiral coil or biserial stage (up to 0·53 mm in length) comprising at least 11 chambers. This is followed by a streptospiral coil in which the chambers quickly become labyrinthic. The last few chambers are rectilinear as in the megalospheric generation.

The earliest stage of growth is difficult to describe accurately from the three specimens presently available. The best individual (Pl. 78, figs. 4 and 5; text-fig. 3*a*) starts with a high trochospiral or biserial stage while the other two appear to be uniserial—a condition probably resulting from damage during dissection.

Variation.

Proloculus. Sectioned and dissected specimens show that the megalospheric form has a large subglobular proloculus. Although accurate measurements have not been possible, the internal diameter appears to be over 0·4 mm in the five specimens in which it is visible.

EXPLANATION OF PLATE 78

Figs. 1–12. *Labyrinthidoma dumptonensis* sp. nov. 1, Dissection of megalospheric form showing streptospiral coil and several uncoiled chambers, ×12. P.48627. Bedwell's Columnar Band, Western Undercliff Promenade, Ramsgate, Kent. 2, External view of large specimen, ×10. P.48628. South of Joss Bay, Broadstairs, Kent. See also fig. 12. 3, Holotype, ×10. P.48623. The partially dissected initial coil shows a cavity which may mark the position of the proloculus. Cf. fig. 1. North of Dumpton Gap, Kent. 4, Thin section of microspheric form showing three phases of growth beginning with a high trochoid spire orbiserial stage, ×11·5. P.48638. South of Dumpton Gap, Kent. 5, Enlargement of initial stage of fig. 4, ×33. 6, Branched specimen with partly abraded surface, ×9·5. P.48630. In flint pebble from beach at Pegwell Bay, Kent. 7, Thin section through uncoiled chambers showing internal partitions and wall structure, ×12. P.48639. 8, Transverse cut through an uncoiled chamber showing vertical internal pillars and short radial plates, ×10. Specimen destroyed during serial sectioning. 9, Internal cast of the uncoiled portion of a test after removal of the wall with dilute acid, ×10·5. P. 48625. 10, Typical apertural view, ×12. P.48626. 11, Part of a septal face showing canals and spongy texture, ×130. P.48947. 12, Apertural face of specimen shown in fig. 2, ×10. P.48628. Note incipient branching. All *in situ* specimens from the Upper Chalk, *Micraster coranguinum* Zone, Kent.

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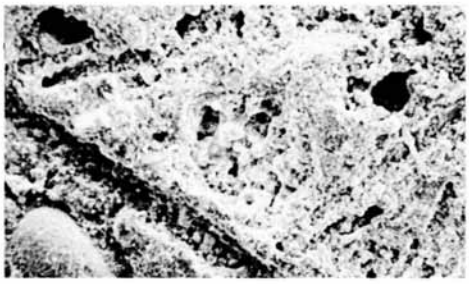

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ADAMS, KNIGHT, and HODGKINSON, *Labyrinthidoma*

Spire. The initial coil is always tight in the megalospheric form and usually comprises 2–3 streptospiral whorls. However, the plane of coiling appeared to change abruptly by 90° in one specimen, while in another a reversal of coiling was observed. The high trochospiral or biserial stage of the microspheric form has been seen in three individuals and is not the result of fortuitous sections through specimens which happen to have incorporated the shell of another species in the wall. Bartenstein (1952) illustrated a specimen of *Lituola irregularis irregularis* (Roemer) from the Campanian of Hannover which seemed to have grown round a *Heterohelix globulosa* seen in the centre of the spire. He noted that this was quite a common phenomenon, but did not indicate whether the individuals concerned were microspheric or megalospheric. Kaever (1971) described specimens which undoubtedly include a biserial stage in microspheric forms from the Santonian of Dortmund-Eving. The present specimens resemble those described by Kaever in their mode of growth, but not in their internal structure.

Uncoiled portion. This varies considerably in length and may comprise up to eighteen chambers. Some broken specimens, believed to belong to this species but lacking an initial coil, possess up to 26 rectilinear chambers. A few of the larger specimens either branch or show a tendency to branch (Pl. 78, figs. 6 and 12). Branched individuals have the same wall structure and labyrinthic interior as unbranched specimens.

Apertures. Up to 31 (normally 16–18) circular, subcircular or elongate pores have been observed in some of the larger specimens. They are usually irregularly disposed over the apertural face (Pl. 78, fig. 10) which is often slightly convex.

Wall. Finely granular, incorporating shell fragments, spicules, small foraminifera (miliolids, bolivinids, and globigerinids), and chalk grains. Abraded or broken surfaces reveal large numbers of fine cytoplasmic canals from 10–40 μm in diameter. They are randomly oriented and are particularly well seen on broken septal faces. The wall is non-labyrinthic in the sense of Loeblich and Tappan (1964, C61), since it does not contain interlaced dendritic channels perpendicular to the surface. It is, nevertheless, spongy, albeit on a finer scale than in species with typical labyrinthic walls.

Labyrinthic interior. The chamber roofs are supported peripherally by short, stout, radial plates, and centrally by vertical, thick, smoothly finished, sinuous, irregular partitions and pillars. These partially occlude the lumen of each chamber, but leave intercommunicating spaces of irregular size and shape into which the apertures open.

Size. Length 1·9–10·0 mm (mean 4·7 mm).
Length (uncoiled portion) up to 7·2 mm (mean 2·5 mm).
Width (coil) 1·5–4·6 mm (mean 2·8 mm).
Width (uncoiled portion) up to 3·6 mm.
Number of chambers visible in coil 8–22 (mean 15).
Number of chambers visible in uncoiled portion up to 18 (mean 7).
Measurements made on forty well-preserved specimens. Broken individuals suggest that some may have been larger than these measurements indicate.

Affinities.

Labyrinthidoma clearly belongs to the Superfamily Lituolacea, but does not fit readily into any of the families or subfamilies as presently defined.

Pokorny (1958) appears to be the only person to have figured specimens which may be conspecific with those described here. He referred his material to *Coscinophragma cribrosa* (Reuss). However, although there is some doubt about the accuracy of Reuss's original description, *Coscinophragma* is believed to be an adherent genus lacking an initial coil and possessing labyrinthic walls (Loeblich and Tappan 1964). It gives its name to the subfamily Coscinophragmatinae (family Lituolidae). The types of *C. cribrosa* are from the Upper Cretaceous of Czechoslovakia.

Secondary transverse septa occur in some members of the family Lituolidae, e.g. *Labyrinthina* Weynschenk, while at least one genus, *Navarella* Ciry and Rat, has a

fully streptospiral initial coil. On the other hand, no known member of this family has a biserial or trochospiral initial stage.

The family Ataxophragmiidae includes *Coprolithina* Marie, a genus with radial partitions and a trochospiral coil but lacking internal pillars. Only in the Pavonitinidae is the complexity of the internal structure similar to that of *Labyrinthidoma*, but the mode of growth of the present specimens, particularly in the initial and adult stages, is rather different from anything known in this family.

The fact that the microspheric form of *Labyrinthidoma* combines characters best seen in three different families of the Lituolacea reflects our ignorance of the mode of growth of this generation throughout the superfamily and indicates that the classification is defective. For this reason no attempt is made to assign *Labyrinthidoma* to a family.

The existence of a biserial stage in *Lituola irregularis* prompted Kaever (1971) to speculate that it might represent a planktonic phase in the life cycle. While this is possible, it is more likely to indicate that the ancestral form is to be found amongst the numerous small biserial and triserial agglutinating benthic species known from the Mesozoic.

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