

## New adherent foraminiferans from the Lower Cretaceous (Aptian) of south-central England

MARK A. WILSON

Department of Geology, The College of Wooster, Wooster, Ohio 44691 USA

**ABSTRACT** — Three new species and one new genus of adherent foraminiferans have been found within bivalve borings in cobbles from the Faringdon Sponge-gravel (Upper Aptian) of south-central England. The new genus and species, *Lapillincola faringdonensis* is a uniserial textulariine with an initial planispiral coil and a multiple aperture. *Lapillincola* gen. nov. is a remarkable homeomorph of *Arenonina* Barnard, which was originally described as an agglutinated form. *Arenonina* is shown here to actually be calcareous and perforate, and thus a junior synonym of *Rectocibicides* Cushman & Ponton. *Acruliammina parvispira* sp. nov. is another uniserial textulariine with an initial coil. *Bullopore ramosa* sp. nov. is an adherent polymorphinid with a branching, irregular series of adherent chambers. These foraminiferans may have used the bivalve borings as spatial refuges from the abrasive, high energy environment of the Sponge-gravel.

### INTRODUCTION

An unusual adherent foraminiferan fauna was found inside bivalve borings in calcareous claystone cobbles from the top 3m of the Lower Cretaceous Faringdon Sponge-gravel, Faringdon, Oxfordshire, England. One new genus and three new species are described from this collection. The genus *Arenonina* Barnard (1958) is morphologically similar to the new genus *Lapillincola*, but re-examination of the type specimen of *Arenonina* has shown it to be calcareous perforate and not agglutinated as originally described. *Arenonina* is redescribed here as a junior synonym of *Rectocibicides* Cushman & Ponton (1932) and a remarkable homeomorph of *Lapillincola* gen. nov.

### STRATIGRAPHY AND LOCATION

The adherent foraminiferans were collected from the "Red gravel" (Meyer, 1864) of the Faringdon Sponge-gravel, 5.5-8.5m above the disconformable contact with Oxfordian limestones of the Corallian Group, exposed in the Wicklesham gravel pit at the southeast edge of Faringdon, Oxfordshire (nat. grid ref. SU 293943; lat. 51° 41' 20" N, long. 1° 34' 45" W; Fig. 1). This gravel has been placed within the *Parahoplites nutfieldensis* Zone of the Upper Aptian (see Casey, 1961 for the detailed stratigraphy).

### MODE OF OCCURRENCE

The foraminiferans are found encrusting the interiors of flask-shaped borings of the ichnogenus *Gastrochaenolites* Leymarie, 1842. These borings, ranging in size from 2-20mm at widest diameter and 4-40mm at greatest depth, are abundant in rounded calcareous

claystone cobbles. One cobble contained the ammonite *Prorastenia bowerbanki* (kindly identified by H. G. Owen) within its matrix, indicating that some of the cobbles, at least, were originally derived from the lower Kimmeridge Clay or the Upper Oxfordian (Upper Jurassic). These cobbles were rolled periodically, as demonstrated by their rounding and the distribution of borings and encrusters on all outside surfaces.

Approximately 40 additional encrusting and nestling species are also found in the Faringdon *Gastrochaenolites* borings. They include bryozoans, serpulids, brachiopods, bivalves and sponges. This fauna is described separately (Wilson, 1986).

The following suprageneric classification is based on that outlined by Loeblich & Tappan (1984).

### SYSTEMATIC DESCRIPTIONS

Order Foraminiferida Eichwald, 1830

Suborder Rotaliina Delage & Hérourard, 1896

Superfamily Planorbulinacea Schwager, 1877

Family Cibicididae Cushman, 1927

Subfamily Stichocibicidinae Saidova, 1981

Genus *Rectocibicides* Cushman & Ponton, 1932

*Rectocibicides cretacea* (Barnard, 1958)

(Pl. 1, figs. 1-3)

1958 *Arenonina cretacea* Barnard: 119, pl. 22, fig. 1 (non fig. 2)

**Emended diagnosis.** Test completely attached, consisting of an initial trochospiral coil with shallow indistinct sutures, followed by a uniserial portion in which the

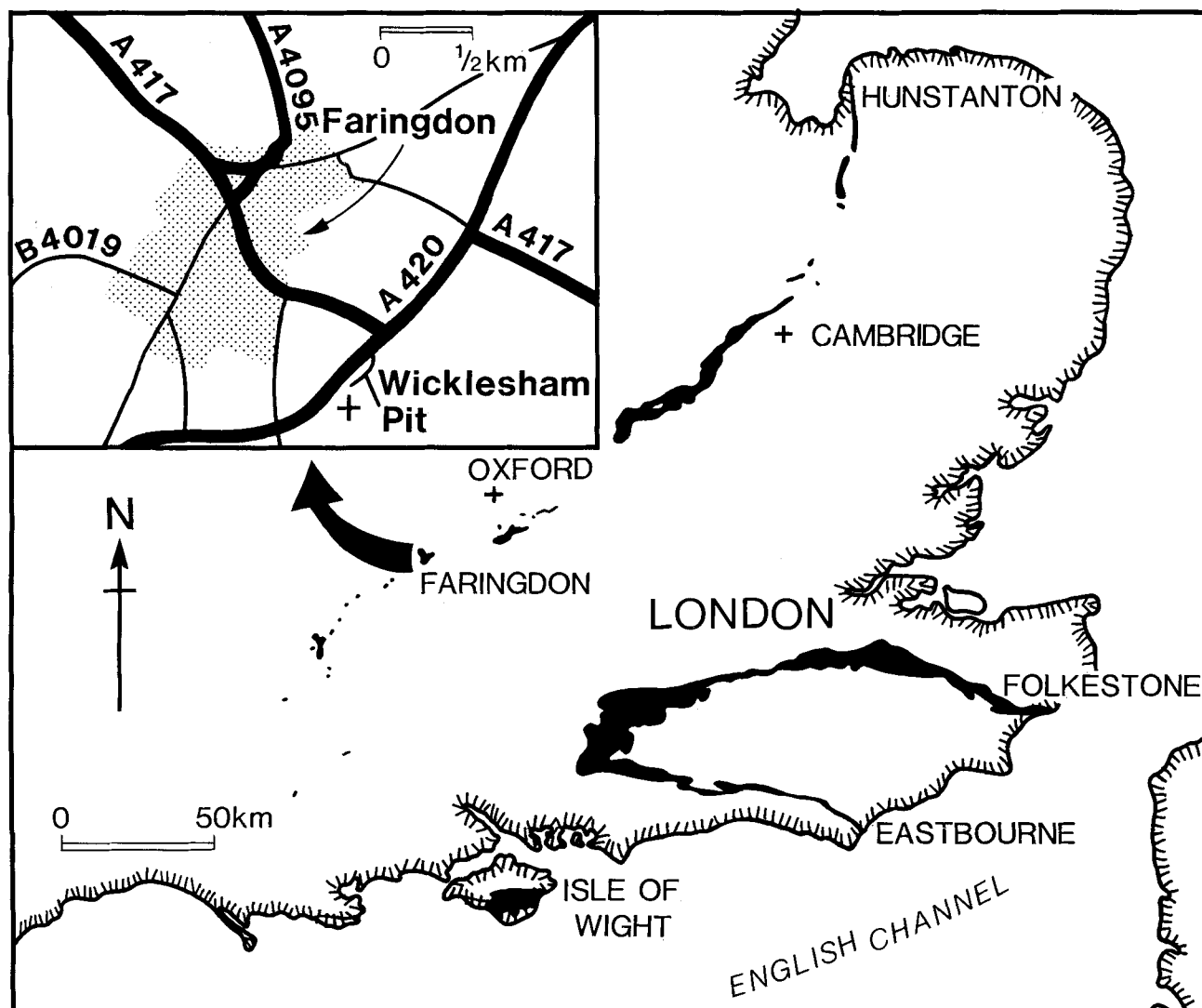


Fig. 1. Location of the Wicklesham Pit, Faringdon, where the foraminifera-bearing cobbles were collected. The solid pattern is the outcrop of the Lower Greensand (of which the Faringdon sponge-gravel is a part) in southeastern England (after Casey, 1961).

chambers are rectangular to arcuate with generally parallel septa; aperture is a row of pores extending along the length of the apertural face; each apertural pore is surrounded by a slight lip; wall calcareous and coarsely perforate.

**Holotype.** British Museum (Natural History) no. P 43656 (Pl. 1, figs. 1-3).

**Material.** One specimen (the holotype).

**Locality and horizon.** "Upper Chalk, Zone of *Micraster coranguinum*, Northfleet, Kent" (Barnard, 1958, p. 119).

**Description.** See Barnard (1958, p. 118) for a full description of the species, noting that the wall is now known to be calcareous and perforate and not arenaceous (see below). The drawing of *Arenonina cretacea* accompanying the original description (Barnard, 1958, text-fig. 1) is also inaccurate. The broken portion of the last-formed chamber is drawn as a large apertural pore, and where the drawing shows 10 undamaged apertural pores there are actually 17. Barnard's (1958, text-fig. 1) drawing also shows deep sutures on the initial coil, which are not visible on the

type specimen. A photograph of the *A. cretacea* paratype (Barnard, 1958, Pl. 22, fig. 2) shows what may be deeper sutures on the initial coil. This specimen was apparently never deposited in a museum collection, so it was unavailable for study. The photograph of the paratype is poor; because it shows none of the characteristic features of the genus, such as spreading chambers or a multiple aperture, it may represent a separate form. The drawing of *A. cretacea* produced by Barnard (1958, text-fig. 1) was reproduced in the *Treatise* (Loeblich & Tappan, 1964, fig. 160) as the illustration of *Arenonina*.

**Remarks.** Barnard (1958, p. 118) erected the genus *Arenonina* to separate an undescribed Upper Cretaceous foraminiferan from *Bdelloidina*, to which it had a "superficial external resemblance". He did not place *Arenonina* in a family, simply listing it as one of a group of "forms with agglutinated tests" (Barnard, 1958, p. 116). Re-examination of the holotype of *A. cretacea* with the aid of a scanning electron microscope showed that the test is calcareous, coarsely perforate and not "arenaceous". Because it also possesses a trochospiral initial coil and a multiple aperture on the terminal face, *Arenonina* is a junior synonym of *Rectocibicides* Cushman & Ponton (1932), previously described from the Miocene of Florida. *R. cretacea* differs from *R. miocenicus* Cushman & Ponton (1932) by the very shallow sutures on the initial coil, the more parallel septa in the uniserial portion of the test, and the reduced apertural lips.

*Rectocibicides cretacea* is not found in the Faringdon Sponge-gravels, but it is an impressive calcareous homeomorph of the agglutinated *Lapillincola faringdonensis* gen. et sp. nov. described below (Pl. 1, fig. 4). Both tests possess an initial coil with very shallow sutures followed by a uniserial portion with spreading chambers and a multiple aperture consisting of a row of pores.

Suborder Textulariina Delage & Hérourard, 1896  
Superfamily Lituolacea de Blainville, 1827  
Family Placopsiliniidae Rhumbler, 1913  
Genus *Lapillincola* gen. nov.

**Type species.** *Lapillincola faringdonensis* sp. nov.

**Derivation of name.** From the Latin, *lapillus* (little stone) and *incola* (dweller).

**Diagnosis.** Test completely attached, consisting of a planispiral initial coil with shallow, nearly absent sutures, followed by a uniserial portion in which the chambers are rectangular to arcuate with generally parallel septa; aperture is a row of pores extending along the length of the apertural face; wall is agglutinated with simple (not labyrinthic) internal structure.

**Remarks.** *Lapillincola* is distinguished from *Rectocibicides* Cushman & Ponton (1932) by the agglutinated wall structure; from *Placopsilina* by the multiple apertures, and from *Acruliammina* by the absence of an erect distal portion or a cribrate aperture.

*Lapillincola faringdonensis* sp. nov.  
(Pl. 1, fig. 4; Pl. 2, figs. 1 and 2)

**Derivation of the name.** From the type locality.

**Diagnosis.** As for genus.

**Holotype.** British Museum (Natural History) no. P 51736.

**Material.** 27 specimens.

**Locality and horizon.** Upper Aptian, *Parahoplites nutfieldensis* Zone, "Red gravel" of the Faringdon Sponge-gravel, 5.5-8.5m above the disconformable contact with Oxfordian limestones of the Corallian Group, Wicklesham gravel pit, southeast Faringdon, Oxfordshire (nat. grid ref. SU 293943; Fig. 1).

**Description.** Test entirely adherent and agglutinated, consisting of coarse, angular grains in a calcareous matrix. Interior walls are simple and not labyrinthic. The initial planispiral coil is one or two whorls, with five to ten chambers in each whorl; sutures are very shallow to indistinct within each whorl. Occasionally an elliptical scar is present near the centre of the coil, possibly indicating the presence of a bulbous proloculus. The uniserial portion of the test contains 10-15 chambers, each delimited by distinct, usually arcuate, sutures. The uniserial chambers increased in height slowly with growth, but chamber width increased much faster, producing a flabellate or spatulate test. The aperture is known only from the uniserial chambers; it is a single row of pores extending across the face of the last-formed chamber parallel to the attachment surface. These pores, numbering in a single aperture from five to eight, are simple openings without lips or associated crenulations. The apertural pore row is usually midway between the attachment surface and the centre of the apertural face.

**Dimensions.** Holotype length = 5.09mm.; diameter of initial coil = 0.81mm.; width of last-formed uniserial chamber = 1.05mm.

Genus *Acruliammina* Loeblich & Tappan, 1946  
*Acruliammina parvispira* sp. nov.  
(Pl. 2, figs. 3-6)

**Derivation of name.** From the Latin, *parvus* (small) and *spira* (coil).

**Diagnosis.** *Acruliammina* with a small initial planispiral coil (diameter less than half the width of the mature apertural face).

**Holotype.** British Museum (Natural History) no. P 51737.

**Material.** 7 specimens.

**Locality and horizon.** As above.

**Description.** Test adherent for all or most of its length, agglutinated, walls consisting of fine to coarse grains in a calcareous matrix. Interior walls are simple. The initial planispiral coil is one or two whorls with 7-10 chambers per whorl; sutures are moderately deep and distinct. A bulbous proloculus is present in some specimens. The initial coil is followed by an irregularly winding series of chambers with distinct sutures; chamber length and width increase in approximately equal proportion. The distal portion of the test may have grown free from its attachment after 10 to 20 adherent uniserial chambers were formed. The aperture consists of two pores on the distal face of the early uniserial chambers. In more mature forms the apertural face has three or four pores arranged in a semi-circle or complete circlet.

**Dimensions.** Holotype length = 4.21mm; width of initial coil = 0.33mm; width of apertural face = 0.87mm.

**Remarks.** *A. parvispira* has a much smaller initial coil than *A. longa* (Tappan, 1940) or *A. serpula* (Tappan, 1943) of the North American midwestern Cretaceous. *A. longa* has a coil almost twice as wide as the mature apertural face, whereas the diameter of the *A. parvispira* coil is usually less than half the width of the mature apertural face.

Suborder Lagenina Delage & Hérouard, 1896  
 Superfamily Nodosariacea Ehrenberg, 1838  
 Family Polymorphinidae d'Orbigny, 1839  
 Subfamily Webbinellinae Rhumbler, 1904  
 Genus *Bullopore* Quenstedt, 1857  
*Bullopore ramosa* sp. nov.  
 (Pl. 2, figs. 7 and 8)

**Derivation of name.** From the Latin, *ramosus* (branching).

**Diagnosis.** *Bullopore* with irregular tubular chambers, a dichotomously branching test, and a wall ornamentation of tubercles.

**Holotype.** British Museum (Natural History) no. P 51735.

**Material.** 17 specimens.

**Locality and horizon.** As above.

**Description.** Test entirely adherent; wall perforate and formed of radiate, fibrous calcite. Basal attachment wall thick. Chambers irregular and tubular, usually swollen and connected by stolons. Outer walls ornamented with fine tubercles. Uniserial series of chambers with irregular dichotomous branching points. Proloculus enveloped by the second chamber, so its form is unknown. Apertures terminal and simple.

**Dimensions.** Holotype: length of entire test = 2.10mm; width of largest chamber = 0.40 mm.

**Remarks.** *B. ramosa* is the only species of *Bullopore* with dichotomous branching. *B. rostrata* Quenstedt (1857) and *B. laevis* (Sollas, 1877) develop irregular tubular chambers (as described by Adams, 1962), and *B. tuberculata* (Sollas, 1877) has a similar tuberculated exterior.

## DISCUSSION

These Faringdon foraminiferans are found in an unusual environment: within the vacated borings of bivalves on loose calcareous claystone cobbles. Most adherent foraminiferans are described from encrusted shells, but a few taxa have been previously noted on hardgrounds (Voigt, 1970; Kaever, 1974; Palmer, 1982). Fossil foraminiferans have been described from within borings, most notably from the Cretaceous of the Netherlands (Hofker, 1965) and the British Jurassic (Hitchings, 1980). Indeterminate calcareous foraminiferans were noted on a loose (or "mobile") hardground of Upper Carboniferous intraclasts by West & Palmer (1982), and foraminiferans have long been described encrusting Jurassic and Cretaceous phosphatic nodules in Europe (Chapman, 1892; Kennedy & Garrison, 1975). This paper, however, records the first occurrence of foraminiferans within borings in a "mobile hardground" (Wilson, 1985) of loose cobbles.

The Faringdon Sponge-gravel was deposited in narrow tidal channels during an Early Cretaceous transgression (Bridges, 1982). The gravel, derived from a variety of pre-Cretaceous units, was continually reworked in its upper layers (Krantz, 1972). Adherent

## Explanation of Plate 1

Figs. 1-3. *Rectocibicides cretacea* (Barnard), holotype BM(NH) no. P 43656, Upper Chalk, Northfleet, Kent: figs. 1a, b, stereo-pair ( $\times 35$ ); fig. 2, stereo-pair showing the multiple aperture ( $\times 37$ ); fig. 3, magnified view of the apertural pores ( $\times 200$ ).

Fig. 4. *Lapillincola faringdonensis* gen. et sp. nov., holotype from the Faringdon Sponge-gravel, Oxfordshire; BM(NH) no. P 51736 ( $\times 11$ ).



1a



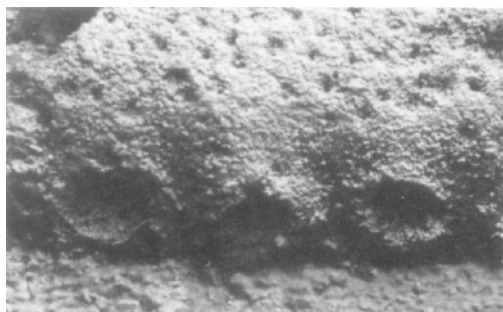
1b



2a



2b



3



4

foraminiferans, with their relatively fragile shells, would have had difficulty surviving on the external surfaces of shells or cobbles under these abrasive conditions. The borings, though, provided a spatial refuge, protecting them from the physical dangers in the loose gravel and from most, if not all, epifaunal predators. Many of the borings intersected other cavities, so there was usually the possibility of flow-through water currents, even within the centres of the cobbles.

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#### Explanation of Plate 2

- Fig. 1. *Lapillincola faringdonensis* gen. et sp. nov., view of the multiple aperture; BM(NH) no. P 51736 (×26).
- Fig. 2. *L. faringdonensis* magnified view of a damaged initial coil showing possible proloculus scar; BM(NH) no. P 51736 (×38).
- Fig. 3. *Acruliammina parvispira* sp. nov., holotype from the Faringdon Sponge-gravel, Oxfordshire; BM(NH) no. P 51737 (×12).
- Fig. 4. *A. parvispira* apertural face of a juvenile specimen; BM(NH) no. P 51738 (×22).
- Fig. 5. *A. parvispira* magnified view of the initial coil and bulbous proloculus; BM(NH) no. P 51737 (×50).
- Fig. 6. *A. parvispira* entire test, showing a broken cribrate aperture; BM(NH) no. P 51739 (×9).
- Fig. 7. *Bullopore ramosa* sp. nov. holotype from the Faringdon Sponge-gravel, Oxfordshire; BM(NH) no. P 51735 (×23).
- Fig. 8. *B. ramosa* magnified view of a broken cross-section of the test wall showing the fibrous calcite composition; BM(NH) no. P 51734 (×90).



1



2



3



4



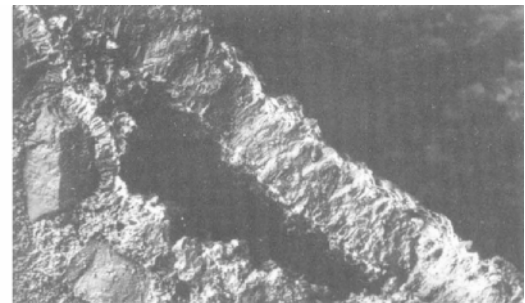
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