

INTERNAL STRUCTURE AND SYSTEMATIC POSITION OF THE FORAMINIFER *CEROBERTINA*

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ABSTRACT—The genus *Cerobertina* is shown by its internal structure to be closely related to *Ceratobulimina*, while the similarity to *Robertina* is purely superficial

INTRODUCTION

FINLAY (1939, p. 118) gave the following diagnosis of *Cerobertina* :

“Shell formation very similar to *Ceratobulimina*, with the same gloss, coiling and furrow-aperture, but with a series of supplementary chambers along the umbilical edge of the main chambers more or less distinctly marked off by a groove or internal line”.

It will be seen that only external features are mentioned. Although Finlay evidently had *Robertina* in mind when he named *Cerobertina*, no mention of the former is made in the discussion of the genus. In his diagnosis of *C. mahoenuica*, Finlay (1939, p. 119) mentions the resemblance to *Robertina* without, however, suggesting the existence of a real relationship. Sigal (1952) and Cushman (1948) place *Cerobertina* close to *Ceratobulimina* while *Robertina* is placed in another family. Glaessner (1948, p. 156), on the other hand, places *Robertina* in his family Ceratobuliminidae and states that *Cerobertina* “resembles both *Ceratobulimina* and *Pseudobulimina*” and that “these low-spined, high-chambered genera connect *Robertina* morphologically with the low-spined *Ceratobulimina*”. Also Bermudez (1952, pp. 79–85) refers both *Robertina* and *Cerobertina* to the Ceratobuliminidae.

In my recent paper on the Ceratobuliminidae (Troelsen, 1954) I have attempted to show that a basic difference exists between *Ceratobulimina* and *Lamarckina* on the one hand and *Robertina* and *Robertinoides* on the other. In the former group, the septal foramina are secondary resorption phenomena, which are not homologous with the apertures, while in the latter group,

which in their external characters and in the presence of incomplete internal partitions in their chambers are somewhat similar to *Ceratobulimina*, the septal foramina are remnants of the external apertures. My conclusion was that no relationship exists between the two groups of genera, just mentioned.

Our objective must, therefore be (1) to examine the internal structure of *Cerobertina* and (2) to determine whether the internal structure affords evidence for placing *Cerobertina* close to either *Ceratobulimina* or *Robertina*.

Of the four species of *Cerobertina* described by Finlay (1939), specimens of all but one (*C. kakahoica* from the Middle Eocene strata of New Zealand) have been available to me.

ACKNOWLEDGMENTS

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DESCRIPTIONS

CEROBERTINA BARTRUMI Finlay,
Pl. 4, figs. 1–3, 10, 13–14

Cerobertina bartrumi Finlay, 1939,
p. 118, pl. 11, figs. 2–3

Material.—Four specimens from the Waitematan formation (Lower Miocene; Hutchin-

sonian stage) of Pakaurangi Point, New Zealand (the type locality).

Description.—Two of my specimens are somewhat narrower than the holotype figured by Finlay. In other respects the agreement seems complete. All the specimens are dextrally coiled. The test wall is of the perforate radiate type (cf. Wood, 1948). The external aperture is of the type found in *Ceratobulimina*, *sensu stricto* (Finlay, 1939; Troelsen, 1954). Partitions exist in the interior of the chambers. In the ultimate chamber the partition is V-shaped in cross-section, and its ventral edge is attached to the posterior margin of the aperture, i.e., to the right-hand edge of the apertural slit which penetrates the apertural face (Pl. 4, fig. 1). The dorsal margin of the partition is partly free and curved toward the apertural face. The partition thus forms a vestibule covering the external aperture and separating it from the septal foramen, which is placed dorsally, or distally, to the partition. To pass out of the test, the protoplasm must flow through the septal foramen into the main part of the ultimate chamber, which lies above (distally to) the partition, and then over the free margin of the down-curving partition into the vestibule that leads to the external aperture.

In the penultimate chamber, the partition is partly resorbed, only its ventral wing being preserved. In a specimen in which the ultimate chamber has been removed it may be seen that the aperture of the penultimate chamber has been closed by the last-formed of the supplementary chambers. It is further seen (Pl. 4, figs. 13–14) that the septal foramen lies outside the former aperture and that it is separated from it by the internal partition. *The septal foramen can not thus be homologous with any part of the external aperture.*

Our species differs from *Ceratobulimina* in two respects only, *viz.*, in that the internal partitions are partly resorbed in the chambers preceding the ultimate one, and in having the early apertures closed by supplementary chambers instead of by little flat plates. I consider both of these differences of minor importance and, therefore, conclude that *Cerobertina* must be very closely related to *Ceratobulimina*.

CEROBERTINA MAHOENUICA Finlay

Pl. 4, figs. 6–9, 11

Cerobertina mahoenuica, Finlay 1939

p. 119, pl. 13, figs. 48

Material.—Three specimens from the Lower Miocene strata of Pakaurangi Point, New Zealand (New Zealand Geological Survey number F5730). All the specimens are sinistrally coiled.

Description.—The microstructure of the test wall is of the perforate radiate type (cf. Wood, 1948). Finlay (*op. cit.*) has given a complete description of the exterior of the test. His illustration is inadequate, however, and the species is therefore refigured. In its internal structure the species turns out to be essentially like *C. bartrumi*. The internal partition is evenly curved, and the external aperture lies within the curvature. The partition is attached for a considerable distance to the dorsal wall of the chamber. The line of attachment is faintly visible on the exterior of the test, and at its base may be seen a pit, which may be the external orifice of a narrow canal. The pit is visible in the ultimate chamber only, while in the older chambers it has been filled. A similar pit has been observed in *Ceratobulimina*, *sensu stricto* (Troelsen, 1954, fig. 1). The septal foramina lie outside (distally to) the curvature of the internal partitions. As the partitions are completely preserved in the older chambers, it is here particularly obvious that a line connecting the septal foramina would lie outside the partitions. The foramina can, therefore, not be homologous with the external aperture.

It is thus beyond reasonable doubt that *C. mahoenuica* should be placed in the subfamily Ceratobulimininae of the Ceratobuliminidae. The previously described members of this subfamily are nearly always dextrally coiled (Troelsen, 1954). It is therefore remarkable that *C. mahoenuica* should be sinistrally coiled (Finlay, 1939, p. 120), but since it is obviously impossible to investigate the genetic structure of an extinct species no explanation for the "inversion" can be offered.

CERATOBULIMINA (CERATOBULIMINA) CREPIDULA
(Finlay)
Pl. 4, figs. 4-5, 12

Cerobertina crepidula Finlay, 1939
p. 121, pl. 11, fig. 1

Material.—Four specimens from a stratum 360 feet above the base of the Goodwood formation (Lower Miocene) of Pleasant Point, New Zealand.

Description.—To Finlay's description the following may be added: Test wall of the perforate radiate type (cf. Wood, 1948). The ultimate chamber is missing in all my specimens, but it may be seen that in the preceding septum the former external aperture has been closed by secondary deposits and that the aperture has been a narrow slit stretching into the apertural face. The septal foramen lies to one side of the former aperture and has clearly originated through secondary resorption. The internal partition is V-shaped in cross-section, and the connection between the penultimate chamber and the outside whorl has been as described above under *Cerobertina bartrumi*. As no supplementary chambers are present, our species must be placed in *Ceratobulimina*

sensu stricto (Finlay, 1939, p. 115; Troelsen, 1954, p. 453), rather than in *Cerobertina*.

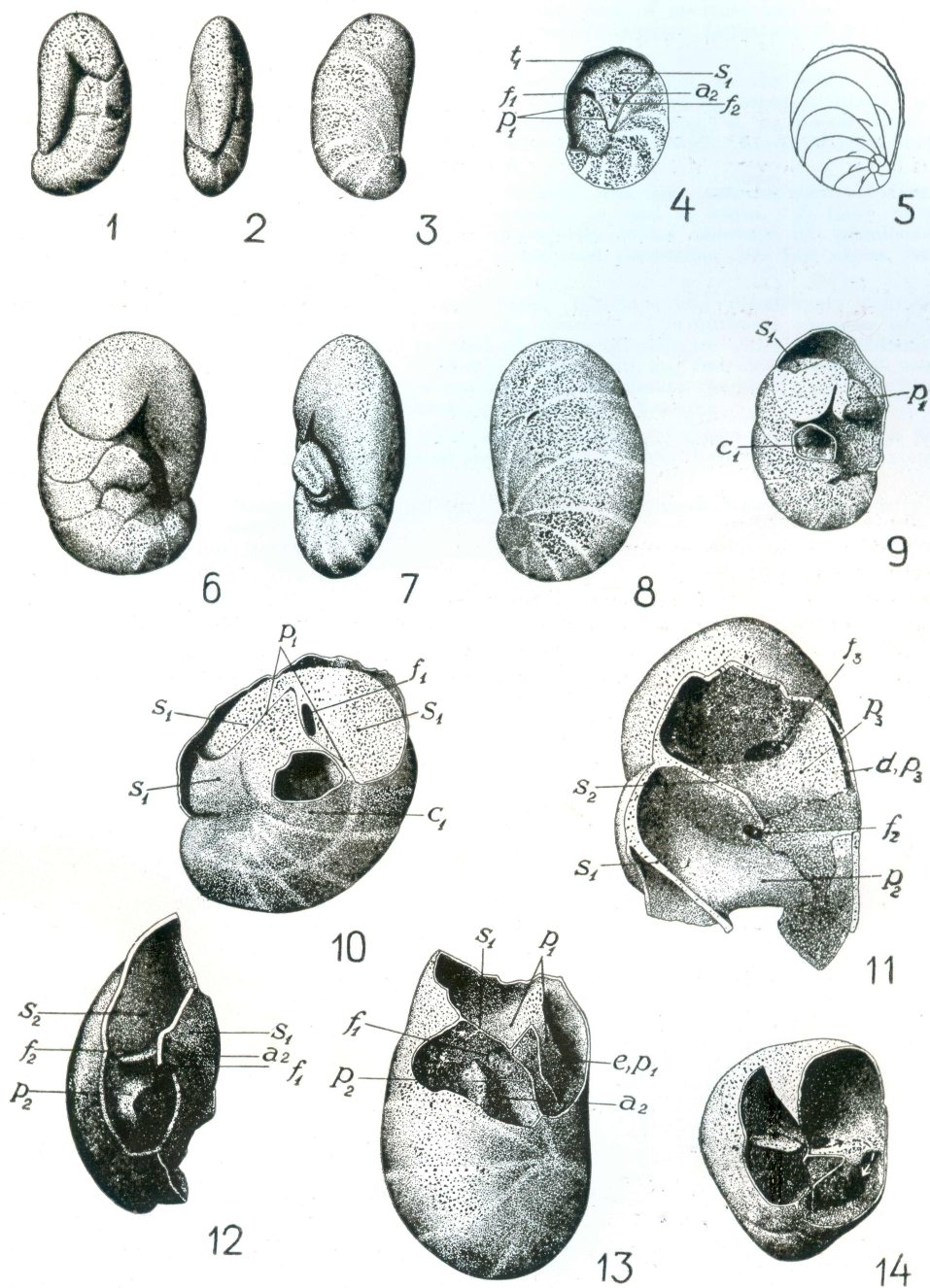
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EXPLANATION OF PLATE 4

- Figs. 1-3—*Cerobertina* aff. *bartrumi* Finlay. 1, ventral view, showing supplementary chambers. 2, peripheral view. 3, dorsal view. 50×. Topotype, Waitematan formation of Pakaurangi Point, New Zealand.
- 4—*Ceratobulimina* (*Ceratobulimina*) *crepidula* (Finlay). Ventral view. Ultimate chamber missing. t_1 , remains of wall of ultimate chamber. s_1 , septum. f_1 , septal foramen of septum s_1 . f_2 , preceding septal foramen, visible through transparent test wall. a_2 , secondarily sealed aperture of penultimate chamber (a_2 lies in s_1). p_1 , line of attachment of internal partition of ultimate chamber. 50×. Goodwood formation, 360 feet above base. Pleasant Point, New Zealand.
- 5—Same as fig. 4. Outline drawing of dorsal side. Test clarified to show dorsal attachments of internal partitions. 50×.
- 6-8—*Cerobertina mahoenuica* Finlay. 6, ventral view, showing aperture and two supplementary chambers. 7, peripheral view. 8, dorsal view, showing attachments of internal partitions of last three chambers and, in ultimate chamber, pit at base of partition. 50×. Lower Miocene strata of Pakaurangi Point (F 5730), New Zealand.
- 9—*Cerobertina mahoenuica* Finlay. Ventral view. Ultimate chamber opened to show internal partition (p_1) and septum (s_1). Vestibule under partition filled with matrix. Last supplementary chamber (c_1) opened to show part of aperture of penultimate chamber. 50×. Lower Miocene strata of Pakaurangi Point (F 5730), New Zealand.

(Contd. on page 69)



TROELSEN: INTERNAL STRUCTURE OF CERBERTINA.

EXPLANATION OF PLATE 4 (contd.)

- 10—*Cerobertina bartrumi* Finlay. Ventral view. Ultimate chamber and its internal partition removed. s_1 , septum. p_1 , line of attachment of internal partition. f_1 , septal foramen. Last supplementary chamber (c_1) opened to show part of aperture and internal partition of penultimate chamber. $125\times$. Topotype, Waitematan formation of Pakaurangi Point, New Zealand.
- 11—*Cerobertina mahoenuica* Finlay. Peripheral view (ventral side to the left). Ultimate chamber removed. Two preceding chambers opened. s_1 and s_2 , septa f_2 (partly preserved) and f_2 , septal foramina. p_2 and p_3 , internal partitions. d , p_3 , dorsal edge of internal partition, exposed by removal of dorsal test wall. $125\times$. Lower Miocene strata of Pakaurangi Point (F 5730), New Zealand.
- 12—*Ceratobulimina (Ceratobulimina) crepidula* (Finlay). Oblique anterior view. Ultimate chamber missing. Penultimate chamber opened. s_1 and s_2 septa. f_1 (only partly preserved) and f_3 , septal foramina. a_2 , secondarily sealed aperture of penultimate chamber. p_2 , internal partition. $125\times$. Goodwood formation, 360 feet above base. Pleasant Point, New Zealand.
- 13—*Cerobertina* aff. *bartrumi* Finlay. Dorsal view. Ultimate and penultimate chambers opened. s_1 , septum. f_1 , septal foramen. a_2 , aperture of penultimate chamber (closed by supplementary chamber). p_1 , internal partition of ultimate chamber (accidentally broken; vestibule under partition filled with matrix). e , p_1 , free dorsal edge of partition. p_2 , free edge of partly resorbed partition of penultimate chamber. $125\times$. Topotype, Waitematan formation of Pakaurangi Point, New Zealand.
- 14—Same as fig. 13. Oblique anterior view, showing route protoplasm must follow to flow through septal foramina around internal partition and into vestibule that leads to external aperture. $125\times$.

Figured specimens deposited in the Mineralogisk-geologisk Museum, University of Copenhagen, Denmark.