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A NEW LITUOLID GENUS FROM THE MIDDLE EOCENE OF RAJASTHAN, INDIA

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ABSTRACT

A new lituolid genus *Alveoclavulina* is described in this paper. The new genus is characterised by an initial triserial stage followed by an incipient or short biserial stage and a prominent uniserial stage which constitutes about 2/3 of the total length of the test. *Alveoclavulina* gen. nov. Singh and Kalia differs from *Clavulina* d'Orbigny in possessing pointed polygonal rod like extensions in the chamber interior, these are arranged normal to the chamber wall and seem to extend to the surface imparting the test a honeycomb or reticulate surface ornamentation.

On the basis of the observations and the studies made on the genera possessing intricate wall structure obtained from the middle Eocene material from Rajasthan, and the available description in the literature on other such genera of the arenaceous foraminiferans, an attempt has been made to categorize these structural features under representative types with definitions.

INTRODUCTION

A number of arenaceous foraminifera are known to possess complex interior of different types, but so far, a standard terminology has neither been proposed nor followed by the workers, resulting in an indiscriminate and even inappropriate usages of the terms labyrinthic, alveolar, partitioned etc. in the existing literature. Bronnimann (1951, p. 97) while describing certain new genera with complex interiors introduced the term 'Alveolar' and has stated,

> "The term Alveolar has been used in order to avoid the ill-applied designation labyrinthic, a term that should be reserved exclusively for the description of wall structure or for the subdivision of the interior of the chambers where no arrangement of the structural elements can be seen.... In the author's opinion, there are morphological differences between the alveoles of *Guppyella-Alveovalvulina* on one hand and *Discamminoides* on the other, but no nomenclatural distinction is proposed at present. In a future monographic study of the valvulinids, lituolids and related groups of foraminifera it will be necessary to revise the wall structures and study the internal subdivisions very carefully."

In the Treatise on Invertebrate Palaeontology, Pt. C, Protista 2, Vol. 1, edited by Moore the term 'labyrinthic' has been employed in a collective sense meaning and including various types of structural features of the wall and the chamber interior, viz. Alveolar, Vacuolar etc. Further, so far the authors have also not come across any publication in which an attempt or proposal to provide definite terminology for various types of wall structures, resulting in the development of complex interior have been made or discussed.

During the study of foraminiferans from Rajasthan, the writers have come across a number of arenaceous forms having complex wall structure and a need for clarification of the current terminology was strongly felt. Therefore, we are proposing a set of terms with definitions. It is felt that the usage of these terms in the future descriptions would not only remove the present confusion created by the indiscriminate usage of the existing terminology but would provide future workers standardised connotations to the terms to be used during description.

PROPOSED STRUCTURAL TYPES OF THE TEST WALL IN ARENACEOUS FORAMINIFERANS

A. Vacuolar—*Bronnimannina* Type.—Vacuoles developed within the walls and the septa not affecting the chamber lumen. (Pl. I,—1, 2).

B. Pocketed—*Jarvisella* Type.—Structures developed due to infolding and undulations of the wall (Pl. I—3).

C. Pillared—*Camagueyia* Type.—Collumella formed by vertical pillars. (Pl. I—12).

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D. Complex—Structures developed by various types of extensions of the inner margin of the wall, arranged normal to the chamber surface.

I. Sectored—Only vertical extensions, subdividing the chamber lumen into compartments.

(i) Partitioned—*Liepusella* Type.—Complete periphero-vertical partition joining the floor and the roof of the chamber. (Pl. I—4-5).

(ii) Semipartitioned—*Pavonitina* Type.—Incomplete partitions, projections or plates in the chamber cavity. (Pl. I—6).

II. Intricate—Two sets of partitions extending into chamber lumen, subdividing it variously.

(i) Labyrinthic—*Textulariella* Type.—Haphazard arrangement of partitions following no regularity of pattern. (Pl. I—7).

(ii) Alveolar—*Guppyella* Type.—Alveolar cavities formed by two sets of partitions (vertical and horizontal). (Pl. I—8).

(iii) Spongy—*Pfenderina* Type.—Spongy collummelar infilling and or subepidermal reticulate layer. (Pl. I—9-11).

The new genus *Alveoclavulina* is abundant in the middle Eocene horizon exposed near Sri Kolayatji area in Bikaner, Rajasthan, besides other forms already reported by Singh (1951, 52, 70) and Singh and Kalia (1968, 70) the arenaceous genus *Bronnimannina* has also been reported by Singh and Kalia in 1968 from the same horizon. The structural feature present in the new genus *Alveoclavulina* differs slightly with that of *Pavonitina* but considering the over all features of the structural complexity, it has been included in the semipartitioned *Pavonitina* Type of the newly proposed grouping discussed in the preceeding part of this paper.

SYSTEMATIC DESCRIPTION

Super family	Lituolacea De Blainville 1825
Family	Pavonitinidae Loeblich and Tappan 1964
Genus	*Alveoclavulina* Singh and Kalia, Gen. nov.
Type species	*Alveoclavulina madhuchakra* Singh and Kalia, Sp. nov.

(Plate II—1-14 ; Plate III—1-4)

Diagnosis : Test elongate, cylindrical, gradually tapering towards the base. Initial whorl triserial, triangular in cross section, followed by a pair of irregularly biserial chambers and ultimately becoming uniserial, the uniserial portion composed of 3-4 nodose chambers rounded in cross section and forms the major part of the test. Sutures distinct and depressed, well pronounced in the uniserial portion. Interior of the chambers semipartitioned by inward extension of pointed polygonal rod like extensions oriented normal to the inner surface of the chambers—*Pavonitina* Type. The pointed polygonal rod like units that extend in the chambers seem to reach the surface of the test developing the surface polygonal ornamentation (Pl. II, figs. 1-10, Pl. III, figs. 1 3). Aperture terminal, large, irregularly rounded with a very small neck and phialine lip. Wall finely arenaceous.

Comparison and Remarks : The new genus *Alveoclavulina* in general appearance is similar to the alveolar genera *Guppyella* Bronnimann and *Alveovalvulina* Bronnimann described from the Oligo-Miocene of Trinidad, but differs from both in possessing an early triserial stage, in having a very short neck with phialine lip, in rapid attainment of the uniserial stage through an irregular biserial stage and in the development of polygonal surface pattern. The new genus differs from all other allied genera namely *Cubanina* Palmer, 1936, *Liebusella* Cushman, 1933 and *Pseudogosella* Keijer, 1945 in possessing the complex internal structure fabricated by inward projection of the pointed polygonal rod like units in the chamber lumen. *Alveoclavulina* gen. nov. has been placed in the family Pavonitinidae, subfamily Pavonitininae mainly on account of the nature of the structures developed in the chamber lumen by the rod like extensions and the arrangement of the chambers.

Alveoclavulina madhuchakra Singh and Kalia, sp. nov.

Description : Test elongate tapering at the initial end in the microspheric form, megalospheric form less tapering and cylindrical in shape as the proloculus is bigger and rounded. Initial whorl of the test composed of three chambers, immediately followed by an irregularly biserial stage, becoming uniserial which forms the major portion of the test ; number of chambers in the uniserial part of an adult test vary from three to four. Test triangular in cross section in the initial portion of the test and rounded in the uniserial stage. Sutures distinct deeply excavated, particularly in the uniserial portion. The early chambers bear angulations at the outer margin, forming a raised ridge along the middle part of the chambers. Uniserial chambers are inflated and nodose. Aperture large terminal, irregularly rounded with a very small neck and phialine lip. Surface of the test have reticulate ornamentation, the border of the reticulation raised and is built by coarsers grains than the area enclosed by them which is composed of smaller sized grains (Pl. III—2 & 4). The polygonal pointed rod like units extending in the chamber lumen and reducing the chamber space are normal to the chamber wall but are not arranged in any regular geometrical pattern (Pl. II—12-14).


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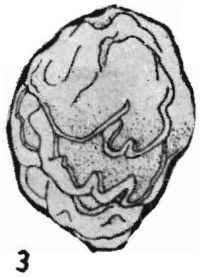
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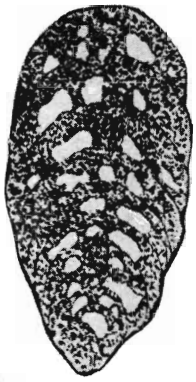
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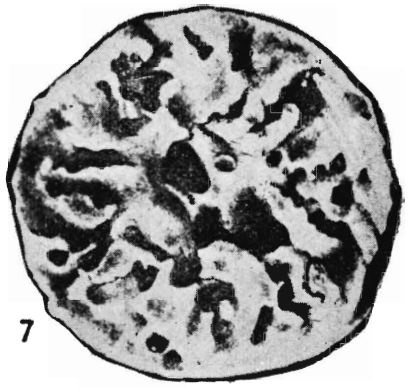
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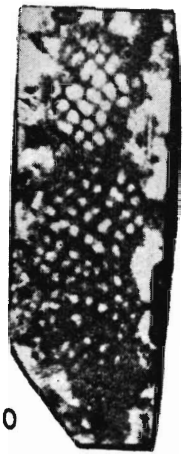
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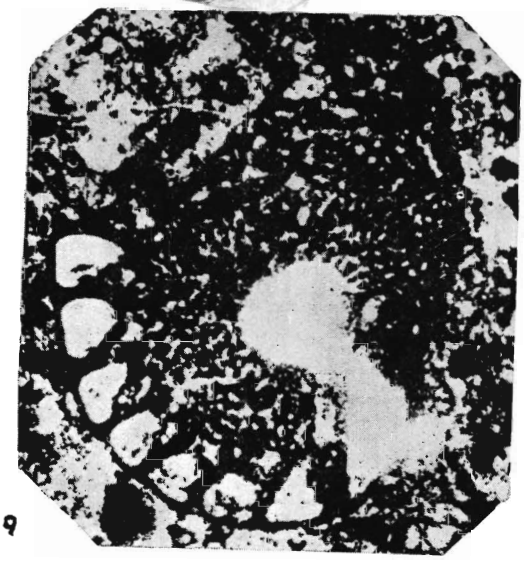
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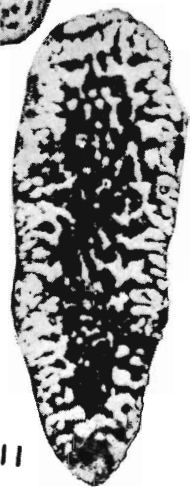
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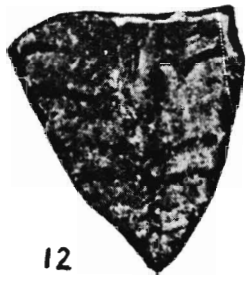
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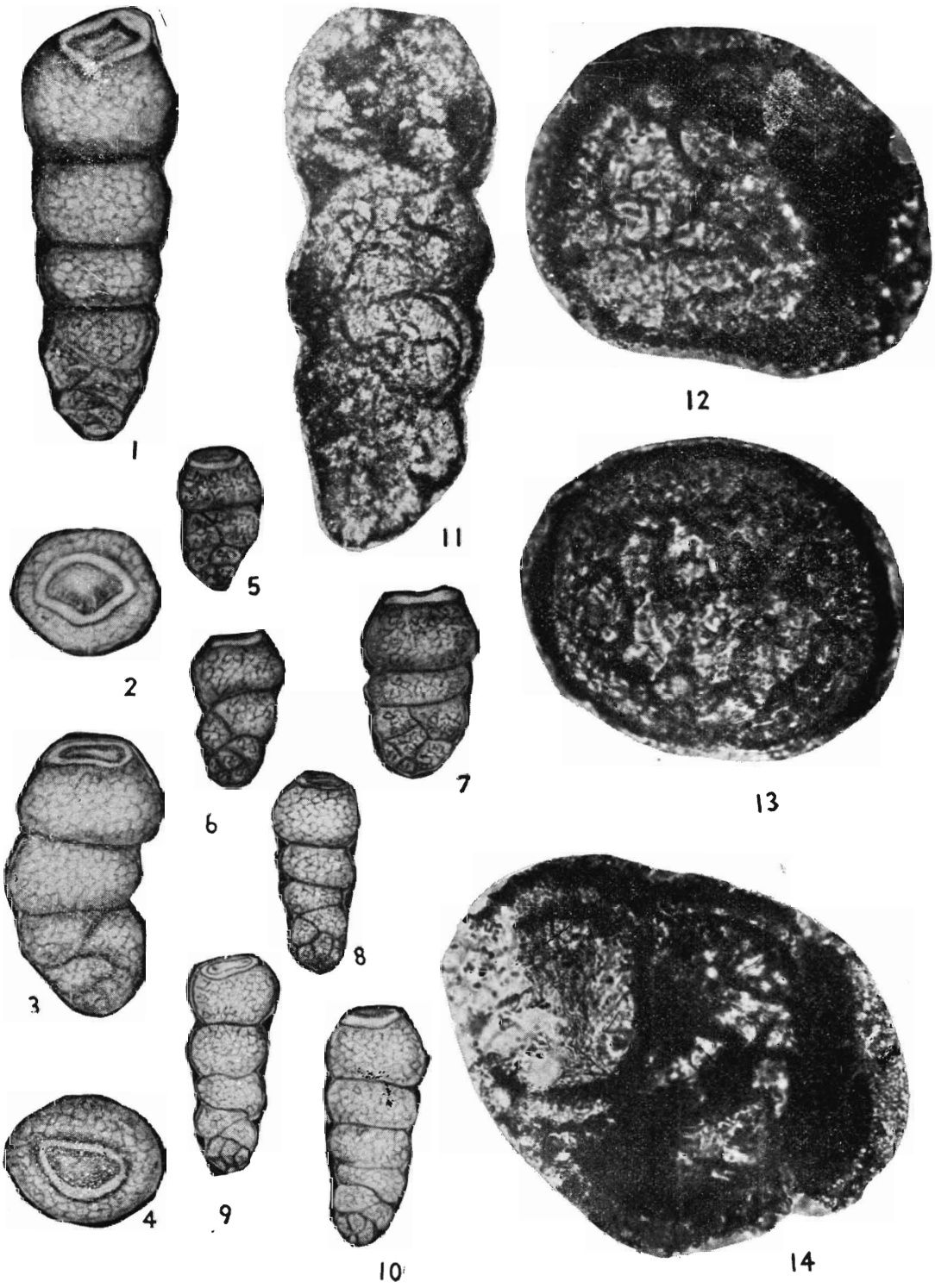
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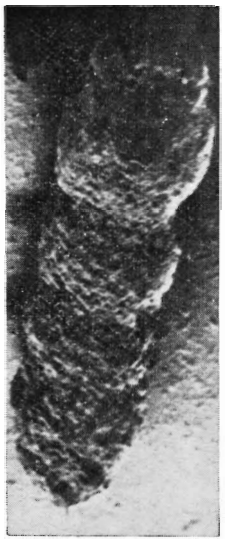

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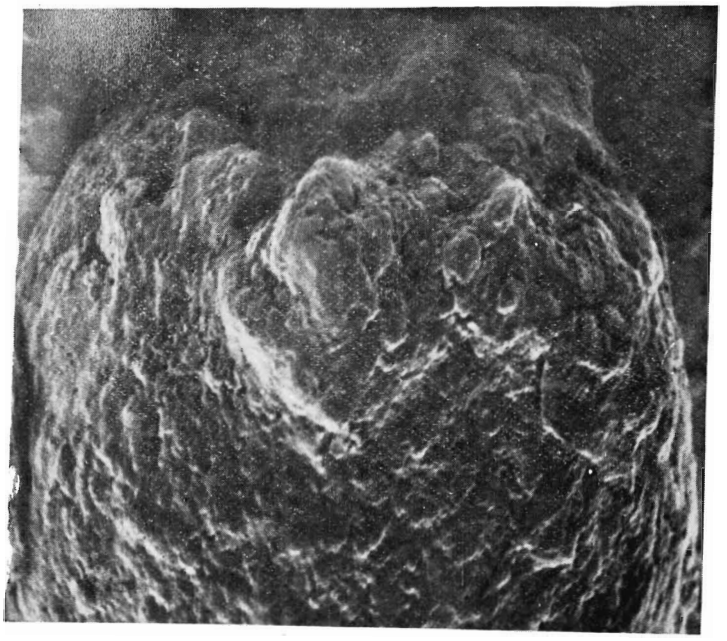

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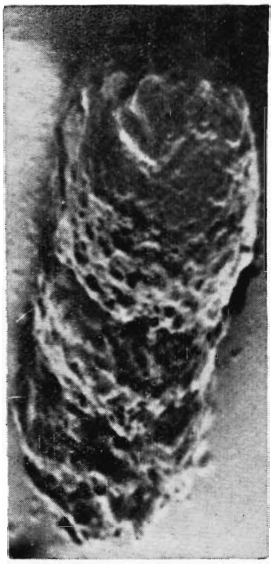

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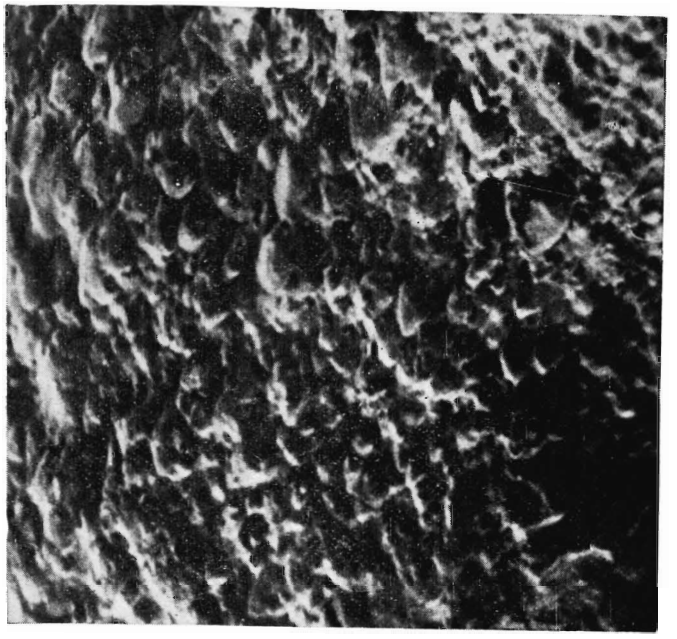

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Measurements in mm.

Specimen No.	Length	Breadth	Thickness
Holotype No. SFKly/22	0.5	0.175	0.15
Paratype No. SFKly/22/1	0.325	0.15	0.125
,, ,, ,, /22/2	0.225	0.15	0.125
,, ,, ,, /22/3	0.325	0.2	0.15
,, ,, ,, /22/4	0.25	0.15	0.125
,, ,, ,, /22/5	0.275	0.15	0.125
,, ,, ,, /22/6	0.425	0.2	0.16
,, ,, ,, /22/7	0.35	0.15	0.15
,, ,, ,, /22/8	0.425	0.175	0.15
,, ,, ,, /22/9	0.4	0.15	0.15

Type locality : About 6 kilometers west of Shri Kolayatji, village near the Fullers earth quarry, Bikaner, Rajasthan, India.

Type horizon : Bikaner stage, Kirthar (Lutetian),

Etymology : The specific name has been derived the Sanskrit word '*Madhuchakra*' which means honeycomb.

Repository : Author's collection, Holotype No. SFKly/22, Paratype Nos. SFKly/22/1-9 and thin section Slide Nos. FKly/M_1—M_3.

ACKNOWLEDGEMENT

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EXPLANATION OF PLATES

Plate I

(All figures except 1 and 2 reproduced from Treatise on Invertebrate Palaeontology 2, Vol. 1, Ed. Moore, showing various types of wall structures in arenaceous foraminifera).

1-2. *Bronnimannina eocenica* Singh and Kalia, showing vacuolar wall. Fig. 1 ×94 ; Fig. 2 ×200.
3. *Jarvisella* Bronnimann showing infolding of the chamber wall. ×24.
4-5. *Liebusella* Cushman and Cubanina Palmer showing internal partitions. Fig. 4 ×10 ; Fig. 5 ×30.
6. *Pavonitina* Schubert, showing incomplete vertical partitions. ×33.
7. *Textulariella* Cushman, showing haphazard arrangement of partitions. ×33.
8. *Guppyella* Bronnimann, showing albeolar cavities formed by two sets of paritions. ×35.
9-11. Fig. 9—*Pfenderina* Henson ×40 and figs. 10 and 11—*Kurnubia* Henson ×36, showing spongy columnelar infilling andro subepidermal reticulate layer.
12. *Camagueyia* Cole and Bermudez, showing collumella formed by vertical pillars. ×41.

Plate II

1-14. *Alveoclavulina madhuchakra* Singh & Kalia, gen. et. sp. nov.
1-2. Holotype (Microspheric Form). 1—Side view. 2—Apertural view. ×130.
3-4. Paratypes 3—side view ; 4—apertural view ×130.
5-7. Paratypes (megalospheric) form showing variation ×90.
8-10. Paratypes microspheric forms showing variations. ×90.
12-13. Transverse section through the Uniserial part showing projections in the chamber lumen. Fig. 12 ×400 ; Fig. 13 ×370.
14. Transverse section through the biserial stage, showing projections in the chamber lumen. ×375.

Plate III

1-4. Scan Electron micrograph of *Alveoclavulina madhuchakra* Singh and Kalia gen. et. sp. nov.
1. Microspheric specimen, showing polygonal surface pattern and apertural outline. ×800.
2-4. Megalospheric specimen, showing polygonal surface pattern and apertural outline. Fig. 2—×3800 ; Fig. 3— ×1090 and Fig. 4—×8,000.