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ARENACEOUS FORAMINIFERAL ASSEMBLAGE FROM MIDDLE EOCENE OF SHRI KOLAYATJI, BIKANER, RAJASTHAN

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ABSTRACT—In the present paper, twenty two species of arenaceous foraminifera belonging to the superfamily Lituolacea from the Kirthar (Lutetian) beds of Rajasthan are recorded and described, of which 8 species are new.

INTRODUCTION

As late as 1959 (see Nagappa) the knowledge of post-Mesozoic strata occurring in Rajasthan was limited to the rocks belonging to the Lower Eocene Laki Series excepting for the report of the discovery of Kirthar beds exposed in Bikaner district by Singh (1951), who later (1952, 1953, 1969) also worked out the larger foraminiferal fauna of the Lower and Middle Eocene of Rajasthan, establishing a regional stratigraphic succession and correlation on their basis.

The study of smaller foraminifera of these rocks has also been almost neglected and limited, except for some preliminary descriptions by Jacob and Sastry (1950) from Fuller's Earth (Laki) and a listing of genera and important species by Singh.

The present paper incorporates descriptions of only the agglutinated forms belonging to the superfamily Lituolacea obtained from the Kirthar (Lutetian) beds exposed near Shri Kolayatji village Bikaner, Rajasthan (for detailed stratigraphy, see Singh 1969). The material is highly fossiliferous, particularly in the number of foraminiferal species, with a fair representation of most of the families belonging to the superfamilies—Lituolacea, Miliolacea, Globigerinacea, Buliminacea, Nodosariacea, Discorbacea, Rotalacea and Cassidulinacea.

SYSTEMATIC DESCRIPTION

Order Foraminiferida EICHWALD 1830

Suborder Textularina DELAGE and HEROUARD 1896

Superfamily Lituolacea DE BLAINVELLE

Family Textulariidae EHREBERG, 1838
Subfamily Textulariinae EHREBERG, 1838
Genus *Textularia* DEFRANCE, 1824.
Textularia anglica LALICKER, 1935.

Pl. 1, fig. 1

1935 *Textularia anglica*, Cushman Found. Foram. Res. Contr. U.S.A., Vol. 11, pt. 1, p. 11. pl. 2.

Remarks. The illustrated specimen and its paratypes, referable to *Textularia anglica* Lalicker, bear a depressed central area at the apertural end and are slightly larger in average size of the test as compared to the original. These differences are merely variational, falling within the range of a species. Fairly common in the material.

Average measurements in mm. Length 0.475 mm, Breadth 0.4. mm and Thickness 0.25 mm.

Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan.

Horizon. Bikaner Stage. Kirthar Series (Lutetian).

Repository. Author's collection, hypotype no. SFKly/1.

Textularia bhaskarai sp. nov.

Pl. 1, figs. 2-4

Description. Test cylindrical, elongate, laterally compressed, increasing in width gradually from a point at the initial and toward the apertural; peripheral margin subacute, chambers rectangular in shape; gradual increase in thier height makes the final chamber-pair subglobose and inflated; sutures distinctly depressed nearly straight with a slight backward curvature; aperture a high arch at the inner margin of the ultimate chamber. Wall composed of medium to coarse arenaceous grains, surface roughly finished.

Measurement. Holotype-Length 0.7 mm, Breadth 0.5 mm and Thickness 0.3 mm.

Average. Length 0.575 mm, breadth 0.3 mm, thickness 0.25 mm.

Comparison and Remarks. Textularia bhaskarai sp. nov. is similar to *T. lontensis* Lalicker described from the Bartonian beds of Italy, but differs in possessing subacute peripheral margin. It also resembles *T. teasi* Cushman and Ellisor 1939 (Oligocene, Louisiana) in general shape of the test but is distinct in all other characters; from *T. farafraensis* Le Roy, 1953 (Palaeocene, Egypt). *T. bhaskarai* differs in possessing a cylindrical and slowly enlarging test.

Etymology. The new species has been named after the famous ancient Indian astronomer "BHASKARA".

Type Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan, India.

Type Locality. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, Holotype no. SFKly/2.

Textularia broussardi HOWE AND WALLACE 1932.

Pl. 1, figs. 5-7

1935 *Textularia broussardi* Howe and Wallace, Louisiana Dept. Conser. Geol. Bull., New Orleans, U.S.A., No. 2, p. 18, pl. 1, fig. 3.

Remarks. The illustrated specimen conforms in its characters with the original type described from the Upper Eocene (Jackson) of Louisiana. Fairly common, especially in the ferruginous layers.

Average Measurements. Microspheric Length 0.8 mm, breadth 0.525 mm, thickness 0.525 mm.

2. Megalospherics. Length 0.75 mm, breadth 0.45 mm, thickness 0.55 mm.

Locality. About 6 kilometers west of Shri Kolayatji, near Fullers's Earth quarry, Bikaner, Rajasthan.

Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, hypotype no. SFKly/3.

Textularia chapmani LALICKER 1935

Pl. 1, figs. 8-10

1892 *Textularia conica*, Chapman (non d' Orbigny), Journ. Roy. Micro. Soc., p. 328, pl. 6, fig. 20.

1935 *Textularia chapmani* Lalicker, C. G., Contr. Cushman Lab. Foram, Res., p. 328, pl. 6, fig. 20.

Remarks. The forms referable to *T. chapmani* occur commonly in the material. These, however, show slight variation from the typical in bearing coarsely arenaceous test, in having an acute margin and suggestion of a lip bordering the aperture.

Average Measurements. Length 0.775 mm, breadth 0.525 mm and thickness 0.375 mm.

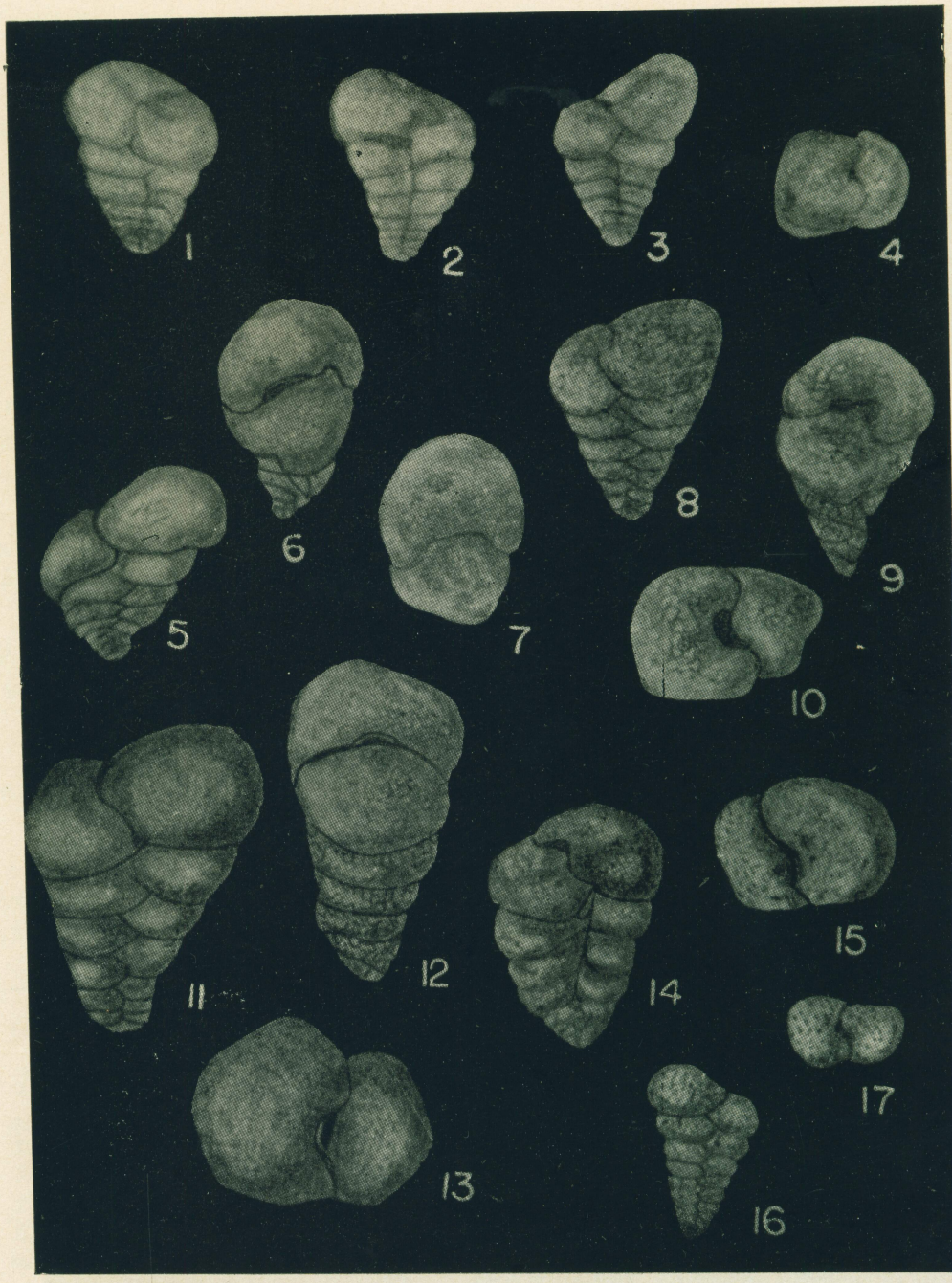
Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan.

Horizon. Bikaner Stage, Kirthar Series (Lutetian).

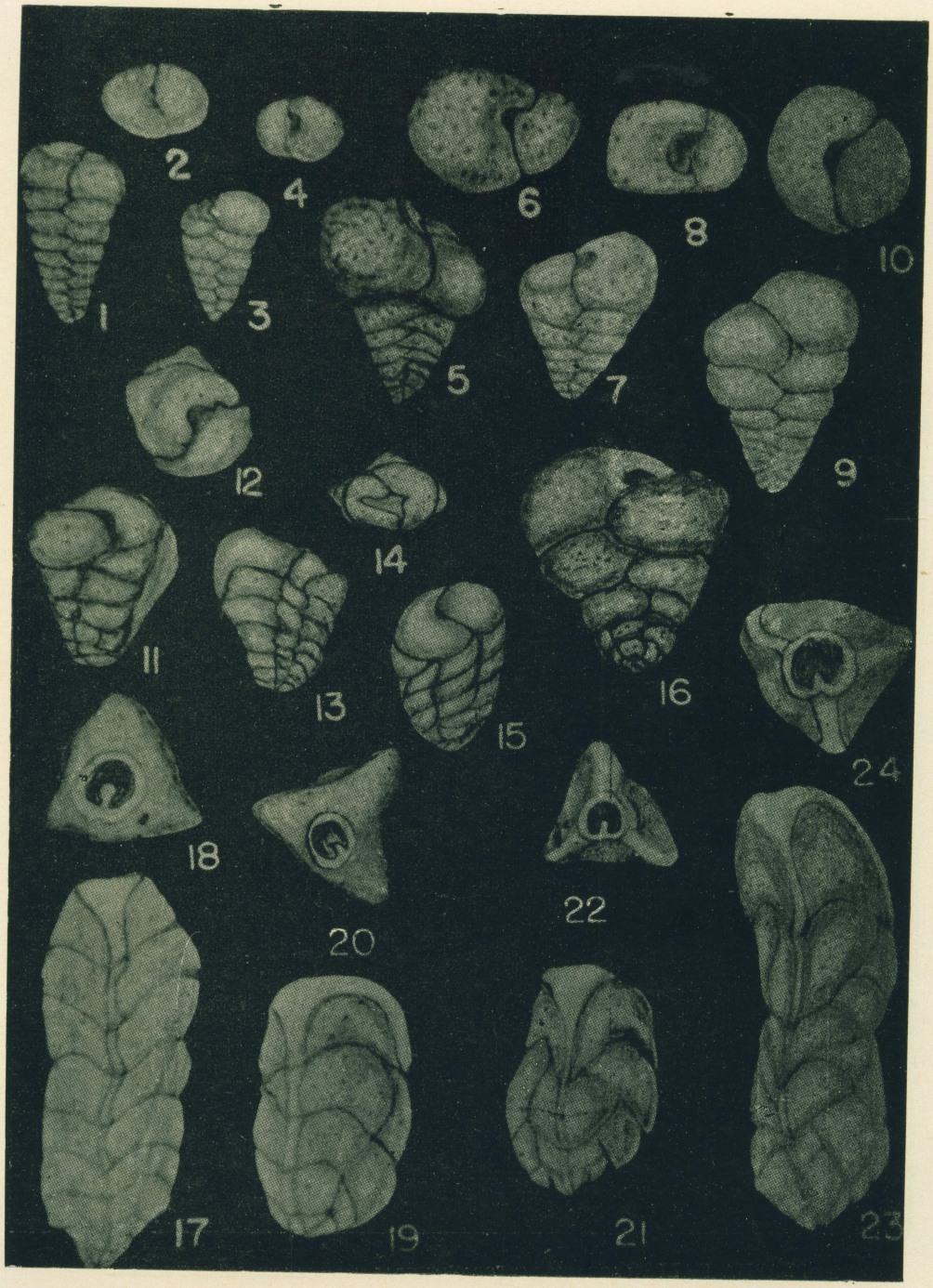
Repository. Author's collection, hypotype no. SFKly/4.

EXPLANATION OF PLATE—1

1. *Textularia anglica* Lalicker, side view. x 40,
2-4. *Textularia bhaskari* sp. nov., Holotype, 2, 3-side viwes, 4-apeatural view. x 40.
5-7. *Textularia broussardi* Howe and Wallace. Hypotype, 5-side view, 6-marginal edge view, 7-apertural view. x 40.
8-10. *Textularia chapmani* Lalicker, hypotype; 8-side view, 9-marginal edge view, 10- apertural view. x 40.
11-13. *Textularia dollifussi* Lalicker, hypotype, 11-side view, 12-marginal edge view, 13-apertural view. x 60.
14-15. *Textularia hanni* Davis, megalospheric hypotype, 14-side view, 15-apertural view. x 60.
.16-17 *Textularia halkyardi* Lalicker, hypotype, 16-side view, 17-apertural view. x 40.



PRABHA KALIA : ARENACEOUS FORAMINIFERAL ASSEMBLAGE, MIDDLE EOCENE



PRABHA KALIA : ARENACEOUS FORAMINIFERAL ASSEMBLAGE, MIDDLE EOCENE

Textularia dollifussi LALICKER 1935

Pl. 1, figs. 11-13

1935 *Textularia dollifussi* Lalicker, C. G., Contr. Cushman Lab. Foram. Res. U. S. A., Vol. 11, pt. 2, p. 45, pl. 7, figs. 8-9.

Remarks. The specimens identical to *T. dollifussi* Lalicker are fairly common in the material. These exhibit some variations in possessing more distinct and depressed sutures and coarser size of the agglutinated grains forming the wall.

Average Measurements Length 0.7 mm. breadth 0.5 mm and thickness 0.35 mm.

Locality. About 6 kilometers west of Shri Kolayatji, near Fullers Earth quarry, Bikaner Rajasthan.

Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, hypotype on. SFKly/5.

Textularia halkyardi LALICKER 1935.

Pl. 1, Figs. 16-17

1917 *Textularia agglutinans* Halkyard, Mem. Proc. Manchester Lit. Phil. Soc. Vol. 62, p. 1.

1935 *Textularia halkyardi* Lalicker, C. G., Contr. Cushman Lab. Foram Res. U. S. A. Vol. 11, pt. 2, p. 45, pl. 7, figs. 5 a-c.

Remarks. A great number of specimens representing the different stages of *T. halkyardi* Lalicker, have been encountered in the material. There are three distinct sets of individuals which probably represent the young, adult and mature ontogenetic stages.

Average Measurements.

	Length	Breadth	Thickness
Set I	0.525 mm,	0.35 mm,	0.25 mm.
Set II	0.4 mm,	0.325 mm,	0.225 mm.
Set III	0.375 mm,	0.3 mm,	0.2 mm.

Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan.

EXPLANATION OF PLATE—2

1-4. *Textularia kirtharana* sp. nov., 1, 2-side and apertural views of the microspheric Holotype 3, 4-side and apertural views of a megalospheric hypotype. x 40.

5-6. *Textularia orbignyi* sp. nov. Holotype, 5-side view 6. apertural view. x 40.

7-8. *Textularia ovulata* Lalicker, hypotype, 7-side view, 8-apertural vsew. x 40.

9-10. *Textularia* aff. *T. ouachitaensis* Howe and Wallace. 9-side view, 10-apertural view. x 40.

11-15. *Gaudryina* aff. *G. hokuseiensis* Chang, 11, 13, 15-side views 14-apertural view. x 40.

16 *Goudryina kugleri* Cushman and Renz, side view of a hypotype.

17.20. *Tritaxia jarvisi* (Cushman), 17, 18-side and apertural views of an adult hypotype, 19, 20-side and apertural views of a young hypotype. x 90.

21-24. *Tritaxia brunswickensis* (Todd and Kniker) 21, 22, side and apertural views of a young hypotype. 23, 24-side and apertural views of an adult hypotype. x 90.

Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, hypotype no, SFKly/6.

Textularia hannai Davis 1941

Pl. 1, Figs. 14-15

1941 *Textularia hannai* Davis, E. E., Journ. Pal. Tulsa Oklahama, U. S. A. Vol. 15, p. 149, pl. 24, figs. 11-13.

Remarks. Both the micro and megalospheric generations of *T. hannai* Davis are present in the material. These vary from the original type in possessing a distinctly depressed apertural face.

Average measurements. Length 0.575 mm, breadth 0.35 mm, thickness 0.25 mm.

Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan.

Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, hypotype no. SFKly/7.

Textularia kirtharana sp. nov.

Pl. 2, Figs. 1-4

Description. Test laterally compressed, elongate, gradually and evenly increasing in width; test margin slightly indented; chambers numerous, upto 18 pairs, broader than high; later chambers show an abrupt increase in height, last formed pair of chambers becomes subglobose; sutures transverse, depressed, aperture a low arch situated at the inner margin of the final chamber. Wall arenaceous, constituted by fine to medium sized grains with considerable cement; surface roughly finished.

Measurements.

	Length	Breadth	Thickness
Holotype (microspheric)	0.625 mm,	0.325 mm,	0.225 mm.
Average=0.55 mm, (megalospheric)		0.325 mm,	0.225 mm.

Comparision and Remarks. This species is similar to *T. midwayana* Lalicker, 1935, in general outline of the test but differs in possessing greater number of chambers, in possessing more globose and inflated ultimate chamber pair and bearing a roughly finished test. *T. kirtharana* sp. nov. occurs commonly

EXPLANATION OF PLATE—3

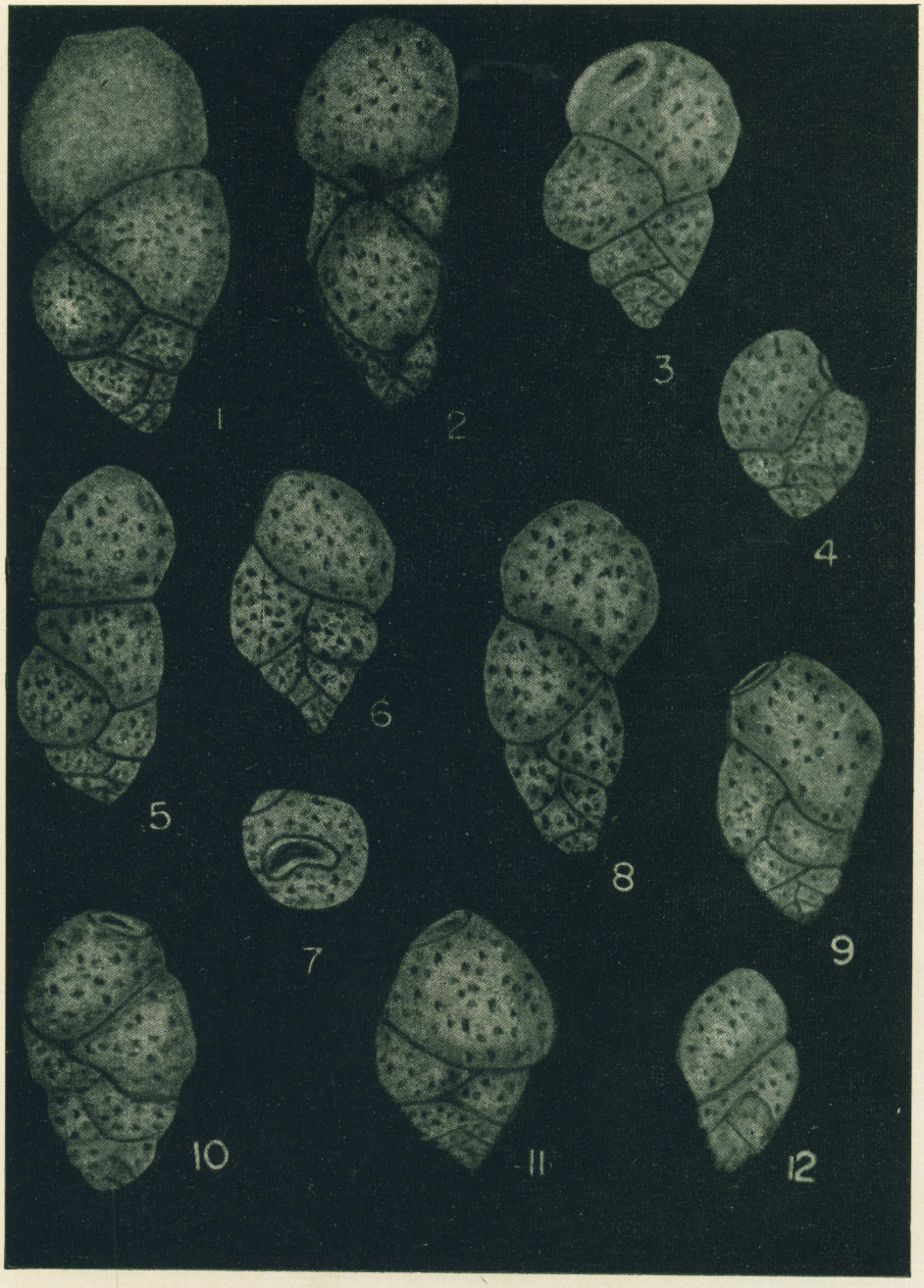
Pseudobolivina kolayatensis sp. nov.

1, 2. Side and edge view of the Holotype.

3, 6, 7, 10, 11-Hypotypes showing almost perfect biserially arranged chambers and laterally placed loop shaped aperture.

5, 8. Specimens showing centrally placed final chamber.

4, 9, 12, Specimens showing variations at different ontogenic stages. 3-8 x 60, 1, 2, 9-12 x 90, 13, 14 x 90).



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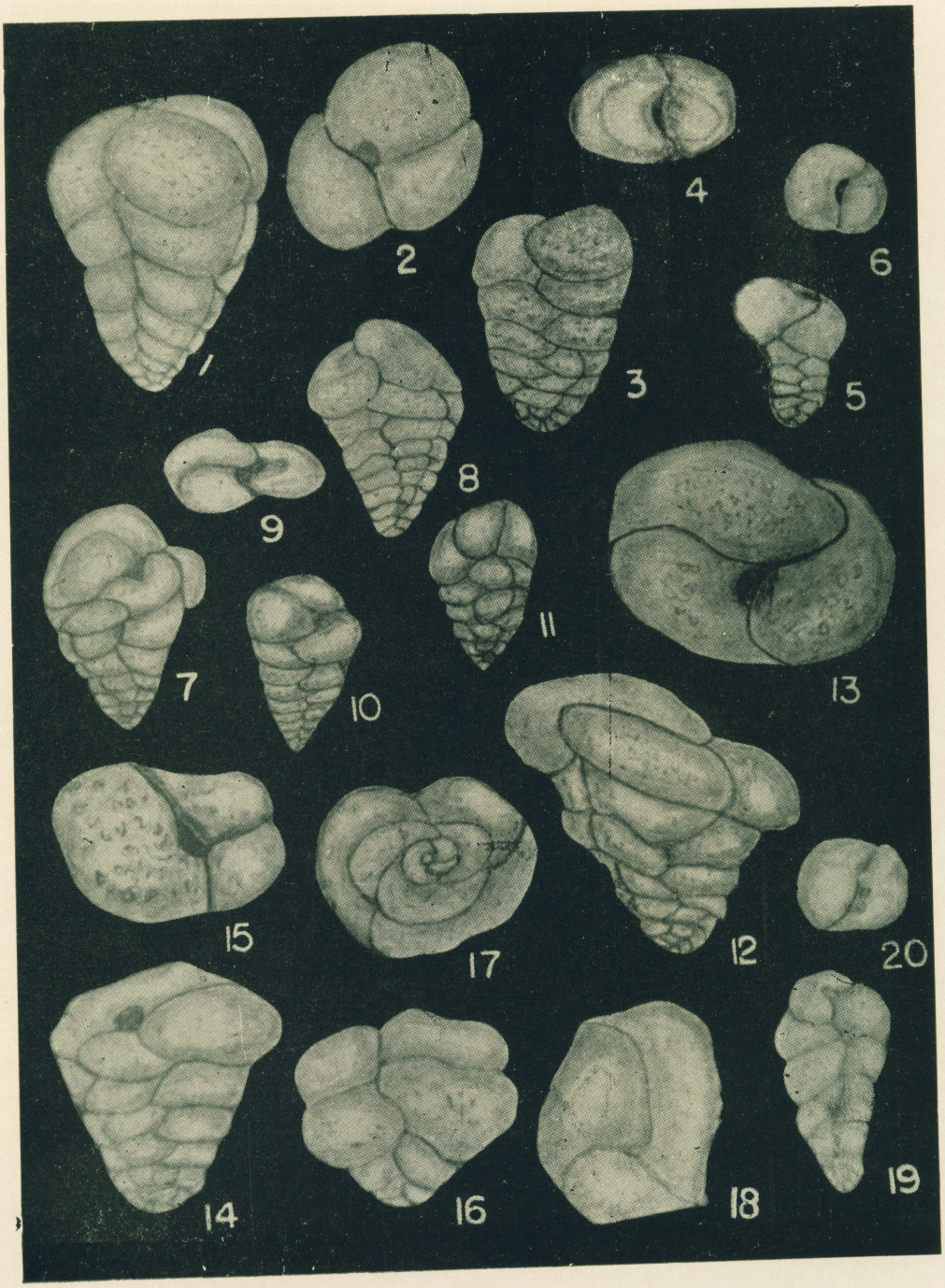

PRABHA KALIA : ARENACEOUS FORAMINIFERAL ASSEMBLAGE, MIDDLE EOCENE

in the material, especially in the yellow layers.

Type Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan, India.

Type Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, Holotype no. SFKly/80, paratypes-assemblage slide no. SFKly/81.

Textularia aff. *ouachitaensis* HOWE AND WALLACE 1932

Pl. 2, Figs. 9-10

1932 *Textularia ouachitaensis* Howe and Wallace, Lousiana Dept. Conser. Geol. Bull. New Orleans, U. S. A., no. 2, p. 20, pl. 1, fig. 1.

Remarks. The illustrated specimen is nearest to *T. ouachitaensis* Howe and Wallace, described from Upper Eocene of Louisiana. Its occurence is very rare in the material, a closer examination of more specimens may later on reveal its correct identity.

Average Measurements. Length 0.885 mm, Breadth 0.5 mm, Thickness 0.385 mm.

Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan.

Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, hypotype no. SFKly/9.

Textularia ovulata LALICKER 1935

Pl. 2, Figs. 7-8

1935 *Textularia ovulata* Lalicker, C. G., new name *T. rugosa* d'Orbigny, Contr. Cushman Found. Foram. Res. U. S. A., Vol. 11, pt. 2, p. 50, pl. 6, figs. 11-12.

Remarks. Fairly common in the material.

Average Measurements. Length 0,7 mm, breadth 0.5 mm, thickness 0.35 mm.

Locality. About 6 kilometers west of Shri Kolayatji, near Fullers Earth quarry, Bikaner, Rajasthan.

Horizon. Bikaner Stage, Kirthar Series (Lutetian).

EXPLANATION OF PLATE—4

1, 2. *Verneuilinoides tharensis* sp. nov., Holotype, 1-side view; 2-apertural view. x 60.
3, 3. *Dorothia valdiyai* sp. nov., Holotype, 3-side view, 4-apertural view. x 60.
5, 6. *Dorothia* sp. indet. 5-side view, 6- apertural view. x 30.
7-11. *Valvulina marhensis*, sp. nov., 7-9-side and apertural views of the Holotypc, 10-11-side views of a young paratype. x 40.
12-18. *Eggerellina mulkraji* sp. nov. 12, 13 side and apertural views of the Holotype; 14, 15-side and apertural view of a paratype; 16-13-different views of a young specimen, 16-side view, 17-initial end view, 18 apertural view. x 40.
19, 20. *Textulariella* sp. Side and apertural views. x 40.

Repository. Author's collection, hypotype no. SFKly/10.

Textularia orbignyi sp. nov.

Pl. 2, Figs. 5-6

Description. Test elongate, tapering, very much compressed in the earlier two-third portion, the remaining being occupied by the globose chambers of the final pair; earlier compressed chambers rectangular in outline, much wider than high; total number of chambers upto sixteen; sutures distinct, curved backwards; apertural face convex, sloping toward inner margin where a low arched aperture is situated. Wall fine grained arenaceous.

Measurements. Holotype. Length 0.65 mm, breadth 0.5 mm, thickness 0.4 mm.

Comparison and remarks. The new species *T. orbignyi* differs from *T. gramen* d'Orbigny in having much compressed earlier chambers and the characteristically inflated chambers of the final pair.

Etymology. The present species is named in memory of Alcide d'Orbigny the pioneer and foremost worker on foraminifera, both living and fossil.

Type Locality. About 6 kilometers west of Shri Kolayatji, near Fullers Earth quarry, Bikaner, Rajasthan, India.

Type Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, Holotype no. SFKly/11.

Subfamily Pseudobolivinae Wiesner 1931

Genus *Pseudobolivina* Wiesner 1931

Pseudobolivina kolayatensis sp. nov.

Pl. 3, Figs. 1-12

Description. Test elongate with twisted axis and distinctly lobulate margins; chambers 8-10 in number, cuneate in outline, wider than high in the first and second perfectly biserial pairs, later chambers loosely appressed and aligned almost alternatingly, marked by a rapid increase in the chamber dimensions and degree of inflation; in a few specimens the tests attain perfect uniseriality as the finally globose chamber becomes centrally placed sutures distinctly depressed, more deeply in the latest 2-3 chambers; aperture terminal, somewhat laterally placed, a curved slit with a suggestion of a border. Wall coarsely arenaceous, roughly finished.

Measurements.

	Length	Breadth	Thickness
Holotype—	0.675 mm,	0.35 mm,	0.225 mm.
Average	0.65 mm,	0.3 mm,	0.2 mm.

Comparison and remarks. In general appearance, the species resembles *P. variana* (Eicher) described from the lower Cretaceous of U. S. A. but is distinguishable from it by the presence of lesser number of chambers in the test; chambers are also broader in *P. kolayatensis* than in *P. variana* (Eicher).

Many specimens resembling *P. punctata* var. *arenacea* (Heron-Allen and Earland) 1922, have here been placed under *P. kolayatensis*, n. sp. as they have been considered to be

merely the variants of the typical; the marked lateral compression of these tests is attributed to collapse under pressure.

Text Fig. 1

P. kolayatensis sp. nov. occurs in great profusion and is represented throughout the Bikaner Stage. The species is highly variable exhibiting a spectrum of minor variations in morphological features. Two distinct sets of specimens belonging to *P. kolayatensis* sp. nov. can be distinguished broadly, these are, (a) more elongate tests tending rapidly to become uniserial through loosely appressed, alternatingly placed, chambers, (b) Tests almost biserial throughout with slightly unequally placed last two chambers and possessing laterally placed buliminoid aperture connected to a short internal tube (Plate 3, figs. 3. 4, 6, 7, 10). Specimens belonging to the set (b) might later be required to be separated from Pseudobolivininae and transferred to Bolivinitidae under the genus *Laterostomella* De Klasz and Rerat, 1962, with which they resemble most. The microstructure of these forms is scarcely discernible. In a section of the test (see Text Fig- 1) the wall appears coarsely granular which may either represent the arenaceous test wall or may be due to the recryrstalisaton of an originally calcitic wall. The latter possibility appears to be more plausible as almost all the specimens are infilled with crystallised calcite which might have affected the walls also.

Type Locality. About 6 kilometers west of Shri Kolayatji near Fullers Earth quarry, Bikaner, Rajasthan, India.

Type horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, Holotype no. SFKly/12, Hypotype assemblage slide no. SFKly/12/2.

Family Ataxophragmiidae Schwager 1877

Subfamily Verneuilinidae Cushman, 1935

Genus *Gaudryina* d'Orbigny, 1845

Gaudryina cf. *G. kokuseiensis* Chang, 1955

Pl. 2, Figs. 11-15

1954 *Gaudryina* (*Pseudogaudryina*) *kokuseiensis* Chang, L.S. Geol. Surv. Bull. No. 7, p. 59, Taiwan, Formosa).

Remarks. Only two poorly preserved specimens of *Gaudryina* sp. were found in the yellow layers of the *Discocyclina* zone. These resemble the figures of the young specimens of *G.* (*Pseudogaudryina*) *kokuseiensis* Chang recorded from Miocene beds of Taiwan.

Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan.

Horizon. *Discocyclina* zone, Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, hypotype no. SFKly/13/1-2.

Gaudryina kugleri CUSHMAN AND RENZ, 1941

Pl. 2, Fig. 16

1941 *Gaudryina kugleri* Cushman and Renz, Contr. Cushman Lab. Foram. Res., Vol. 17, P. 73-79, pl. 13.

Remarks. Specimens of *Gaudryina kugleri* Cushman and Renz occur commonly in the material.

Average measurements. Length 0.425 mm, breadth 0.35 mm, thickness 0.25 mm.

Locality. About 6 kilometers west of Shri Kolaoatji, near Fuller's Earth quarry, Bikaner, Rajasthan.

Horizon. Bikaner Stage, Kirthar, Series (Lutetian).

Repository. Author's collection, hypotype no. SFKly/14.

Genus *Tritaxia** REUSS, 1860

Tritaxia brunswickensis (TODD AND KNIKER

Pl. 2, Figs. 21-24

1952 *Clavulinoides brunswickensis* Todd and Kniker, Contr. Cushman Found. Foram. Res. Spec. Publ. Vol. 2 No. 1. p. 11, pl. 2

Remarks. Several specimens of *Tritaxia* identical to *Clavulinoides brunswickensis* Todd and Kniker, have been encountered in the material. In these specimens, however, the aperture is provided with a knob like projection of the internal tube which was not reported to occur in the original type. Specimens belonging to this species occur commonly throughout the Bikaner Stage.

Average measurements.

	Length	Breadth
Mature specimens—	0.75 mm,	0.375 mm.
Young specimens—	0.5 mm,	0.275 mm.

Locality. About 6 kilometers west of Shri Kolyatji, near Fuller's Earth quarry, Bikaner, Rajasthan.

Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, hypotype no. SFKly/15.

Tritaxia jarvisi (CUSHMAN) 1936

Pl. 2, Figs. 17-20

1936 *Clavulinoides jarvisi* Cushman. Cushman Lab. Foram. Res. Specl. Publ. No. 6, p. 37, pl. 3, figs. 18 a, b.

Remarks. The illustrated specimens are identical to *Clavulinoides jarvisi* Cushman, des-

*The genus *Clavulinoides* Cushman, along with ***Pseudogaudryinella*** Cushman and *Siphloclavulina* Silvestri has rightfully been placed under the synonymy of the genus *Tritaxia* Reuss by Loeblich and Tappan (1964, p. C 272).

cribed from the Miocene of Trinidad. These occur commonly in the material.

Average Measurements.

	Length	Breadth
Mature specimens—	0.8 mm,	0.3 mm.
Young specimens—	0.45 mm,	0.375 mm.

Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan.

Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, hypotype no. SFKly/16.

Genus *Vernuilinoides* Loeblich and Tappan, 1945.

Verneuilinoides tharensis sp. nov.

Pl. 4, Figs. 1-2

Description. Test elongate, tapering, broadest at the apertural end, consisting of three distinct vertical rows of subglobular inflated chambers; earlier chambers broader than high, later becoming equal in height and breadth. Sutures distinctly depressed. Apertural end-view roughly triangular with rounded edges, apertural face convex slightly sloping toward the inner margin, aperture low arched, centrally placed at the inner margin of the last chamber. Wall finely arenaceous, smoothly finished.

Measurements. Holotype : length 0.7 mm, breadth 0.55 mm, thickness 0.4 mm.

Comparison and Remarks. The new species is very similar to *V. tryphera* Loeblich and Tappan, 1950, described from the Red Water shales of South Dakota but differs with it in possessing greater number of chambers and slowly enlarging test of larger size.

Type Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan, India.

Type Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, Holotype no. SFKly/17, paratypes assemblage-slide no. SFKly/17/1.

Subfamily Globotextulariinae Cushman 1927.

Genus *Dorothia* Plummer 1931.

Dorothia valdiyai, sp. nov.

Pl. 4, Figs. 3-4,

Description. Test cylindrical, gradually tapering toward the initial end from the broader apertural end; initially a trochoid spire with five chambers to a whorl, reducing rapidly in number in the successive third and fourth whorls and finally becoming biserial in the adult; number of biserial whorls varies between 3 to 5; chambers wider than high, increasing in size as added; sutures somewhat obscure in the initial spiral whorls, distinct and depressed in the triserial and adult biserial stages. Apertural end elliptically rounded, apertural face characteristically smooth, sloping with rounded edges, depressed along the inner margin around the semicircular aperture. Wall coarsely arenaceous and roughly finished.

Measurements.

	Length	Breadth	Thickness
Holotype—	0.55 mm,	0.38 mm,	0.25 mm.
Paratypes—	0.6 mm,	0.35 mm,	0.25 mm.
	0.5 mm,	0.375 mm,	0.25 mm.
	0.45 mm,	0.35 mm,	0.175 mm.
	0.5 mm,	0.35 mm,	0.25 mm.

Comparison and Remarks. Dorothia valdiyai n. sp. differs with *D. wadiai* Tewari and Srivastava, 1968, described from the Ariyalur stage (Cretaceous of Tiruchirapalli, India) in the cylindrical, less elongate, broader and gradually tapering nature of the test. In general appearance, it is also very near to *D. confraga* Belford, 1960, described from the Upper Cretaceous (Santonian) of Toolinga Point, western Australia, but differs in possessing a broadly rounded, nearly truncate periphery rather than irregularly indented one, and in the rough finish of the test surface and higher proportion of cement in the coarsely arenaceous wall which consists of angular fragments of calcareous grains.

Etymology. The present species has been named after Dr. K.S. Valdiya, Department of Geology, Lucknow University.

Type Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan, India.

Type Horizon. Bikaner Stage, Kirthar, Series (Lutetian).

Repository. Author's collection, Holotype no. SFKly/18, paratypes assemblage-slide no. SFKly/18/1.

Dorothia sp. indet.

Pl. 4, Figs. 5-6

Description. Test conical, tapering toward the initial end; earlier whorls arranged in a spiral consisting of 5-6 chambers in each whorl, gradually reducing in number per volution, becoming ultimately biserial in the final whorl, the last two chambers suddenly become inflated and increase in size. Sutures obscure in the early portion of the test; distinct, oblique and curved upwards in the later portion. Apertural face slanting, with a low arched aperture situated at the inner margin. Wall coarsely arenaceous, roughly finished. Length of the sketched specimen 0.7 mm, breadth 0.45 mm, thickness 0.325 mm.

Remarks. As only one specimen of *Dorothia* sp. indet, is obtained so far, its detailed comparison and identification has not been attempted.

Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's earth quarry, Bikaner, Rajasthan.

Horizon. Discocyclina zone, Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, no. SFKly/19.

Genus *Eggerellina* MARIE 1941.

Eggerellina mulkraji sp. nov.

Pl. 4, Figs. 12-17

Description. Test pyramidal with indented margins, consisting of triserially arranged subglobular chambers, earlier chambers rounded in shape, gradually gaining in width and becoming much broader in the later whorl;

sutures distinctly depressed; apertural end roughly quadrangular in outline, convex with a pronounced central depression, apertural face sloping with a slit like aperture situated at the inner margin. Wall roughly finished, constituted of fairly large angular grains and considerable cement.

Measurements.

	Length	Breadth	Thickness
Holotype—	0.525 mm,	0.5 mm,	0 375 mm.
Paratypes—	0.8 mm,	0.735 mm,	0.5 mm.
	0.7 mm,	0.55 mm,	0.475 mm.
Megalo-spheric (young)	0.425 mm,	0 5 mm,	0.425 mm.

Comparison and Remarks. The new species *E. mulkraji* is distinct from all other known species of the genus *Eggerellina.* It occurs throughout the Bikaner Stage, common, more in *Discocyclina* zone,

Etymology. The new species has been named after Dr. Mulk Raj Sahni, formerly Professor of Geology, Punjab University.

Type Locality. About 6 kilometers west of Shri Kolayatji, near Fuller's Earth quarry, Bikaner, Rajasthan, India.

Type Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, Holotype no. SFKly/20, paratypes nos. SFKly/20/1-2.

Subfamily Valvulininae BERTHELIN 1880

Genus *Valvulina* D' ORBIGNY 1826

Valvulina marhensis sp. nov.

Pl. 4, Figs. 7-11

Description. Test elongate, tapering to a point at the initial end, maximum width of the test formed by the ultimate volution; composed of 7-8 whorls of triserially arranged chambers; chambers wider than high,gradually increasing in the height and degree of inflation, making chambers of the later whorls subglobose; sutures distinct, depressed, slightly curved backwards. Aperture a high arch, at the inner margin of the final chamber, provided with a valvular tooth. Wall finely arenaceous, smoothly finished,

Measurements.

	Length	Breadth	Thickness
Holotype—	0.775 mm,	0.325 mm,	0.25 mm.
Paratypes—	0.525 mm,	0.325 mm,	0,20 mm.
	0.575 mm,	0.35 mm,	0.25 mm.
	0.425 mm,	0.275 mm,	0.15 mm.
	0.4 mm,	0.3 mm,	0.175 mm.

Comparison and Remarks. The new species *Valvulina marhensis* is very near to *V. flexilis* Cushman and Renz, 1941, described from the Agua Salada formation (Upper Oligocene, Trinidad) in the nature of easily collapsible wall. It differs from *V. flexilis*, particularly in possessing a more tapering test, different shape of the chambers and rate of increasing of various dimensions of the test. *Valvulina marhensis* n. sp occurs profusely. Because of the collapsible wall the percentage of distorted tests is considerable in the material.

Etymology. The species is named after the Marh village, located in the vicnity of Fuller's Earth quarry, Bikaner.

Type Locality. About 6 kilometers west of Shri Kolayatjl, near Fuller's Earth quarry, Bikaner, Rajasthan, India.

Type Horizon. Bikaner Stage, Kirthar Series (Lutetian).

Repository. Author's collection, Holotype no. SFKly/21, paratypes assemblage-slide no. SFKly/21/1.

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