

# A NEW ASTERIGERINID GENUS FROM THE KIRTHARS OF RAJASTHAN, INDIA

S. N. SINGH AND PRABHA KALIA\*

*Department of Geology, University of Lucknow, Lucknow-7,*

## ABSTRACT

The new genus *Alfredina* described in this paper occurs quite commonly in the middle Eocene beds exposed near Shri Kolayatji village, district Bikaner, Rajasthan. This form, while possessing the ventral stellar chamber pattern like *Asterigerina* d'Orbigny, is very distinct from all the known asterigerinid genera in bearing primary multiple aperture and also secondary multiple sutural apertures on the ventral and dorsal sides. This uniqueness of the apertural feature has necessitated the creation of the new subfamily Alfredinae under the family Asterigerinidae d'Orbigny. During the study it was observed that the arrangement of the ventral asterigerine chambers in all the existing genera under the family asterigerinidae can be grouped under two distinct types. Because these arrangements reflect their different modes of formation, it has been proposed that the existing members of this family be redistributed under two families, namely Asterigerinidae in which the forms possessing *Asterigerina* like pattern and *Asterigerinatidae* in which the forms possess *Asterigerinata* Bermudez like pattern of the ventral stellar chambers.

## INTRODUCTION

Since the erection of the family Asterigerinidae d'Orbigny 1839, it has been conventional to place in it, all the genera bearing ventral 'stellar chambers'. Recent studies made by BRONNIMANN (1951), HOFKER (1951, 1956, 1959) and REISS (1963) have demonstrated that the process of formation of the ventral 'stellar chambers' in different forms is varied. Therefore, it seems highly erroneous to group all the genera bearing ventral 'stellar chamber' under the same family.

On the basis of the disposition of the apertures present in the dorsal and the asterigerine chambers in *Alfredina* Singh & Kalia, gen. nov. the only plausible order of their development seems to be the same as described by BRONNIMANN (1951) for *Asterigerina carinata*, with the difference that in case of *Alfredina*, both the chambers are true chambers. This fact further goes to suggest that atleast in Asterigerinidae s.s. the asterigerine chambers have not been formed by the tooth-plate as explained by REISS (1963).

Although specimens of *Alfredina* occur quite commonly in both the middle Eocene zones of Rajasthan, (for detailed stratigraphy see SINGH 1970) it is unfortunate that the interior of all the specimens is filled with crystalline calcite, which obliterates the internal features in the majority of the specimens and thus made it impossible to prepare dissected specimens for the study of the internal features. However, out of a number of dissected specimens, only one showed the nature of the aperture in the dorsal chamber, while in others either it is seen partially or has been destroyed by recrystallisation.

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\*Present address—Department of Geology, University of Delhi, Delhi-7, India.



SYSTEMATIC DESCRIPTION

Superfamily DISCORBACEAE Ehrenberg, 1838  
 Family ASTERIGERINIDAE D'Orbigny, 1839  
 Subfamily ALFREDININAE subfam. nov.  
 Type Genus ALFREDINA gen. nov.

*Subfamily diagnosis*—Test flaring, carinate, low trochoid, with ventral stellar chambers occupying the radial sectors, i.e. intercalated between the ventrally visible part of the adjacent dorsal chambers, arranged in a rosette around the umbilical plug. Primary aperture interiomarginal multiple, secondary multiple dorsal and ventral sutural apertures.

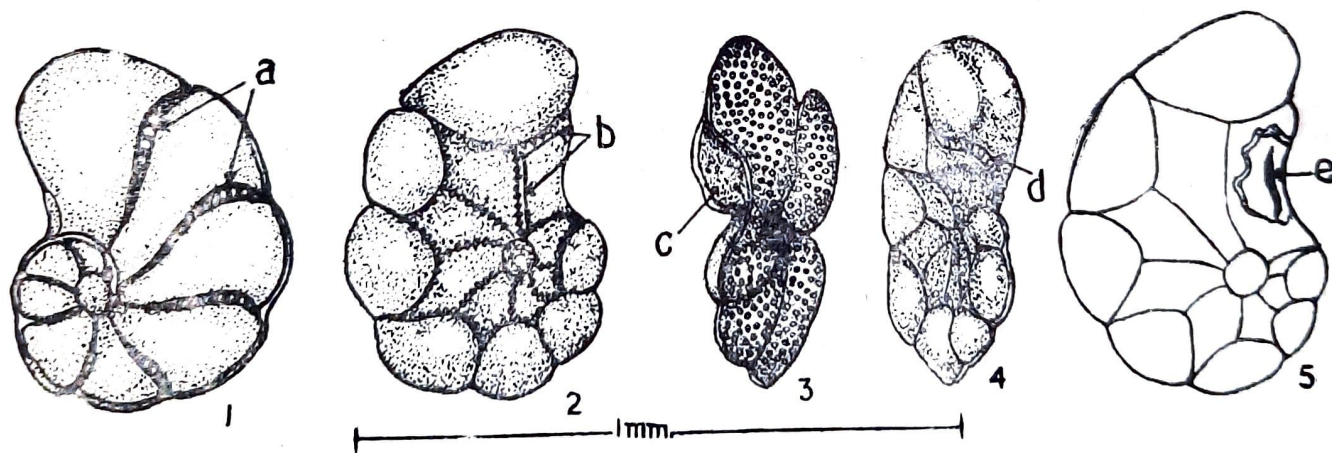
**Alfredina** gen. nov.

Type Species—*Alfredina tappanae* sp. nov.

*Generic diagnosis*—Test a low trochoid, convexo-concave, carinate, all chambers visible on the dorsal side except the initial few which are covered by a layer of shell substance; ventral involute side characterised by the asterigerine chambers occupying the radial sector and arranged in a rosette around the umbilical plug; chambers of the final whorl exhibit marked flaring; dorsal sutures directed backward, fissured, with secondary multiple aperture, similarly the asterigerine chambers have multiple aperture all along their sutures. Primary aperture interiomarginal, multiple, lodged in a long bordered slit along the last formed asterigerine chamber. Wall calcareous, coarsely perforate, built of radially arranged calcite, monolamellar.

*Occurrence*—Kirthar series (Middle Eocene), India.

*Etymology*—The genus has been named after Dr. Alfred R. Loeblich, Jr.



1-5. Camera Lucida figures of *Alfredina tappanae*: Text-Figs. 1. Dorsal view showing (a) Septal fissures with multiple aperture; 2. Ventral view showing, (b) asterigerine chambers with multiple sutural aperture; 3. Inclined edge view showing, (c) part of the asterigerine chamber projecting beyond the dorsal chamber; 4. Inclined view showing (d) primary multiple aperture in the asterigerine chamber; 5. Ventral view with a part of the asterigerines chamber removed to show the spertural position in the dorsal chamber.

**Alfredina tappanae** sp. nov.

Pl. 1, figs. 1-10; Text-figs. 1-5

*Description*—Test a low trochoid with  $2\frac{1}{2}$  whorls, convexoconcave, last whorl exhibits marked flaring, periphery carinate, carina persists along the spiral suture and gradually dies out towards the end of the final whorl, i.e. faintly developed in the last chamber. Evolute dorsal side convex, the point of maximum elevation marked by the deposite of shell substance, which obscures the details of the initial few chambers and also makes this side apparently



advolute. Chambers gradually increase in size in the earlier  $1\frac{1}{2}$  whorls but exhibit a pronounced flaring in the final whorl. Dorsal septal sutures deeply fissured, sigmoid and directed backward, with multiple openings formed by the horizontal bars developed across the fissure. The ventral involute side of the test is concave with a prominent umbilical plug around which the asterigerine chambers are arranged in a rosette, the asterigerine chambers are confined in the radial sectors, i.e. they are intercalated between the ventrally visible part of the two adjacent chambers. The sutures of the ventral asterigerine chambers bear multiple secondary apertures along their course. The primary aperture is interiomarginal, a boarded slit bearing multiple apertures along the edge of the last formed asterigerine chamber.

In equatorial sections cut at different levels, besides the characteristic flaring nature of the coiling, is seen the shape of the chambers in the whorls, interseptal fissures, the wall microstructure and also that the adjacent dorsal chambers do not communicate with each other either directly or through the interseptal fissures. The dorsal chamber is seen to communicate with the asterigerine chamber by its aperture (seen in dissected specimens only) which is multiple and basal in position.

				<i>Measurements in mm</i>		
				<i>Max. Diameter</i>	<i>Min. Diameter</i>	<i>Height</i>
Holotype	No.	SFKly/62	.. ..	0.75	0.575	0.3
Paratype	No.	SFKly/62/1	.. ..	0.9	0.625	0.175
Paratype	No.	SFKly/62/2	.. ..	0.5	0.375	0.15
Paratype	No.	SFKly/62/3	.. ..	0.6	0.525	0.25
Paratype	No.	SFKly/62/4	.. ..	0.575	0.425	0.225
Paratype	No.	SFKly/62/5	.. ..	0.52	0.375	0.15
Paratype	No.	SFKly/62/6	.. ..	0.75	0.525	0.2
Paratype	No.	SFKly/62/7	.. ..	0.6	0.35	0.175

*Comparison and remarks*—*Alfredina* gen. nov. is similar to *Asterigerinata* Bermudez 1949 in the compressed nature of the test, but is very distinct from it in the arrangement of the ventral stellar chambers with reference to the dorsal chambers and in possessing the multiple primary aperture. It is similar to *Asterigerina* d'Orbigny 1839 in the arrangement of the ventral chambers, but differs from it in being low trochoid and in possessing the multiple primary aperture and the secondary sutural apertures both on the dorsal and ventral sides. *Alfredina* bears only superficial resemblance with the epistomerid genera in possessing multiple sutural apertures, but differs with them in all other characters. Although the apertures in *Alfredina* seem to be morphologically similar to the septal aperture developed in *Tremastegina* Bronnimann 1951 but the two genera are basically different in the microstructure of their tests.

*Etymology*—The species has been named after Dr. Helen Tappan Loeblich.

*Type locality*—About 6 kilometers west of Shri Kolayatji village, near Fuller earth's quarry, Bikaner, Rajasthan.

*Type horizon*—Bikaner stage, Kirthar series (Lutetian).

*Repository*—Authors' collection, Holotype No. SKFly/62 and Paratype Nos. SKFly/62/1-7, at Lucknow University.

## DISCUSSION

The published data available on various genera possessing the ventral stellar chambers, and our observations made on the new genus *Alfredina*, and the other forms present in the middle Eocene material from Rajasthan, lead us to the conclusion that all the foraminifera



which bear ventral stellar chamber cannot and should not be grouped together only on the basis of their apparent resemblance in bearing this ventral feature, because, the mode of development and the structural elements involved in the formation of these stellar chambers are varied.

There exists a diversity of opinions regarding the mode of formation of true asterigerine 'chambers', i.e., those occupying the radial sector on the ventral side, intercalated between the ventrally visible part of the two adjacent dorsal chambers as in *Asterigerina* s.s. BRONNIMANN (1951) followed by SIGAL (1952) and HOFKER (1956, 1959) are of the opinion that the growth of these chambers in *Asterigerina carinata* d'Orbigny is in alternating series, one dorsal and one asterigerine 'chamberlets' being formed from one and the same primary aperture.

REISS (1963, p. 61) contradicting Bronnimann states, "...Lately BRONNIMANN (1951 b) stated that the chamberlet of *Asterigerina* (s. str.) are formed alternately with the 'primary chambers' i.e. at different instars and that the tooth-plate itself is formed in several phases. BRONNIMANN (op. cit.) assumed five growth stages... The present writer has examined a large number of excellently preserved specimens of *Asterigerina carinata* d'Orbigny from Cuba and Barbados and has found the stellar chamberlets to be nothing but part of the chamber separated from the remainder by the tooth-plate, which is never an external wall and which is formed undoubtedly at one and the same instar like the compartments it separates, this is support of HOFKER's earlier opinion (1951 b)."

Our observations on *Alfredina* reveal that the ventral asterigerine chambers bear their own basal multiple aperture and that the dorsal chamber communicates with the ventral chamber through these, while the adjacent dorsals do not communicate with each other directly, i.e. their communication is through the intervening ventral asterigerine chamber. This fact supports Bronnimann's observation that the growth of these two series of chambers is alternating.

## CONCLUSIONS

The fact about the arrangement of the ventral stellar chamber in various genera of Asterigerinidae is very striking in the sense that two distinct types of pattern are seen to develop: the 'Asterigerina Type', in which the stellar chambers occupy an alternating position with reference to the ventrally visible part of the adjacent dorsal chamber and the *Asterigerinate-Epistomaria* type in which the stellar chambers lie back for one radial sector. This morphological distinction in the arrangement of chambers and or chamberlets reflects their different mode of formation i.e. in the *Asterigerina* type these have developed by alternating growth stages and in the *Asterigerinata-Epistomaria* type, either by secondary lamellar superimposition or by the attachment of the internal tooth-plate. In view of the above observations, it is proposed here that the existing family Asterigerinidae d'Orbigny 1839 be redefined accordingly and should include only those forms in which the stellar chambers occupy the position as in *Asterigerina* s.s. The family be subdivided into the subfamilies Asterigerininae with two genera namely *Asterigerina* d'Orbigny 1839 and *Asterigerinella* Bandy 1949, and the subfamily Alfredininae with the genus *Alfredina*. The remaining genera included in the family Asterigerinidae in the Treatise on Invertebrate Paleontology, Loeblich and Tappan, possessing *Asterigerinata* type of arrangement of the stellar chambers by transferred to a new family Asterigerinatidae typified by the genus *Asterigerinata* Bermudez, 1949.

## REFERENCES

- BRONNIMANN, P. (1951). Die Mundöffnung bei *Asterigerina carinata*. *Eclog. geol. Helv.* **44**(2): 469-474.
- HOFKER, J. (1956). Foraminifera dentata. Foraminifera of Santa Cruz and Thatch-Island Virginia Archipelago, West-Indies. *Spolia zool. Mus. haun.* **XV**, Köbenhavn.
- HOFKER, J. (1959). Die asterigeriniden Foraminiferen. *Paläont. Z.* **33**(4).
- LOERLICH JR., A. R. & TAPPAN, H. *et al.* (1964). Protista 2, Sarcodina, Chiefly Thecamoebians and Foraminifera, in Moore, R. C. (Editor), *Treatise on Invertebrate Paleontology*. Pt. C, *Geol. Soc. Am. and Univ. Kansas Press*.
- REISS, Z. (1963). Reclassification of Perforate Foraminifera. *Bull. geol. Surv. Israel.* **35**: 1-111.
- SIGAL, J. (1952). Ordre des Foraminifera. in Piveteau, J., *Traité de Paleontologie*. I. Masson et Cie, Paris.
- SINGH, S. N. (1969). Stratigraphy of the Eocenes of Rajasthan. *Abst. Proc. Indian Sci. Cong., 56th. Session.* pt. III: 216-217.
- SINGH, S. N. (1970). Planktonic foraminifera in the Eocene Stratigraphy of Rajasthan, India. *Proc. II Planktonic Conference, Rome*.
- SINGH, S. N. & KALIA, PRABHA (1970). A new Planktonic Foraminifera from the Middle Eocene of India. *Micropaleontology.* **16**(1): 76-82.

## EXPLANATION OF PLATE I

### *Alfredina tappanae* gen. et sp. nov.

1. Dorsal view of holotype showing nature of coiling and the interseptal fissure with multiple aperture.  $\times 45$ .
2. Ventral view of holotype showing arrangement of the asterigerine chambers and the multiples sutural apertures.  $\times 45$ .
- 3, 4. Ventral view of two paratypes showing the coarsely perforate nature of the wall of the ventral and dorsal chambers and the multiple apertures along the asterigerine sutures.  $\times 60$ .
5. Horizontal section showing interseptal fissure and the radial calcitic wall structure.  $\times 65$ .
6. Horizontal section showing the arrangement of and disposition of the dorsal and the asterigerine chambers.  $\times 60$ .
7. A thick horizontal Section.  $\times 70$ .
8. Vertical section along the shorter diameter showing the trochoid coiling and the umbilical plug.  $\times 90$ .
9. Vertical section along the longer diameter showing arrangement and relation of the dorsal and the asterigerine chambers.  $\times 115$ .
10. Part of fig. 9 magnified.  $\times 230$ .





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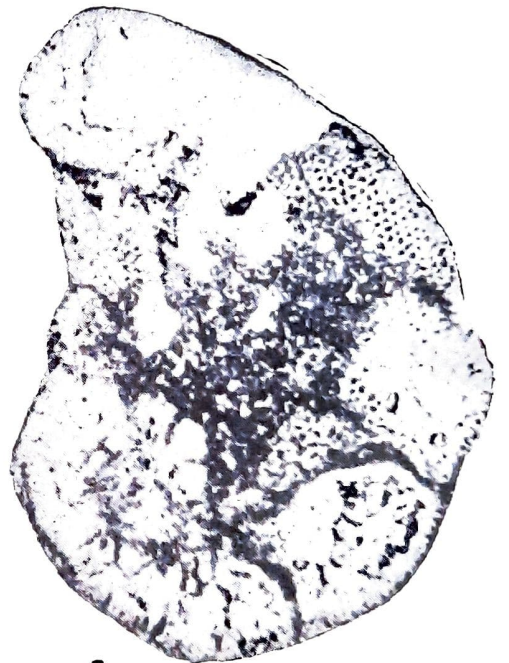
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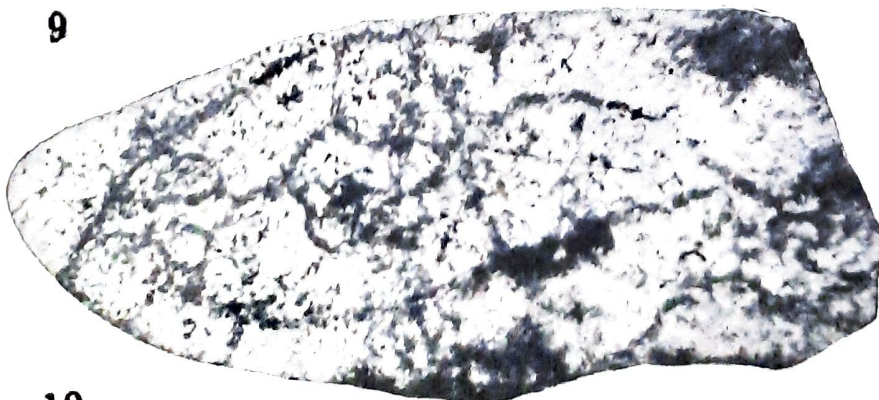
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