THE GENUS *TROCHOLINA* FROM THE CRETACEOUS ROCKS OF ARIYALUR STAGE, SOUTH INDIA

B. S. TEWARI and R. P. SRIVASTAVA*
Department of Geology, Lucknow University, India

ABSTRACT—A biometric study of *Trocholina sahnii* Tewari & Srivastava has been made, and it has been studied in detail and redescribed from Marly beds of Lower Maestrichtian age, near, Ariyalur, Trichinopoly district, South India. Its stratigraphic importance has been discussed.

INTRODUCTION

THE marine Cretaceous formations of Trichinopoly of South India, constitute a veritable museum of palaeontology. The stratigraphical relationship of the beds of different stages and their fossil content have been known by the publications of Kaye (1840), Forbes (1844), Blanford (1864), Stoliczka (1871), and Vredenburg (1908). In the recent years, however, Rama Rao (1953,54,56), Narayana Rao (1941), Jacob and Sastry (1951), and Rasheed (1962), have contributed to our knowledge of foraminiferal assemblage of these beds.

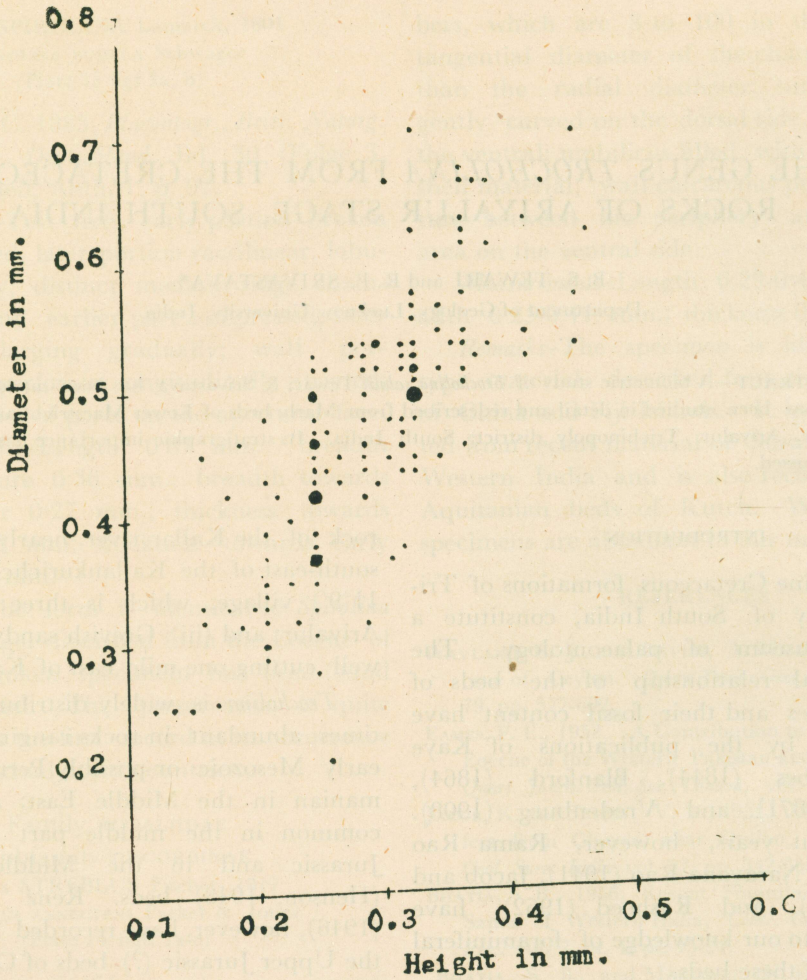
The genus *Trocholina,* which forms the subject matter of this paper, was for the first time noticed by the present authors (1963) from this country from the Ariyalur stage of the Cretaceous rocks of South India. A large number of well preserved specimens were isolated for the present study from (i) Compact yellow marls, outcropping in a tributary of the Kallar stream-cutting in the vicinity of the village Konerirayapuram (79° 6′ : 11° 8′), nearly one and half miles east of Ariyalur (79° 4′ 30″ : 11° 8′); (ii) Compact, brownish yellow clayey Limestone forming the bed-rock of the Kallar river, nearly four furlongs south-east of the Kallankurichchi (79° 7′ 15″ : 11°9′) village, which is three miles east of Ariyalur; and (iii) Greyish sandy marl from a well cutting one mile east of Kallankurichchi.

Trocholina is widely distributed and sometimes abundant in rocks ranging in age from early Mesozoic or possibly Permian to Cenomanian in the Middle East; and it is most common in the middle part of the Upper Jurassic and in the Middle Cretaceous (Henson, 1948) beds. Renz and Reichel (1946), however, have recorded *Trocholina* from the Upper Jurassic (?) beds of Cyprus.

In the present work the Cushman's classification has been adopted. After the publication of the original description of this species, fresh material was collected which yielded very well preserved, almost translucent and characteristic specimens of *Trocholina sahnii* Tewari and Srivastava from Kallankurichchi river bed and a well cutting nearby.

Number of chambers and the nature of the sutures along with other characters of the species have been studied by immersing the specimen in a clearing liquid like water or glycerine enabling us to redescribe it in detail.

*Present address : Dr. B.S. Tewari, Geology Department, University of Punjab, Chandigarh and Dr. R.P. Srivastava, Geologist, Geological Survery of India, Jaipur.



TEST FIG. 1—Scatter diagram of diameter and height of the test of *Trocholina sahnii* Tewari & Srivastava.

SYSTEMATIC DESCRIPTION

Family OPHTHALMIDIIDAE

Subfamily CORNUSPIRINAE

Genus TROCHOLINA, Paalzow, emend. Henson, 1948

TROCHOLINA SAHNII Tewari and Srivastava

(Plate 1 figs 1 & 2 a, b, c,)

Trocholina sahnii Tewari and Srivastava, 1963., *Pal. Soc. India.*, Vol. 5

Description:—Test lenticular, subglobular, ventral surface flat, dorsal swollen at the poles, only the last whorl forming the margin of the test is externally visible; ventrally umbilicate; peripheral margin slightly keeled, subrounded with slight constriction to crenate in majority; chambers usually nine to twelve in number, indistinctly visible when wetted with water; chamber walls are calcareous, translucent, and micro-granular; dorsal side is filled with superficial deposits of crystalline calcite which forms at the surface a mass of small granules lacking any systematic arrangement, and gives rise to pitted appearance; the umbilicus on the ventral side is filled with a similar deposits of crystalline calcite, producing on the surface a pattern of reticulate ridges over the poles, merging into

fine radial ridges towards the margin, the ridges bifurcate and continue upto the margin completely disappearing on the dorsal side; sutures indistinctly visible when specimen is wetted with water, emerging radially but slightly curved near the peripheral margin on the ventral side, while on the dorsal side it is recurved, shapeds; aperture a simple terminal opening at the end of the spiral tube, situated on the periphery and extending to the ventral side.

Diameter of the Holotype 0·51 mm;
Height 0·27 mm.
Diameter of the Paratype 0·36 mm;
Height 0·23 mm.

Comparison-This species differs distinctly from *Trocholina lenticularis* Henson, reported from Lower Cenomanian beds of Dukhan, Arabia, by the absence of radial ridges on the dorsal side of the test.

Association-This species occurs, abundantly in association with *Orbitocyclina ariyalurensis Rao*, *Globotruncana arca* (Cushman), *G. gansseri Bolli*,, *Lepidorbitoides blanfordi Rao, L. inornata Rao*, *Siderolites calcitrapoides* Lamarck. In addition to these, the genus *Textularia, Dentalina, Nodosaria, Bolivina, Lenticularis, Gaudyrina, Dorothia, Nonionella, Buliminella, Marginulina, Vaginulina, Bolivinoides, Gumbelina, Gumbelitria, Lagena, Quinquloculina, Triloculina, Cibicides*, and *Ostracodes* etc. are also found.

Remarks :—The age of the *Trocholina sahnii* Tewari and Srivastava as such occurring in the Marly beds near Ariyalur, in association with the above foraminiferal assemblage, have been assigned to Lower Maestrichtian.

STATISTICAL TREATMENT

Burma (1948) has pointed out that in qualitative palaeontology, inferences from sample to population are made on the basis of opinion. As a result of it, opinion differs so widely that one person has no way of checking another's opinion because of its subjective nature. Simple statistical methods should be utilized for attacking such problems. With this view in mind, he has elaborately discussed the importance of mean, standard deviation, and standard error. He assumes that if we collect a suite of some particular kind of fossil from a homogeneous population this sample will have certain individual characteristics. It will consist of certain number of individuals (N). It will have a certain arithmetic mean (M)

$$M = \frac{\Sigma X}{N}$$

Where $\times$ is the individual measure of one character of one specimen. It will also show a certain variability which will not be exactly duplicate variability of the population from which the sample was drawn. It will have a certain standard deviation (S)

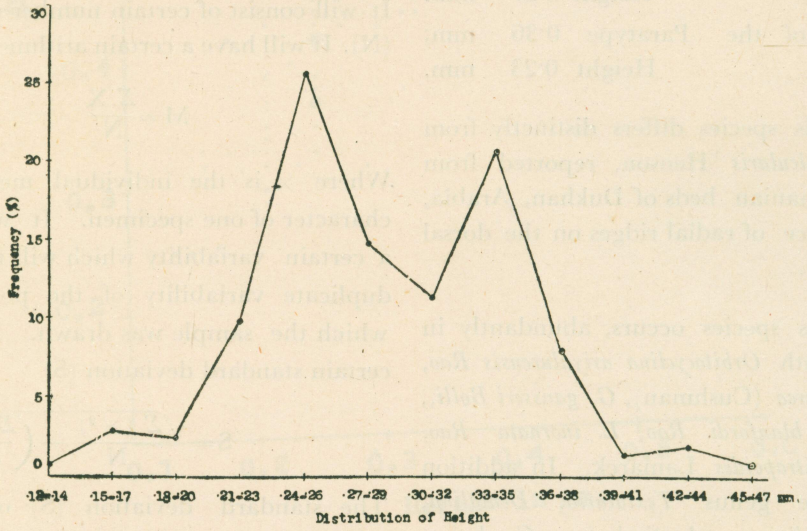
$$S = \sqrt{\frac{\Sigma (\times^2)}{N} - \left(\frac{\Sigma \times}{N}\right)^2}$$

The standard deviation (S) obtained thus, refers to a measure of the central tendency of a sample i. e. the tendency for its members to group themselves about a mean. The smaller the value of S, the less variable the sample is and the larger its value, the greater the variability. The value $M \pm 3S$ is commonly used to assess the variability of the population. If the standard deviation is divided by the square root of the number of the individuals in the sample ($S/\sqrt{N}$), a measure known as the standard error of the mean (SM) is obtained. The value $M \pm 3S\ M$ gives an idea of the range within which the mean of the population may be expected to fall.

TABLE 1—HEIGHT DISTRIBUTION : ABSOLUTE PERCENTILE, MEAN AND STANDARD DEVIATION

Mm.	f.	p. c.
0·12 – 0·14	2	0·66
0·15 – 0·17	9	2·9
0·18 – 0·20	7	2·3
0·21 – 0·23	29	9·6
0·24 – 0·26	77	25·5
0·27 – 0·29	44	14·6
0·30 – 0·32	34	11·2
0·33 – 0·35	62	20.5
0·36 – 0·38	24	7·9
0·39 – 0·41	4	1·3
0·42 – 0·44	6	1·9
0.45 – 0.47	3	0·9
TOTAL	301	99.26

Mean ± Standard Error 0·29±0.035 Standard Deviation 0·061

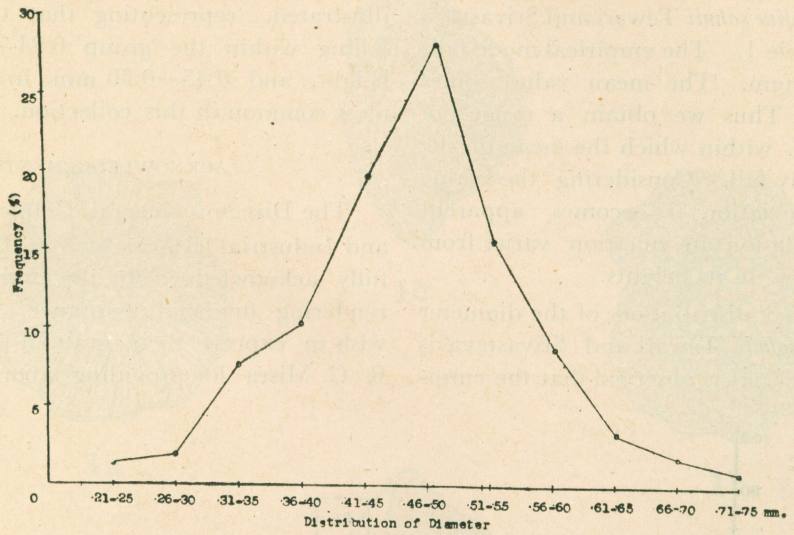


TEST FIG. 2—Percentage distribution of height of *Trocholina sahnii* Tewari & Srivastava

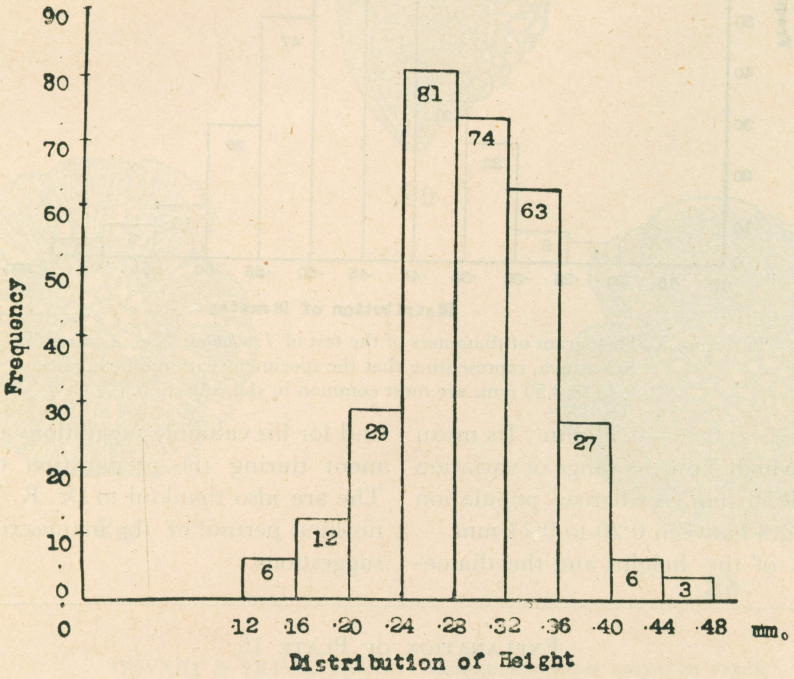
TABLE 2—DIAMETER DISTRIBUTION : ABSOLUTE PERCENTILE, MEAN AND STANDARD DEVIATION

Mm.	f.	p. c.
0·21 – 0·25	4	1·3
0·26 – 0.30	6	1·9
0·31 – 0·35	23	7·6
0·36 – 0·40	31	10·2
0·41 – 0·45	60	19·9
0·46 – 0·50	85	28·2
0·51 – 0·55	47	15·6
0·56 – 0·60	26	8·6
0·61 – 0·66	10	3·3
0·66 – 0·70	6	1·9
0·71 – 0·75	3	0·9
TOTAL	301	99.4

Mean ±Standard Error 0·47 ± 0·062 Standard Deviation 0·09



TEXT FIG. 3—Percentage distribution of diameter of *Trocholina sahnii* Tewari & Srivastava.

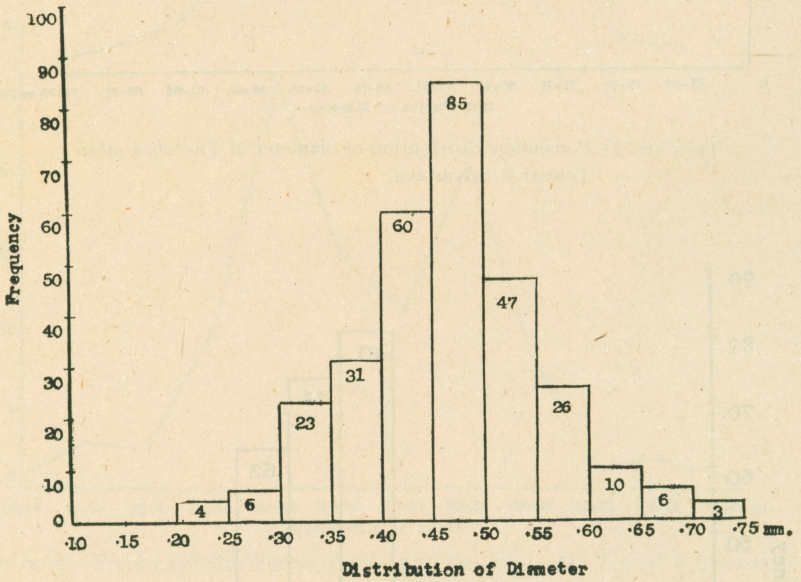


TEXT FIG. 4—Histogram of the height of the test of *Trocholina sahnii* Tewari & Srivastava, representing that specimens falling within the group, 0.24-0.28 mm. in height are most common in the collection.

Conclusion-The frequency distribution of the height of *Trocholine sahnii* Tewari and Srivastava is shown in Table 1. The empirical mode falls at 0·24—0·26 mm. The mean value comes to 0·29±0.35. Thus we obtain a range of 0·19—0·40 mm. within which the mean of the population may fall. Considering the value of standard deviation it becomes apparent that the population in question varies from 0·11 to 0·47 mm. in its heights.

The frequency distribution of the diameter of *Trocholina sahnii* Tewari and Srivastava is shown in Table 2. It is observed that the empirical mode stands at 0·46—0·50 mm. Its mean is 0·47±0·062 which shows its range of variation from 0·28 to 0·56 mm., whereas population variability ranges between 0·20 to 0·74 mm.

Histograms of the heights and the diameters of the test of this species have also been illustrated, representing that the specimens falling within the group 0·24—0·28 mm. in height, and 0.45—0·50 mm. in diameter are most common in this collection.



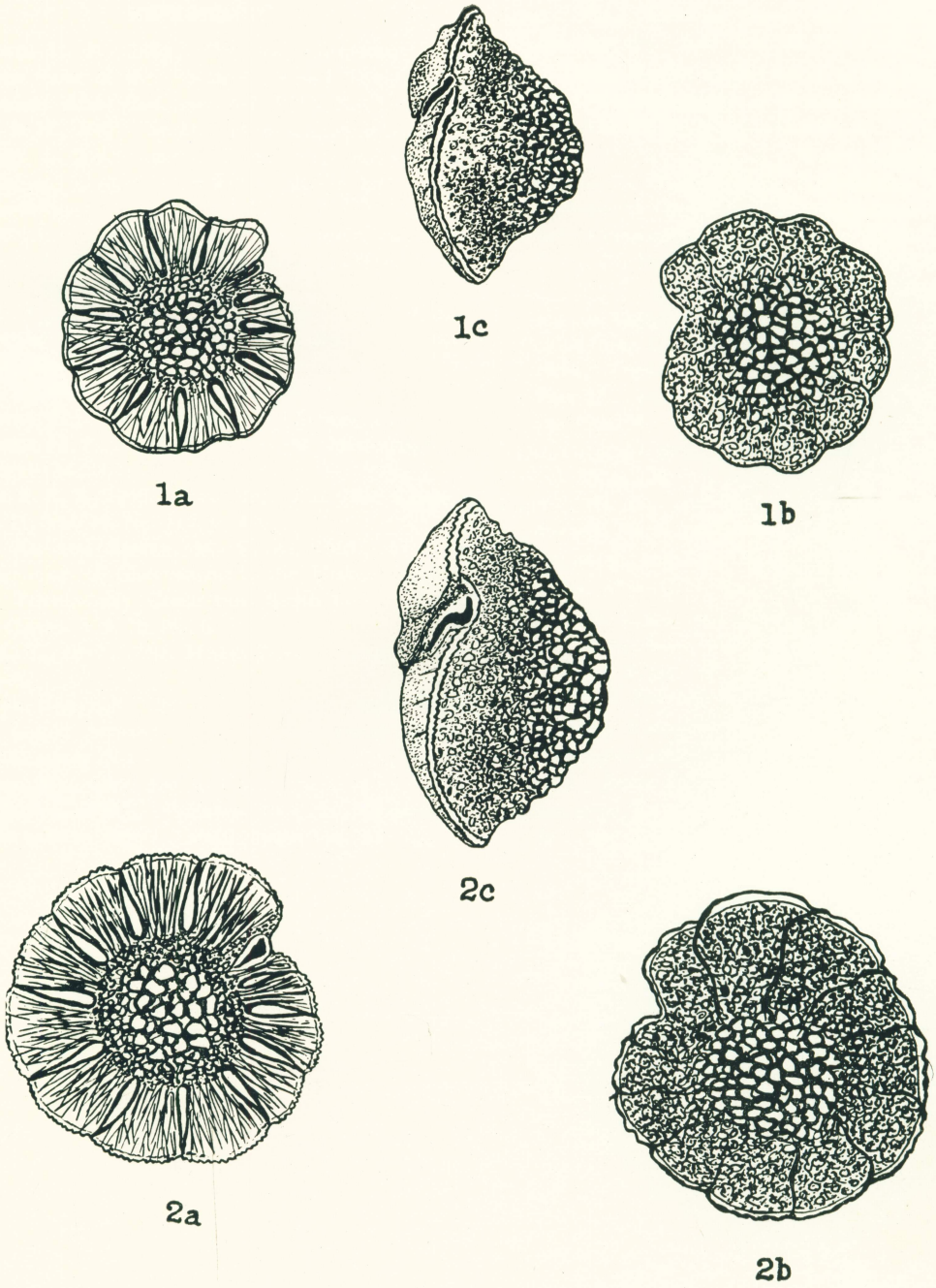
TEXT FIG. 5—Histogram of diameters of the test of *Trocholina sahnii* Tewari & Srivastava, representing that the speeimens with diameters from 0.45 to 0.50 mm. are most common in the collection.

ACKNOWLEDGEMENTS

The Director General, Council of Scientific and Industrial Research, New Delhi, is gratefully acknowledged by the Junior author, for rendering financial assistance. The authors wish to express their grateful thanks to Prof. R. C. Misra for providing laboratory facilities and for his valuable suggestions and encouragement during the preparation of this paper. The are also thankful to Dr. R. V. Sitholey for his kind perusal of the manuscript and critical suggestions.

EXPLANATION OF PLATE 16

Trocholina sahnii Tewari and Srivastava X 114, fig. 1 showing the peripheral margin subrounded to lobulate ; 2 showing crenate periphery and distinct S-shaped recurved sutures on the dorsal side. a ventral, b dorasl, c apertural view.



TEWARI & SRIVASTAVA : TROCHOLINA FROM ARIYALUR STAGE

REFERENCES

BLANFORD, H. F., 1864., On the Cretaceous and other rocks of the South Arcot and Trichinopoly Districts. *Mem. Geol. Surv. Ind.* Vol.4, No. 1

BURMA, B. H., 1948, Studies in quantitative palaeontology, 1. Some aspects of the theory and practice of the quantitative invertebrate palaeontology. *Jour Paleontology*. Vol. 22, pp. 725-761.

CUSHMAN, J. A., 1959, Foraminifera, their classification and economic use. Harv. Univ. Press., Cambridge, Massachusetts.

ELLIS, B. F., and MASINA, A. R., (Upto 1962), Catalogue of Foraminifera. *Spec. Publ. Amer. Mus. Nat. Hist., New York.*

FORBES, E., 1844, *Quart. Journ. Geol. Soc. London.*

GALLOWAY, J. J., 1933., A Manual of Foraminifera.

GLAESSNER, M. F., 1945., Principles of Micropalaeontology. Melbourne Univ. Press.

HENSON, F. R. S., 1948., *Ann. Mag. Nat. Hist. London.*, ser. 11, Vol. 14, No. 115, p. 446.

JACOB, K., and SASTRY, M. V. A., 1951., On the occurrence of *Globotruncana* in the Utatur stage of the Trichinopoly Cretaceous, South India. *Science and Culture*. Vol. 16, No. 6.

KAYE, C. T., 1840., *28th, Madras Journ. of Literature and Science.*

NARAYANA RAO, S.R., 1941., Cretaceous *Orbitoids* from the Upper Ariyalur beds (Maestrichtian) of the Trichinopoly District, South India. *Journ. Mys. Univ.* Sec. B, Vol. 2, Pt. 9.

RAMA RAO, L., 1953., *Orbitoids* from the Cretaceous rocks near Ariyalur. *Current Science*. Vol. 22, No. 9.

IDEM. 1954., *Siderolites* from the Cretaceous rocks near Ariyalur. Ibid. Vol. 23, No. 1.

IDEM. 1956., Recent contribution to our knowledge of the Cretaceous rocks of South India. *Proc. Ind. Sci.*, Vol. 44; No. 4, pp. 185-245.

RASHEED, D. A., 1962 a., Some Arenaceous and Calcareous Porcellaneous Foraminifera from the Cullygoody (Dalmiapuram) Limestone, Trichinopoly Cretaceous, Madras State, India, Part 1., *Journ. Madras Univ.*, B. 32, No. 1, pp. 21-47.

IDEM. 1962 b., Some Calcareous Foraminifera belonging to Lagenidae, Ellipsoidinidae and Heterohelicidae from the Cullygoody (Dalmiapuram) Limestone, Trichinopoly Cretaceous of South India. Part II. *Journ. MadrasUniv.*, B. 32, Nos. 2 and 3, pp. 199-266.

RENZ, C. and REICHEL, M., 1946, *Eclogae. Geol. Helv.*, vol. 38, p. 226

SIMPSON, G. G., and ROE, A., 1939.. Quantitative zoology. Mc Graw-Hill New York.

STOLICZKA, F., 1861-71., Cretaceous Fauna of Southern India. *Mem.* Geol. *Surv. India. Pal. Indica.* Vols. 1-4.

TEWARI, B. S., and SRIVASTAVA, R. P., 1963., Microraminifera from the upper part of the Lower Ariyalur Stage of Kallankurichchi, Trichinopoly. *52nd Proc. Ind. Sci. Cong. Chandigarh.* (Abstract)

IDEM. 1965., Foraminifera from the Upper part of the Lower Ariyalur Stage, Cretaceous of Trichino poly. *Journ. Pal. Soc. India.* Vol.

VREDENBURG, E., 1908., Cretaceous *Orbitoides* of India. *Rec. Geol. Surv. Ind.* Vol. 36, Part. 3.