announced about the occurrence of manganese ores in this part in December 1962.

Economically workable deposits of manganese ores are found in Jamdapur (Long. 19° 44'; Lat. 78° 31'), Ghotkur (Long. 19° 44'; Lat. 78° 30') and Pippargunta (Long. 19° 45'; Lat. 78° 29'). One of the authors (G. S.) mapped the ore deposit and the associated rock types on 4" = 1 mile scale in 1963, and made a representative collection of ore and associated rock types for further mineralogical and petrographic work.

The manganese ores are bedded and are conformable with the associated limestones and are considered to be Penganga in age. The bedded nature and similar structural deformation in the ore, as also in the associated limestones, suggest it to be sedimentary and syngenetic.

The essential ore minerals are braunite, hausmannite, pyrolusite and psilomelane. A part of the ore body is altered and in such parts, it is associated with irregular jasper bands. Most of the ore minerals are idiomorphic to subidiomorphic; the granularity is variable from fine to coarse. The microstructures exhibit banding (colloform, concretion and replacement).

The limestones associating ore vary in colour from buff to gray and are succeeded by shales on the top. They are overlying in order sandstones, a discontinuous thin conglomeratic horizon, and granite, which forms the basement. The granite sandstone contact is disconformable. So the sequence from top to bottom in the area can be given as follows: shales, limestones (manganese ore), sandstones—unconformity—(conglomerate) and granite.

The position of the manganese ores in this sequence suggests them to be Pengangas, the exact stratigraphic position of which is controversial. Lithologically the Penganga beds are said to have much in common with the Kurnool series of Andhra. These were correlated with the limestone group (upper stage) in the sequence of Chattishgarh basin. King (1881) considered the Penganga beds to be Pakhals. Heron (1948) correlated them with Pakhals of the Godavary Valley.

The correlation of the manganese ores of Adilabad District with those in other parts of India (Eastern Ghats, Sausar series) is not possible and the manganese deposits in these places were formed at different periods during Pre-Cambrian, perhaps due to one and the same process, namely sedimentation.

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ON THE OCCURRENCE OF *GLOBOTRUNCANA* IN ARIYALUR STAGE OF TRICHINOPOLY CRETACEOUS, SOUTH INDIA

THE note embodies the results of micropalæontological investigations carried out on the material, collected from the basal part of the Ariyalur stage, Cretaceous of Trichinopoly, South India. The rocks of the Ariyalur formation have yielded prolific foraminiferal fauna, the earliest record of which was made by Stoliczka.[1] Later, Narayana Rao[2] and Rama Rao[3,4] made exhaustive foraminiferal studies from the Orbitoid-bearing Arenaceous Limestone referred to Ariyalurs and better known as "*Gryphæa* bed" representing Mæstrichtian horizon, occurring east of the town of Ariyalur. Recently, the present authors[5-7] have also carried out detailed investigations on the foraminiferal assemblage of the Orbitoidal Limestone east of Ariyalur, and reported the occurrence of *Globotruncana arca* (Cushman) and *Globotruncana gansseri* Bolli, in association with *Orbitocyclina ariyalurensis* Rao, *Lepidorbitoides inornata* Rao, *Lepidorbitoides blandfordi* Rao, and *Siderolites calcitrapoides* Lamarck, typical of the Mæstrichtian age.

Sastry, Mamgain and Rao[8] have recorded the occurrence of *Globotruncana lapparenti tricarinata* (Quereau) and *Globotruncana* cf. *lapparenti* Brotzen from the basal Ariyalurs outcropping near the village Sadaiyakkanpatti about 4 miles north of Ariyalur. They assigned a Campanian age to this bed on account of the presence of the above species of *Globotruncana*, absence of *Orbitoidal* fauna and stratigraphically lower position from that of the Mæstrichtian Orbitoid-bearing bed.

The present paper deals with the foraminiferal content from a marl bed obtained from a well-cutting east of the village Sillakkudi (97° 1': 11° 4' 45") on way to Kannanore. The material was collected during the month of March 1964.

This study is significant, since the present locality hitherto considered unfossiliferous from the foraminiferal point of view, has now yielded a rich assemblage of foraminifera which throws important light on the age of the enclosing beds. The rocks occur few feet below the surface, interbedded with cream-coloured gritty sandstone and consist of buff-coloured, soft and highly friable, marly shale somewhat gypseous. This marly bed has yielded abundant *Globotruncana* species in association with other foraminifers, but is conspicuously devoid of typical Mæstrichtian *Orbitoidal* and *Siderolites* fauna. The foraminiferal fauna yielded by this bed is listed below :

Textularia sp., *Robulus* sp., *Lenticulina* sp., *Marginulina* sp., *Nodosaria* sp., *Dentalina* sp., *Lagena* sp., *Nonion* sp., *Nonionella* sp., *Discorbis* sp., *Gyroidina* sp., *Anomalina* sp., *Globotruncana* sp., *Globotruncana lapparenti lapparenti* Brotzen, *Globotruncana lapparenti tricarinata* (Quereau).

The Sillakkudi bed is characterised on the one hand by the occurrence of *Globotruncana lapparenti tricarinata* (Quereau) and *Globotruncana lapparenti lapparenti* Brotzen in abundance, and on the other hand by the conspicuous absence of the typical foraminiferal species of Mæstrichtian age like *Lepidorbitoides inornata* Rao, *Lepidorbitoides blandfordi* Rao, *Orbitocyclina ariyalurensis* Rao and *Siderolites calcitrapoides* Lamarck. Moreover, this bed occupies stratigraphically lower position than that of the Orbitoid-bearing bed. In view of the above facts, a Campanian age has been assigned to this bed, which suggests that it may be synchronous with the *Globotruncana-lapparenti-tricarinata* bed reported from Sadaiyakkanpatti by Sastry, Mamgain and Rao.

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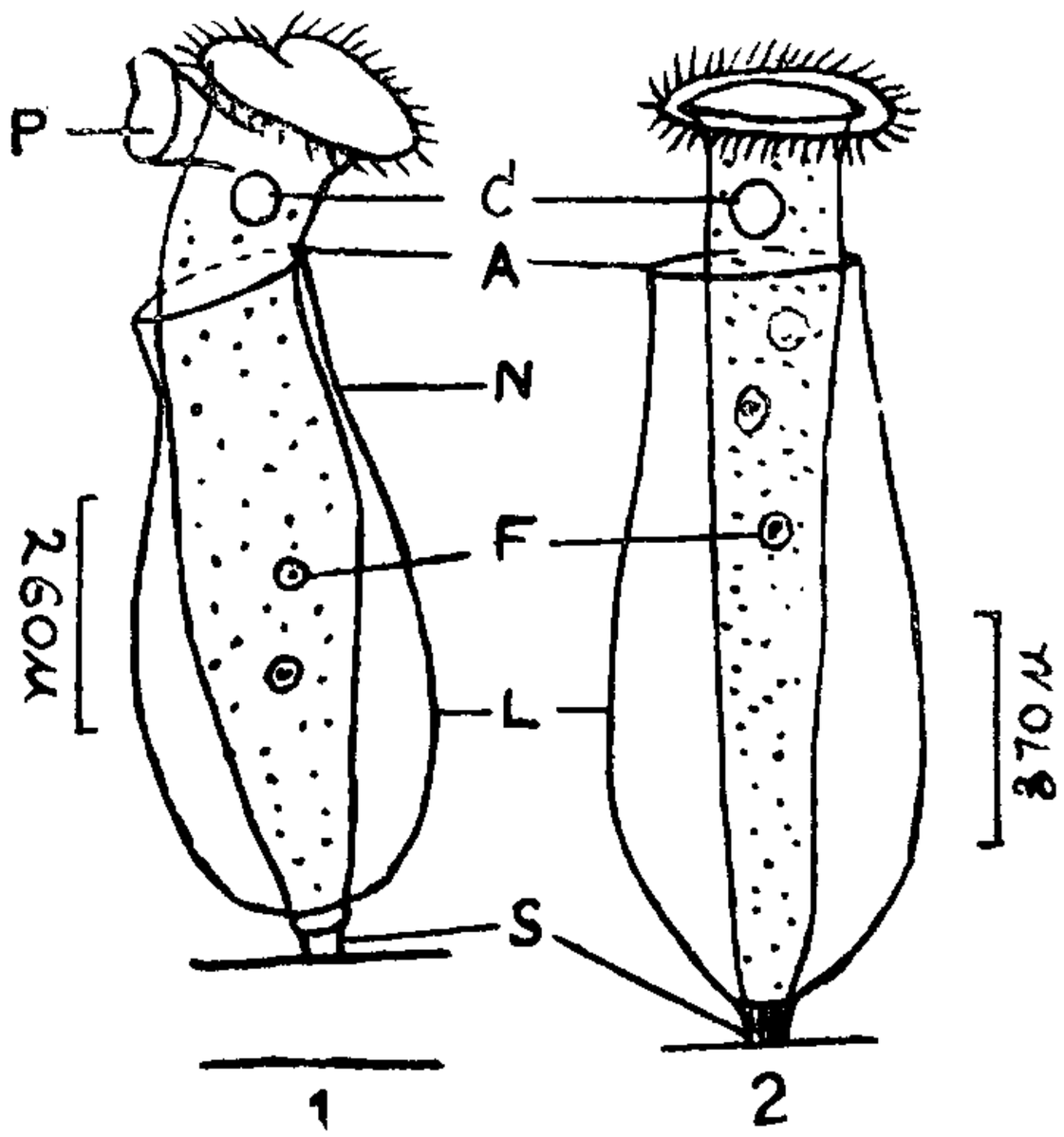
OCCURRENCE OF TWO *VAGINICOLID* SPECIES (PERITRICHA: CILIOPHORA) FROM CHITTOOR, ANDHRA PRADESH

Of the 90 species of Vaginicolidæ (Noland, 1959) known to science, 5 species are reported from the Indian sub-continent (Bhatia, 1936 ; Naidu, 1965). They are *Vaginicola* sp., *Thuricola obconica* Kent, *Pyxicola carteri* (Kent), *Cothurina annulata* Stokes and *Cothurina* sp. The last mentioned undetermined species of *Cothurina* is *Cothurina imberbis* Ehrenberg.

This note reports the occurrence of two vaginicolid ciliates, *Pachytrocha cothurnoides* Kent and *Cothurina imberbis* Ehrenberg. Both are new to this sub-continent. They were collected by the author from filamentous algæ of an old unused well at Chittoor, Andhra Pradesh.

Pachytrocha cothurnoides Kent (Fig. 1)
Noland, 1959, p. 294, Fig. 10.32(*g*).

Dimensions : Lorica : 77 $\mu \times 30\ \mu$, aperture : 20 μ wide, neck : 16 μ wide.
Extended animal : 100–110 μ. long.



FIGS. 1–2. Fig. 1. *Pachytrocha cothurnoides* Kent. Fig. 2. *Cothurina imberbis* Ehrenberg. A, aperture ; C, contractile vacuole ; F, food vacuole ; L, lorica ; N, neck ; P, protoplasmic plug ; S, stalk.