CHAPTER 4

COMPOSITION, AGE AND AFFINITY OF THE MICROFAUNA

In the following pages, the composition, age and affinity of the microfauna from the Khuiala and Bandah Formations is discussed. These formations contain abundant smaller and larger foraminifers as well as ostracodes (charts 1-7). Reference has already been made to the previous works which have been carried out on the microfossils from these formations from Rajasthan. From areas adjoining Rajasthan, in India, west Pakistan and Afghanistan, the Eocene larger foraminifers are known in considerable detail mainly through the works of Nuttall (1925 et seq.), Davies (1926 et seq.), Davies and Pinfold (1937), De Cizancourt (1938), Gill (1953B), Nagappa (1959) and others. The stratigraphic ranges of the larger foraminifers, therefore, are quite precisely known. The same, however, cannot be said for the smaller foraminifers and ostracodes which are known very inadequately. The only works dealing with smaller foraminifers are by Haque (1956), Tewari et al. (1968) and on the ostracodes by Latham (1940), Tewari and Tandon (1960), Lubimova et al. (1960), Guha (1965, 1967, 1968) and Tewari and Singh (1966). The following discussion on the age and affinity of the microfauna is therefore based on limited data and must be considered to be of a provisional nature.
KHUIALA FORMATION

The microfaunal assemblage of the Khuiala Formation comprises five taxa of larger foraminifers, sixteen of smaller foraminifers and forty-four of ostracodes. An analysis of the microfauna is given below.

LARGER FORAMINIFERS

(i) One species - *Assilina* sp. - could not be precisely identified and is possibly new. Hence it cannot be used at present for correlation purposes.

(ii) One species - *Nummulites atacicus* Leymerie - is long ranging and in India is known to range from Lower Eocene to Middle Eocene. It has also been recorded from the Ypresian and Lutetian of Europe and Afghanistan. In Rajasthan, this species occurs only in the Khuiala Formation.

(iii) Three species - *Assilina daviesi* de Cizancourt, *A. granulosa* (d'Archiac) and *A. lacunata* de Cizancourt - are characteristic of the Lower Eocene. All the three species occur abundantly in the Ypresian of Afghanistan. *A. granulosa* also occurs in the Lower Eocene beds of India and in the Ypresian of Europe, while *A. daviesi* occurs in the Bhadrar beds (Lower Eocene) of Salt Range.

SMALLER FORAMINIFERS

(i) Eight species are not sufficiently diagnostic
morphologically and three species - *Pyrgo* sp. cf. *P. elongata* (d'Orbigny), *Cibicides aknerianus* (d'Orbigny) and *Glandulina laevigata* d'Orbigny - are long ranging. These are therefore of little value in correlation.

(ii) Two species and a variety - *Clavulina parisiensis* d'Orbigny, *Rotalia subgranulosa* Jacob and Sastri and *Nonion scapha* var. *indica* Jacob and Sastri - occur both in the Khuiala and Bandah Formations of Rajasthan. *C. parisiensis* was originally described from the Lutetian of France.

(iii) Two species - *Asterigerina indica* Jacob and Sastri and *Rotalia crookshankiana* Jacob and Sastri - have been so far recorded only from the Khuiala Formation of Rajasthan.

OSTRACODES

(i) Twenty-three taxa, which include seven indeterminate and sixteen new, are at present of little chronological value.

(Jones) - ranges from Eocene to Recent. These species, also cannot be used for precise correlation purposes.

(iii) Two species - *Xestoleberis* sp. cf. *X. mulleri*ana Lienenklaus, *Quadracythere lagaghimoensis* (Apostolescu) - originally described from the Oligocene of Europe and Palaeocene of Nigeria and Libya respectively, also occur in the Khuiala Formation of Rajasthan.

(iv) Five species - *Bairdia qliberti* (Keij), *Krithe indica* Tewari and Tandon, *Krithe* sp. cf. *K. cancuenensis* van den Bold, *Schizocythere appendiculata* Triebel and *Xestoleberis subglobosa* (Bosquet) - occur throughout the Khuiala Formation, and except for *K. sp. cf. K. cancuenensis*, also occur in the Bandah Formation. All these species are characteristic of the Eocene.

(v) Two species - *Anticythereis memorans* (Lubimova and Guha) and *Cythereella tawaica* Singh and Tewari previously recorded from the Lower Eocene of Kutch and Jammu respectively occur in the equivalent horizons in Rajasthan and appear to be characteristic of the Lower Eocene.

(vi) Four species - *Neocyprideis bhupendri* (Singh and Misra), *Schizocythere bikanerensis* Singh and Misra, *Eucytherura vimali* (Singh and Misra) and *Semicytherura rameshi* (Singh and Misra) - are so far known only from Rajasthan. The first three species occur in the Khuiala Formation and the fourth in both the Khuiala and Bandah
Formations.

Although about two third of the micro-faunal taxa are either long ranging or are not morphologically distinct, the overall evidence suggests a Lower Eocene (Ypresian) age for the microfauna of the Khuiala Formation.

BANDAH FORMATION

The microfauna of the Bandah Formation comprises seventeen taxa of larger foraminifers, thirty-five of smaller foraminifers and sixteen of ostracodes.

LARGER FORAMINIFERS

(i) The following seven species of larger foraminifers occur abundantly in the Bandah Formation of Rajasthan and are characteristic of Middle Eocene (Middle Lutetian): *Nummulites maculatus* Nuttall, *N. stamineus* Nuttall, *Discocyclina dispansa* (Sowerby), *D. sella* (d' Archiac), *D. sowerbyi* Nuttall, *Dictyoconoides cooki* (Carter) and *Alveolina elliptica* var. *flosculina* Silvestri. These species occur abundantly in the Middle Eocene of Sind, Baluchistan and Kutch.

SMALLER FORAMINIFERS

(i) Nine species are either indeterminate or could not be identified for want of sufficient material,
and three species are new. These are, therefore, of little chronological significance at present.


(iv) One species and a variety - *Nonion scapha var. indica* Jacob and Sastri and *Rotalia subgranulosa* Jacob and Sastri - occur both in the Khuiiala and Bandah Formations.

(v) Four species and a variety - *Alabamina wolterstorffi* (Franke), *Cibicides sp. cf. C. dutemplei* (d'Orbigny), *Fursenkiona dubia var. robusta* (Haque), *Textularia punjabensis* Haque, *Triloculina sarahae* Haque - previously known
only from the Palaeocene and Lower Eocene beds, also occur in the Bandah Formation of Rajasthan.

OSTRACODES

(i) One species and a subspecies are new and one species - *Cytherella protuberantis* Lubimova and Guha - is long ranging.

(ii) Six species - *Bairdia gliberti* (Keij), *Krithe indica* Tewari and Tandon, *Kestoleberis subglobosa* (Bosquet), *Bythocypris* sp. cf. *B. cancanaensis* (van den Bold) and *Paichenborchella* (*Eupaienenborchella*) sp. cf. *P. eocaenica* Triebel - are characteristic of the Eocene and except for the last two species (which in Rajasthan have been found only in the Bandah Formation) the rest occur both in the Khuiala and Bandah Formations.

(iii) Seven species - *Bairdia indica* Tewari and Tandon, *B. kirtharensis* Tewari and Tandon, *Bythocypris mianica* Tewari and Tandon, *Hemicythere sahnii* Tewari and Tandon, *Kingmaina marhensis* (Tewari and Tandon), *Quadarcythere arcanus* (Lubimova and Guha), *Uroleberis kutchensis* Guha - have so far been recorded only from the Middle Eocene beds of Kutch and Rajasthan.

The overall evidence suggests a Middle Eocene (Middle Lutetian) age for the microfauna of the Bandah Formation, Rajasthan.