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MISCELLANEA PFENDER, 1935 (FORAMINIFERIDA) FROM THE SOUTH SHILLONG REGION, N.E. INDIA

A.K. JAUHRI

DEPARTMENT OF GEOLOGY UNIVERSITY OF LUCKNOW, LUCKNOW, INDIA

ABSTRACT

The *Miscellanea* assemblage in the Shillong region shows presence of some species (they are referable to *M. yvettae* Leppig and *M. juliettae* Leppig reported previously from the Western Tethys – Spain, France, Yugoslavia and Turkey) besides the generotype, *M. miscella* (d'Archiac & Haime) common in the Middle East and the Eastern Tethyan area. The occurrence of the European species in the studied area is found to correspond to the *Glomalveolina primaeva* and *G. levis* zones (Thanetian) of the Mediterranean region and predates the appearance of *M. miscella* which occurs in the Shillong succession at a younger stratigraphic level corresponding to the *Alveolina vredenburgi* zone (Early Ilerdian). The present report extends the distribution of the early *Miscellanea* species from Europe and discusses the biostratigraphical significance of the early as well as the younger species of the genus. An attempt is also made to point out the relevance of their distribution to the effectiveness of ecological barrier which led to the separation of Western Tethyan faunas from those of Eastern Tethys in the Ilerdian.

Key words: *Miscellanea*, Lakadong Limestone, Thanetian, Ilerdian, Eastern Tethys, South Shillong.

INTRODUCTION

During the recent studies of the Palaeogene carbonates of the Shillong region by the author (Jauhri, 1988; Jauhri, *in review*), the basal portion of the Sylhet Limestone in the Um Sohryngkew River section near the village Therria (fig.1) showed the presence of the larger foraminifera typical of *Alveolina*-bearing algal limestone of the Old World. The samples from the basal 100m portion yielded a number of specimens of *Miscellanea* in thin section. A close examination of the material shows that besides the already known *M. miscella* (d' Archiac & Haime)(Nagappa, 1951, 1959), a few species unreported from the present area are also present. Hitherto known only from the Western Tethyan area (Leppig, 1988a,b; Sirel, 1997), their discovery in Shillong extends their geographic range from Europe and is of considerable value in the correlation of the Mediterranean and the Eastern Tethyan faunas. The purpose of this paper is to document the species of *Miscellanea* from the present area, to examine their stratigraphic importance in the Early Palaeogene correlation, and to note palaeobiogeographic significance of their presence in the Shillong region.

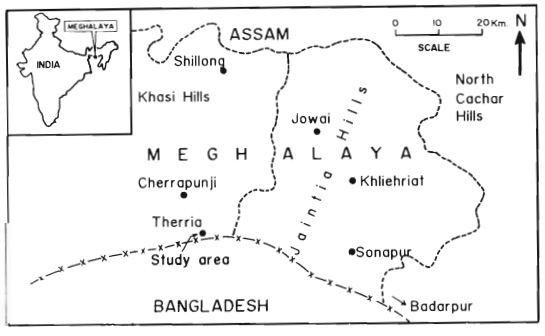

Fig. 1. Location map showing the area of study in the Shillong Plateau. The inset shows position of Meghalaya in India.

The Palaeogene carbonate succession in the South Shillong Plateau has long been known to range from the Late Palaeocene to the Middle Eocene (Wilson and Metre, 1953; Nagappa, 1959; Biswas, 1962; Chakraborti and Baksi, 1972; Das Gupta, 1977; Samanta and Raychoudhary, 1983). Lithostratigraphically, they have been designated as the Sylhet Limestone Group which corresponds to the "Nummulitic Series" of Medlicott (1869). Nagappa (1959) described the vertical distribution of the characteristic larger foraminifera in the Sylhet Limestone and regarded it as being definitely of "Ranikot", "Laki" and "Kirthar" in age (fig.2). The basal part of the Sylhet Limestone Group constitutes the Lakadong Formation which includes two subunits. The lower part is developed in carbonate

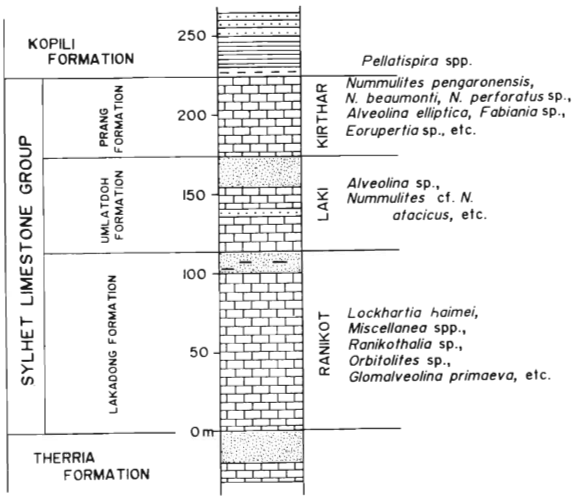

Fig. 2. The Sylhet Limestone Group with broad foraminiferal distribution in the Shillong Plateau (modified after Nagappa, 1959).

facies (The Lakadong Limestone) and contains the typical Ranikot larger foraminifera. The succeeding Laki-equivalent part is distinguished as the Umlatdoh Formation and is separated from the underlying limestone by a coal-bearing/carbonaceous sandstone horizon (the Lakadong Sandstone). The carbonate part of this formation is known as the Umlatdah Limestone which is rich in foraminifera. The overlying topmost part is wholly developed in carbonate facies and is designated as the Prang Formation that has yielded the Kirthar-equivalent larger foraminiferal fauna.

The carbonate sequence exposed in the Um Sohryngkew River section is steeply dipping and is about 352m thick, of which the lower 130m represents the Therria Formation which has not yielded foraminifera and is not considered here part of the Sylhet Limestone Group. The Therria Formation and the topmost part of the underlying Langpar Formation have been regarded as the equivalent of the *Planorotalites pseudomenardii - P. pusilla* zone (=P4) in view of their position in sequence (Pandey and Ravindran, 1988). The total thickness of the Sylhet Limestone Group is approximately 222m in this section, of which the basal 100m possibly represents the Lakadong Limestone which is thick, massive and is composed mainly of algae and foraminifera (fig.3) It may have been deposited in a back-reef – reefal environment developed as a result of progradation of the transgressive seas in the South Shillong Plateau during the Thanetian and Ilerdian (Jauhri, 1994a; Jauhri, *in review*).

Previously, the foraminifera of this limestone were studied by several workers (e.g., Nagappa, 1959; Pandey and Ravindran, 1988). However, the European species of *Miscellanea* have not been reported from this region. In most of the works in the past, they were identified with *M. miscella* despite some obvious differences in size of the test and proloculus and arrangement of pillars. Also, no report of their occurrence in other areas of Eastern Tethys has so far been made.

Recent work by the author on the foraminifera shows that the Lakadong Limestone is faunally divisible into two parts. The Lower part characterized by *Glomalveolina primaeva* (Reichel) and allied species, is referable to *G. primaeva* and *G. levis* zones corresponding to the Late P4 zone and P4/P5 zonal boundary (late Early to Late Thanetian); the Upper part which is characterized by *Ranikothalia nuttalli* (Davies), *Miscellanea miscella* (d' Archiac & Haime), etc. is considered to have an age equivalence to the *Alveolina vredenburgi* zone corresponding to the P5 zone (Early Ilerdian) (Hottinger and Drobne, 1988; Hottinger, 1994; Jauhri, *in review;* Serra-Kiel, Hottinger, Caus, Drobne, Ferrandez, Jauhri, Less, Pavlovec, Pignatti, Samso, Schaub, Sirel, Strougo, Tambareau, Tosquella and Zakrevskaya, 1998; Jauhri and Agarwal, *in review*).

The studied sequence of the larger foraminifera shows that the species of *Miscellanea* are fairly common throughout the succession, though some reduction in their frequency is observed at some levels. *Miscellanea* populations from the Lower part of the Lakadong Limestone (86/Lkd/DR1- DR5 and 91/Lkd/DR2'-DR5') are not representative of *M. miscella*, but are much smaller in size and belong to the older species found in the Western Tethyan area (Leppig, 1988a,b; and Sirel, 1997). They are referable to *M. juliettae* Leppig and *M. yvettae* Leppig. See Jauhri (1988, pl. 1, fig. 4; pl.2, fig.1). The relatively larger specimens occurring in the Upper part (86/

Lkd/DR6-DR10 and 91/Lkd/DR7'-DR10') are the true representatives of *Miscellanea miscella* (d' Archiac & Haime) which has so far not been found in the Mediterranean successions (Leppig, 1988b). The samples from an isolated, 30m thick outcrop on the Shillong-Cherrapunji Road between 32.1 km and 32.5 km milestones near Cherrapunji have also shown presence of miscellaneids which are representative of the older species of Leppig (1988b) and Sirel (1997). See fig 3.

SYSTEMATIC PALAEONTOLOGY

Superfamily **Nummulitacea** de Blainville, 1825

Family **Miscellaneidae** Sigal, 1952.

Genus ***Miscellanea*** Pfender, 1935

(Type Species: *Nummulites miscella* d' Archiac & Haime, 1954)

Miscellanea miscella (d'Archiac & Haime) 1853
(Pl. I, figs. 2-3; Pl. II, figs. 9-11)

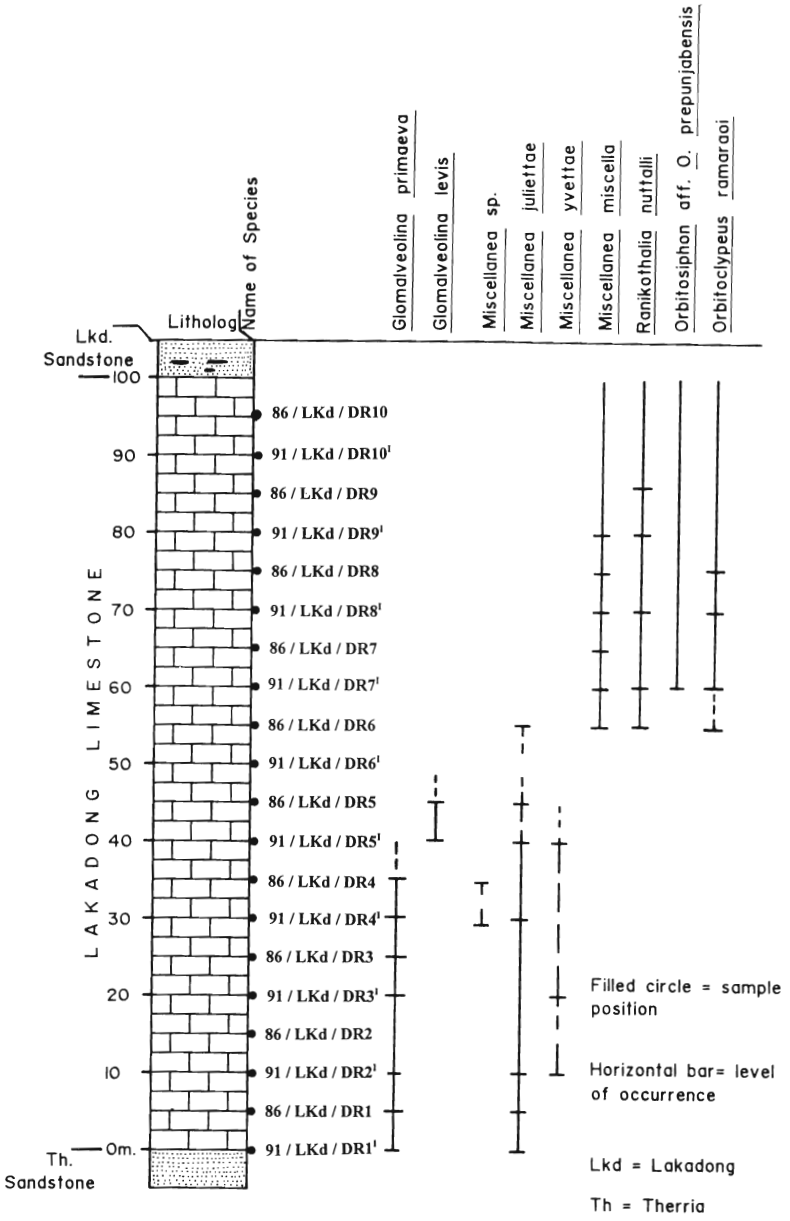

Fig. 3. Litholog of the Lakadong Limestone with positions of samples and distribution of the species of *Miscellanea* and other important associated taxa in the Um Sohryngkew River section near the village Therria, Shillong.

Nummulites miscella d' Archiac & Haime, 1853, p. 345, pl.35, figs. 4a-c.

Siderolites miscella (d' Archiac & Haime), Douville, 1916, p. 38, pl.15.- Nuttall, 1926, p.116, text-fig. 3. - Davies, 1927. p. 277, pl. 21, fig. 9.

Siderolites stampi Davies, 1927, p. 278, pl. 21, figs. 1-8.

Miscellanea miscella (d' Archiac & Haime), Pfender, 1935, p. 231, pl.11, figs. 6,7, pl.13,figs. 2-4.- Davies & Pinfold, 1937 p.43, pl. 4, figs. 1-3, 7-8.

Miscellanea stampi (Davies), Davies & Pinfold, 1937, p. 42, pl. 4, figs. 4, 6, 9-10, 17-18.

Miscellanea miscella (d' Archiac & Haime), Nagappa, 1951, p.43.- Nagappa, 1959, text-figs. 8,11, pl,3, fig.3. pl.4, fig.1.- Kaever, 1971, p. 96, pl. 8, figs. 8-10.- Hottinger, 1971, p.147, 148.- Sirel, 1972, p. 284-287, pl. IV, figs. 1-7.- Rahaghi, 1983, p. 63, pl. 43, figs. 14-18.- Leppig, 1988b, p. 703, pl. 1, fig.1, pl.2, fig.1, pl.3, fig.1, pl.7, figs.1-6, pl.8, figs.1-2.- Sirel, 1997, p. 81, pl. 3, figs. 1-14, pl. 4, figs. 1-10.

Remarks: The megalospheric specimens seen, in thin section, in the samples 86/Lkd/DR6-10 and 91/Lkd/DR7'-10' are referable to *Miscellanea miscella* (d'Archiac & Haime) and are in close agreement with the Leppig's (1988b) diagnosis of the species, especially in the characters of size of the test and proloculus, alar prolongations (extending to the poles) and ornamented pillars (scattered all over the lateral surface of the test). The rare microspheric specimens (Pl. I, fig. 2) show invagination of the peripheral margin of the test. However, the orientated sections are not available in sufficient numbers to allow detailed taxonomic observations.

M. miscella, in the studied section, is associated with *Ranikothalia nuttalli*, *Discocylina* sp., *Lockhartia* sp., *Orbitosiphon* aff. *O. praepunjabensis* (A-form), *Daviesina ruida*, etc. It is also known from the equivalent horizons of Afghanistan (Kaever, 1970), the Sistan area of Iran (Rahaghi, 1983) and the Kars region of the northeastern part of Turkey (Sirel, 1972, 1997).

Horizon and locality: Upper part of the Lakadong Limestone and lower part of the Umlatdoh Limestone, Um Sohryngkew River section (near the village Therria), East Khasi Hills, Shillong; Jowai-Badarpur Road, Jaintia Hills, Shillong.

Age: Early Ilerdian (*Alveolina vredenburgi* zone).

Miscellanea yvettae Leppig
(Pl. I, figs. 9, 11-12; Pl. II, figs. 1-2)

Miscellanea yvettae Leppig, 1988, p. 702; Tambareau *et al.*, 1994, pl. 1, fig. 6.

Miscellanea sp., Villattae, 1962, p. 63, p. 80, pl. 22, figs. 1-2.

Miscellanea sp., Hottinger, 1971, p. 147.

Remarks: The forms referred here to *Miscellanea yvettae* Leppig occur less commonly in the samples both from a section on the Cherrapunji-Shillong Road and the Um Sohryngkew River section. They are represented by megalospheric (A-form) and microspheric (B-form) forms and have about 2.5-3 whorls and test proportions which fall in the range of this species. However, more material is required to define it sufficiently in the area of study.

In the Um Sohryngkew River section, it is associated with *M. juliettae* and *Glomalveolina primaevi, G. levis*, etc.

Horizon and Locality: Lower part of the Lakadong Limestone exposed in the Um Sohryngkew River section, East Khasi Hills and the Lakadong Limestone exposed on the Cherrapunji-Shillong Road between 31.2 km and 32.5 km milestones near Cherrapunji, East Khasi Hills.

Age: Thanetian (*Glomalveolina primaeva* and *G. levis* zones).

Miscellanea juliettae Leppig
(Pl. I, figs. 1, 4-8, 10; Pl. II, figs. 3-8, 12-13)

Miscellanea juliettae villattae Leppig, 1988, p. 702, pl.1, fig.3; pl.2, fig.3; pl.3, fig; 3 pl.5, figs. 1-8.- Pignatti, 1994, p. 390, pl II, fig.3.

Miscellanea juliettae pfenderae Leppig, 1988, p. 702, pl. 1, fig. 4; pl. 2, fig. 4; pl. 3, fig. 4/1, 2; pl. 4, figs. 1-10.

Miscellanea miscella (d'Archiac & Haime), Jauhri, 1988, pl.1 fig. 4, pl.2 fig.1.

Miscellanea juliettae Leppig, Sirel, 1997, p. 78-81, pl. I, figs. 1-14; pl. II, figs. 1-18.

Remarks: This species is represented both by megalospheric (A-Form) and microspheric (B-Form) forms in the Shillong region.

The megalospheric forms occurring in the Lower part of the Lakadong Limestone (e.g., 86/Lkd/DR2, earlier illustrated as *Miscellanea miscella* (Jauhri, 1988, pl.1, fig. 4; pl. 2, fig. 1) are closely comparable with *M. juliettae* Leppig which is known from the Late Thanetian (*Glomalveolina primaeva* zone) of northwestern Spain, northwestern

Yugoslavia and Eastern Turkey. The axial sections seen in random thin sections of the samples 86/Lkd/DR1-DR6 and 91/Lkd/DR2'-DR5' are strongly biconvex and show ornamental pillars confined to the umbilical area (Pl. I, figs. 1, 8; Pl. II, fig. 4).

The microspheric forms noticed in the samples 87/Lkd/CH-SHLG/1-2 are characterized by the invaginated peripheral margin of the last whorl and seem to fall in the morphological range of *M. juliettae*.

Miscellanea juliettae in the Um Sohryngkew River section is associated with *Glomalveolina primaeva, G. dachelensis, G. levis, Broeckinella arabica, Lockhartia haimei* (Davies), etc. in the samples of the Lower part. In the sample 86/Lkd/DR6 (Upper part), it occurs in association with *M. miscella* and *Ranikothalia nuttalli*.

Horizon and Locality: Lower part and basal portion of the Upper part of the Lakadong Limestone, Um Sohryngkew River section (near the village Therria); Lakadong Limestone exposed on the Cherrapunji-Shillong Road between 31.2 km and 32.5 km milestones near Cherrapunji, East Khasi Hills, Shillong.

Age: Thanetian (*Glomalveolina primaeva* and *G. levis* zones) - earliest Ilerdian.

BIOSTRATIGRAPHIC SIGNIFICANCE

The older species of *Miscellanea* (e.g., *M. juliettae, M. yvettae*) have been dated by *Glomalveolina primaeva* (Reichel), etc. as the Thanetian in Europe (Leppig, 1988a,b). The occurrence of *G. primaeva* (represented by specimens relatively larger in size than the types) and allied species in the Lower part of the Lakadong Limestone suggests an age equivalence to the Thanetian stage which, in terms of larger foraminiferal zonation, would correspond to the *G. primaeva* and *G. levis* zones, i.e. Late P4 zone and P4/P5 zonal boundary of the planktic zonation (Hottinger and Drobne, 1988; Hottinger, 1994; Serra-Kiel *et al.*, 1998). Thus , the associated early species of *Miscellanea* can be regarded as Thanetian in age in the Shillong area, too. *M. juliettae*, however, extends up to the earliest Ilerdian (basal portion of the Upper part of the Lakadong Limestone) and, as such, can be considered to range from the Thanetian to the basalmost Ilerdian.

Miscellanea miscella is observed in Afghanistan (Kaever, 1970), northeastern part of Turkey (Sirel, 1972, 1997) and the Sistan area of Iran (Rahaghi, 1983) in the horizons equivalent of the *A. vredenburgi* zone (= *A. cucumiformis* zone, Serra-Kiel *et al.*, 1998; Hottinger, Sameeni and Butt, 1998). Hottinger (1971) noticed the presence of *M. miscella* in the upper Ranikot of Sind (Pakistan) in association with *A. vredenburgi* and *Ranikothalia nuttalli*, and in the Khairabad Limestone and the Patala Shales in association with *Alveolina* s. str. and *R. nuttalli*. This association shows that these formations are equivalent to the *A. vredenburgi* zone (Early Ilerdian) of the Mediterranean region .

M. miscella occurs in the Upper part of the Lakadong Limestone and the lower part of the Umlatdoh Limestone of the present area in association with *R. nuttalli* and *Daviesina ruida* (*D. ruida* occurring only in the Umlatdoh Limestone) which are the Early Ilerdian species (Jauhri, 1996). On the basis of the evidence of these species, the Upper part of the Lakadong Limestone and the lower part of the Umlatdoh Limestone can be correlated with the *A. vredenburgi* zone, i.e. P5 zone of the planktic zonation, Early Ilerdian. In the Shillong region, *M. miscella* can, therefore, be considered to correspond to this zone and regarded as the late species of the genus all through its occurrence in the Tethys.

PALAEOBIOGEOGRAPHIC ASPECTS

The record of the early species of *Miscellanea* in the Late Palaeocene rocks in the Shillong region indicates that the genus appeared during the Late P4 zone (Thanetian) in Eastern Tethys. This level of its occurrence is younger in comparison to that of the Western Tethyan region where it occurs in the P3b zone (Sirel, Dager and Sozeri, 1986; Tambareau, 1994; Hottinger, 1994). However, in the present area its presence is linked with the widespread distribution of the suitable facies which occurred during the P4 zone of the Late Palaeocene and gave rise to uniform communities of larger foraminifera over large geographic areas in the Tethys

(Hottinger, 1987; Hallock, Premoli Silva and Boersma, 1991). It also suggests the possibility of even larger number of species being shared between the two regions than hitherto believed. This report extends the geographic range of these species from Europe and points to the incomplete nature of the existing knowledge on the fossil record of the Late Palaeocene larger foraminifera in Eastern Tethys. A clear picture of their exact geographic and stratigraphic distribution will emerge only when the Palaeogene faunal successions in the Eastern parts have been completely known.

As for the absence of *M. miscella* in Europe, the idea of Leppig (1988b) seems valid in the light of currently available information on the Early Palaeogene bioprovinces (Hottinger, 1983). The Turkish occurrence of this species is believed to have been derived from the Middle East. In this context, Prof. Ercüment Sirel observes, " So far numerous miscellaneid species have been described as *M. miscella* from the Thanetian of Turkey, whereas *M. miscella* occurs only in one locality (Sirel, 1972, 1997). The limestone blocks with *M. miscella* in the ophiolitic melange may come from the autochthonous carbonate platform of the Ilerdian in the outcrops of the other Middle East countries" (personal communication).

The widespread distribution of this species in Eastern Tethys seems to suggest that it is native to the eastern part of the Tethys. It may have evolved from the populations of one of the older species of *Miscellanea* that migrated to the eastern region during the Thanetian. Though the exact timing of its origin is uncertain, its appearance and wide distribution in the lower Ilerdian sequences suggests that it evolved and achieved its known distribution in Eastern Tethys and the West Asian region during the Early Ilerdian transgression. In the high-diversity areas of the Western Tethys (Europe), *M. miscella* must have failed to survive the competition with the simultaneously evolving groups of larger foraminifera and, therefore, could not colonize even the suitable environment there. It seems that the high-diversity assemblages of nummulitids, alveolinids, etc. resulting from rapid evolution in shallow, neritic regimes of Europe during the Ilerdian, did not leave enough ecological niches for its colonization, as reported previously for the late Middle Eocene European shallow, neritic regimes in the context of studies for some smaller benthic foraminiferal species (Jauhri, 1994b) and some species of *Nummulites* (Samanta, Bandopadhyaya and Lahiri, 1990) from Kachchh (=Kutch). On the other hand, in the low-diversity areas of Eastern Tethys where the competition among the co-existing groups was relatively less severe, *M. miscella* thrived in the steadily available ecospace and became an important component of the larger benthic foraminiferal assemblages of the lower Ilerdian successions.

CONCLUSIONS

1. In the South Shillong Plateau, the *Miscellanea* assemblage is characterized by three species, of which two (*M. juliettae* Leppig, and *M. yvettae* Leppig) have been reported previously from Western Tethys only (Spain, France, Yugoslavia and Turkey). These species are older than the already known *M. miscella* common in the Eastern Tethyan area. They correspond to the *Glomalveolina primaeva* and *G. levis* zones, i.e. Late P4 and P4/P5 zonal boundary (Thanetian) of the Mediterranean region.
2. *Miscellanea miscella* (d' Archiac & Haime) is a younger, advanced species which is characteristic of the *Alveolina vredenburgi* zone, i.e. P5 zone (Early Ilerdian).
3. The record of the older European species of *Miscellanea* from the Shillong area extends their geographic range from Europe and points to the incomplete nature of the existing knowledge of the fossil record of the Late Palaeocene larger foraminifera from Eastern Tethys. Although known to range from the P3b to P4 zones in the European Tethys, they became widely distributed during the P4 zone when the favourable facies achieved widespread distribution in the Tethys.

4. From the geographic distribution of *M. miscella*, it appears that it is native to the eastern part of the Tethys. It might have arisen possibly during the Early Ilerdian from the populations of one of the older species of *Miscellanea* that migrated to the eastern region during the Thanetian. Its absence in the European sections seems to be due to absence of vacant ecological niches. The high-diversity assemblages of larger foraminifera during the Early Ilerdian posed severe competition for *M. miscella* and did not allow its colonization on the shelves of the Mediterranean region. On the the other hand, in the absence of the sufficiently strong competition, the low-diversity faunal assemblages of the Eastern Tethyan region allowed it to evolve and get dispersed within this part of the Tethys during the Ilerdian.

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EXPLANATION OF PLATES

Plate I

1,4-8,10. *Miscellanea juliettae* Leppig

1, axial section, megalospheric form, Cherrapunji-Shillong Road, East Khasi Hills, sample No. 87/Lkd/CH-SHLG/2; slide No. Lkd/CH-SHLG/216/a, x60;

4, equatorial section, megalospheric form, Um Sohryngkew River section (near Therria), East Khasi Hills, Sample No. 86/Lkd/DR5; Slide No. Lkd/DR5/b, x25;

5, equatorial section, Um Sohryngkew River section, East Khasi Hills, sample No. 86/Lkd/DR2; slide No. Lkd/DR2/203/A_1, x25;

6, equatorial section, megalospheric form, Cherrapunji-Shillong Road, sample No. 87/CH-SHLG/1; slide No. Lkd/CH-SHLG/1a, x25;

7, equatorial section, megalospheric form, Cherrapunji-Shillong Road, sample No. 87/Lkd/CH-SHLG/3; slide No. Lkd/CH-SHLG/3/217/a, x25;

8, axial section, megalospheric form, Um Sohryngkew River section (near Therria), sample No. 86/Lkd/DR2; slide No. Lkd/DR2/203/e, x25;

10, equatorial section, megalospheric form, Um Sohryngkew River section (near Therria), sample No. 86/Lkd/DR6; slide No. Lkd/DR6/208/a, x25.

2-3. *Miscellanea miscella* (d'Archiac & Haime)
2, axial section, microspheric form, Um Sohryngkew River section, sample No. 86/Lkd/DR6; slide No. Lkd/DR6/iii, x25;

3, axial section, megalospheric form, Um Sohryngkew River section (near Therria), sample No. 86/Lkd/DR8; slide No. Lkd/DR8/b60, x35.

9,11-12. *Miscellanea yvettae* Leppig
9, equatorial section, megalospheric form, Um Sohryngkew River section (near Therria), sample No. 86/Lkd/DR2; slide No. Lkd/DR2/203/c, x25;

11, equatorial section, megalospheric form, Um Sohryngkew River section (near Therria), sample No. 86/Lkd/DR3; slide No. Lkd/DR3/C_1, x25;

12, axial section, microspheric form, Cherrapunji-Shillong Road, sample No. 87/Lkd/CH-SHLG/2; slide No. Lkd/CH-SHLG/2/216/2; X25.

(All slides are prefixed Geol./L.U./).

Plate II

1-2. *Miscellanea yvettae* Leppig

1, axial section, microspheric form, Um Sohryngkew River section, East Khasi Hills, sample No. 86/Lkd/DR2; slide No. Lkd /DR2/203/a, x30;

2, axial section, microspheric form, Um Sohryngkew River section, East Khasi Hills, sample No. 86/ Lkd /DR2; slide No. Lkd /DR2/203/e, x30.

3-8,12-13. *Miscellanea juliettae* Leppig
3, equatorial section, megalospheric form, Um Sohryngkew River section, sample No. 86/ Lkd /DR4; slide No. Lkd /DR4/205/ii, x25;

4, axial section, megalospheric form, Um Sohryngkew River section, sample no. 86/ Lkd /DR2; slide No. Lkd /DR2/203/c, x25;

5, axial section, Cherrapunji-Shillong Road, sample No. 87/ Lkd /CH-SHLG/2; slide No. Lkd /CH-SHLG/2/216/b, x30;

6. axial section, megalospheric form, Um sohryngkew River section, sample No. 86/ Lkd /DR2; slide No. Lkd /DR2/203/a, x40;

7, equatorial section, megalospheric form, Um Sohryngkew River section, sample No. 86/ Lkd /DR6; slide No. Lkd /DR6/208/a, x25;

8, axial section, megalospheric form, Um Sohryngkew River section, sample No. 86/Lkd /DR3; slide No. Lkd /DR3/204/b, x30;

12, equatorial section, megalospheric form, Cherrapunji-Shillong Road, sample No. 87/ Lkd /CH-SHLG/3; slide No. Lkd /CH-SHLG/3/217/a, x25;

13, equatorial section (lower) and axial section (upper left), megalospheric form, Cherrapunji-Shillong Road, sample No. 87/ Lkd /CH-SHLG/1; slide No. Lkd /CH-SHLG/1/217/b, x25.

9-11. *Miscellanea miscella* (d'Archiac and Haime)
9, microfacies showing *M. miscella* in axial section, both megalo- and microspheric forms, Um Sohryngkew River section, sample No. 86/ Lkd/ DR6; slide No. Lkd /DR6/a, x10;

0, axial section, microspheric form, Um Sohryngkew River section, sample No. 86/ Lkd /DR6; slide No. Lkd /DR6/207, x25;

11, axial section, Um sohryngkew River section, sample No. 86/ Lkd / DR6; slide No. Lkd /DR6/a, x25.

(All slides are prefixed Geol./L.U./).


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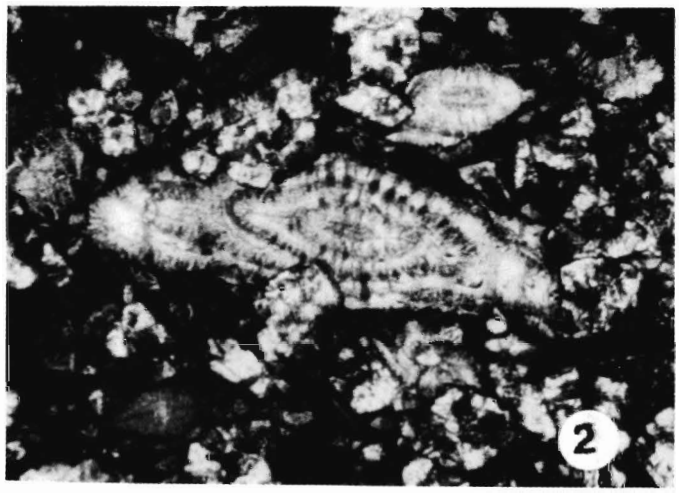
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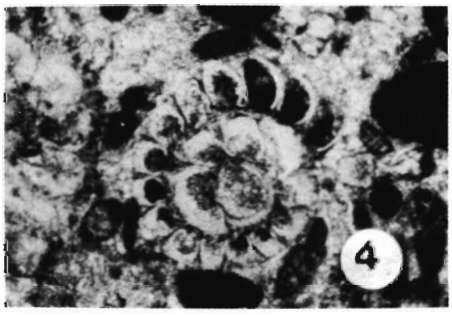
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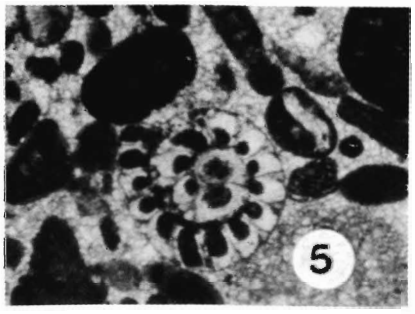
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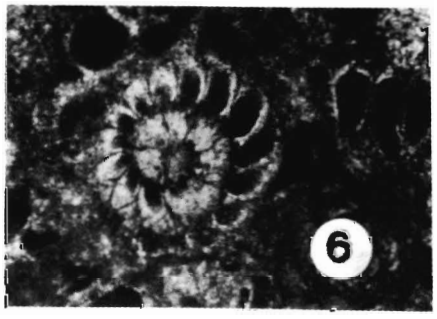
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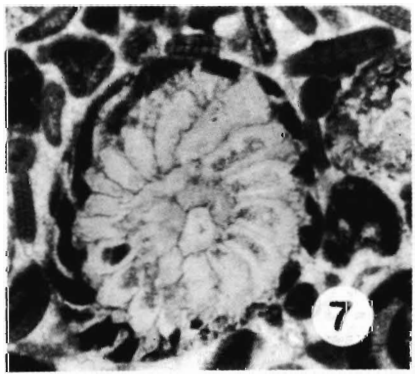
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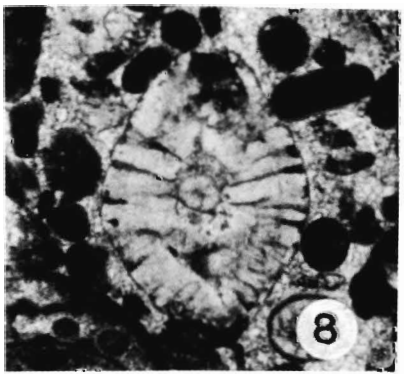
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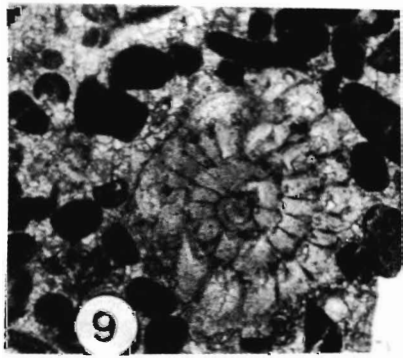
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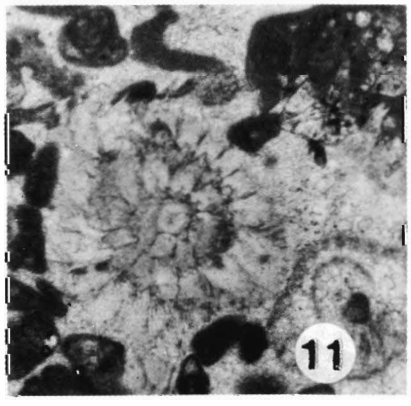
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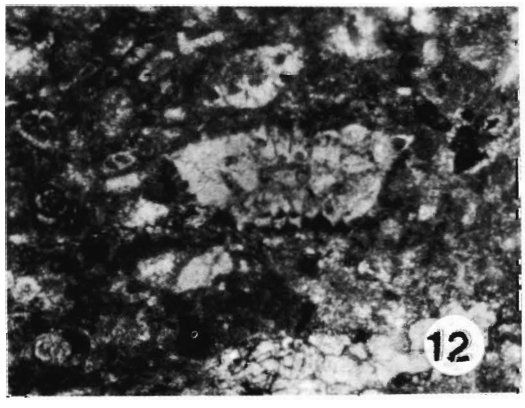
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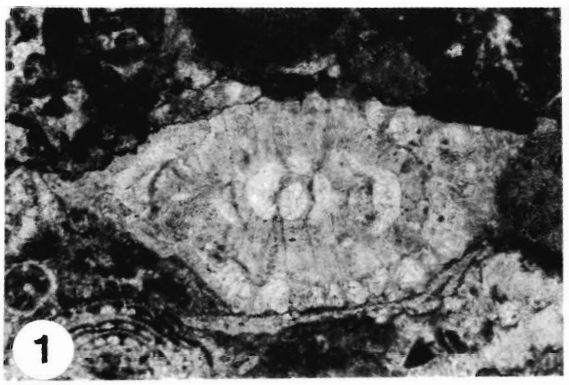
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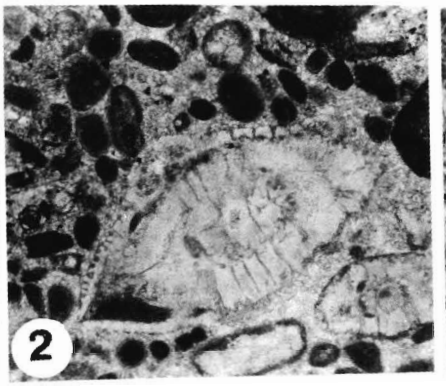
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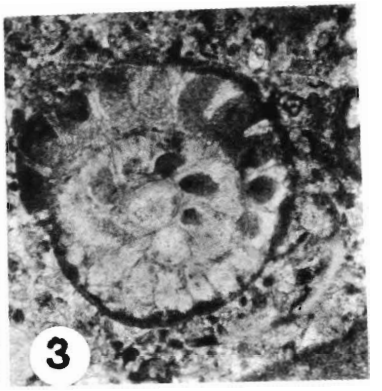
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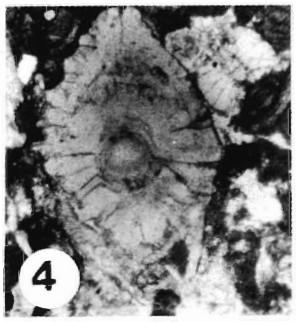
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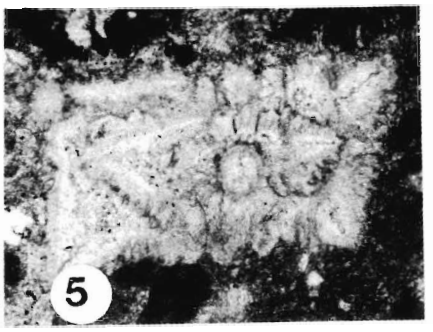
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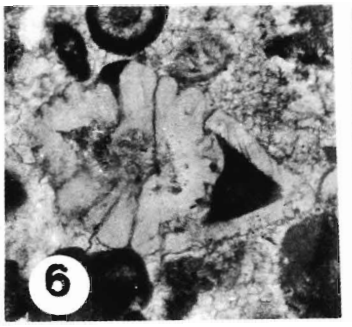
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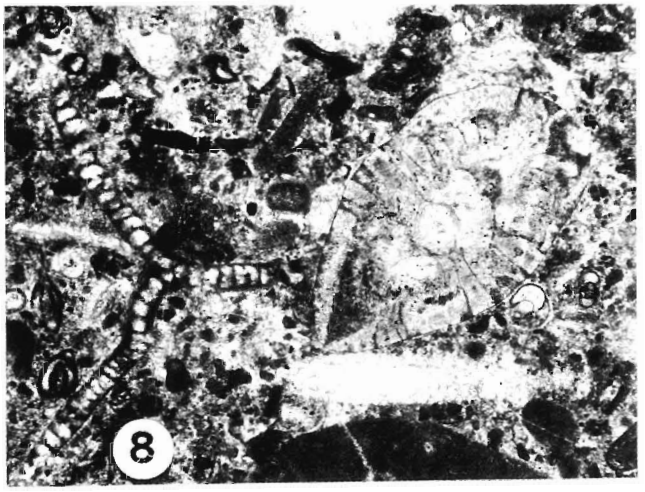
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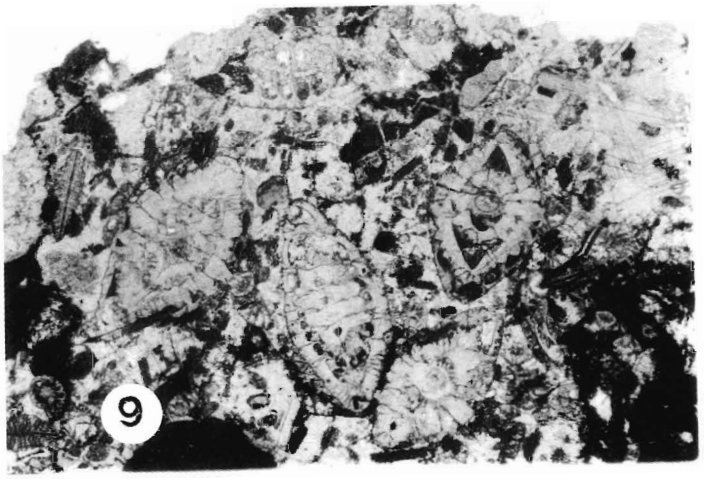
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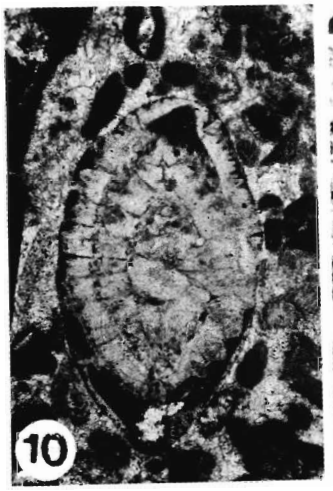
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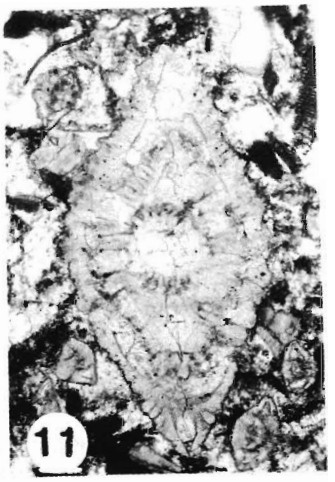
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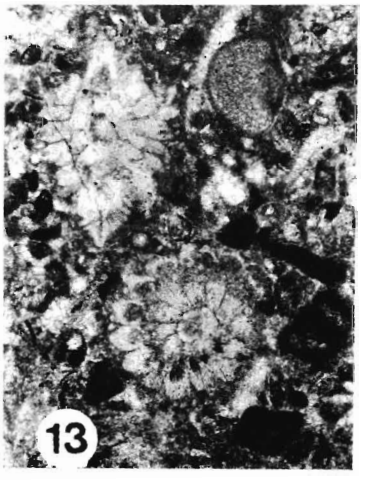
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